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Banking Globalization, Local Lending, and Labor Market Effects: Micro-Level Evidence from Brazil *

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Abstract

This paper estimates the effect of a foreign funding shock to banks in Brazil after the collapse of Lehman Brothers in September 2008. Our robust results show that bank-specific shocks to Brazilian parent banks negatively affected lending by their individual branches and trigger real economic consequences in Brazilian municipalities: More affected regions face restrictions in aggregated credit and show weaker labor market performance in the aftermath which documents the transmission mechanism of the global financial crisis to local labor markets in emerging countries. The results represent relevant information for regulators concerned with the real effects of cross-border liquidity shocks.

JEL classification: E24; E44; G01; G21

Keywords: Financial crisis; international shock transmission; bank lending; regional labor markets

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1 Introduction

Since the outbreak of the 2008-2009 global financial crisis, the cross-border transmission of liquidity shocks through banks, as a particular element of banking globalization, has (re)gained attention in financial economics. Contributions have stressed how disruptions in one financial system can be transmitted to other markets and affect bank lending (Puri, Rocholl and Steffen, 2011) as well as firms' investment and performance (Schnabl, 2012; Ongena, Peydro and van Horen, 2015).

Such studies also face several identification challenges though (Schnabl, 2012). First, due to the systemic nature of liquidity shocks, identifying affected and unaffected financial institutions becomes difficult without accessing very granular data. Second, a key requirement for investigating a lending channel of cross-border liquidity shocks is disentangling the supply from the demand drivers of the credit provision (Khwaja and Mian, 2008; Degryse et al., 2016). Liquidity shocks and credit demand may be determined by the same economic forces. Third, even if empirical results support a lending channel of liquidity shocks, borrowers may be able to substitute for a shortfall in bank lending. Therefore, it is important to trace the shocks to a level that makes an analysis of real effects possible.

This study follows established research to investigate how the 2008-2009 global financial crisis affected a large emerging country through regional bank lending, employment, and gross domestic product (GDP) growth. In particular, we rely on a novel, bank-level, micro data set for Brazil and investigate the extent to which bank-specific foreign funding shocks triggered by the crisis affected lending by individual bank branches and the performance of local labor markets in Brazilian municipalities. Similar to De Haas and van Horen (2012), Chodorow-Reich (2014) or Ongena, Peydro and van Horen (2015), we use the collapse of Lehman Brothers in September 2008 as a cut-off point, separating the

pre-crisis period from the crisis itself. With these two periods, we calculate the difference in foreign interbank funding for each bank and thereby identify banks that were largely affected by the sudden reduction in the availability of foreign funding.

A key innovation of our research design is that though foreign funding shocks occur at the level of the headquarters of banking conglomerates, we observe lending at the individual bank branch level. This approach has three main advantages. First, it enables us to separate the corporate level at which the shock takes place from the the level at which outcomes are observed, thereby avoiding double-causality concerns. Second, by observing the lending by each branch in each municipality, we can partial out demand effects, similar to Khwaja and Mian (2008), Schnabl (2012), or Degryse et al. (2016). That is, we introduce municipality fixed effects in a regression with first differences of lending and foreign funding. Third, using hand-collected data about job creation and job termination at the municipality level, we can trace the effect of the foreign funding shock's lending channel on regional labor markets. With this empirical setup, we can investigate the real effects of the cross-border transmission of the 2008-2009 global financial crisis. To the best of our knowledge, this study is the first to analyze the real effects, in the form of labor market outcomes of a lending channel of foreign funding shocks funneled through a network of regional bank branches.

Our robust results show that a bank branch connected to a parent bank that experiences a drop of foreign funding of 26% percent (one standard deviation in our sample) between the crisis and the pre-crisis period decreases its credit growth by 7.41%. Given a mean value for credit growth of 14%, this decrease is sizeable and indicates an economically significant bank(-branch) lending channel of financial contagion triggered by the September 2008 events. This contagion channel led to fewer interbank, commercial, and consumer loans; real estate loans and leasing operations appear less sensitive to the shock. These

results remain robust even when we use different definitions for the crisis period and alternative methods to compute the size of the foreign funding shocks. Moreover the empirical model reveals consistent results when testing different specifications.

Complementing extant literature, we carefully consider how the nature of foreign funding shocks might differ between local and foreign banks (Noth and Ossandon Busch, 2016). Foreign funding relationships might differ between groups, due to foreign banks' access to intra-bank liquidity allocation through their multinational bank holding companies. Global banks' tendency to manage and allocate liquidity from a consolidated perspective can lead these banks' subsidiaries to be more sensitive to international shocks.[1] Consistent with this hypothesis, the channel of foreign funding shocks is mainly driven by foreign banks. Conversely, we find no evidence of a lending channel by government-owned banks.

By extending our sample to account for the characteristics of foreign banks' international exposures, we also find that the lending channel crucially depends on the performance of the foreign bank holding companies (FBHC) headquartered abroad during the crisis. If foreign banks belonging to FBHC suffer from higher capital losses and increase their liquid asset buffers during the crisis, they reduce lending more than do other foreign banks, in response to reported foreign funding shocks. This effect is somewhat moderated by FBHC's access to the U.S. Term Auction Facility (TAF) program, which indicates cross-border spillovers of large monetary interventions during the crisis.

Regarding the link between the lending channel of foreign funding shocks and local adjustments in the real economy, we find that in municipalities more affected by the shock, the growth rates of aggregated credit and net job creation drop significantly more after September 2008. In particular, a 1% increase in the market share-weighted foreign funding

[1] Cetorelli and Goldberg (2011) provide evidence of how global banks' consolidated liquidity allocation affected the stability of lending in emerging countries during the crisis.

shock (i.e., our proxy for local exposures to shocks), reduces aggregated credit growth by around 0.58% and also reduces the growth rate for the net job creation per capita by 0.57%. Similar results emerge for GDP growth and alternative measures of labor market outcomes, suggesting the far-reaching effect of the shock on local economies. When we extent the analysis, we also find that this effect is increasing with municipalities' ex ante financial vulnerabilities, as measured by the credit-to-GDP ratio, the historical procyclicality of local credit markets, and foreign banks' market penetration.

Our research relates to literature that investigates international banking activities, the transmission of shocks between financial systems, and whether the shocks affect lending or the real sector. In particular, the notion that international banking activities can transmit financial shocks to the real economy across borders goes back to Peek and Rosengren (1997), who discuss how Japanese banks' U.S. affiliates contributed to transmit the Japanese recession of 1990 to the United States. Van Rijckeghem and Weder di Mauro (2001) also provides evidence of the existence of common-lender contagion effects during the Mexican, Thai, and Russian crises, and De Haas and van Lelyveld (2006) reveal that home-country economic conditions crucially determine lending by foreign-owned banks in Eastern Europe.

The financial crises of the late 2000s brought to light a renewed interest in the role of banks for transmitting shocks across countries. De Haas and van Lelyveld (2010) thus investigate the role of internal capital markets in relating global banks' financial strength to lending by their foreign affiliates. Jeon, Olivero and Wu (2013) explicitly measure foreign banks' reliance on parent banks' funding to show how intra-bank capital markets can affect lending in countries that host foreign banks. Schnabl (2012) also highlights the importance of cross-border funding shocks for banks by analyzing the 1998 Russian crisis and tracing the effect of the associated international liquidity shock on lending by

Peruvian banks. That study suggested that Peruvian firms could not offset the negative liquidity shock. Our focus on the role of foreign-owned banks in shaping the transmission of shocks also links our research to De Haas and van Lelyveld's (2014) exploration of the impact of the characteristics of a global bank headquartered abroad on local lending. We explicitly explore the interactions of foreign funding shocks and other dimensions of banking globalization to advance this literature stream.

The case of the global financial crisis provides ample evidence that international liquidity conditions shape the extent of its cross-border spillovers. Previous studies show that the extent of the transmission of the crisis related to the home country liquidity conditions of foreign bank affiliates (Cetorelli and Goldberg, 2011), to the size of bank-level foreign funding shocks (Aiyar, 2012; Noth and Ossandon Busch, 2016), to information asymmetries in the global market for syndicated loans (De Haas and van Horen, 2012; Giannetti and Laeven, 2012), and to global banks' exposures to wholesale interbank markets (De Haas and van Lelyveld, 2014). Buch and Goldberg (2015) provide a more general picture of how global liquidity conditions affected local lending across the globe by relying on several country-level studies as part of the International Banking Research Network.[2]

Furthermore, Popov and Udell (2012) find that German firms relying on funding from relatively more affected banks were the ones that faced more difficulties during to the crisis. Other studies similarly offer evidence that German savings banks more exposed to the crisis rejected significantly more loan applications ex post (Puri, Rocholl and Steffen, 2011) and reduced employment and labor compensations (Popov and Rocholl, 2016). Aiyar's (2012) explicit analysis of foreign funding shocks is closer to our study, though he focuses on

[2]These authors summarize country-level evidence obtained using regulatory data about 11 countries. Using a similar methodology, they also find that local lending and cross-border lending were affected by banks' ex ante liquidity risk during times of high global interbank distress. These findings support the hypothesis of a global transmission of shocks; our study is different in that we put a spotlight on an explicitly observed foreign funding shock, as well as on the real effects of the lending channel triggered by the shock.

indentifying a lending channel of shocks in England during the crisis. Besides analyzing how this lending channel varies according banks' characteristics, we expand the analysis by tracing the entire channel of financial contagion, from foreign funding shocks to real economic outcomes.

Finally, the transmission of the global financial crisis from an emerging economy perspective has scarcely been explored. Most studies rely on country-level data (Cetorelli and Goldberg, 2011), which prevent a clear identification of the underlying bank-level mechanisms driving the transmission of liquidity shocks. An exception is Ongena, Peydro and van Horen (2015), who use a sample of yearly matched, bank-firm-level data for Eastern Europe and Turkey to analyze adjustments to the firms' outcomes that stem from banks' ex ante exposures to the crisis. The authors compare firms borrowing from locally funded domestic banks with those borrowing from foreign-funded domestic banks or foreign-owned banks and find evidence of the transmission of the crisis through banks' ex ante international exposures. In contrast to their approach we track the timing and size of foreign funding shocks on a monthly basis for both domestic and foreign banks. Moreover, we allow the shocks to interact with the ownership dimension of foreign exposure and with the traits of FBHC abroad, thus drawing a more comprehensive picture of the link between banking globalization and local lending during the crisis.

Overall then, our work differs from previous studies in three central respects. First, we investigate the transmission of the global financial crisis to the largest economy in Latin America, Brazil, using local, bank-level regulatory data. Second, this study makes a major contribution by documenting the lending channel and the real effects of bank-level foreign funding shocks funneled through internal capital markets throughout Brazil. Third, we carefully address the interaction between foreign funding shocks and other dimensions of banking globalization, documenting the more complex nature of the transmission of shocks

to the real economy than what previous literature indicated.

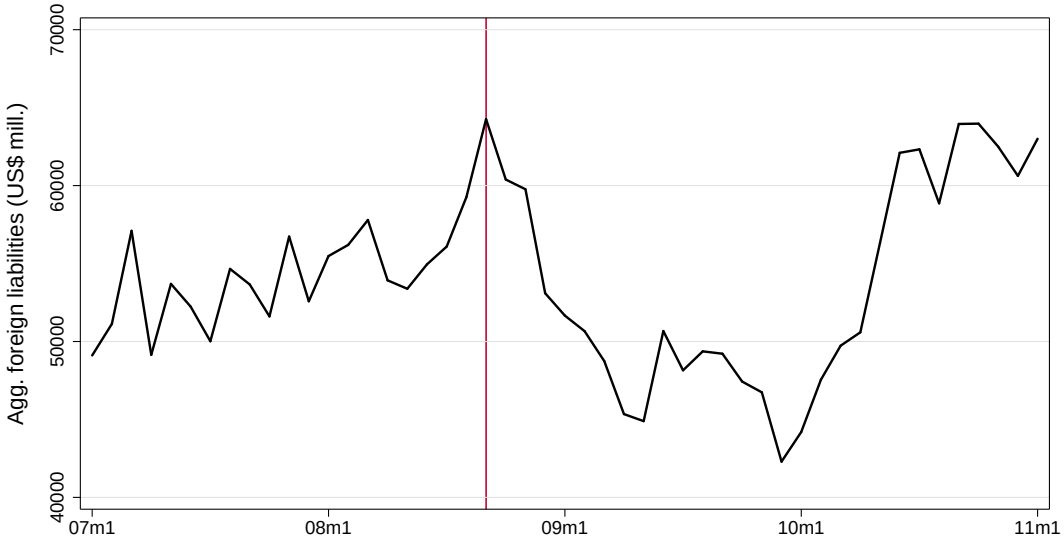
2 Identification and Data

2.1 Identification

The aim of this study is to identify how a foreign funding shock to banks' headquarters in Brazil affects the credit supply of their affiliated branches operating in Brazilian municipalities. Our purpose is to isolate this specific supply channel from other economy-wide trends, so the identification must fulfill two central requirements to produce unbiased results. First, the foreign funding shock must be uncorrelated with branches' ex ante credit supply. Second, to identify effects on the credit supply, we need to exclude the possibility that the analysis is driven by demand considerations, such as by different borrower fundamentals faced by banks that experience greater drops in foreign funding during the crisis.

Regarding the exogeneity requirement, we argue that the default of Lehman Brothers in September 2008 is unaffected by credit supply in Brazil, in line with other studies that use this collapse to identify the transmission of international funding shocks (De Haas and van Horen, 2012; Ongena, Peydro and van Horen, 2015). Considering that we analyze credit supply at the branch level, this argument is even stronger, in that it is unlikely that any feedback effects from the lending behavior of the branches spread to disruptions in international interbank markets. Even if these arguments hold, the shock still should reflect banks' own decisions to reduce their exposure to global interbank markets in the context of the crisis. As we discuss subsequently, the banks in our sample never fully halted their foreign funding practices during the crisis. This situation helps reduce any concerns

Figure 1: Aggregated Foreign Funding.



Notes: This figure shows the development of aggregated foreign funding for Brazilian banks between January 2007 and December 2010. The vertical line is set at September 2008, the month when the collapse of Lehman Brothers triggered a freeze in global interbank markets. Foreign funding is aggregated from the bank-level data in the baseline sample. The variable is reported in real 2013 US$ millions.

that foreign funding demand considerations drive the analysis.

Our identification also acknowledges the significant impact of the collapse of Lehman Brothers on Brazilian banks' access to foreign funding. Figure 1 shows the development of aggregated foreign funding (expressed in real US$ millions) of banks in Brazil,[3] documenting the steady increase of foreign funding before September 2008 and sharp decrease right after. The sharp decrease after the Lehman default in September 2008 constitutes the core of our identification strategy. Similar to Khwaja and Mian (2008), we use the varying impacts of this drought in foreign funding on banks in Brazil to investigate how the magnitude of the decrease affects local lending through bank branches.

A second requirement for the identification of a bank lending channel is the distinction between credit demand and supply adjustments that correlate with the funding shock.

[3]Note that we transformed our data to real 2013 US$ millions.

To avoid concerns about a demand-driven, bias we rely on a within-borrower estimation (Khwaja and Mian, 2008), exploiting our observation of several banks operating in a single municipality. Equation (1) contains the baseline regression for the bank lending channel.

$$\Delta\text{Log credit}_{ij} = \lambda_j + \beta_1 \Delta\text{Log foreign funding}_i + \sum_{k=2}^{K} \beta_k x_{kij} + \epsilon_{ij}, \tag{1}$$

where ΔLog credit is the change in the natural logarithm of the total amount of credit of branch i in municipality j between the pre- and post-crisis periods. To compute this value, we take the average outstanding credits of branch i for the periods January 2007 to August 2008 and September 2008 to December 2010. Then ΔLog credit represents the change in the logarithm of these averages between the two periods. Our main explanatory variable is ΔLog foreign funding, which indicates the change in the (log) foreign funding of branch i's headquarters between the same two periods. Our coefficient of interest is β_1, which indicates the effect of a foreign funding shock at the headquarter level on lending by regional bank branches. In Brazil, only banks' headquarters may obtain direct funding from foreign interbank markets, so we are able to separate the corporate level, where the shock strikes, from retail banking operations at the branch level. In our regulatory data, foreign funding pertains to credits obtained in interbank markets abroad.

