Banking Globalization, Local Lending and Labor Market Outcomes: Micro-level Evidence from Brazil*

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Abstract

This paper estimates the effect of a foreign funding shock to banks in Brazil triggered by the collapse of Lehman Brothers in September 2008. Using an identification of the bank lending channel similar to Khwaja and Mian (2008) we find robustly that bank-specific shocks to Brazilian parent banks negatively affected lending by their individual branches in Brazilian municipalities. This intrabank channel of financial contagion triggers a number of real economic consequences in Brazilian municipalities: more affected regions face a restriction in aggregated credit and report a weaker job market performance in the post-crisis period. This analysis documents for the first time the full transmission mechanism of the global financial crisis from bank-specific foreign funding shocks to local labor markets in emerging countries. This evidence represents valuable policy information for regulators concerned with the stability and well-functioning of banking sectors worldwide.

Keywords: Financial crisis; interbank market; liquidity risk; central bank interventions.

JEL Classification: G01; G11; G21; E58.

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1 Introduction

Since the outbreak of the 2008-09 global financial crisis a particular aspect of banking globalization, the cross-border transmission of banking shocks, has (re)gained attention in the literature on financial economics. Contributions on this regard have stressed how turbulences in one financial system can transmit into other markets and affect bank lending and real economic outcomes in the form of growth, employment or investment.

There is ample evidence that global liquidity shocks can be transmitted in a cross-border fashion (e.g., Puri et al., 2011; Ongena et al., 2015) but identifying a causal channel usually comes with different identification challenges (see 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 condition to investigate the lending channel of financial contagion is to disentangle supply from demand-driven effects affecting the provision of credit (Khwaja and Mian, 2008). This is foremost important because liquidity shocks and credit demand may be determined by the same economic forces. Furthermore even if the econometric results support a lending channel of financial contagion, individuals may be able to substitute 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 paper follows the established research and investigates how the 2008-09 global financial crisis affected a large emerging country via regional bank lending, employment and GDP growth. In particular we rely on a novel bank-level micro dataset for Brazil to assess the effect of bank-specific foreign funding shocks during in the crisis on lending by bank-branches in Brazilian municipalities. Similar to De Haas and van Horen (2012), Chodorow-Reich (2014) or Ongena et al. (2015) we use the collapse of Lehman Brothers in September 2008 as a cut-off that separates the pre-crisis period from the crisis itself and use the two periods to calculate the difference

in foreign liabilities for each bank to identify banks that experienced a sudden stop in the provision of foreign funding. While foreign-funding shocks are computed at the parent-bank level, we assess their effect on lending by banks' branches located in Brazilian municipalities. This approach presents two main advantages. First, it allows us to separate the corporate-level at which the shock takes place from the level at wich outcomes are observed, avoiding several double-causality concerns. Secondly, by observing lending by each branch on a monthly basis in each municipality we can partial out demand effects in the vein of Khwaja and Mian (2008) or Schnabl (2012) by introducing municipality fixed effects in a first-differenced regression.

Our results show that a bank that experienced a drop of foreign funding of 1 percent between the crisis and the pre-crisis period decreased credit growth by 0.25%, evidencing a bank lending channel of financial contagion for Brazil triggered by the September 2008 events. This lending channel comes in the form of fewer interbank, commercial and consumer loans, whereas real estate loans remain less sensible to the funding shock.

In opposite to the existant literature we take specially into consideration the fact that the nature of foreign funding shocks can differ between local and foreign banks. Foreign funding relationships might differ between these groups due to foreign banks' access to intrabank liquidity allocation within their multinational bank-holding companies. This could lead to different counterparty information asymmetries, which in turn can affect the characteristics of shocks in a context of global financial distress. By extending our sample to account for foreign parent-bank characteristics we show that the bank lending channel at the level of foreign banks operating in Brazil crucially depends on the performance during the crisis of their bank holding companies headquartered abroad. In particular, banks belonging to banking groups that reduce their activity in the wholesale market and suffer from higher capital losses during the crisis reduce lending by more than other foreign banks as a consequence of the reported foreign funding shock. This effect is somewhat moderated by

banking groups' access to the TAF programm in the U.S., evidencing a cross-border spillover of large monetary interventions during the crisis.

Using aggregated information at the level of individual Brazilian municipalities we find evidence that borrowers are not able to compensate for the foreign funding shock triggered by the crisis. In particular we find an impact of bank-specific foreign funding shocks on a number of job market performance measures including the number of jobs created per month in Brazilian municipalities. Similar results are found for GDP growth and aggregated credit growth, evidencing the far-reaching effect of the shock on local economic performance. By extending the empirical strategy we also find this effect to be increasing in municipalities' ex-ante financial vulnerabilities, as measured by the credit to GDP ratio, the historical procyclicality of local credit markets and foreign banks' degree of market penetration.

Our research is related to different strands in the literature that investigate international banking activities, the transmission of shocks between financial systems and whether theses shocks affect lending and the real sector.

Peek and Rosengren (1997) was the first study to use bank-level data to attempt the identification of cross-border financial contagion, showing how Japanese banks affiliates in the U.S. contributed to transmit the Japanese recession of 1990 to the U.S. market. Later on important contributions were made by Van Rijckeghem and Weder di Mauro (2001) and De Haas and van Lelyveld (2006). The former study provided evidence on the existence of common-lender contagion effects during the Mexican, Thai and Russian crises, whereas the latter one showed that home-country economic conditions crucially determine lending by foreign-owned banks in Eastern Europe.

In recent years the late-2000s financial crises brought into light a renewed interest in understanding the role of banks in transmitting shocks across countries. In this regard De Haas and van Lelyveld (2010) investigate the role of internal capital

markets in relating global banks' financial strength with lending by their foreign affiliates. Jeon et al. (2013) explicitly measure foreign banks' reliance on parent banks' funding to show how intrabank capital markets can affect lending in countries hosting foreign banks.

Liquidity conditions in international interbank markets shaped the transmission of the global financial crisis. In this respect Cetorelli and Goldberg (2011) show that the reduction in foreign banks lending in emerging countries was linked to the size of the liquidity shock faced by their home countries. From further contributions we know that the transmission of the crisis was also affected by banks' reliance on foreign interbank funds (Aiyar, 2012), by information asymmetries in the global market for syndicated loans (De Haas and van Horen, 2012; Giannetti and Laeven, 2012) and by banks' exposures to wholesale interbank markets (De Haas and van Lelyveld, 2014). Furthermore, Popov and Udell (2012) show that the transmission of the crisis had also strong effects in the real economy, considering that firms relying for funding from relatively more affected banks were the ones facing more difficulties due to the crisis. Moreover, Puri et al. (2011) find evidence of a significant supply side effect for German savings banks triggered by different exposure to the 2008-09 global financial crisis. Here, exposed banks reject significantly more loan applications than banks not affected by the subprime crisis. Using the same identification strategy Popov and Rocholl (2015) show a significant decline in employment and in labor compensation for German banks more exposed to the crisis.