If the model delivers results in line with the hypothesis of a lending channel of foreign funding shocks, we would expect β_1 to produce a positive sign. Moreover, the positive sign for β_1 should be driven mainly by banks' experiences of a negative foreign funding shock that reduces their credit balances proportionally more than those of other banks. In Section 3, we extend Equation (1) to test this specific prediction.

To differentiate between demand and supply effects, the model includes municipality fixed effects represented by λ_j, introduced after first differentiating the data. We restrict

our sample to municipalities that host at least two banks active in global interbank markets, so that λ_j holds fixed anything that is municipality-specific, such as local demand for credit. Therefore β_1 should function to isolate the credit-supply channel linking foreign funding shocks and lending activity.[4]

As an important feature, Equation (1) permits us to collapse the sample's time dimension by computing the variables' averages per period. Instead of working with the monthly underlying data at hand, we adopt this procedure and thus avoid concerns about our standard errors being biased due to auto-correlation (Bertrand, Duflo and Mullainathan, 2004). This approach also adds simplicity to the structure and interpretation of Equation (1), because aggregated time trends and banks' unobserved, time-invariant characteristics get ruled out of the analysis by first-differentiating the data. Collapsing the time dimension rules out the possibility that the error terms might correlate across branches within the same banking conglomerate or that are active in the same regions. Accordingly, our analysis considers clustering the standard errors at either the municipality or the bank headquarter level (Khwaja and Mian, 2008; Petersen, 2009). The only variables that we can observe separately in both periods are the ones included in the vector of controls x_k. This identification approach leads us to work with a sample that consists of one observation per branch, with control variables reported as either pre- or post-crisis averages. Our estimation includes these latter two alternatives.

We select multiple headquarter- and branch-level characteristics to serve as control variables within the vector x_k. At the branch level, we include the log of total assets and the ratios of liquid assets and deposits to total assets to control for their size and the

[4]An underlying assumption of this approach is that demand shocks are homogeneously distributed across branches in each municipality. Because credit demand cannot be observed explicitly, a natural concern would be that branches operate in different segments of the local credit markets, such that λ_j does not completely alleviate concerns of a demand-driven bias. To account for this issue, Section 3 presents an extension of Equation (1) in which the empirical model is estimated for different credit segments in which branches are active.

Table 1: Variables definitions.

Variable	Definition
Δ Log credit	Δ in log average outstanding credit in the post- minus the pre-crisis period.
Δ Log foreign funding	Δ in log average foreign liabilities balances in the post- minus the pre-crisis period.
Headquarter-level	
Size (Log Assets)	Log of total assets.
Capital Ratio	Ratio of total equity to total assets.
Liquidity Ratio	Ratio of liquid assets (cash, bank deposits, gold) to total assets.
Deposit Base	Ratio of total deposits (interbank, sight and savings deposits) to total assets.
Credit Risk	Ratio of non-performing loans to total outstanding credit.
Foreign	Dummy equal to 1 if a bank is foreign-owned.
State-owned	Dummy equal to 1 if a bank is government-owned.
Foreign Funding Ratio	Pre-crisis average ratio of foreign funding to total assets.
Branch-level	
Size (Log Assets)	Log of total assets of an individual bank branch.
Liquidity Ratio	Ratio of liquid assets (cash, bank deposits and gold) to total assets.
Deposit Base	Ratio of total deposits (interbank, sight and savings deposits) to total assets.
RoA	Ratio of net income to total assets.
Net Interbank Assets	Pre-crisis average ratio of net interbank assets (loans + deposits) to total assets.
FBHC-level	
Δ Capital Ratio	Change in capital ratio between 2009 and 2007.
Δ Liquidity	Change in the ratio of liquid assets to total assets between 2009 and 2007.
Δ Deposit Ratio	Change in the ratio of deposits to total assets between 2009 and 2007.
Δ RoA	Change in the RoA ratio between 2009 and 2007.
TAF Index	Normalized average ratio of TAF balances to capital divided by the normalized inverse of the foreign funding shock.
Size (Log Assets)	Log of unconsolidated total assets.
Capital Ratio	Ratio of total equity to total assets.
Liquidity Ratio	Ratio of unconsolidated liquid to total assets.
Deposit Base	Ratio of unconsolidated deposits to total assets.
Municipality-level	
Size (GDP)	Annual GDP in real US$ mill.
Credit / GDP Ratio	Ratio of total aggregated credit to municipal GDP.
Job Creation	Number of signed job contracts per month.
Net Job Creation	Job creation minus the number of job contracts terminated.

Notes: This table provides a description of the main variables used for the empirical analysis reported in the paper. The sources are the Brazilian Central Bank, the Brazilian Institute of Geography and Statistics, the Brazilian Ministry of Labor, Bloomberg (for TAF data) and BankScope (for FBHC traits).

characteristics of their funding structure. We also introduce bank traits that control for the characteristics of the banks' headquarters. A dummy identifying banks with a foreign owner is a central control variable, in line with evidence that indicated the notable role played by foreign-owned banks for transmitting the crisis across borders (Ongena, Peydro and van Horen, 2015). The information to define foreign ownership comes mainly from the banks' websites and from Claessens and Van Horen's (2014) Bank Ownership Database. We follow the standard that indicates that banks are foreign owned if at least 50% of their shares are held by foreign firms. We also introduce a second dummy to identify government-owned banks, noting Coleman and Feler's (2015) finding that government-owned branches in Brazilian municipalities helped offset the effects of the global financial crisis. Furthermore, we control for the log of total assets as a measure of size, the capital-to-asset ratio, liquidity, and deposits, mirroring the controls at the branch level, as well as a measure of credit risk. This latter variable corresponds to the share of non-performing loans, as a proportion of total outstanding credit at the headquarter level. Table 1 provides a detailed description of all variables. In choosing these variables, we expect to capture the main characteristics of banks' funding and assets structure.

2.2 Data and descriptive statistics

To address the research question, we rely on information on banks' balance sheets and income statements from call reports published by the Brazilian Central Bank. This source provides monthly data on banks' lending activity and funding structure. We integrate a data set that contains information on Brazilian banks' headquarters with the (unconsolidated) balance sheets of their individual branches located in Brazilian municipalities. Thus we can observe both the characteristics of the parent bank at the country level as well as

the characteristics of the individual regional branches of each bank.[5] Our sample covers the period from January 2007 to December 2010. We restrict the sample to banks with a network of municipal branches throughout the period, so that we can assess the impact of shocks on lending at individual region level. This restriction reduces the sample of 123 banks active in Brazil as of January 2007 to 100 banks.

When analyzing banks' global linkages, we consider two main bank characteristics: foreign funding and foreign ownership. Foreign banks have a strong presence in Brazil, representing 37% of total assets in the (reduced) sample as of January 2007. Foreign banks operating in Brazil are headquartered in 20 different countries of origin, ranging from regional players like Mexico and Argentina to banks from Korea and Japan. Spain and the United States have the largest representation of foreign banks in the sample, with 6 and 8 banks, respectively.

For the sampling, we also require banks and individual bank branches to have been active during the whole sample period from January 2007 to December 2010. Because we observe lending at the individual regional bank branch level, we restrict the sample to municipalities that host at least two active banks over the sample period. This restriction is important for the identification strategy outlined previously, in that it enables us to control for common credit-demand shocks that affected the two or more active branches in each region. Furthermore, we check that the banks regularly report positive balances of foreign funding, which means we can compare banks that are similarly active in global interbank markets that continued relying on foreign funding during the crisis. As previously mentioned, this filter underpins our interpretation of the foreign funding shocks as a supply-driven phenomenon, also allowing us to focus on the intensive margin of foreign funding shocks. As a final sample restriction, we drop branches with missing information for the

[5]See the Appendix for further details on the data collection process.

bank traits we use as control variables, while ensuring that after this restriction, each municipality still reports the activity of at least two individual branches.

Through this screening procedure, we retain a sample of 41 banks that provide credit to 1,768 municipalities through 6,632 branches in the period from January 2007 to December 2010. The banks in our sample represent the largest institutions in Brazil, such that our restricted sample still represents 62.6% of the total banking assets in the country. Furthermore, the outstanding credit observed in the final sample covers 76.3% of the aggregated credit market in Brazil. In terms of geographical coverage, it accounts for more than 90% of total assets in 23 of the 27 federal states. The sample is less representative in the country's main financial centers though, which is to be expected, considering our focus on regional branches and retail credit. That is, banks focused solely on the investment or corporate sectors, with a larger presence in financial centers, are not represented in the sample.

Our sample banks report an average ratio of foreign funding to total assets of 11.6% in the pre-crisis period. This ratio varies considerably along the foreign-ownership dimension; foreign banks report an average ratio of 15.5%, whereas domestic banks finance their balance sheet, with an average of 5.6% of foreign funding. We cannot observe the counterparts of foreign funding relationships, but this latter observation can be interpreted as foreign banks that access different sources of foreign funding compared with local banks. In particular, the different funding ratio might be related to foreign banks' access to internal liquidity through their bank-holding companies abroad.[6] This preliminary evidence is in line with the findings about foreign funding in Brazil presented by Noth and Ossan-

[6]As Figure A.1 in the Appendix reveals, pre-crisis exposure to foreign funding related inversely to the size of the foreign funding shock after September 2008. This is important because it reveals that the mere fact of having active balances in foreign funding does not predict per se a large funding shock during the crisis. This heterogeneity in the size of funding shocks permits us to investigate the differential impact of the shock on lending, depending on the size of the shocks.

Table 2: Descriptive statistics of the bank sample.

	Statistics				Shock-affected		
	Mean	SD	Min	Max	Yes	No	Diff
ΔLog Credit	0.14	0.26	-0.76	0.70	0.05	0.18	-0.13*
ΔLog Foreign Funding	0.25	0.60	-1.22	1.46	-0.35	0.55	-0.90*
Headquarter-level							
Size (log Assets)	9.15	1.40	8.13	12.72	9.10	9.04	0.06
Capital Ratio	0.13	0.07	0.04	0.32	0.14	0.13	0.01
Liquidity Ratio	0.22	0.10	0.06	0.43	0.19	0.23	-0.05
Deposit Base	0.41	0.13	0.24	0.74	0.35	0.42	-0.08*
Credit Risk	0.13	0.08	0.04	0.27	0.12	0.14	-0.02
Foreign	0.39	0.49	0.00	1.00	0.57	0.30	0.28*
State-owned	0.20	0.40	0.00	1.00	0.21	0.19	0.03
Branch-level							
Size (log Assets)	5.18	2.07	1.33	8.76	5.19	5.13	0.06
Liquidity Ratio	0.06	0.06	0.00	0.22	0.06	0.07	-0.01
Deposit Base	0.15	0.18	0.01	0.73	0.12	0.16	-0.04
RoA	0.08	0.04	0.02	0.18	0.08	0.07	0.00
Pre-crisis trends							
Credit growth	0.05	0.36	-0.77	1.51	0.06	0.05	0.00
Assets growth	0.08	0.29	-0.49	0.96	0.03	0.11	-0.08
Deposits growth	0.09	0.28	-0.49	0.85	0.08	0.09	0.00

Notes: This table reports descriptive statistics. The branch- and headquarter-level summary statistics are computed as pre-crisis values. The sixth and seventh columns report the pre-crisis average for each variable within the groups of shock-affected and not-affected banks respectively. Shock-affected banks are those reporting Δ Log foreign funding below the sample median. The last column shows the difference in means between affected and non-affected banks. * indicates whether the difference is significant by normalized differences (Imbens and Wooldridge, 2009), i.e., a value of larger than |0.25|. The pre-crisis trends at the bottom of the table are computed as average 12-month growth rates in the respective variables during the period from January 2007 to August 2008. Variables are defined in Table 1 and winsorized at the 1st and 99th percentiles.

don Busch (2016).

Table 2 provides descriptive statistics for the variables in our analysis and shows the mean values for the pre-crisis period for two groups of banks, according to whether they experienced a change of (log) foreign funding below (shock affected) or above (non-affected) the sample median. We compute normalized differences (Imbens and Wooldridge, 2009; Lambert, Noth and Schüwer, 2015) to investigate whether the differences in variables between the two groups differ significantly from each other. Relevant prior literature suggests that absolute values smaller than 0.25 indicate a non-significant difference.

The first two lines in Table 2 report summary statistics for the main variables of

interest for the identification strategy: the changes in log credit and log foreign funding between the two aforementioned periods. By construction, Table 2 shows that foreign funding growth was weaker for shock-affected banks. Credit expanded in a slower fashion in the case of shock-affected banks, which report 13 percentage points lower credit growth between the pre- and post-crisis periods.

In addition, Table 2 documents that banks affected or not by a foreign funding shock shared similar characteristics in the pre-crisis periods. The only significant differences appear in the deposit ratio at the headquarter level and in terms of the likelihood of being a foreign-owned bank. These statistically significant differences are marked with asterisks. Shock-affected banks tend to operate with fewer deposits at the headquarter level and are more likely to be foreign-owned in the pre-crisis period. The foreign-ownership dimension becomes important when analyzing the transmission of foreign funding shocks and for interpreting the results in Section 3. For the rest of the control variables, we cannot reject the null hypothesis that the averages between the banks affected or not by the shock are equal. We control for these (level) variables in our regressions and thus are confident that the rather small differences between shock-affected and non-affected banks are not a matter of concern for our results.

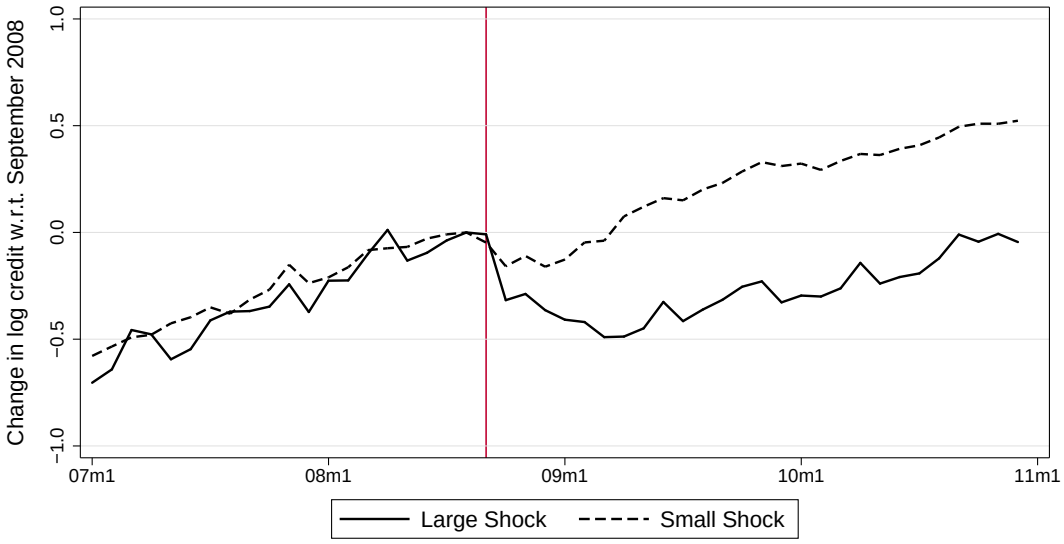
A further critique of the identification strategy is the potential existence of ex ante trends in banks differently affected by foreign funding shocks. More affected banks already might be experiencing weaker credit growth in the pre-crisis period, which would prompt a bias in our estimation. The assumption of parallel trends in the pre-crisis period therefore must be addressed explicitly. In the bottom panel of Table 2, we report the results of tests of whether average pre-crisis growth in credit, total assets, and deposits differed significantly between the two groups of banks. Our results do not indicate any statistically significant differences in pre-crisis trends between banks affected or not by the funding shock. This

result implies that ex ante sorting in our sample should not be a substantial concern when interpreting the results.