Aiyar (2012) approach is closer to our study, even though his analysis on the effect of foreign funding shocks on lending is restricted to the lending-effect of foreign funding shocks in England during the crisis. Besides of analyzing banks in Brazil, we expand the analysis by tracing the whole lending channel of financial contagion from foreign funding shocks towards local credit markets in Brazilian region and real economic outcomes.

Our complementary focus on the role played by foreign-owned banks in shaping the

transmission of shocks relates our paper to De Haas and van Lelyveld (2014), who also explores the impact on lending of foreign banks' characteristics. Nevertheless they take the perspective of multinational banks, looking at their affiliates in a large number of countries by using BankScope's yearly balance-sheet data. In contrast, we use regulatory data covering all banks in the Brazilian banking system on a monthly basis, therefore including in our sample variables affecting the transmission of the crisis both by local and foreign owned banks. Moreover by observing on a monthly basis banks' reliance on foreing interbank funding we are able to track the timing of the crisis and to explicitly employ for the analysis the bank-specific characteristics of foreign funding shocks.

The transmission of the global financial crisis from the perspective of emerging countries has been scarcely explored. The few existent studies on this regard rely on country level data reported on a yearly basis (e.g., Cetorelli and Goldberg, 2011; Buch and Goldberg, 2014). When it refers to identifying the mechanisms shaping the cross-country transmission of the crisis this latter approach does not allow a comprehensive comparison of the different bank characteristics that might be involved in banks' adjustments during the crisis. On this regard our data and empirical approach allows us to present a more detailed analysis that takes better account of the complexities involved in the cross-border transmission of shocks. This is particularly important due to the exogenous nature of the global financial crisis from emerging countries' perspective, which poses challenges for financial stability that differ in their nature from the ones faced by developed countries. We contribute to this literature by tracking to the best of our knowledge for the first time the transmission mechanism from foreign funding shocks to local lending disruptions and thence to real economic consequences in regional labor markets.

Two more studies are closely related to ours. First, Schnabl (2012) exploits the 1998 Russian crisis and traces the associated liquidity shock to lending by Peruvian banks. This study suggests that Peruvian firms could not offset the negative liquidity shock

what ultimately affected borrowers real economic outcomes. Secondly Ongena et al. (2015) uses a sample of matched bank-firm level data for small and medium-sized firms in Eastern Europe and Turkey to analyze effects stemming from the Lehman collapse of 2008. They find credit reductions in the order of 7 percentage points to 16 percentage points that come mainly from internationally-borrowing domestic and especially foreign-owned banks.

Our work distinguishes from previous studies in at least three central aspects. First our study investigates the transmission of the global financial crisis to the largest economy in Latin America, Brazil, by using local bank-level regulatory data. Second, this study makes its major contribution by documenting the full transmission mechanism of the crisis, including the link between foreign funding shocks and local labor markets via regional retail banking networks. Thereby our analysis reveals important findings regarding the way banking systems have reacted to recent episodes of global financial distress and how these reactions shaped the performance of the real sector in emerging countries. Finally we study the differential effect of foreign funding shocks on lending conditional on banks' foreign ownership, extending the analysis to account for cross-border spillovers of liquidity interventions in the U.S.

The paper is organized as follows. Section 2 discusses the importance of foreign funding for Brazilian banks. Section 3 describes our dataset and discusses the methodological approach. Section 4 presents the results for the bank lending channel whereas Section 5 discusses the real economic impact of this latter channel of financial contagion. Section 6a concludes.

2 Banking globalization and the brazilian financial system

To investigate the research question we rely on information on banks' balance sheets and income statements from banks' call reports published by the Brazilian Central Bank. This source provides us with monthly data on banks' lending activity and

funding structure. A dataset containing information on Brazilian bank holding companies was further merged with the (unconsolidated) balance sheets of their individual branches located in Brazilian municipalities. This allows us to observe both the characteristics of the bank-holding company at the country level as well as the characteristics of the individual regional branches of each bank [1]. Our sample period covers from January 2007 to December 2010. We restrict the sample only to banks holding a network of municipal branches throughout this period in order to assess the impact of shocks on lending at the level of individual regions. Out of a total of 123 banks active in Brazil as of January 2007 this restriction leaves us with a sample of 100 banks.

When analyzing banks' global linkages we look at 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 from Mexico or Argentina to banks from Korea and Japan. Spain and the U.S. are the countries with the largest representation of foreign banks in the sample, with 6 and 8 banks respectively.

To analyze the role of foreign funding in banks' lending activity we further restrict the sample to banks without missing values in foreign liabilities during the sample period. This filter is important to account to the fact that only the largest banks in Brazil held a regular activity in global interbank markets. Moreover the fact that these banks do not exit global interbank markets during the crisis underpins our interpretation of the foreign funding shock as being a supply-driven phenomenon. Finally this filter allows us to estimate the effect of foreign funding shocks within a group of comparable banks that share similar characteristics of their balance sheets (see discussion in Section 3). Out of the 100 banks of the baseline sample 41 banks report a regular operations in global interbank markets.

1 See the Appendix for further details on the data colletion process followed to build up the sample.

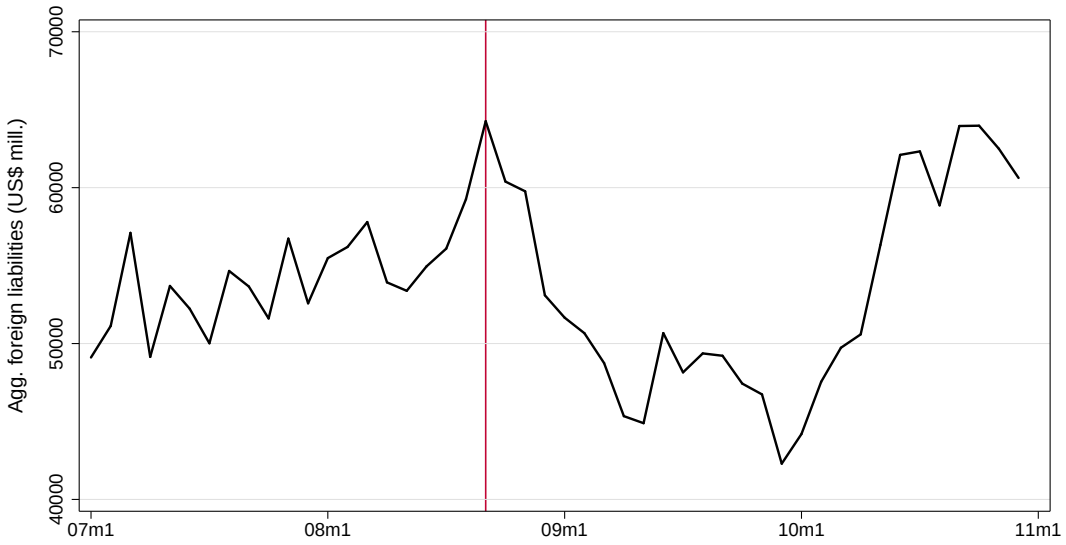


Figure 1: Total Foreign Liabilities

Notes: This figure shows the development of aggregated foreign liabilities for Brazilian banks between January 2007 and December 2011. The vertical line is set at September 2008, the month at which the collapse of Lehman Brothers triggered a freeze in global interbank markets. Foreign liabilities are aggregated from the bank-level data in the baseline sample. The variable is reported in real 2013 US$ millions.

For these banks foreign funding plays an important role in their funding structure, with the average ratio of foreign liabilities to total assets being around 4.3%. This ratio varies considerably along the foreign-ownership dimension: foreign banks report an average ratio of 6.2% whereas local banks finance their balance-sheet with an average of 3.2% of foreign liabilities. Even though we cannot observe the counterparty of foreign funding relationships, this latter observations can be interpreted as foreign banks accessing different sources of foreign funding compared to local banks. In particular the different funding ratio might be related to foreign banks' access to intrabank liquidity via their bank-holding companies abroad[2]. This preliminar evidence is in line with the findings on foreign funding in Brazil discussed in Noth and Ossandon Busch (2016).

Figure 1 shows the development of aggregated foreign funding (expressed in US$ Bill.) of banks in Brazil. We document a steady increase of foreign liabilities before

2 As it can be seen in Figures A.1 and A.2 in the Appendix the pre-crisis exposure to foreign liabilities was inversely related to the size of the foreign funding shock after September 2008. This is important because it means that the mere fact of having active balances in foreign liabilities does not predict per se a large funding shock during the crisis. This heterogeneity in the size of funding shocks allows us to investigate the differential impact of the shock on lending depending on the size of this shock.

September 2008 and a sharp decrease right after. This sharp decrease after the Lehman collapse in September 2008 is at the heart of our identification strategy. Very similar to Khwaja and Mian (2008) we use the different impact of this drought in foreign funding to the banks in Brazil and investigate how the magnitude of the decrease affects local lending via bank branches.

3 Data and methodology

Summarizing the discussion in the previous section, the procedure to sample the data is as follows: First, we require banks and individual bank branches being active during the whole sample period. Additionally, since we observe lending at the level of individual regional bank branches we require to restrict the sample to municipalities hosting at least two active banks over the sample period. As we will discuss later, this restriction is important for the identification strategy since it allows us to control for common credit-demand shocks affecting the two or more active branches in each region, following the approach by Khwaja and Mian (2008).

Furthermore as explained in Section 2 we check that the banks in our sample report regularly positive balances of foreign liabilities. As a final sample restriction we drop branches with missing information for the bank traits we use as control variables, ensuring that after this restriction each municipality still reports the activity of at least to individual branches. This overall screening procedure leaves us with a sample of 41 banks providing credit to 1,768 municipalities via 6,632 branches in the period from January 2007 to December 2010. Since the banks in our sample represent the largest institutions in Brazil, our restricted sample still represents on average 62.6% of total banking assets in the country. More important, the outstanding credit observed in the final sample covers on average 76.3% of the total credit market in Brazil. In terms of geographical coverage, the sample covers over 90% of total assets in 23 out of the 27 federal states in Brazil. The sample is less representative in the

country's main financial centers. This is to be expected since our focus on regional branches and on retail credit implies that banks focused solely on the investment or corporate sectors are not represented in the sample.

A central contribution of this study is the fact that we can explicitly observe on a monthly basis the foreign funding shock triggered by the crisis. Important to our identification is the fact that this sudden freeze in global interbank markets observed in September 2008 was exogeneous from the Brazilian banks' perspective, especially for the local branches at which credit in our setup realizes. In this regard, the sampling procedure explained above is intended to underpin the argument that the foreign funding shock was supply driven and not triggered by local conditions in Brazil.

Our identification for the bank lending channel is similar to Khwaja and Mian (2008). We estimate Equation [01] which reduces the sample to only two periods per bank: the pre-crisis period from January 2007 to August 2008 and the period in the aftermath of the crisis' outbreak, September 2008 to December 2010. By collapsing the sample and using the variables' averages per period instead of the monthly underlying data at hand we avoid concerns about our standard errors being biased due to auto-correlation (Bertrand et al., 2004). This important feature of the identification strategy leads us to work with a sample consisting in two observations per branch, one for each of the aforementioned pre- and post-crisis periods.

$$\Delta\text{Log credit}_{ij} = \beta_0 + \beta_1 \Delta\text{Log foreign liabilities}_i + \lambda_j + \sum_{k=2}^{K} \beta_k x_{kijt} + \epsilon_{ijt} \quad [1]$$

In Equation [01] ΔLog credit is the change of the natural logarithm of the total amount of credit of bank i to municipality j between January 2007 to August 2008

and September 2008 to December 2010. Our main explanatory variable is ΔLog foreign liabilities which indicates the change in (log) foreign liabilities of bank i between the same two periods. Our coefficient of interest is thereby β_1 which indicates the effect on lending by regional bank branches of foreign-funding shocks affecting their bank-holding companies at the country-level.

Since our variables of interest are computed as log changes between the two periods we only work with one single observation per branch in each estimation. The only variables that we can observe separately in both periods are the ones included in the vector of controls x_k. Therefore when estimating the model we will either rely on the contemporaneous controls reported in the post-crisis period or on the lagged variables reported as averages in the pre-crisis period. A key feature of this empirical setup is that bank or branch fixed effects are no longer needed after first-differentiating our variables of interest on both sides of Equation [01].

A major concern with a regression performed on Equation [01] is to differentiate between demand and supply effects affecting the evolution of credit. In fact a positive and significant coefficient in β_1 might be driven by shock-affected banks experiencing a larger decrease in credit demand compared to non-affected banks. The model takes this concern into account by introducting municipality fixed effects represented by λ_j after first differentiating the model. Since our sampling procedure allows only for municipalities hosting at least two banks active in global interbank markets, λ_j holds fixed everything that is municipality-specific, i.e., local demand for credit. Therefore β_1 is expected to isolate the credit-supply channel linking foreign funding shocks and lending activity.