The potential bias in the ordinary least squares (OLS) estimation of Equation (1), arising from contemporaneous credit demand shocks, can be positive or negative, ex ante. The sign depends on the correlation between the size of the foreign funding shock and the adjustment in credit demand by each bank's borrowers during the crisis. Perhaps, shock-affected banks are also more sophisticated financial institutions, serving customers with a more diversified funding structure, such that they can better offset the effects of the crisis and accordingly experience relatively small reductions in their credit demand. Alternatively, shocked-affected banks might have faced larger vulnerabilities overall prior to the crisis, inducing borrowers to switch off their credit sources and triggering relatively large credit demand shocks for those banks. If the former hypothesis is true, a simple OLS estimation of Equation (1) would produce conservative estimates of the true effect of ΔLog foreign funding on ΔLog credit. We return to this point in our discussion of the empirical results, but Table 2 provides some preliminary on this regard. That is, we find no statistically significant differences in the ex ante profitability of branches largely affected by the shock, possibly because they serve relatively similar firms and households compared to other branches, facing similar demand shocks. Still, we remain cautious about this interpretation. The results obtained from estimating Equation (1) will shed some light on the actual sign of the demand-driven bias in the model.

Before turning to the results, we use Figure 2 to provide some preliminary non-parametric evidence about the effect of the foreign funding shock on lending by Brazilian banks. It shows the change in aggregated log outstanding credit for groups of banks reporting a change in log foreign funding, both above and below the sample median after September 2008. Credit growth is computed as proportional to outstanding credit as of

Figure 2: Bank Lending Channel.



Notes: This figure illustrates the different pattern of credit growth followed by banks affected or not by a foreign funding shock after September 2008. The vertical line is set at September 2008, the month when the collapse of Lehman Brothers triggered a freeze in global interbank markets. The volume of outstanding credit is aggregated from the branch-level data per bank group and plotted as log first differences with respect to September 2008. Banks affected by a relatively large shock are those with a change in log foreign funding below the sample median.

September 2008. Figure 2 supports the suggested identification strategy, in that it shows no diverging pre-trends in lending between these two groups of banks, in accordance with our findings from Table 2. After the outbreak of the crisis, shock-affected banks reduce lending by more, and credit growth remains in the negative region until the end of the sample period. We conducted simple difference-in-differences tests to confirm that the difference between the two groups is statistically significant only in the post-crisis period. However, this preliminary analysis cannot rule out the possibility that the diverging paths observed in Figure 2 might be driven by different credit-demand shocks or by bank or branch traits correlated with the size of the foreign funding shock.

In Section 3, we discuss the baseline results of estimating Equation (1), as well as several extensions of the model intended to shed light on the mechanisms behind the cross-border transmission of the foreign funding shock.

3 Results

3.1 The Bank Lending Channel

The baseline results obtained from Equation (1) are in Table 3. The baseline model with municipality fixed effects appears in Column (1).[7] A 1% decrease in foreign funding growth after the crisis led to a significant reduction in the growth rate of lending, of about 0.29%. Considering that shock-affected banks experienced an average drop in foreign funding of 35%, the foreign funding shock explains roughly 10% of the average growth rate of credit within that group (35×0.29=10.15). Compared this with the average growth rate in credit within that group (5%), the model explains a sizable portion of credit growth in the sample.

Consider now the difference between the average growth rates in foreign funding of affected and non-affected banks. Our estimates imply that, on average, credit growth was 26% (90×0.29) lower for affected banks as a consequence of the shock. If an average non-affected bank would had realized the foreign funding growth rate of an average affected bank, its credit growth rate would have been more than three times lower (18% versus -8.1%). This illustrates the extent of the effect of the shock on local credit supply.

The documentation of a bank lending channel for the Brazilian financial system mirrors the findings of other studies that analyze how funding shocks affect banks' lending behavior (e.g., Khwaja and Mian, 2008; Schnabl, 2012; Ongena, Peydro and van Horen, 2015). Even though we rely on a similar approach to control for credit demand, the use of borrower fixed effects could fail to fulfill its purpose if banks face idiosyncratic credit demands. For example, firms within a municipality might demand two distinct credit products, commercial loans and working capital funding. If two banks operate in this

[7]Note that we use standard errors clustered at the branch level throughout Table 3.

Table 3: Effect of foreign funding shocks on lending.

	(1) Baseline Model	(2) Commercial Lending	(3) Consumer Lending	(4) Mortgage Lending	(5) Leasing Balances	(6) Interbank Lending
ΔLog foreign funding	0.285***	0.424***	0.313***	0.060	-0.008	0.197**
	(0.103)	(0.127)	(0.077)	(0.044)	(0.022)	(0.081)
Headquarter-level						
Size (log Assets)	0.033	0.001	0.045	0.003	-0.004	0.060***
	(0.024)	(0.028)	(0.028)	(0.026)	(0.006)	(0.021)
Capital Ratio	-0.608	-0.123	0.417	-3.187***	-0.210	0.850
	(1.008)	(1.279)	(0.892)	(1.123)	(0.145)	(0.925)
Liquidity Ratio	-1.669***	-1.140**	-0.782*	-1.807***	0.037	0.758**
	(0.435)	(0.487)	(0.400)	(0.295)	(0.125)	(0.329)
Deposit Base	0.306	0.224	0.310	-0.409	-0.081	0.161
	(0.551)	(0.695)	(0.449)	(0.543)	(0.076)	(0.370)
Credit Risk	-1.658***	0.423	-1.259**	-1.441***	-0.090	0.297
	(0.506)	(0.621)	(0.475)	(0.522)	(0.180)	(0.418)
Foreign	-0.062	-0.082	0.120	-0.033	0.012	0.047
	(0.085)	(0.113)	(0.072)	(0.087)	(0.015)	(0.089)
State-owned	0.309***	0.050	0.362***	0.267***	0.014	-0.119
	(0.073)	(0.097)	(0.073)	(0.063)	(0.029)	(0.092)
Branch-level						
Size (log Assets)	0.041	0.046**	0.056**	0.016	0.008*	0.032*
	(0.027)	(0.021)	(0.023)	(0.020)	(0.005)	(0.017)
Liquidity Ratio	0.065	-0.207	-0.196	0.833*	0.540**	0.050
	(0.667)	(0.589)	(0.596)	(0.489)	(0.259)	(0.822)
Deposit Base	0.024	0.079	-0.054	-0.015	-0.012	0.163**
	(0.092)	(0.090)	(0.072)	(0.045)	(0.014)	(0.079)
RoA	2.826**	0.118	2.750***	-1.629**	-0.114	-1.678***
	(1.141)	(0.958)	(0.930)	(0.633)	(0.121)	(0.599)
Obs.	6632	6632	6632	6632	6632	6632
R-squared	0.405	0.318	0.456	0.612	0.117	0.344

Notes: This table reports the results of estimating Equation (1) for different specifications. In all regressions, the dependent variable is a measure of the change in log average outstanding credit between the post- and pre-crisis periods for specific credit segments. The pre-crisis period is between January 2007 and August 2008; the post-crisis period is between September 2008 and December 2010. Column (1) reports the baseline specification with municipality-FE from Equation (1) using total outstanding credit to compute the dependent variable. Columns (2) to (6) replicate the estimation for the segments of commercial lending, consumer lending, mortgage lending, leasing and interbank lending, respectively. For a detailed definition of all variables, see Table 1. We provide standard errors clustered on the branch level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

municipality, and each of them focuses exclusively on one of these products, municipality fixed effects would fail to capture the dynamics of credit demand, leading to biased results.

To overcome this concern, we extend our analysis in Table 3 for subsets of five different credit segments: commercial loans, consumer loans, mortgages, leasing, and interbank loans. The bank-lending channel holds, even for specific credit categories. In particular, commercial, consumer, and interbank loans are sensitive to the variation in foreign funding triggered by the crisis. In contrast, we do not find evidence of a bank lending channel for mortgages or leasing. This finding might reflect the importance of collateral in retail credit markets, especially during a global financial crisis (Ongena, Peydro and van Horen, 2015). Whereas mortgages and leasing products can insure banks against repayment delinquency, the other three categories of credit do not necessarily provide this function. We expect this to be a relevant factor in Brazil considering the theoretical and empirical evidence on the importance of collateral for credit markets in emerging countries compared to developed countries (e.g., Fostel and Geanakoplos, 2008; Menkhoff, Neuberger and Suwanaporn, 2006). In support of this interpretation, we note that unlike the United States, Brazil did not experience a housing bubble before or during the crisis.

The strongest explanatory power associated with commercial credit speaks to the importance of the funding shock for credits related to investment and trade, both of which fall within this category. Because funding from abroad typically is denominated in foreign currency, we expect banks with more exposure to foreign funding to serve firms that are also active in the foreign trade, infrastructure, and physical capital investment sectors. This evidence suggests a potential transmission of the lending channel to real economic outcomes through firms' investments, an aspect that we carefully address in Section 4, when we analyze the real effects of the funding shock.

A higher exposure to credit risk is associated with a weaker credit growth. Also branches whose headquarters report larger liquidity ratios reduce credit by more, what might be related to a liquidity hoarding effect, as documented for the global financial crisis in the United States by Cornett et al. (2011) and Berrospide (2013). In this sense greater liquidity holdings might be built up as cushion against an uncertain business environment that threatens the strength of credit growth. In line with previous findings by Coleman and Feler (2015), we find credit supply to be positively correlated with government ownership of banks, evidencing a potential offsetting effect of government-owned banks interventions in local credit markets. To shed more light into this finding, we explicitly explore the link between government ownership and the lending channel of foreign funding shocks in Section 3.2. At the branch-level, we find credit supply to be positively associated with branches' size and liquidity ratios in some of the specifications. Branches' profitability, as measured by the RoA ratio, reports ambiguous effects on credit supply depending on each credit segment.

The main results hold after controlling for foreign ownership, which represents important evidence regarding the cross-border transmission of shocks. There is ample evidence that global banking networks contributed to the spread of financial distress (Cetorelli and Goldberg, 2011; De Haas and van Horen, 2012), yet thus far foreign ownership has been analyzed only as a separate channel, in comparison with direct foreign funding exposures (Ongena, Peydro and van Horen, 2015). The evidence in Table 3 shows that foreign funding shocks continue to be important vectors for the transmission of financial distress even when we control for the ownership status of a bank. Although somewhat puzzling, this first result regarding the effect of foreign ownership on lending also leads in to some interesting insights about the bank lending channel, as we discuss subsequently.

3.2 Robustness and Alternative Shock Definitions

Standard errors and control variables. Table 4 provides the results for alternative specifications of Equation (1). Column (1) presents the results when including only ΔLog foreign funding as the explanatory variable. Columns (2) and (3) add the control variables at the headquarter and branch level, respectively. Although the statistical significance of the coefficient for ΔLog foreign funding remains unchanged, the size of the coefficient increases when adding the vector of controls x_k. The regression in Column (3) replicates the baseline results from Table 3, Column (1), but without municipality fixed effects or clustered standard errors. All these specifications report similar estimates of the lending channel of foreign funding shocks.

An open question in our estimation is whether standard errors should be better clustered at the bank headquarter or municipality level. On the one hand, we are working with several hundred branches per bank, so the results for branches associated with a particular bank holding company are likely to be correlated. On the other hand, regional specificity issues related to the functioning of the banking sector and the level of industrialization of each municipality might lead to regional correlations in the standard deviations of the estimation. Therefore, in Columns (4) and (5), we replicate the regression from Column (3) by adding municipality and headquarter bank clustered standard errors, respectively. These regressions do not include the municipality fixed effects. Both regressions produce similar results, but the use of headquarter-level clusters generates standard errors that are slightly higher. Therefore, we use this latter setup, which provides a more conservative estimation of the bank lending channel, and our subsequent analyses in this section rely on standard errors clustered at the bank headquarter level.

The coefficient for the funding shock in Table 4, Column (5), is only marginally larger

Table 4: Alternative specifications of the model.

	(1) Baseline Model	(2) Headquarter Controls	(3) Branch Controls	(4) Regional Cluster	(5) Bank Cluster	(6) Lagged Model
ΔLog foreign funding	0.082***	0.336***	0.301***	0.301***	0.301***	0.285***
	(0.012)	(0.016)	(0.016)	(0.030)	(0.078)	(0.088)
Headquarter-level						
Size (log Assets)		0.018***	0.007	0.007	0.007	0.069**
		(0.004)	(0.005)	(0.009)	(0.026)	(0.033)
Capital Ratio		-1.626***	-0.869***	-0.869**	-0.869	-0.474
		(0.204)	(0.202)	(0.401)	(0.894)	(0.885)
Liquidity Ratio		-1.630***	-1.565***	-1.565***	-1.565***	-0.117
		(0.098)	(0.095)	(0.187)	(0.363)	(0.410)
Deposit Base		-0.136	0.187**	0.187	0.187	-0.289
		(0.089)	(0.091)	(0.152)	(0.529)	(0.370)
Credit Risk		-1.564***	-1.501***	-1.501***	-1.501**	-1.406***
		(0.133)	(0.140)	(0.232)	(0.566)	(0.288)
Foreign		0.002	-0.040**	-0.040	-0.040	0.083
		(0.019)	(0.019)	(0.025)	(0.079)	(0.069)
State-owned		0.260***	0.243***	0.243***	0.243***	0.454***
		(0.020)	(0.019)	(0.032)	(0.062)	(0.081)
Branch-level						
Size (log Assets)			0.084***	0.084***	0.084***	-0.084**
			(0.003)	(0.004)	(0.027)	(0.032)
Liquidity Ratio			-0.115	-0.115	-0.115	-0.236
			(0.172)	(0.263)	(0.442)	(0.477)
Deposit Base			0.093***	0.093***	0.093	0.329***
			(0.019)	(0.025)	(0.137)	(0.074)
RoA			2.426***	2.426***	2.426**	-0.343
			(0.194)	(0.238)	(0.964)	(0.691)
Constant	0.279***	0.717***	0.216**	0.216	0.216	
	(0.005)	(0.102)	(0.101)	(0.206)	(0.529)	
Obs.	6632	6632	6632	6632	6632	6632
R-squared	0.007	0.144	0.232	0.232	0.232	0.433

Notes: This table reports the results of estimating Equation (1) for different specifications. In all regressions, the dependent variable is the change in log average outstanding credit between the post- and pre-crisis periods. The pre-crisis period is between January 2007 and August 2008; the post-crisis period is between September 2008 and December 2010. In Columns (2) to (5), the control variables are computed as averages during the post-crisis period. Column (6) reports the results of the control variables entering the model as pre-crisis averages. Standard errors are clustered at the municipality-level in Column (4) and at the parent-bank level in Columns (5) and (6). For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

than our baseline regression on Table 3, Column (1) with municipality fixed-effects. Thus, if anything, the OLS estimation of Equation (1) is underestimating the true effect on credit growth. The positive bias induced by credit demand is in line with the preliminary evidence in Table 2 regarding the similar ex ante profitability of largely affected branches in the pre-crisis period. This result is pertinent to our subsequent discussion of the identification strategy for the real effects of the lending channel (see, Section 4).