We select a number of bank- 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 holdings and deposits to total assets. We further introduce more bank traits to control for bank characteristics at the parent bank level. A dummy identifying banks with a foreign owner is a central control variable due to

Table 1

Summary statistics and non-parametric analysis

					Shock affected:		
	mean	sd	min	max	Yes	No	dif.
Δ Log Credit	0.27	0.27	−0.90	1.00	0.10	0.30	−0.12*
Δ Log Foreign Funding	0.20	0.35	−1.22	1.66	0.04	0.23	−0.19*
Parent-level							
Foreign	0.15	0.36	0.00	1.00	0.18	0.13	0.05
Size (log Assets)	13.58	1.27	5.07	14.57	13.56	13.61	−0.04
Capital Ratio	0.08	0.01	0.00	0.29	0.08	0.08	0.00
Liquidity Ratio	0.08	0.02	0.00	0.20	0.08	0.09	−0.01*
Deposit Base	0.07	0.04	0.00	0.26	0.08	0.07	0.01*
Credit Risk	0.90	5.37	0.00	617.43	0.78	1.15	−0.37
Branch-level							
Size (log Assets)	3.63	1.41	0.62	8.76	3.71	3.32	0.39
Liquidity Ratio	0.05	0.02	0.00	0.12	0.05	0.05	0.00
Deposit Base	0.41	0.21	0.01	0.84	0.41	0.39	0.02
Pre-crisis trends							
Assets growth	−0.11	0.29	−2.43	2.35	−0.09	−0.13	0.04
Credit growth	−0.12	0.30	−2.59	2.70	−0.13	−0.12	−0.01
Deposits growth	−0.03	0.13	−1.49	1.08	−0.03	−0.01	−0.03

Notes: This table reports descriptive statistics for bank traits. The variables Δ Log Credit and Δ Log Foreign Funding are computed as changes between the average (log) volumes before and after September 2008. The branch- and parent-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 non-affected banks respectively. Shock-affected banks are those reporting Δ Log Foreign Funding below the sample median. The last column show the difference in means between affected and non-affected banks. * indicates whether the difference is significant by normalized differences (Imbens and Wooldridge, 2009). 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. Source: banks' call reports, authors' calculations. Variables are defined in Table A.4. in the Appendix.

the previous evidence on the role played by foreign-owned banks in transmitting the crisis across borders (see for example Ongena et al. (2015)). The information to define foreign ownership comes mainly from the banks' websites and from the Claessens and van Horen (2015) Banks Ownership Database. Here we follow the standard in the literature in considering banks being foreign owned when 50 percent or more of their shares are held by foreign firms. Since we dispose larger availability of variables at the parent level, we include the log of total assets as a measure of size, the capital to assets ratio, liquidity and deposits controls mirroring the ones at the branch level and a measure of credit risk. This latter variable corresponds to the share of non-performing loans to total outstanding credit at the bank-holding company level.[3] In choosing these variables we expect to capture the main characteristics of banks' funding and assets structure.

Table 1 provides descriptive statistics for the variables used in our analysis and

3 All variables are explained in detail in Table A.4. in the Appendix.

shows mean values for the pre-crisis period for two groups of banks: banks that experienced a change of (log) foreign funding below (shock affected) and above (non-affected) the sample median. We further provide normalized differences (Imbens and Wooldridge, 2009) to indicate whether the differences in variables between the two groups significantly differ from each other. The related literature suggests that absolute values smaller than 0.25 indicate a non-significant difference.

The first two lines in Table 1 report summary statistics for the main variables of interest for the identificaiton strategy: the changes in log credit and log foreign funding between the two aforementioned periods respectively. By construction Table 1 shows that foreign funding growth was weaker for shock-affected banks. More interesting is the fact that also credit expanded in a more slow fashion in the case of shock-affected banks.

Banks affected and not by a foreign funding shock shared similar characteristics in the pre-crisis periods. The only significant differences are observed in the liquidity and deposit ratios at the parent level, although these differences do not appear to be particularly sizeable. For the rest of the control variables we cannot reject the hypothesis of averages between more and less affected banks being equal. Interestingly, the presence of foreign-owned banks is not significantly different between the two groups. This will become important when discussing the role of foreign banks in affecting the transmission of foreign funding shocks in the next section. Since we control for these (level) variables in our regressions we are confident that the rather small differences between shock-affected and non-affected banks will not be a matter of concern for our results.

A further critique to the identification strategy discussed so far at potential ex-ante trends in banks differently affected by foreign funding shocks. It might be the case that more affected banks where already experiencing a weaker credit growth in the pre-crisis period inducing a bias in our estimation. To account for this the bottom panel in Table 1 tests whether average pre-crisis growth in assets, credit and

deposits was significantly different between the two groups of banks. Our results do not suggest the existence of statistically significant differences in pre-crisis trends between more and less affected banks. This results imply that ex-ante sorting in our sample should not be an important challenge to the identifications strategy.

The potential bias in the OLS estimation of Equation [01] arising from contemporaneous credit demand shocks can, ex-ante, be of positive or negative sign. The sign of this bias will depend crucially on the correlation between the size of the foreign funding shock and the adjustment in credit demand by bank customers. One hypothesis could be that shock-affected banks are also more complex financial institutions serving more profitable customers that can better offset the effects of the crisis, experiencing relatively small reductions in credit demand. An alternative view might suggest that shocked-affected banks faced generally larger vulnerabilities prior to the crisis, inducing customers to switch-off their credit sources and triggering relatively large credit demand restrictions for those banks. If the first hypothesis is true, a simple OLS estimation of Equation [01] would produce conservative estimates of the true effect of Δ Log Foreign Funding on Δ Log Credit. Although we will come back to this issue once discussing the empirical results, not reported preliminary tests evidenced that shock-affected banks tend to serve more profitable firms ex-ante (proxied by banks' return on assets in the pre-crisis period). The results of estimating Equation [01] will allow us to shed some light on the actual sign of the demand-driven bias in the model.

Before turning to discuss the results, Figure 2 provides preliminary non-parametric evidence on the effect of the foreign funding shock on lending by Brazilian banks. The graph shows the change in log outstanding credit by all banks reporting a change in log foreign liabilities above and below the sample median after September 2008. Credit growth is here computed proportional to outstanding credit as of September 2008. Figure 2 supports the suggested identification strategy in that it shows no diverging pre-trend in lending between these two groups of banks. This confirms

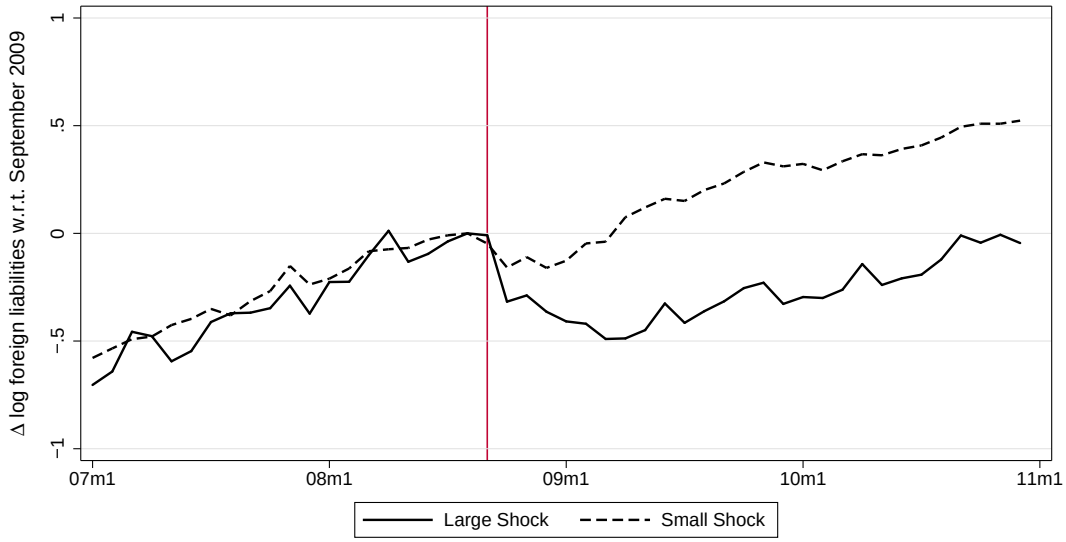


Figure 2: Bank Lending Channel

Notes: This figure illustrates the different pattern of credit growth followed by banks affected and not by a foreign funding shock after September 2008. The vertical line is set at September 2008, the month at which 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 category and ploted as first differences with respect to September 2008. Banks affected by a relatively large shock are those with a change in log foreign liabilities between before and after the crisis below the sample median. Banks experiencing a rather small shock are those reporting a change in foreign liabilities below the sample median.

our previous findings from Table 1. After the crisis' outbreak shock-affected banks reduce lending by more than other banks, with credit growth remaining 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 only statistically significant in the post-crisis period. Nevertheless at this stage it is not possible to rule out the possibility that this difference might be driven by different credit-demand shocks or by bank or branch traits different to the mere effect of the foreign funding shock.

In Section 4 we will discuss the baseline results of estimating Equation [01] as well as several extensions of the model inteded to shed light on the mechanisms behind the cross-border transmission of shocks.

Table 2

Effect of foreign funding shocks on lending.

	(1) Baseline Model	(2) Parent Controls	(3) Branch Controls	(4) Regional Cluster	(5) Bank Cluster	(6) FE Model	(7) Lagged Model
Δ log foreign funding	0.080***	0.244***	0.263***	0.263***	0.263***	0.268***	0.248**
	(0.012)	(0.016)	(0.016)	(0.033)	(0.080)	(0.095)	(0.109)
Parent-level							
Foreign		−0.061***	−0.073***	−0.073***	−0.073	−0.108	−0.021
		(0.014)	(0.014)	(0.016)	(0.095)	(0.112)	(0.149)
Size (log Assets)		0.032***	0.035***	0.035***	0.035	0.053*	0.037
		(0.004)	(0.005)	(0.006)	(0.030)	(0.031)	(0.045)
Capital Ratio		1.340**	2.207***	2.207***	2.207	3.334	1.373
		(0.565)	(0.548)	(0.695)	(2.223)	(2.749)	(4.562)
Liquidity Ratio		−5.005***	−4.194***	−4.194***	−4.194*	−4.707**	−3.635*
		(0.292)	(0.314)	(0.636)	(2.257)	(2.329)	(1.840)
Deposit Base		2.779***	2.645***	2.645***	2.645***	2.845***	3.435*
		(0.170)	(0.169)	(0.300)	(0.854)	(0.965)	(1.731)
Credit Risk		0.023**	0.001	0.001	0.001	0.008	0.000
		(0.009)	(0.009)	(0.010)	(0.020)	(0.021)	(0.001)
Branch-level							
Size (log Assets)			0.076***	0.076***	0.076***	0.044*	−0.012
			(0.003)	(0.003)	(0.024)	(0.022)	(0.028)
Liquidity Ratio			−0.536*	−0.536	−0.536	−1.277	−2.628***
			(0.306)	(0.356)	(0.820)	(1.064)	(0.810)
Deposit Base			0.152***	0.152***	0.152	0.040	0.250**
			(0.028)	(0.033)	(0.201)	(0.173)	(0.123)
Constant	0.280***	−0.280***	−0.675***	−0.675***	−0.675		
	(0.005)	(0.065)	(0.072)	(0.075)	(0.449)		
Clustered SE (Parent)	No	No	No	No	No	Yes	Yes
Clustered SE (Region)	No	No	No	Yes	No	No	No
Region FE	No	No	No	No	No	Yes	Yes
Obs.	6632	6632	6632	6632	6632	6632	6632
R-squared	0.041	0.074	0.156	0.156	0.156	0.333	0.306

Notes: This table reports the results of estimating Equation [01] for different especifications. 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 defined between January 2007 and August 2008, whereas the post-crisis period is defined between September 2008 and December 2010. In regressions (1) to (6) the control variables are computed as averages during the post-crisis period. Column (7) reports the results of the control variables entering the model as pre-crisis averages. Standard errors are clustered at the regional-level in column (4) and at the parent-bank level in columns (5) to (7). Variables are winsorized at the 1st and 99th percentiles to control for outliers. *** indicates significante at the 1% level; ** at the 5%; * at the 10%.

4 Results

4.1 The Bank Lending Channel.

We provide results for the bank lending channel in Table 2. A preliminary result is reported in column (1), where a simple OLS regression without further control variables is estimated. We osberve a positive and significant coefficient of Δ foreign funding on Δ credit, in line with the descriptive evidence in Section 3. Comparing this coefficient with the mean and standard errors of Δ foreign funding in Table 1 leads us to conclude, that we are obtaining a reasonable explanation of Δ credit. In concrete, an decrease in 1% in the growth rate of foreign funding, leads to a 0.08%

decrease in the growth rate of credit. Nevertheless, it should be noted that the inclusion of parent bank controls in column (2) and branch control in column (3) leads to significant increases in this coefficient. A more reasonable interpretation of our findings suggests tehrefore that a 1% decrease in foreign funding growth is associated with aproximately a 0.25% lower growth rate of credit.