A further concern might arise because the preceding results were estimated using the control variables computed as post-crisis period averages. Although all these variables refer to levels, they might capture changing patterns in banks' assets and liability structures that could be correlated with both the foreign funding shock and the credit growth rate. The regression in Column (6) rules out this concern, by replicating our prefered estimation using the control variables computed as pre-crisis period averages. The estimated coefficient for β_1 remains significant reporting the same size as in our baseline regression in Table 3.

Crisis definition. A potential drawback of our identification is that we rely on very specific definitions, both for the crisis period and for the way in which we compute the foreign funding shock. The aim of this section is to check that the baseline results hold when we allow for alternative definitions of the shock and for the crisis period itself.

In Figure 2, we saw that the collapse of Lehman Brothers was associated with a strong divergence in the credit growth trends displayed by banks that were more versus less affected by the shock. These two groups of banks appear to maintain their different growth paths throughout the post-crisis period, such that our baseline results might be driven not by the funding shock itself but rather by an overall shift in banks' capacities to obtain liquidity abroad. Recall that Equation (1) computes the shock as the change in log foreign funding between the averages of the pre- and post-crisis periods. Although unlikely,

the baseline regressions theoretically could be capturing the effects of events occurring after September 2008, which are not related directly to the global financial crisis. This concern is particularly pertinent because we define the post-crisis period as lasting until December 2010, which is the approximate date at which the volume of foreign funding in Brazil returned to its pre-crisis level.

Table A.1 in the Appendix shows that this latter concern did not affect our results though. We alternatively define the shock as the log change in foreign funding between September 2008 and June 2009 and between December 2009 and December 2010 for this analysis. The former window captures the peak-to-trough change in foreign funding, but the latter functions like a placebo test. Comparing the results from Columns (1) and (2) in Table A.1, we find that the foreign funding shock explains credit growth only if computed around September 2008. To avoid the possibility that these results were driven by the arbitrary definition of the months when we computed the shock, we ran regressions in which we defined the shock as the change in log foreign funding from three months before to three months after a given date, to create rolling time windows between January 2008 and January 2010. The estimated coefficients are in Figure A.3 in the Appendix; they show that the positive and significant coefficient from Table A.1, Column (1), emerges only when we define the shock as starting around September 2008. The lending channel we identify thus is strictly related to the foreign funding shock triggered by Lehman's collapse.

We also check the results when we defined the shock as the average 12-month growth rate in log foreign funding during the months between September 2008 and June 2009. This alternative shock definition confirms our main results (see Column (3) in Table A.1). With a falsification test during the pre-crisis period, we also exclude the possibility of the results being driven by pre-crisis diverging trends in credit growth, which already is a rather minor concern according to our analysis in Table 2. For this purpose, we define a

(virtual) crisis between June 2007 and August 2008. The (virtual) pre-crisis period is from January 2007 to May 2007. As expected, the results reported in Table A.1, Column (4), show no significant effects of the virtual shock on credit growth.

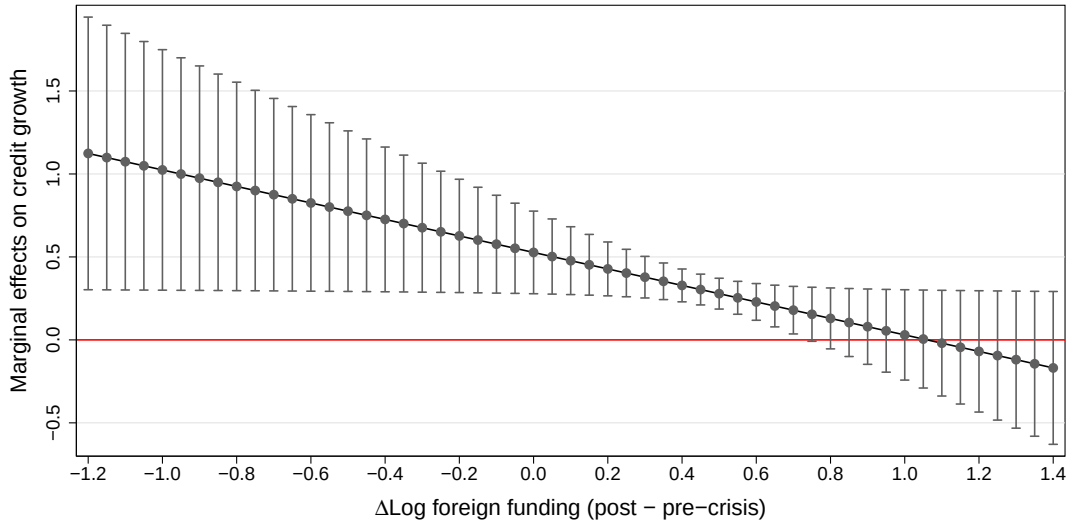
Non-linear effects of the foreign funding shock. Our results might be also be driven by multiple banks reporting a very large increase in both foreign funding and credit after September 2008. Although unlikely, this concern is important, in that the positive coefficient of ΔLog foreign funding in Table 3 cannot explicitly reveal whether the effect stems from negative funding shocks associated with a contraction in lending, as we expect, or from positive funding shocks associated with a large increase in lending. To ensure that the results can be interpreted as driven by large negative funding shocks, we ran a non-linear version of Equation (1), which takes the following form:

$$\begin{aligned} \Delta\text{Log credit}_{ij} = \lambda_j + \beta_1 \Delta\text{Log foreign funding}_i \\ + \beta_2 \Delta\text{Log foreign funding}_i^2 + \sum_{k=3}^{K} \beta_k x_{kij} + \epsilon_{ij}. \end{aligned} \tag{2}$$

With the additional squared term of Δ Log foreign funding, we can estimate the marginal effects of our baseline results along the distribution of foreign funding shocks in the sample. If our hypothesis is true, the coefficient should be positive and statistically significant only on the left-hand side of the distribution of foreign funding growth.

Figure 3, which shows the marginal effects for ΔLog foreign funding coming from Equation (2), provides evidence that the bank lending channel is driven by the bank that experienced a strong negative decrease in foreign funding. For banks reporting an increase in foreign funding, the lending channel is not significant. This result affirms that the main findings from Table 3 can be interpreted in line with our hypothesis, namely, as a signal

Figure 3: Marginal effects on credit growth along the distribution of Δ Log foreign funding.

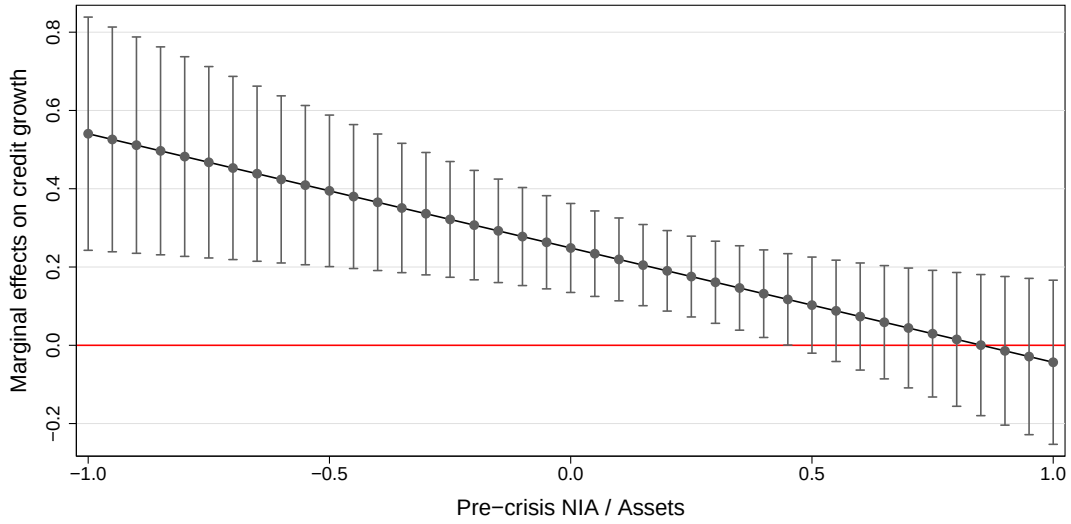


Notes: This figure illustrates the marginal effects at the 95% confidence level from Equation (2). The estimated coefficients of the underlying regression from which marginal effects are retrieved is in Columns (1) and (2) in Table A.2

that the negative foreign funding shocks after September 2008 led to a significant reduction in the supply of credit by Brazilian banks.

Our analysis thus far has relied on the underlying assumption that frictions in internal capital markets between a branch and its parent bank explain the within-country transmission of the shock. Although our regulatory data do not reveal the funding obtained by a branch from its headquarters, we do know, in the aggregate, the volume of interbank credits and deposits held by each branch in its balance sheet. If, as we expect, a branch obtains much of this funding from the same banking conglomerate to which it belongs to, then branches that ex ante dependent more on these funds should experience a stronger adjustment in credit growth. This evidence would suggest that branches that are more dependent on internal funding cannot easily replace their funding sources in the interbank market, so shocks at the headquarter level get transmitted to a greater extent. We test this hypothesis by replicating an alternative to Equation (2), in which ΔLog foreign funding

Figure 4: Marginal effects on credit growth along the distribution of net interbank assets.



Notes: This figure illustrates the marginal effects at the 95% confidence level from an alternative version of Equation (2), in which ΔLog foreign funding interacts with the average pre-crisis ratio of net interbank assets to total assets (NIA). The estimated coefficients of the underlying regression from which marginal effects are retrieved is reported in Columns (7) and (8) in Table A.2.

interacts with the average pre-crisis ratio of net interbank assets to total assets (NIA). A low value of NIA reflects a branch being a net borrower in the interbank market.

Figure 4 reveals the marginal effects of the shock on credit growth along the distribution of net interbank assets to total assets. We find that the positive coefficient on ΔLog foreign funding decreases along the distribution the net interbank assets ratio. Thus, net borrower branches adjust credit growth to a larger extent as a consequence of the collapse of Lehman Brothers, in line with the assumption that internal capital market frictions drive our results. This finding is consistent by previous evidence on the sensitivity of bank branches to the performance of their banking conglomerate (e.g., Houston and James, 1998; Houston, James and Marcus, 1997; Boutina et al., 2013). More generally, Giroud and Mueller (2017) show that business establishments in the United States were sensible to the financial leverage of their firm conglomerates during the global financial crisis. Our results add to this literature by providing evidence on how local internal capital markets

augmented the effect of banks foreign funding shocks during the crisis.

Pre-crisis foreign funding exposure as an instrument for the shock. Our identification strategy and robustness tests address numerous concerns associated with estimating Equation (1), but it could be still argued that ΔLog foreign funding is not sufficiently exogenous to branches' credit growth. For example, strong correlations in credit growth across branches in a given banking conglomerate might lead a bank's headquarters to cut its demand for foreign funding, as a reaction to deterioration of local credit market conditions. In this case, the observed contraction in foreign funding might reflect not only the sudden freeze in global interbank markets after September 2008 but also a weaker demand for these funds, due to an expectation adjustment that occurs locally in Brazil. We consider this a minor concern in our study, in that banks in the sample never fully stop relying on foreign funding, but we still address the potential exogeneity of ΔLog foreign funding with an instrumental variables approach.

Specially, we follow Aiyar (2012) and rely on banks' pre-crisis exposure to foreign funding as an instrument for the shocks' size. The average pre-crisis ratio of foreign funding to total assets for banks' headquarters in the sample is the same variable used in Figure A.1. Reasonably, banks with a greater exposure to foreign funding should be more likely to suffer from greater drops in the growth rate of foreign funding during the crisis, as supported by the preliminary evidence in Figure A.1. In support of the exogeneity of the instrument, because the headquarters' foreign funding ratio is a stock variable realized before the shock occurs, it is unlikely to be determined by future changes in branch-level local lending. We run regressions after first differentiating the data, such that it also becomes unlikely that this ratio would affect local branch lending by channels, beyond the size of the corresponding foreign funding shock itself. These arguments make it plausible

that the pre-crisis ratio of foreign funding is a valid instrument for the size of the shocks during the crisis.

When estimating Equation (1) with the IV approach, we continue to identify the lending channel of foreign funding shocks similarly to the way we have for our previous analysis. The estimation results appear in Table A.3 in the Appendix. Column (1) reports the first stage of the estimation, with ΔLog foreign funding as the dependent variable and the pre-crisis foreign funding ratio as the main explanatory variable. Consistent with our previous discussion, a larger pre-crisis ratio predicts a lower growth rate of foreign funding after September 2008. Column (2) reports the results of the second stage using our preferred FE estimation. The IV estimation confirms the baseline estimated effect of ΔLog foreign funding on ΔLog credit.

Columns (3) and (4) perform a final test in which we replicate the instrumental variable model for the subsample of banking conglomerates whose headquarters report a pre-crisis foreign funding ratio below the 25th percentile of the headquarters' sample distribution. Following Angrist, Lavy and Schlosser (2010), we expect these banks to be "never-takers", in the sense that the model should not be informative about their lending channel because the instrument should not affect the size of their funding shocks. The results confirm this hypothesis. As we expected, the instrument is only informative about the size of shocks and effectively identifies a lending channel for banks with relatively large ex ante exposure to foreign funding.

3.3 Zooming In: The Role of Foreign Banks

Foreign ownership. Table 3 provides evidence that the foreign ownership dummy, identifying banks in Brazil that belong to a FBHC, has no effect on the main finding of the

empirical model, namely, that a positive relationship existed between negative foreign funding shocks and the contraction in credit during the crisis. Foreign ownership is an important aspect of banking globalization, so in this section we seek to provide further insights into the role of foreign banks in affecting the lending channel identified at this stage.

The baseline results suggest that the effect of the funding shocks persists when controlling for foreign ownership, yet the size of this effect might differ, depending on the ownership structure of a bank. In contrast with domestic banks, foreign banks have access to liquidity allocations within the international network of financial institutions to which they belong. During a global financial crisis, such intra-bank capital markets could work either in favor or against the stability of a foreign-owned bank in Brazil. On the one hand, FBHC can provide internal liquidity even if global interbank markets are suffering from distress, compensating for the freeze in traditional interbank funding sources. On the other hand, FBHC affected by the crisis might allocate liquidity from a consolidated perspective. If a foreign bank in Brazil can provide a source of liquidity for other members of its banking network, its own capacity to underpin its core credit business might suffer. The actual role of foreign ownership in shaping the effects of a foreign funding shock is therefore a more complex question that cannot be properly addressed by our baseline results.

As a first step toward analyzing the role of foreign ownership, we extend the baseline model by adding an interaction term between ΔLog foreign funding and foreign ownership. This approach is different from previous studies on the effect of foreign funding exposures on lending, in which foreign ownership and proxies for foreign funding exposure enter the empirical model separately (Ongena, Peydro and van Horen, 2015). We already have shown that the effect of foreign funding shocks is relevant for all banks, so we believe that an interaction model can provide more detailed information about the differential effects

of the shock conditional, on ownership characteristics. Under this setup, Equation (1) is modified to:

$$\begin{aligned}\Delta\text{Log credit}_{ij} = \lambda_j &+ \beta_1 \Delta\text{Log foreign funding}_i \\ &+ \beta_2 \Delta\text{Log foreign funding}_i \times \text{Foreign}_i \\ &+ \sum_{k=3}^{K} \beta_k x_{kij} + \epsilon_{ij}.\end{aligned} \tag{3}$$

With Equation (3) we can retrieve the marginal effect of the foreign funding shock for foreign and domestic banks. In Columns (3) and (4) in Table A.2 we show that the positive coefficient is significantly larger and has greater explanatory power for foreign banks. According to this analysis, on average, the pass-through of foreign funding shocks to lending was more pronounced for foreign banks. Our results confirm that our two dimensions of banking globalization – foreign funding and foreign ownership – relate strongly, and the underlying transmission channel of a foreign liquidity shock arises from their interaction, not solely from their stand-alone effects.