An open issue in our estimation is whether standard errors should be better clustered at the parent bank or at the municipality level. On the one hand, one could argue that since we are working with several hundred branches per bank, the results for branches within one 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 also lead to regional correlations in the standard deviations of the estimation. To account for this columns (4) and (5) replicate the regression from column (3) by adding municipality and parent bank clustered standard errors respectively. Although the coefficients remain unchanged, we observe a slightly loss in the statistical significance of the estimated parameter including parent bank clusters. Therefore, we consider this latter setup to provide us with a more conservative estimation of the bank lending channel. For this reason the subsequent analyses in this section make use of standard errors clustered at the bank level.

Column (6) report the results of including the full set of control variables, clustered standard errors and municipality fixed effects. Reprising the discussion on the sign of the correlation between foreign funding shocks and credit demand shocks, a comparison of columns (5) and (6) shows that this correlation appears to be positive: banks facing relatively large funding shocks are also banks experiencing relatively low contractions in the demand for credit compared to other banks. This can be seen from the fact that the OLS regression from column (5) reports a lower explanatory power than the fixed-effect model in column (6). This can be interpreted as the OLS model providing underestimated results of the true effect of the shock. This

important feature of our results will come again into play when analyzing the real consequences of the lending channel of financial contagion in Section 5.

A further concern might arise from the fact that results so far have been estimated using the control variables computed as post-crisis period averages. Although all these variables are in levels, they might capture changing patterns in banks' assets and liabilities structure that could be correlated with the funding shock. The regression reported in column (7) rules out this concern by replicating the estimation using the control variables computed as pre-crisis period averages. The estimated coefficient for β_1 remains significant although somewhat smaller in size compared to column (6).

Control variables show reasonable effects that remain consistent when we test the different especifications of the model. Larger banks and banks with more deposits tend to increase credit by more than other banks. An interesting result is the contrast between the deposits and liquidity holdings measures. While the former is positively correlated with credit growth, the latter reports a negative relationship with our outcome variable. This might be related to a liquidity hoarding effect, documented for the global financial crisis in the U.S. by Cornett et al. (2011) and Berrospide (2013). In this sense larger liquidity holdings might be builded up as cushion against an uncertain business evironment harming the stength of credit growth.

The fact that the main results hold after controling for foreign ownership adds important evidence to the literature on the cross-border transmission of shocks. There is ample evidence that global banking networks contributed to the spreading of finacial distress across borders (Cetorelli and Goldberg, 2011; De Haas and van Horen, 2012). Nevertheless foreign ownership has been so far only analyzed as a separate channel compared to direct foreign funding exposures, as for example in Ongena et al. (2015). The evidence from Table 2 shows that foreign funding shocks were important vectors for the transmission of financial distress regardless of the

Table 3

Effect of foreign funding shocks on credit segments.

	(1) Commercial Credit	(2) Consumer Credit	(3) Mortgages	(4) Leasing	(5) Interbank Credit
Δ log foreign funding	0.383***	0.377***	−0.106	−0.005	0.142**
	(0.128)	(0.090)	(0.084)	(0.019)	(0.055)
Parent-level					
Foreign	−0.103	−0.021	−0.200**	−0.016	0.166*
	(0.080)	(0.085)	(0.099)	(0.011)	(0.082)
Size (log Assets)	0.021	0.058**	0.047**	0.001	0.055**
	(0.021)	(0.028)	(0.017)	(0.004)	(0.021)
Capital Ratio	1.669	2.307	−1.652	−0.791	1.294
	(2.067)	(2.612)	(2.764)	(0.535)	(2.144)
Liquidity Ratio	−4.082	−3.371*	−4.306**	0.103	2.738*
	(2.592)	(1.928)	(1.855)	(0.335)	(1.515)
Deposit Base	2.403*	1.742**	2.901**	−0.094	−0.623
	(1.208)	(0.771)	(1.108)	(0.131)	(0.666)
Credit Risk	0.015	0.001	0.031	−0.014	0.084***
	(0.046)	(0.022)	(0.036)	(0.009)	(0.014)
Branch-level					
Size (log Assets)	0.048**	0.072***	0.043	0.003	0.014
	(0.020)	(0.019)	(0.028)	(0.004)	(0.016)
Liquidity Ratio	−2.040*	−2.351**	−0.689	0.316	0.507
	(1.072)	(0.908)	(1.559)	(0.259)	(1.367)
Deposit Base	0.158	−0.053	−0.158	−0.023	0.100
	(0.182)	(0.166)	(0.104)	(0.028)	(0.124)
Region FE	Yes	Yes	Yes	Yes	Yes
Obs.	6632	6632	6632	6632	6632
R-squared	0.296	0.390	0.511	0.114	0.333

Notes: This table reports the results of estimating Equation [01] for different subsamples of credit segments. In all regressions the dependent variable is the change in the log of average outstanding credit between the post- and the pre-crisis periods for a single category of credit. 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. All regressions reported include municipality fixed-effects. Standard errors are clustered at the parent-bank level. The credit segments considered in the analysis represent the credit segmentation reported in the banks' call reports. Commercial credits are granted for specific purposes, as for example working capital or physical capital investment. Consumer credits are credits granted without a specific purpose and are normally subjected to shorter maturity periods. The mortgages category include all loans granted to acquire or build real estates in Brazil. Whereas leasing follows the standard international definition of financial leasing, interbank credits include all types of loans and on-lending operations vis-à-vis other banks. Variables are winsorized at the 1st and 99th percentiles to control for outliers. *** indicates significante at the 1% level; ** at the 5%; * at the 10%.

ownership status of a bank. Although somewhat puzzling, this first result on the effect of foreign ownership on lending will demonstrate to be hidding interesting insights about the bank lending channel indentified so far, as we will discuss below.

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 et al., 2015). Even though we rely on a similar approach to control for credit demand, the use of borrower fixed-effects could fail to fullfill its purpose if banks face rather idio-

syncratic credit demands. Firms within a municipality might for example demand two distinct credit products, commercial loans and working capital funding. If two banks operate in this municipality and each of them focuses exclusively on one of these products, it is likely that municipality fixed effects might fail to capture the dynamics of credit demand. To overcome this concern we extend our analysis in Table 3 by replicating our baseline results from Table 2, column (6) for a subset of five different credit categories: commercial loans, consumer loans, mortgages, leasing and interbank loans.

The results from Table 3 prove that the bank-lending channel holds even within certain categories of credit. In particular we find that commercial, consumer and interbank loans are especially sensible to the variation in foreign funding triggered by the crisis. In contrast to this we do not find evidence of a bank lending channel for mortgages or leasing. One explanation for this finding might be related to the importance of collateral in the credit market and in particular during the global financial crisis (Ongena et al., 2015). Whereas mortgages and leasing products are typically by construction insuring the banks in case of repayment delinquency, this is not that clear for the other three categories of credit. Furthermore and in opposite to the U.S., Brazil did not experience a housing bubble at the onset of the crisis, so that real estates were still a realiable investment during the first months after the Lehman's collapse.