By replacing the foreign ownership dummy by a government ownership dummy, we can also show with Equation (3) whether a differential effect of ΔLog foreign funding on ΔLog credit for the group of government-owned banks exists. This analysis splits the sample between government- and privately owned banks, estimating whether the baseline effect of ΔLog foreign funding varies between the two bank groups. The results from this extension show that this is not the case (see Columns (5) and (6) in Table A.2). This contrasts with findings by Coleman and Feler (2015), where aggregated banks' balance sheets in Brazil at the municipality-level are used to show that municipalities with a larger presence of government-owned banks suffered from lower credit restrictions in the crisis. Our analysis with granular branch-level data shows that even if the regional presence of

government-owned banks could have been beneficial in the aggregate, the specific lending channel of foreign funding shocks was still similarly active for these banks compared to other institutions.

Crisis performance of foreign parent banks. Can the differential effect of the shock for foreign banks be linked to the performance of their FBHC headquartered abroad during the crisis? If the FBHC of a given bank was, for example, exposed to the U.S. subprime mortgage market in the U.S., the Brazilian affiliates of that bank likely would be more affected by a foreign funding shock than its other foreign-owned competitors.

To shed light on this potential heterogeneity in the lending channel, we restrict the sample to foreign-owned banks and add variables that can account for the distinct performance of FBHC after September 2008. From Bureau Van Dijk's BankScope, we obtain yearly information about FBHCs' yearly assets, liquid assets, capital, deposits and net returns. From this data we compute ratios of capital, liquidity, deposits and net returns to total assets for 2008 and 2009. Then we compute the change in these end-of-year ratios between 2008 and 2009 in order to capture the effect of the crisis on FBHCs assets and liabilities' structure, capitalization and profitability. We follow Ongena, Peydro and van Horen (2015) in measuring banks' performances during the crisis with this approach. By construction the aforementioned ratios increase when a FBHC increases its capital, liquidity, deposits or net profit ratios in 2009 compared to 2008. We use hand-collected identifiers of the FBHCs of banks in our sample to merge the FBHC variables with our baseline Brazilian sample. The information to create this identifier comes from banks' own websites and from the the Claessens and Van Horen (2014) Banks Ownership Database.

By merging these data sources, we aim to determine whether the lending channel's primary identification with foreign-owned banks relates to the link between the size of

foreign funding shocks and the performance of FBHC during the crisis. If so, it would provide indirect evidence that an international internal capital markets channel is driving our results. Moreover, it would address the open question about why foreign funding shocks and foreign ownership seem to interact when it comes to identifying the lending channel of foreign funding shocks.

The reduced sample of foreign banks consists of 16 foreign-owned banks with a total network of 545 bank branches. As in our baseline specification, we ensure that at least two foreign-owned banks are active in each municipality and thus can estimate our preferred model with municipality fixed effects, to capture common shocks to all banks within each regional entity. Extending the model in Equation (1), we can account for the interaction between foreign funding shocks and FBHC traits, similar to our previous extensions. Formally,

$$\begin{aligned} \Delta\text{Log credit}_{ij} = \lambda_j &+ \beta_1 \Delta\text{Log foreign funding}_i \\ &+ \beta_2 \Delta\text{Log foreign funding}_i \times \Delta\text{FBHC trait}_i \\ &+ \sum_{k=3}^{K} \beta_k x_{kij} + \epsilon_{ij}. \end{aligned} \tag{4}$$

The variable ΔFBHC trait represents the change in the ratios of capital, liquidity, deposits or net profit ratios to the FBHC between 2008 and 2009. In the Appendix, Table A.4 provides descriptive statistics about the FBHC traits. Mirroring Figure 2 we split the reduced sample by the median shock size to define banks that were more and less affected by the foreign funding shock. Overall, 267 branches belong to shock-affected banks, and 278 branches represent the group of non-affected banks. Replicating Table 2 then we report the difference in the average FBHC-trait between these two groups of banks. FBHC-traits are well distributed across banks differently affected by funding shocks. Tests of normalized

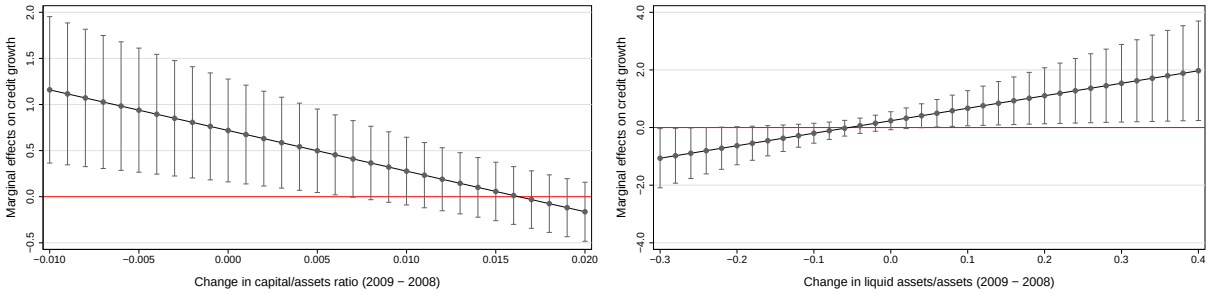
differences show that, if anything, largely affected banks tend to belong to FBHCs that increase their capitalization by more after 2008. We exploit this feature in the data to estimate the differential pass-through of banks with a similar ΔLog foreign funding for different values of ΔFBHC trait.

To explore this hypothesis formally, we estimate Equation (4) and provide results in Table A.5 in the Appendix. Our main variable of interest is the interaction term between ΔFBHC trait and ΔLog foreign funding. The ΔFBHC trait identifies the respective FBHC performance measures at the top of Columns (1) to (4). We add to the vector of controls x_k the log of total assets, the ratios of capital-to-assets, liquidity-to-assets and deposits-to-assets as of 2007, computed at the FBHC level. We expect these variables to capture the effect of the size, the capitalization, and the funding structure of FBHC on their ability to cope with the effects of the crisis.

Bank branches from FBHC that lose relatively more capital and increase their liquidity ratios by more than other FBHC report weaker credit growth as a consequence of the foreign funding shock. We do not find evidence of the effect of the shock being correlated with adjustments in FBHC profitability or funding structures though. This result links our previous findings to an international internal capital market that becomes disrupted after September 2008. In other words, local frictions in internal capital markets between the branches and their headquarters are not the only influences that shape the transmission of the crisis; international frictions in access to foreign funding also explain substantial heterogeneity in the estimated lending channel when compare domestic with foreign banks.

In more detail, Figure 5 depicts the marginal effects of the foreign funding shock on lending growth along the distribution of changes in the capital ratio (upper panel) and in the liquidity ratio (bottom panel). In line with the preceding discussion, the pass-through

Figure 5: Marginal effects by FBHC traits.



Notes: This figure illustrates the marginal effects at the 95% confidence level of Equation (4) estimated for the subsample of foreign-owned banks. The first panel shows the marginal effects of ΔLog foreign funding along the distribution of the change in the capital-assets ratio between 2008 and 2009. The second panel replicates the exercise using the ratio of liquid to total assets. The regression results are reported in Table A.5 in the Appendix.

of the foreign funding shock is more likely to occur if FBHC face a negative capital shock or increase their available liquid assets. In particular, this latter finding could be linked to a cross-border spillover of the liquidity hoarding reaction by banks documented for the global financial crisis by Cornett et al. (2011), Berrospide (2013) and Acharya and Merrouche (2013). Even though we do not observe the counterpart of Brazilian banks' foreign liabilities, the analysis suggests a high sensitivity of the lending channel to the performance of FBHC during the crisis for foreign banks in Brazil. This finding is in line with the hypothesis of the existence of internal capital market frictions between foreign banks and their FBHC abroad.

Overall, our analysis of FBHC suggests some degree of sensitivity of the lending channel to the performance of FBHCs during the crisis, in line with previous findings on the importance of cross-border internal capital markets in emerging countries (e.g., De Haas and van Lelyveld, 2010; Cetorelli and Goldberg, 2011). Our findings depict the lending channel of foreign funding shocks as a complex phenomenon, in which different dimensions of banking globalization – foreign funding, foreign ownership and cross-border internal capital markets – interact to determine the extent of the pass-through of foreign funding

shocks to local credit supply.

U.S. Government bailouts. A final extension of our baseline model involves an analysis of large liquidity injections in the United States after the outbreak of the crisis. In our sample, FBHC are mostly large global banks that had access to the Term Auction Facility (TAF) program than enabled depository institutions in the United States to borrow, once the interbank markets show signs of financial distress. The auctions were conducted between 2008 and 2010 and represented an important alternative source of liquidity for banks facing a sudden freeze in interbank markets. Koetter, Kick and Storz (2015) show that TAF access translated into credit interest rate adjustments by banks in Germany that had an affiliated bank in the United States, but no evidence exists for how TAF access influence lending adjustments by foreign banks in emerging countries. To investigate the potential cross-border spillover of the TAF program, we adjust our baseline specification as follows:

$$\begin{aligned} \Delta\text{Log credit}_{ij} = \lambda_j &+ \beta_1 \Delta\text{Log foreign funding}_i \\ &+ \beta_2 \Delta\text{Log foreign funding}_i \times TAF_i \\ &+ \sum_{k=3}^{K} \beta_k x_{kij} + \epsilon_{ij}, \end{aligned} \tag{5}$$

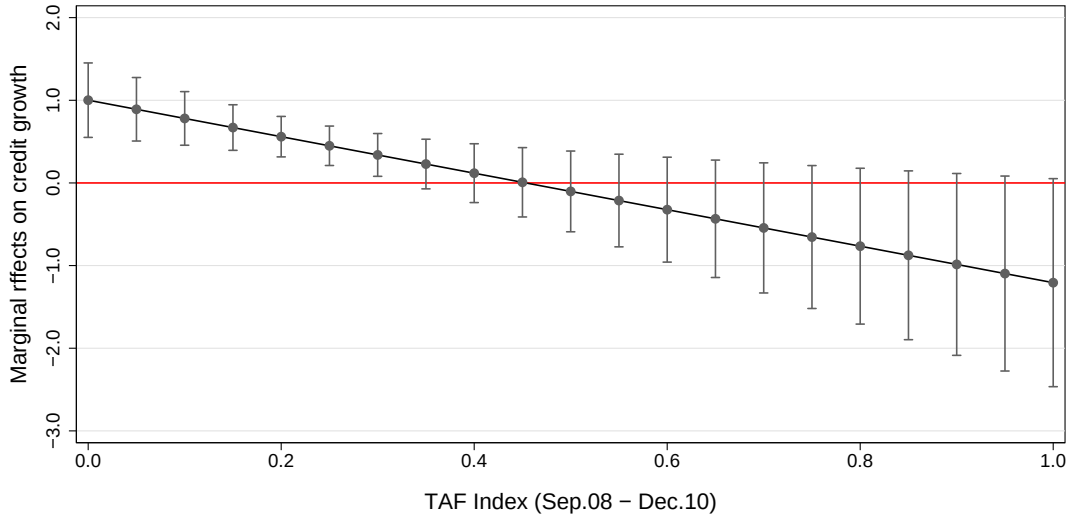
where TAF is an index indicating the extent of access to the TAF program for a given FBHC, weighted by the size of the foreign funding shock of its subsidiary in Brazil. To transform this index into a variable thar is easier to interpret, we first normalize the inverse of the ΔLog foreign funding to generate a continuous variable between 0 and 1, where 1 indicates banks with a relatively large negative foreign funding shock. Next, we collect monthly data about individual access by FBHC to the TAF program from Bloomberg. This source also enables us to compute the average ratio of TAF balances to capital during

the post-crisis period. This latter variable constitutes the TAF ratio. Finally, we divide the TAF ratio by the foreign funding shock index and normalize the statistic to obtain a continuous variable between 0 and 1 that increases when the TAF ratio is larger, relative to the size of the foreign funding shock. The economic intuition behind this index is that it should reflect the extent of the excess liquidity provided by the U.S. Fed, relative to the liquidity shortage at the Brazilian subsidiary level, triggered by the foreign funding shock.

We follow the same approach we used for the FBHC traits to assess whether the lending channel can be identified for a given portion of the distribution of the TAF index. Preliminary results in Table A.4 show that FBHC from more affected foreign banks reported similar TAF ratios in the post-crisis period compared to less affected banks. However, we do find statistically significant differences in the TAF index. On average, more affected banks reported a lower access to TAF liquidity at the FBHC-level relative to the size of their foreign funding shocks.

The formal results of this analysis are reported in Columns (1) to (3) in Table A.6 in the Appendix. As a first test, we report in Column (1) the interaction term between ΔLog foreign funding and the (unweighted) TAF ratio. This interaction enters the model with a negative sign, indicating that the positive coefficient for ΔLog foreign funding decreases and approaches 0 when the TAF ratio increases, that is, when access to the TAF program is relatively large relative FBHC capitalization. We then replicate the exercise by using the average TAF index in Column (2), finding similar results. Since the TAF-access data is reported on a monthly basis, using the average TAF index might fail to properly capture TAF liquidity if a given FBHC only reports relatively large balances in a few months across the post-crisis period. In a final specification we therefore recalculate the index as the maximum post-crisis TAF ratio weighted by the respective shocks' size. Results reported in Column (3) confirm our findings.

Figure 6: Marginal effects of Δ Log foreign funding along the distribution of the TAF Index.



Notes: This figure illustrates the marginal effects at the 95% confidence level of Equation (5) estimated for the subsample of foreign-owned banks. The associated regression results are reported in Table A.5 in the Appendix.

A natural concern with this analysis is the potential correlation between access to TAF liquidity and the financial health of the FBHC. If FBHC self-select into the TAF program when they face larger financial restrictions in the crisis, then TAF access could correlate with ΔLog foreign funding. If the TAF index is not weighted by the shocks' size, this latter concern would lead us to expect the interaction term in Table A.6 to be positive – that is, a stronger lending channel if FBHC report greater access to the TAF. We regard this as a minor concern, because the shock weight in the TAF index allows us to specify the effect of TAF access on the identified lending channel, conditional on the size of the reported funding shock. Moreover, the negative coefficient on the interaction term contradicts the prediction that would stem from this critique.

While still considering our previous results, we also compute the marginal effects of ΔLog foreign funding along the distribution of the TAF index, as reported in Figure 6. The estimated coefficient for the foreign funding shock turns positive and statistically significant

for banks whose FBHC abroad had relatively less access to the TAF program, relative to the shock. In other words, wider access to the TAF program partially offset the negative consequences of foreign funding shocks in Brazilian foreign bank affiliates.

This latter result is important in at least two critical regards. First, it documents, for the first time, that access to liquidity facilities by global banks during the crisis had internal effects on those institutions worldwide. Brazilian banks whose FBHC were able to obtain more resources from the TAF program benefited from having an alternative to compensate for the foreign funding shock. Second, the evidence in Figure 6 shows that countries can benefit from a better coordination of liquidity interventions when financial distress is global. Interventions in one country can affect the worldwide banking network, so countries should coordinate the timing, size, and target of large liquidity interventions to make them more effective as policy tools.

4 Real Effects of the Bank Lending Channel

The most relevant aspect of a bank lending channel is whether it gets transmitted to the real economy or if borrowers can compensate for a shortfall in credit from one affected bank by tapping another, less affected bank. We provide a second set of regressions in which we investigate if and how real outcomes at the municipality level were affected by a shock to the foreign funding position of banks that were active in those regions.

For this purpose, and according to Khwaja and Mian (2008), we include all bank branches that were active in the municipalities from our baseline analysis in Section 3 at each point in time. In doing so, we allow for the possibility that borrowers might offset the lending restriction imposed by shock-affected banks by accessing credit in other banks, even

those without direct exposures to global interbank markets. For this analysis, we aggregate the data at the municipality level by weighting bank traits by the share of each bank in each municipality's credit market.[8] With this data set, we ran the following regression:

$$\Delta\text{Log outcome}_j = \alpha_0 + \alpha_1 \Delta\text{Log foreign funding}_j + \sum_{k=2}^{K} \alpha_k x_j + \epsilon_j, \tag{6}$$

where outcome refers to four real outcome variables on the municipality level j: the total amount of credit (monthly), number of jobs created (monthly), difference between jobs created and terminated (monthly), and real GDP (yearly).

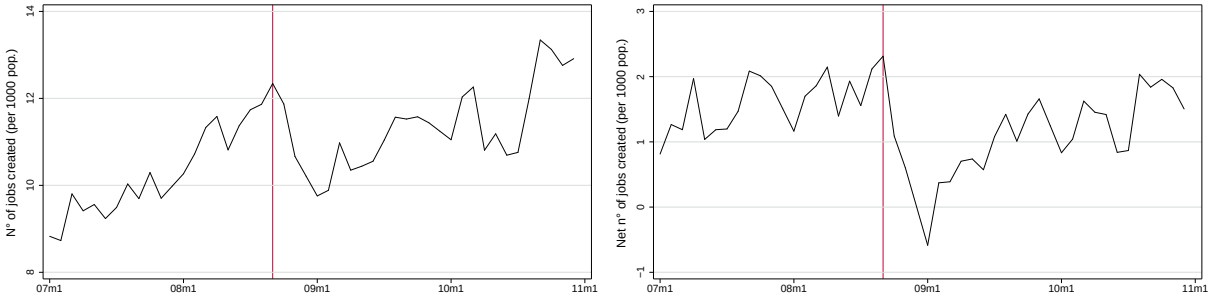
From Equation (6), it becomes clear that the credit demand control described in Equation (1) cannot be implemented in this stage of the analysis. By construction, all variables are aggregated at the municipality level. Recall the correlation between foreign funding shocks and demand shocks that arise from our results, such that we confirmed that an OLS estimation of Equation (1) underestimates the true effect of the lending channel, in that shock-affected banks tend to experience large positive credit demand shocks too. Furthermore, shock-affected banks served more profitable firms in the pre-crisis period, resulting in a larger average profitability of the credit portfolio. Leveraging these previous arguments, we assert that an OLS estimation of Equation (1) provides conservative estimates of the real adjustments triggered by the bank lending channel.

[8] If a bank has missing data related to its foreign funding position, we impose an assumption that the bank experienced a growth in "virtual" foreign funding of 0 between the two periods analyzed. Khwaja and Mian (2008) instead might suggest an assumption in which the banks experience foreign funding growth equal to the sample average, with no variation in the results. We need to retain banks that do not report regularly active positions of foreign liabilities in the sample to obtain conservative estimates of the borrowing channel of financial contagion. If we instead consider only the 41 banks from the baseline sample, we would only allow customers to switch off their funding sources across banks. The final sample including all banks features 100 banks and 11,134 bank branches in the same 1,768 municipalities. This restriction ensures a reasonable and consistent comparison between the two bodies of results provided herein.

To ensure that our analysis of the borrowers' perspective on the foreign funding shock mirrors that from the previous section, we retain the control variables from Equation (1). For example, the virtual deposit ratio of a given municipality is defined as the credit market share-weighted deposit ratio of all bank branches active in that municipality at a given point in time. We again collapse the time dimension to avoid concerns of serial correlation. As municipality-level control variables, we include their size (GDP in log US$ million) and the ratio of total credit to GDP. This latter variable should capture the effects of financial depth and financial dependence on regional economic performance during the crisis. The municipality GDP data are reported by the Brazilian Institute of Geography and Statistics. Aggregated credit can be computed from branch-level data.

As a first step in the analysis, we note that if we expect to observe an effect of the funding shock on local labor markets, we should observe first that borrowers were not able to compensate for the shock by switching their funding sources, even to banks that were not directly exposed to the shock. We test this prediction by estimating the effect of the (market-share weighted) shock on the change in log aggregated outstanding credit in each municipality. The results in Column (1) of Table 5 confirm this condition: Municipalities facing a larger market-weighted shock in their banks experience weaker credit growth, and the result is statistically significant. We thus have initial evidence that borrowers were unable to offset the shock, opening a path for further consequences in local economies. The same data source has been previously used by Carvalho (2014) to investigate the real effects of government-owned banks in Brazil.

Figure 7: Time series of labor market performance in Brazil.



Notes: Aggregated job creation (first panel) and net job creation (second panel) per 1000 population in Brazilian municipalities. The underlying time series report the number of working contracts officially signed in a given municipality per month, as well as the number of working contracts terminated during the same period. Net job creation is computed by subtracting the terminated contracts from the number of new contracts. The graph shows the disruption in local labor markets triggered by the global financial crisis in September 2008 (vertical line).

4.1 Lending Channel and Labor Market Outcomes

We can trace the foreign funding shock to a regional level and investigate its effects on real outcomes, such as job creation in each municipality in each month. We collected relevant data from the website of the Brazilian Ministry of Labor, which reports these statistics under the General Survey of Employed and Unemployed (Cadastro-Geral de Empregados e Desempregados). The Brazilian government uses these official statistics to assess developments in the labor market. Firms must report all new labor contracts and terminated contracts at the end of each month. The results are made publicly available, aggregated to the municipality level. The measures only cover the official labor market, so we cannot observe trends in the informal labor markets. The Ministry of Labor also conducts studies of the real coverage of the labor statistics and has concluded that they represent approximately 73% of total hiring and firing per month. We cannot confirm this evaluation, but relying on data from the official labor market provides a reasonable context to understand the relationship between credit and labor markets, because informal and less institutionalized firms likely are excluded from formal credit markets anyway.

Table 5: Real effects of the lending channel.

		Unweighted		Per 1000 population		
	Agg. ΔCredit	ΔJob Creation	ΔNet Job Creation	ΔJob Creation	ΔNet Job Creation	ΔGDP 08-09
	(1)	(2)	(3)	(4)	(5)	(6)
ΔLog foreign funding	0.580***	0.461**	0.917***	0.364***	0.567***	0.157*
	(0.168)	(0.197)	(0.287)	(0.133)	(0.198)	(0.081)
Headquarter-level						
Size (log Assets)	-0.004	-0.102***	-0.087*	-0.060**	-0.049	-0.003
	(0.029)	(0.032)	(0.052)	(0.024)	(0.039)	(0.015)
Capital Ratio	0.028	3.920***	2.907*	2.044**	2.464*	0.838*
	(0.979)	(1.211)	(1.765)	(0.827)	(1.266)	(0.500)
Liquidity Ratio	-1.606	-2.769***	-4.908***	-1.934***	-4.231***	-1.083**
	(1.073)	(0.935)	(1.751)	(0.713)	(1.443)	(0.532)
Deposit Base	0.847	1.681***	1.800*	1.362***	2.308***	-0.067
	(0.566)	(0.625)	(1.030)	(0.491)	(0.833)	(0.323)
Credit Risk	-5.219**	3.946**	4.248	1.907	2.230	3.980***
	(2.057)	(1.812)	(3.242)	(1.377)	(2.492)	(0.976)
Foreign	-0.396*	-0.454*	-0.852**	-0.387**	-0.929***	-0.348***
	(0.231)	(0.244)	(0.400)	(0.187)	(0.306)	(0.120)
State-owned	0.518*	-0.111	-0.049	-0.116	-0.326	-0.473***
	(0.303)	(0.274)	(0.480)	(0.215)	(0.385)	(0.147)
Branch-level						
Size (log Assets)	-0.005	0.005	-0.003	-0.003	-0.018	-0.027***
	(0.018)	(0.019)	(0.030)	(0.015)	(0.024)	(0.009)
Liquidity Ratio	9.653***	17.683***	18.416***	6.011***	6.686**	0.617
	(2.470)	(3.488)	(5.382)	(2.023)	(3.266)	(1.471)
Deposit Base	0.649***	0.279	0.449	0.198	0.115	-0.059
	(0.168)	(0.222)	(0.322)	(0.158)	(0.237)	(0.094)
RoA	-4.492*	-8.336**	-12.042**	-4.051	-4.867	-1.926
	(2.649)	(3.693)	(5.190)	(2.582)	(3.757)	(1.381)
Municipality-level						
Size (GDP)	0.049***	0.031**	0.034	0.030***	0.024	0.029***
	(0.014)	(0.014)	(0.020)	(0.012)	(0.018)	(0.006)
Credit/GDP Ratio	-0.012***	0.008	-0.008	0.010*	0.012*	-0.006**
	(0.004)	(0.006)	(0.007)	(0.005)	(0.007)	(0.003)
Constant	0.297***	-0.101*	-0.072	-0.095**	-0.132	0.157***
	(0.050)	(0.059)	(0.105)	(0.047)	(0.082)	(0.034)
Obs.	1768	1768	1768	1768	1768	1768
R-squared	0.185	0.077	0.042	0.048	0.027	0.053

Notes: This table reports the results of estimating Equation (6) for different real economic outcomes at the municipality-level. The sample includes the 42 banks of the baseline sample plus all other active banks not relying on foreign funding during the sample period. This makes an overall sample of 100 banks and 11,134 bank branches. This data set is aggregated at the municipality-level. The pre-crisis period is defined between January 2007 and August 2008, whereas the post-crisis period is defined between September 2008 and December 2010. Standard errors are clustered at the municipality-level. The real outputs considered are the change in log aggregated outstanding credits (Column (1)), the change in the log number of new contracts ("job creation", Column (2)), the change in the log number of new contracts minus terminated contracts ("net job creation", Column (3)), the change in log job creation per 1000 inhabitants (Column (4)), the change in log net job creation per 1000 inhabitants (Column (5)), and the change in log GDP between 2008 and 2009 (Column (6)). For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

We construct two measures for labor market outcomes: the change in the log of the average jobs created in the post-crisis period minus the average in the pre-crisis period, or "job creation", and the net number of jobs created (number of jobs created minus number of jobs destroyed) in each region, or "net job creation". The absolute number of jobs created relates directly to the size of each municipality, so we add regressions in which the measures of job creation are weighted by the municipalities' population and reported in terms of jobs created per 1000 inhabitants. The time series of these variables are plotted in Figure 7, which shows large disruptions in job creation (first panel) and net job creation (second panel), coinciding with the outbreak of the global financial crisis.

The results of estimating Equation (6) are reported in Columns (1) to (6) in Table 5. Column (1) reports the aforementioned effect on aggregated credit growth. The baseline results on labor market performance in Columns (2) and (3) show a significant effect with the expected positive sign of the funding shock on job creation and net job creation. We anticipate that these results might be affected by heterogeneity in municipalities' size, so we weighted the outcome measures by the municipalities' population, obtained from the yearly statistics of the Brazilian Institute of Geography and Statistics. This extension, reported in Columns (4) and (5), confirms the effect of the lending channel of foreign funding shocks on labor market outcomes. The results for the population-weighted net job creation, which reflects more economically meaningful results, show that a 1% decrease in market-share weighted foreign funding growth translates into a 0.57% lower growth rate in net job creation in the post-crisis period.

Column (6) further shows that the economic fragility triggered by the funding shock is not restricted to the job market in particular; GDP (change in log GDP between 2008 and 2009) is also weaker as a consequence of the funding shock. A cross-border lending channel like the one identified in Section 3 thus is by no means innocuous. When borrowers

fail to access alternative funding sources to substitute for their reliance on affected banks, the lending channel can have significant effects on the real economy.[9]

4.2 Are Regions Equally Vulnerable?

As was the case at the bank level, different municipalities might vary in their adjustment to the funding shock. Several vulnerabilities might come into play; one that deserves attention is the fragility arising from a large procyclicality of credit (Borio et al., 2001). If our results regarding the real economic consequences of the lending channel are correct, we expect the results to be associated with more structural underlying fragility in the financial sectors of the individual municipalities. Substantial procyclicality has been associated with information asymmetries and moral hazard faced by financial institutions. If the current risk of a borrower cannot be assessed effectively, this uncertainty will lead banks to overreact in times of both booms and crisis. Evidence that our results are driven by municipalities for which this particular fragility is historically stronger would help confirm that the effect of the funding shock is transmitted to the real economy when banks operate under higher degrees of uncertainty. Moreover, it would have important policy implications; instead of a foreign funding shock stemming exogenously from abroad, the local procyclicality of credit can be addressed by local macroprudential policies.

For a more widespread analysis of regional ex-ante vulnerabilities, we address the role of other characteristics that have been identified in prior literature as affecting the

[9]For robustness, we check our results by employing the pre-crisis exposure to foreign funding as an instrument for the shocks' size as in Section 3.2, when we consider the bank lending channel on the branch level. We report first and second stage results and results for the reduced form in Figure A.4. The top panel shows that the instrument is relevant for ΔLog foreign funding and that the second stage results remain significant for the different dependent variable we use in Table 5. The bottom panel reports regressions for the subsample of municipalities with a foreign funding ratio below the 25th percentile of the sample distribution. Here, the first stage results and the reduced form regressions are insignificant providing evidence for the exclusion restriction of our instrument.

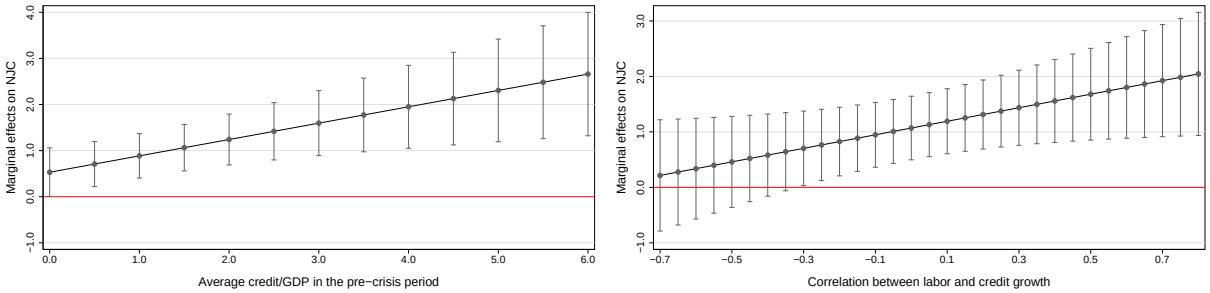
transmission of financial shocks to the real sector. To do so, we augment Equation 6, as follows:

$$\begin{aligned}\Delta\text{Log outcome}_j = \alpha_0 &+ \alpha_1 \Delta\text{Log foreign funding}_j \\ &+ \alpha_2 \Delta\text{Log foreign funding}_j \times MP_j \\ &+ \sum_{k=3}^{K} \alpha_k x_j + \epsilon_j,\end{aligned} \tag{7}$$

and we test four interacting variables separately, represented by MP. First, we interact the shock with our measure of the credit-to-GDP ratio. Following Rajan and Zingales (1998), we expect the pass-through of the funding shock to be stronger in financially dependent municipalities. Second, we interact the shock with the municipalities' size, measured as the log of GDP. Khwaja and Mian (2008) find that smaller firms are more likely to be affected by financial shocks. We test whether a similar conclusion exists at the regional level, such that smaller municipalities have more trouble offsetting the size of the funding shock. Finally, we determine whether we can replicate our results regarding the role of foreign banks from Section 3 in this analysis of real economic outcomes. Accordingly, we interact the funding shock with foreign banks market shares in each municipality.

For this final exercise, we estimate Equation (7). The interacting variables correspond to the credit-to-GDP ratio, log GDP, average market share of foreign banks, and the average historical correlation (2005-2008) between the month-on-month change in log aggregated credit and the month-on-month change in log net job creation in the municipalities in the sample. We therefore rely on the earliest observations available for credit and job market credit, dating back to 2005. We compute these variabes in the pre-crisis period in order to avoid double-causality concerns. The dependent variable is the change in net job creation per 1000 population (see Table 5, Column (5)).