The fact that we find the strongest explanatory power for commercial credit speaks to the importance of this very specific lending channel for credits related to investment and trade, both within this category. Since funding from abroad is typically denominated in foreign currency, we would expect banks with a larger exposure to this type of funding to serve firms that are also active in foreign trade, infrastructure and physical capital investment sectors. We will come back to dicuss the sensitivity of investment to the bank lending channel in Section 5, where the real effects of the funding shock are analyzed.

4.2 Robustness and alternative shock definitions.

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 followed by banks more and less affected by the global interbank market freeze. Since the two trends appear to maintain their difference along the post-crisis period, one could argue that our baseline results are not driven by the funding shock around September 2008 itself but rather by an overall changing pattern in banks capacities to obtain liquidity abroad. Here it is important to recall that Equation [01] implies computing the shock as the change in log foreign liabilities between the averages of the pre- and post-crisis periods. Although unlikely, we could be capturing in our baseline regressions the effects of events occurring after September 2008 and therefore not directly related to the global financial crisis. This is specially important considering that we define the post-crisis period until December 2010, aproximately the date at which the volume of foreign liabilities in Brazil recovers it pre-crisis level.

Table A.1. in the Appendix shows that this latter concern is not affecting our results. To prove this we alternatively define the shock as the log change in foreign liabilities between September 2008 and June 2009 and between December 2009 and December 2010. The results show that the foreign funding shock explains the change in credit only if computed around September 2008. To avoid the possibility of these results being driven by arbitrarily defining the months at which the shock is computed, we run regressions where the shock is defined as the change in log foreign liabilities between 3 months before and 3 months after a given date for rolling time windows between January 2008 and January 2010. The estimated coefficients are reported in Figure A.4 in the Appendixand show that the positive and significant coefficient

from Table A.1, column (1), emerges only when defining the shock as starting within 6 months after September 2008. This finding confirms that the lending channel we identify is strictly related to the foreign funding shock triggered by the Lehman's collapse.

Alternatively we also check the results of defining the shock as the average 12-month change in log foreign liabilities between September 2008 and June 2009, the peak-to-trough of the foreign liabilities' time series. This alternative shock definition also confirms our main results (see column (3) in Table A.1). Furthermore we run a falsification test during the pre-crisis period to exclude the possibility of the results being driven by pre-crisis diverging trends in credit growth, a rather minor concern if we take into account our analysis from Table 1. For this purpose a (virtual) crisis is defined between June 2007 and August 2008. The (virtual) pre-crisis period is set between January 2007 and Mai 2007. Results reported in Table A.1, column (4), show no significant effects of the virtual shock on lending.

A final concern with our results is related to the fact that the results could also be driven by a number of banks reporting a very large increase in both foreign liabilities and credit around September 2008. Although rather unlikely, this is still possible since the positive coefficient on Δ foreign liabilities found in Table 2 cannot explicitly tell us whether the effect is stemming 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 being driven by large negative funding shocks we run a non-linear version of Equation [01] of the form $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i^2 + ...$ The additional squared term of Δ foreign liabilities allows us to estimate the marginal effects of our baselie results along the distribution of foreign funding shocks in the sample. If our hypothesis is true, we would expect the coefficient to become positive and statistically significant only in the left-hand side of the distribution of shocks.

Figure 3 shows the marginal effects for ΔLog foreign funding coming from a re-

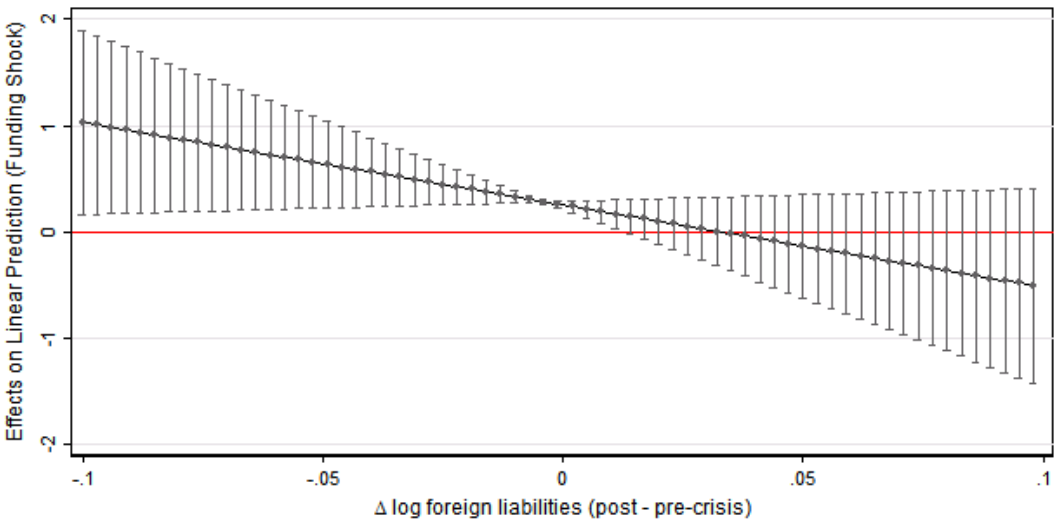


Figure 3: Marginal effects along the distribution of foreign funding shocks.

Notes: This figure illustrates the marginal effects at the 95% confidence level of a non-linear extension of Equation [01], in the form of $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i^2 + ...$ The regression from which the marginal effects are computed is based on the FE specification from column (6) in Table 2, including the full set of control variables, regional fixed effects and clustering standard errors at the parent-bank level. The figure shows that the positive coefficient estimated in Table 2 stems from the negative section of the distribution of Δ log foreign liabilities. This evidence suggests that negative foreign funding shocks are a driving force behind falling credit growth after September 2008.

gression like the one described above. The figure thereby provides evidence for the fact 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 liabilities, the lending channel is not significant. This result confirms that the main findings from Table 2 can be interpreted in line with our hypothesis, namely, as a signal of negative foreign funding shocks after September 2008 leading to a significant reduction in the supply of credit by Brazilian banks.

4.3 Zooming in: the role of foreign banks.

From Table 2 we learned that the foreign ownership dummy, identifying banks in Brazil that belong to a foreign bank holding company, did not affect 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. Since foreign ownership is an important aspect of banking globalization we aim in this section

at providing further insights on the role of foreign banks in affecting the lending channel identified at this stage.