Figure 8: Marginal effects of municipalities' ex-ante vulnerabilities.



Notes: This figure illustrates the marginal effects at the 95% confidence level of Equation (7). In the first panel the marginal effects are retrieved from a regression with an interaction of Δ Log foreign funding and $Credit/GDP_j$ which represents the pre-crisis average of the ratio of total credit to GDP in each municipality j. In the second panel the marginal effects are obtained from an interaction with $Corr(\Delta Credit, \Delta NJC)_j$ which corresponds to the average historical correlation (2005-2008) between the month-month change in Log aggregated credit and the month-month change in Log net job creation per 1000 inhabitants in the municipalities in the sample. The estimates come from Table A.7 in the Appendix.

In Table A.7 in the Appendix, the vulnerability measures correspond to one of the aforementioned variables related to the expected characteristics of municipalities that might affect the pass-through of the foreign funding shock. In line with predictions, this pass-through is stronger when municipalities report a large credit-to-GDP ratio, a large market share of foreign banks, and a large procyclicality of credit growth. We do not find evidence of a differential pass-trough of the lending channel for small vs. large municipalities.

The marginal effect of the funding shock on net job creation along the distributions of credit-to-GDP ratio (top panel) and credit versus job market correlation (bottom panel) are depicted in Figure 8. The results confirm our conjecture that the effects are driven by municipalities with substantial financial dependence, as measured by the credit-to-GDP ratio and historically large procyclical banking sectors.

5 Conclusion

We document how the turbulence of international interbank markets after the collapse of Lehman Brothers affected the Brazilian financial system. Using an identification setup similar to Khwaja and Mian (2008), we find robust evidence of a bank-branch lending channel, such that local municipal branches associated with parent banks that suffered decrease of foreign interbank funding after September 2008 significantly reduced their credit. The pass-through of the foreign funding shock to local credit markets was particular pronounced for foreign-owned banks, evidently because foreign banks were particularly sensitive to the financial performance of their bank holding companies abroad. Moreover, we document spillover effects of access to the TAF program during the crisis; bank affiliates in Brazil whose parent banks reported greater access this program were less affected by the foreign funding shock.

The results regarding the existence of a bank lending channel corroborate findings by Khwaja and Mian (2008), Schnabl (2012), and Ongena, Peydro and van Horen (2015). Extending those studies, our results shed light on the specific role played by foreign banks in shaping the cross-border transmission of shocks by explicitly observing banks' activity in foreign interbank markets during the crisis. Moreover, our analysis of a lending channel within the network of regional bank branches in a large emerging country provides new insights on how a shock can be transmitted through retail banking networks to the real economy. Brazilian municipalities that hosted more affected branches saw a decline in job creation and GDP after the Lehman Brothers collapse of 2008.

Our results thus suggest that a funding shock generated abroad can be transmitted through banks' branch network across borders and thereby affect regional economic outcomes. This result in turn suggests effective ways to achieve a better balance between the

benefits and risks of banking globalization.

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A Appendix

This Appendix is for Online Publication and provides further details on the data and results of the article.

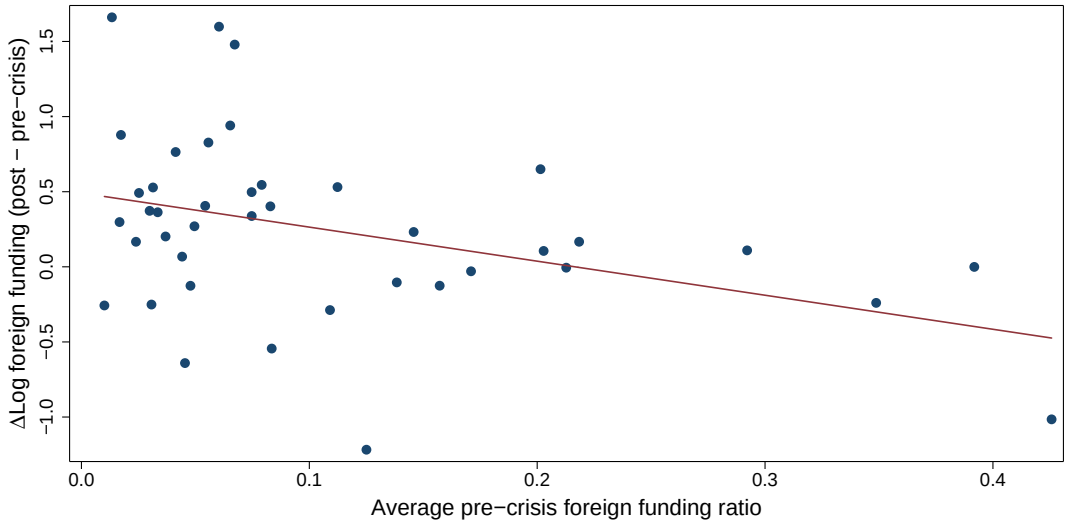
B Data Construction

Bank-level data were retrieved from banks' call reports, collected and published by regulatory authorities in Brazil. This data set consists of information on banks' balance sheets and income statements on a monthly basis, reported in local currency. The data were downloaded from the website of the Brazilian Central Bank at different moments between 2014 and 2015. After downloading the information, the data were adjusted, translated, and labeled to ensure their consistency. Mandatory reporting by banks ensures comprehensive coverage of all financial institutions with a banking license in Brazil. Non-bank financial institutions without a banking license are not included in the call reports.

To account for valuation effects and facilitate interpretations, we converted the data from the nominal local currency to real U.S. millions of dollars as of December 2013, by collecting end-of-month data on the respective exchange rates from the website of the Federal Reserve Bank of St. Louis. From the same source, we obtained end-of-month U.S. inflation data, which we used to compute a dollar deflator, for which the 100% level is set at December 2013. The original data also were extended by including information on banks' ownership status, collected mainly from the banks' websites and from Claessens and Van Horen's (2014) Banks Ownership Database.

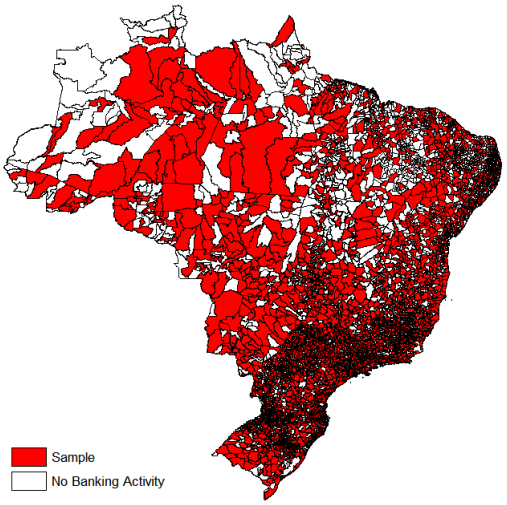
C Figures and tables

Figure A.1: Change in foreign funding vs. pre-crisis exposure to foreign funding.



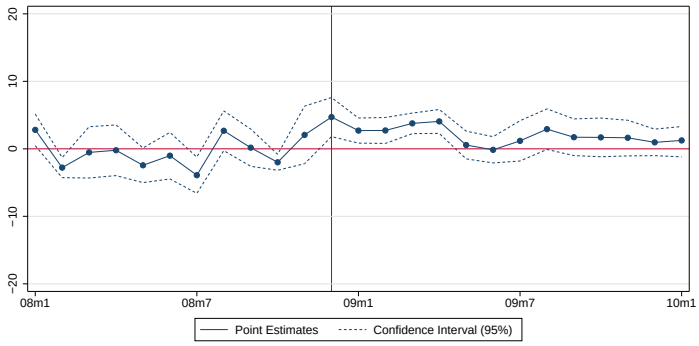
Notes: This figure illustrates the relationship between the change in log foreign funding between the pre- and post-crisis periods and the pre-crisis ratio of foreign funding to total assets for the banks in the sample. The change in foreign funding is computed as the log difference of average foreign funding in the periods between January 2007-August 2008 and September 2008-December 2010. The pre-crisis ratio is the average monthly ratio reported in the sample. The negative relationship between the two variables is statistically significant at the 1% level.

Figure A.2: Geographical distribution of the sample.



Notes: This figure depicts the geographical distribution of the baseline sample. Regions in red represent municipalities reporting banking activity through local bank branches between 2007 and 2010. The regions in white are those in which no banking activity is reported. For each municipality in the sample, the monthly call reports of all individual active branches were collected. Overall, banks report being active in 3,242 of 5,570 municipalities in Brazil. This corresponds to 58% of total municipalities, or 87% of Brazilian GDP in 2008.

Figure A.3: Alternative definitions of the crisis period.



Notes: This figure illustrates the estimated coefficients when running the regression from Table A.1, Column (1), for multiple, alternative time windows. Each coefficient represents a point estimate with their respective confidence intervals for regressions; the shock is defined as the change in log foreign liabilities between three months before and three months after each date. The vertical line represents December 2008, capturing the effect of the change in foreign liabilities between September 2008 and March 2009.

Table A.1: Alternative shock definitions ans placebo tests.

	(1) Shock Def. Δ 9m6-8m9	(2) Shock Def. Δ 10m12-9m12	(3) Shock Def. Av.%Δ 8m9-9m6	(4) Shock Def. Crisis 07m6-08m8
ΔLog foreign funding	3.061**	-0.305	2.550*	-0.036
	(1.564)	(0.793)	(1.411)	(0.091)
Headquarter-level				
Size (log Assets)	0.026	0.051	0.022	-0.010
	(0.023)	(0.032)	(0.024)	(0.014)
Capital Ratio	0.751	0.258	0.610	0.161
	(1.425)	(1.804)	(1.468)	(0.536)
Liquidity Ratio	-0.523	-0.829**	-0.575	0.038
	(0.359)	(0.393)	(0.358)	(0.227)
Deposit Base	0.729	0.239	0.798	0.110
	(0.727)	(0.736)	(0.825)	(0.209)
Credit Risk	-1.908***	-1.812**	-1.772***	0.348
	(0.626)	(0.734)	(0.651)	(0.223)
Foreign	-0.058	-0.068	-0.037	0.042
	(0.092)	(0.125)	(0.090)	(0.034)
State-owned	0.354***	0.371***	0.328***	-0.007
	(0.078)	(0.088)	(0.085)	(0.033)
Branch-level				
Size (log Assets)	0.026	0.034	0.028	-0.005
	(0.028)	(0.027)	(0.029)	(0.013)
Liquidity Ratio	-0.347	-0.328	-0.354	-0.423**
	(0.710)	(0.711)	(0.716)	(0.200)
Deposit Base	-0.017	0.022	-0.006	0.094*
	(0.082)	(0.094)	(0.083)	(0.052)
RoA	3.350***	3.876***	3.330***	0.878**
	(1.107)	(1.032)	(1.148)	(0.391)
Obs.	6632	6632	6632	6632
R-squared	0.394	0.375	0.391	0.250

Notes: This table reports the results of estimating Equation (1) by changing the definition of the foreign funding shock. Column (1) reports the results of defining the shock as the change in log foreign liabilities during the peak-to-trough period within the crisis (September 2008 to June 2009). Column (2) tests the alternative hypothesis of the shock being driven by changes in foreign liabilities during the post-crisis period (December 2009 to December 2010). The regression reported in Column (3) defines the funding shock as the average 12-month growth rate in foreign liabilities during the peak of the crisis. Column (4) reports the result of changing the crisis period to generate a falsification test. The (virtual) crisis is set between June 2007 and August 2008, and the pre-crisis period is defined between January 2007 and July 2007. All regressions include regional fixed effects; standard errors are clustered at the bank headquarter level. For a detailed definition of all variables, see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A.2: Interaction models.

	Quadratic Regresssion		Foreign Ownership		State Ownership		Net Interbank Assets	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLog foreign funding	-0.249**	-0.363***	-0.000	0.003***	-0.023	0.110	-0.338**	-0.332**
X Bank trait	(0.121)	(0.126)	(0.001)	(0.001)	(0.091)	(0.105)	(0.153)	(0.138)
ΔLog foreign funding	0.528***	0.523***	0.004***	0.002***	0.350***	0.289***	0.294***	0.210***
	(0.124)	(0.121)	(0.000)	(0.000)	(0.034)	(0.029)	(0.058)	(0.076)
Bank trait			0.039*	0.050**	0.258***	0.444***	-0.311***	-0.265**
			(0.021)	(0.020)	(0.022)	(0.019)	(0.104)	(0.102)
Headquarter-level								
Size (log Assets)	-0.025	0.064**	-0.016*	0.071***	-0.017*	0.071***	-0.001	0.074**
	(0.016)	(0.032)	(0.009)	(0.008)	(0.010)	(0.009)	(0.019)	(0.034)
Capital Ratio	-1.656***	-0.893	-1.336***	-0.273	-1.311***	-0.522**	-0.986*	-0.190
	(0.534)	(0.637)	(0.332)	(0.226)	(0.310)	(0.225)	(0.544)	(0.667)
Liquidity Ratio	-0.920**	-0.416	-0.677***	0.200	-0.615***	-0.299	-0.531	-0.019
	(0.352)	(0.404)	(0.173)	(0.147)	(0.205)	(0.205)	(0.338)	(0.433)
Deposit Base	-0.343	-0.176	-0.418***	-0.030	-0.403***	-0.265***	-0.425*	-0.248
	(0.271)	(0.316)	(0.138)	(0.128)	(0.125)	(0.097)	(0.233)	(0.339)
Credit Risk	-1.680***	-2.126***	-1.214***	-1.250***	-1.143***	-1.673***	-1.394***	-1.673***
	(0.331)	(0.395)	(0.140)	(0.118)	(0.308)	(0.295)	(0.207)	(0.295)
Foreign	0.255***	0.471***			0.041	0.061**	0.169***	0.368***
	(0.046)	(0.076)			(0.027)	(0.029)	(0.059)	(0.090)
State-owned	-0.014	0.016	0.256***	0.458***			-0.068	-0.016
	(0.051)	(0.053)	(0.025)	(0.018)			(0.059)	(0.076)
Branch-level								
Size (log Assets)	0.046*	-0.090**	0.043***	-0.090***	0.043***	-0.085***	0.047**	-0.061*
	(0.027)	(0.034)	(0.005)	(0.012)	(0.005)	(0.012)	(0.021)	(0.032)
Liquidity Ratio	0.587	-0.177	0.448*	-0.249	0.445*	-0.205	0.834**	0.102
	(0.363)	(0.491)	(0.265)	(0.221)	(0.255)	(0.233)	(0.362)	(0.445)
Deposit Base	0.315***	0.296***	0.335***	0.312***	0.334***	0.331***	0.731***	0.654***
	(0.063)	(0.068)	(0.025)	(0.032)	(0.024)	(0.029)	(0.110)	(0.129)
RoA	-0.211	-0.165	-0.238	-0.376	-0.232	-0.427*	-0.807*	-0.388
	(0.627)	(0.507)	(0.223)	(0.257)	(0.217)	(0.248)	(0.452)	(0.778)
Constant	0.768**		0.547***		0.521***		0.062	
	(0.345)		(0.186)		(0.164)		(0.386)	
Obs.	6632	6632	6632	6632	6632	6632	6632	6632
R-squared	0.196	0.447	0.188	0.435	0.188	0.433	0.272	0.479

Notes: This table reports regression results variants of Equation (1) in which ΔLog foreign funding is interacted with other bank traits. Columns (1) and (2) report the results of a quadratic regression in which ΔLog foreign funding enters the model as a quadratic term. Columns (3) and (4) report a regression in ΔLog foreign funding is interacted with the foreign ownership dummy, whereas Columns (5) and (6) replicate this exercise using a government ownership dummy. Columns (7) and (8) report regressions in which the average pre-crisis ratio of net interbank assets to total assets at the branch-level is used as an interaction variable. While regressions are reported as either OLS or FE estimation, standard errors are clustered at the headquarter-level. For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A.3: Instrumental variable model.

	Full Sample		< 25th percentile	
	First stage	IV FE	First stage	Reduced Form
	(1)	(2)	(3)	(4)
ΔLog foreign funding		0.127***		
		(0.046)		
Foreign funding / Assets	-6.088***		-18.517	9.941
	(2.005)		(11.993)	(8.563)
Headquarter-level				
Size (log Assets)	0.032	0.044***	-0.025	0.141***
	(0.042)	(0.008)	(0.052)	(0.044)
Capital Ratio	3.040	-0.028	10.479***	-2.491
	(2.773)	(0.393)	(1.971)	(1.788)
Liquidity Ratio	3.546***	-1.154***	1.290***	0.791
	(0.771)	(0.179)	(0.287)	(0.606)
Deposit Base	-0.804	0.309**	-3.750	1.286
	(1.166)	(0.153)	(2.414)	(1.463)
Credit Risk	1.886	-1.723***	-0.144	-1.679*
	(1.409)	(0.178)	(0.960)	(0.888)
Foreign	0.195	-0.067**		
	(0.244)	(0.026)		
State-owned	-0.018	0.338***	-0.239**	0.355***
	(0.205)	(0.021)	(0.110)	(0.079)
Branch-level				
Size (log Assets)	-0.014	0.037***	0.025	0.096***
	(0.016)	(0.006)	(0.021)	(0.017)
Liquidity Ratio	-0.983	-0.163	0.084	-1.821***
	(0.642)	(0.216)	(0.667)	(0.564)
Deposit Base	0.048	0.026	0.003	-0.365***
	(0.101)	(0.034)	(0.010)	(0.130)
RoA	3.818***	3.440***	0.998***	1.777**
	(1.012)	(0.290)	(0.339)	(0.895)
Obs.	6632	6632	1878	1878
R-squared	0.722	0.396	0.983	0.593

Notes: This table reports the results of estimating Equation (1) using an instrumental variables (IV) model. Banks' average pre-crisis foreign funding to total assets ratios are used as instruments of ΔLog foreign funding. Column (1) reports the first stage of the IV model, whereas Column (2) reports the second stage of the estimation when using the FE specification. All further regressors of the structural equation are used when estimating the predicted value of ΔLog foreign funding. Columns (3) and (4) replicate the analysis for the subsample of banks reporting a foreign funding ratio below the 25th percentile of the headquarter-banks distribution. In all regressions standard errors are clustered at the headquarter-level. For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A.4: FBHC traits by shocks' size.

	Mean	sd	Min	Max	Shock size Yes	Shock size No	Diff.
ΔCapital Ratio	0.0091	0.0149	-0.0119	0.0255	0.0132	0.0049	0.0083*
ΔLiquid Assets Ratio	0.0102	0.0379	-0.0311	0.0500	0.0120	0.0085	0.0035
ΔDeposits Ratio	0.0149	0.0372	-0.0542	0.0698	0.0187	0.0106	0.0081
ΔRoA	0.0037	0.0084	-0.0027	0.0330	0.0027	0.0048	-0.0021
TAF Ratio	0.3162	0.5648	0.0000	1.7182	0.2908	0.3417	-0.0510
TAF Index	0.1967	0.3232	0.0000	1.0000	0.1217	0.2825	-0.1608*

Notes: This table reports descriptive statistics fro variable at the level of FBHCs. It further reports the means and differences in means for each variable for the subsamples of banks affected and not by the funding shock. The sample consists of the 16 foreign-owned banks observed in the baseline sample. Variables in changes are computed as first-differences between 2009 and 2008 (end of year). Banks affected by large shocks are those reporting a change in Log foreign liabilities between the pre- and post-crisis periods below the sample median. * denotes statistical significance by normalized differences (Imbens and Wooldridge, 2009). Variables are winsorized at the 1st and 99th percentiles.

Table A.5: The effect of FBHCs' performance.

	ΔCapital Ratio (1)	ΔLiquid Assets Ratio (2)	ΔDeposits Ratio (3)	ΔRoA (4)
ΔLog foreign funding	-44.079***	5.157*	4.265	-52.398
X FBHC trait	(16.290)	(3.078)	(5.721)	(43.592)
ΔFBHC trait	-2.931	0.549	2.589	-29.925
	(5.300)	(3.479)	(3.128)	(18.822)
ΔLog foreign funding	0.718**	0.160	0.215**	0.478***
	(0.339)	(0.215)	(0.109)	(0.134)
FBHC-level				
Size (log Assets)	-0.023	-0.010	-0.070	-0.056
	(0.036)	(0.016)	(0.044)	(0.048)
Capital Ratio	0.463	0.517	-2.314	23.640***
	(7.562)	(7.719)	(7.835)	(8.933)
Liquidity Ratio	0.937	-0.351	3.274***	4.385*
	(0.655)	(0.824)	(1.105)	(2.482)
Deposit Base	1.672	5.629	-0.421	-13.958***
	(5.801)	(9.450)	(5.391)	(4.428)
Headquarter-level				
Size (log Assets)	-0.098	-0.005	0.098	-0.252**
	(0.098)	(0.073)	(0.136)	(0.127)
Capital Ratio	0.157	-2.813	-0.026	3.176
	(2.236)	(2.710)	(1.940)	(3.117)
Liquidity Ratio	-0.628	0.634	-0.391	3.766*
	(1.646)	(2.464)	(1.799)	(2.007)
Deposit Base	0.782	-0.791	-0.426	1.457
	(0.777)	(0.739)	(0.671)	(1.083)
Credit Risk	-0.968	-1.503	-2.425**	-0.107
	(1.033)	(0.972)	(1.035)	(1.127)
Branch-level				
Size (log Assets)	0.111***	0.115**	0.115***	0.116***
	(0.040)	(0.048)	(0.042)	(0.044)
Liquidity Ratio	2.687	2.627	2.314	3.000*
	(1.840)	(1.847)	(1.911)	(1.730)
Deposit Base	-0.105	-0.135	-0.133	-0.096
	(0.188)	(0.175)	(0.175)	(0.188)
RoA	7.529***	7.276***	7.766***	7.620***
	(1.671)	(1.763)	(1.659)	(1.725)
Obs.	545	545	544	545
R-squared	0.675	0.676	0.681	0.676

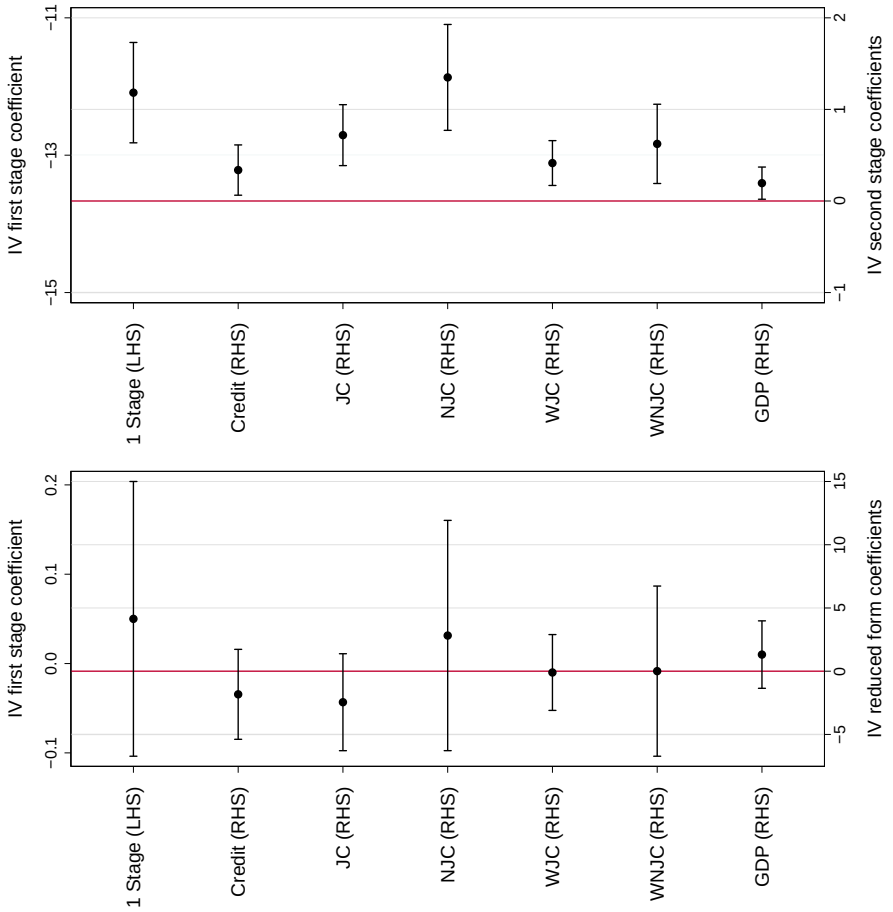
Notes: This table reports the results of estimating Equation (4) for different measures of FBHCs performance around the crisis. As interaction terms with ΔLog foreign funding we use the change in the capital-asset ratio (Column (1)), the change in the ratio of liquid to total assets (Column (2)), the change in the ratio of deposits to total assets (Column (3)) and the change in the ratio of net returns to total assets (Column (4)). All regressions include regional fixed effects, standard errors are clustered at the headquarter-bank level. For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A.6: The effect of FBHCs' TAF access.

	TAF Ratio (1)	Av. TAF Index (2)	Max. TAF Index (3)
ΔLog foreign funding	-0.788**	-2.208**	-1.346**
X FBHC trait	(0.339)	(0.984)	(0.683)
ΔFBHC trait	-0.167	-1.064**	-0.660**
	(0.144)	(0.418)	(0.265)
ΔLog foreign funding	0.272***	1.001***	0.762***
	(0.088)	(0.274)	(0.202)
FBHC-level			
Size (log Assets)	-0.031	-0.018	-0.006
	(0.033)	(0.024)	(0.020)
Capital Ratio	10.806*	21.631***	11.700**
	(6.013)	(5.065)	(5.046)
Liquidity Ratio	2.200**	2.572***	1.023**
	(0.936)	(0.916)	(0.397)
Deposit Base	-6.286*	-12.257***	-4.613
	(3.242)	(1.760)	(3.216)
Headquarter-level			
Size (log Assets)	-0.064	-0.389***	-0.269***
	(0.089)	(0.111)	(0.063)
Capital Ratio	2.515	-0.593	-2.421
	(2.211)	(1.735)	(1.671)
Liquidity Ratio	2.135	2.565	0.883
	(1.651)	(1.838)	(1.719)
Deposit Base	0.689	0.672	-0.065
	(0.524)	(0.567)	(0.524)
Credit Risk	-0.744	-2.877***	-3.382***
	(0.732)	(0.825)	(0.888)
Branch-level			
Size (log Assets)	0.113***	0.119***	0.119***
	(0.043)	(0.040)	(0.040)
Liquidity Ratio	3.026*	2.677	2.672
	(1.700)	(1.934)	(1.939)
Deposit Base	-0.098	-0.146	-0.147
	(0.186)	(0.181)	(0.181)
RoA	7.596***	7.523***	7.447***
	(1.706)	(1.702)	(1.714)
Obs.	545	545	545
R-squared	0.675	0.681	0.680

Notes: This table reports the results of estimating Equation (5) for different measures of FBHCs access to TAF liquidity during the post-crisis period. As interaction terms with ΔLog foreign funding we use the average TAF ratio (Column (1)), the TAF index computed from the average TAF ratio (Column (2)) and the TAF index computed from the maximum TAF ratio in the post-crisis period (Column (3)). All regressions include regional fixed effects, standard errors are clustered at the headquarter-bank level. For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure A.4: Coefficients on ΔLog foreign funding for the IV Estimation.



Notes: This figure illustrates the estimated coefficients with their respective confidence intervals at the 90% confidence level when we employ an IV regression setup to Equation (6). In particular, ΔLog foreign funding is instrumented by the pre-crisis market-share weighted average foreign funding ratio at the municipality-level. The scale on the left hand side represents the estimated coefficients for the first-stage regressions, whereas the scale on the right hand side depicts the estimated coefficients for the second-stage regressions. The upper-panel estimates Equation (6) for the full sample, while the bottom-panel reports regressions on the subsample of municipalities with a foreign funding ratio below the 25th percentile of the sample distribution. Each estimated coefficient represents a single regression in which a real economic outcome variable is estimated as a function of ΔLog foreign funding. The economic outcome variables are credit growth (Credit), job creation growth (JC), net job creation growth (NJC), the growth rate of job creation and net job creation per 1000 inhabitants (WJC and WNJC, respectively) and GDP growth (GDP).

Table A.7: Effect of ex-ante municipalities' vulnerabilities.

	(1) Credit to GDP	(2) Log GDP	(3) Foreign Share	(4) Av. Correlation (ΔCred, ΔNJC)
ΔLog foreign funding	0.616*	0.827***	0.735**	0.996***
	(0.314)	(0.289)	(0.300)	(0.346)
Vulnerability-Variable	-0.027**	-0.000	-2.779***	-0.186**
	(0.012)	(0.000)	(0.796)	(0.089)
ΔLog foreign funding ×	0.292**	0.003	12.628***	1.256*
Vulnerability-Variable	(0.144)	(0.002)	(4.458)	(0.719)
Headquarter-level				
Size (log Assets)	-0.091*	-0.090*	-0.129**	-0.124**
	(0.052)	(0.053)	(0.056)	(0.060)
Capital Ratio	3.344*	2.554	2.698	3.443*
	(1.792)	(1.757)	(1.784)	(2.082)
Liquidity Ratio	-5.309***	-4.738***	-4.367**	-6.230***
	(1.776)	(1.752)	(1.787)	(2.124)
Deposit Base	2.279**	1.622	2.235**	2.927**
	(1.062)	(1.027)	(1.071)	(1.150)
Credit Risk	2.885	4.268	5.439*	6.038
	(3.291)	(3.240)	(3.271)	(4.069)
Foreign	-0.967**	-0.861**		-1.179***
	(0.402)	(0.399)		(0.428)
State-owned	-0.048	-0.071	-0.260	-0.501
	(0.480)	(0.481)	(0.486)	(0.581)
Branch-level				
Size (log Assets)	-0.014	0.017	0.001	0.004
	(0.031)	(0.024)	(0.031)	(0.031)
Liquidity Ratio	19.247***	18.582***	17.440***	22.562***
	(5.472)	(5.418)	(5.396)	(6.639)
Deposit Base	0.606*	0.423	0.443	0.381
	(0.339)	(0.326)	(0.330)	(0.370)
RoA	-11.462**	-10.441**	-11.031**	-11.884**
	(5.203)	(4.983)	(5.249)	(5.449)
Municipality-level				
Size (GDP)		-0.010	-0.008	-0.005
		(0.009)	(0.009)	(0.009)
Credit/GDP Ratio	0.045**		0.029	0.020
	(0.022)		(0.021)	(0.021)
Constant	-0.060	0.005	-0.010	-0.034
	(0.105)	(0.109)	(0.109)	(0.107)
Obs.	1768	1768	1768	1648
R-squared	0.044	0.040	0.046	0.051

Notes: This table reports the results of estimating Equation (6) including an interaction term between ΔLog foreign funding and four alternative variables describing ex-ante vulnerabilities at the municipality level. The interacted variables are either the average pre-crisis credit to GDP ratio (Column (1)), the log GDP as of 2007 (Column (2)), the average pre-crisis market share of foreign banks (Column (3)) and the average historical correlation (2005-2008) between the month-on-month changes in log aggregated credit and log net job creation per 1000 inhabitants. The dependent variable captures the log change in net job creation per 1000 population between the pre- and post-crisis periods. For a detailed definition of all variables see Table 1. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

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