Even though our baseline results suggest that the effect of the funding shocks persists independently of foreign ownership, we could expect that the size of this effect might be different depending on the ownership structure of a bank. In opposite to domestic banks, foreign banks have access to liquidity allocation within the international network of financial institutions they belong to. In the context of a global financial crisis such intrabank capital markets could work either in favor or against the stability of a forein owned bank in Brazil. On the one hand, foreign bank holding companies (in what follows FBHC) can provide intrabank liquidity even when global interbank markets are suffering from large distress, compensating for the freeze in the traditional interbank funding sources. On the other hand, FBHC largely affected by the crisis might allocate liquidity from a consolidated perspective. If a foreign bank in Brazil can be used as a source of liquidity for other members of its banking network, its own capacity to underpin its core credit business might become harmed. The actual role of foreign ownership in influencing the effects of a foreign funding shock is therefore a more complex question that cannot be properly addressed by simply looking at our baseline results.

As a first step towards the analysis of the role of foreign ownership we extend the baseline model by adding an interaction term between the foreign funding shock and foreign ownership. This approach is at odds with previous studies on the effect of foreign funding exposures on lending, in which foreign ownership and foreign funding enter the empirical model separatelly. Since we have shown that the effect of foreign funding shocks is relevant for all banks, we believe that an interaction model can provide more detailed information about differential effects of the shock conditional on ownership characteristics. Under this setup Equation [01] is modified to take the form $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i \times Foreign_i + ...$, which allows us to retrive the marginal effect of the foreign funding shock for

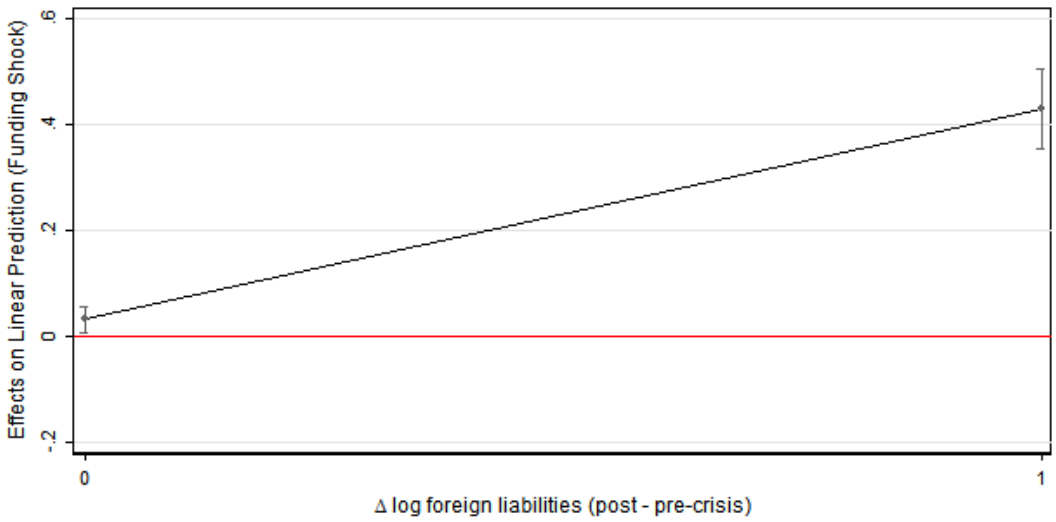


Figure 4: Marginal effects by local and foreign ownership.

Notes: This figure illustrates the marginal effects at the 95% confidence level of a non-linear extension of Equation [01], in the form of $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i \times Foreign_i + ...$ The underlying regression includes regional fixed effects and clustering standard errors at the parent-bank level. The main variable of interest is interacted with a dummy identifying with a 1 those banks that are foreign owned. This graph shows that on average, the positive coefficient for the foreign funding shock reported in Table 2 is larger in size for the group of foreign owned banks.

foreign and domestic banks. This results is depicted in Figure 4, showing that the positive coefficient identified so far is significant for both local and foreign banks. Nevertheless Figure 4 also shows that the effect is more sizable for foreign banks. We find that, on average, the pass-through of foreign funding shocks to lending was more pronounced for foreign banks.

Based on the discussion above, a natural question is whether the differential effect of the shock for foreign banks can be linked to the performance of FBHCs during the crisis. If the FBHC of a given bank was, for example, largely exposed to the subprime mortgages market in the U.S. we could expect the Brazilian affiliates of that bank to be more affected by a foreign funding shock than its other foreign-owned peers.

To shed some light on this important aspect of the cross-border transmission of shocks we restrict our sample to foreign-owned banks and add a number of variables accounting for the changing performance of FBHC after September 2008 in several dimensions. From Bureau Van Dijk's BankScope we obtain yearly information on

Table 4

Foreign bank holding companies traits by shocks' size

	Shock's size: Large (1)	Small (2)	Large-Small (3)
Foreign bank holding traits			
Δ capital/assets	0.0087	0.0095	−0.0008
Δ wholesale assets/assets	−0.0125	0.0061	−0.0186
Δ wholesale funding/ssets	−0.0529	−0.0572	0.0043
Δ liquidity/assets	0.0079	0.0125	−0.0046
Average TAF balances/capital	0.2978	0.3353	−0.0375
Shock-weighted TAF balances	3.1632	10.5072	−7.3440
N° of Banks	8	8	
N° of Branches	267	278	

Notes: This table reports variables at the level of foreign bank holding companies for the subsamples of shock-affected banks (column (1)) and non-affected banks (column (2)). The sample consists of the 16 foreign-owned banks observed in the baseline sample. Variables are defined in Table A.4 in the Appendix. Variables in changes are computed as first-differences between 2009 and 2008 (end of year). The TAF-variables are reported as averages between September 2008 and December 2009. 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. Column (3) reports the difference in averages between shock-affected banks and non-affected banks. Sources: Bloomberg (TAF data) and BankScope (FBHC traits).

FBHCs' yearly assets, total wholesale outstanding credits, total wholesale liabilities, capitalization, and liquidity holdings. From this data we compute ratios of wholesale assets, wholesale liabilities, capital and liquidity to total assets for 2008 and 2009. Since BankScope reports end-of-year balance sheet information, we expect these changed to capture the performance of FBHCs around the crisis period. We follow Ongena et al. (2015) in measuring banks' performances during the crisis with this approach. By construction the aforementioned ratios increase when a FBHC increases its liquidity, capital or wholesale credit and liabilities ratios in 2009 compared to 2008.

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. This allows us to estimate our prefered model with municipality fixed-effects capturing common shocks to all banks within each ragional entity. The model in Equation [01] is extended to account for the interaction between foreign funding shocks and FBHC traits. The model takes the form of $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i \times Parent\,Trait_i + ...$, where the variable $Parent\,Traint_i$ represents either the capital,

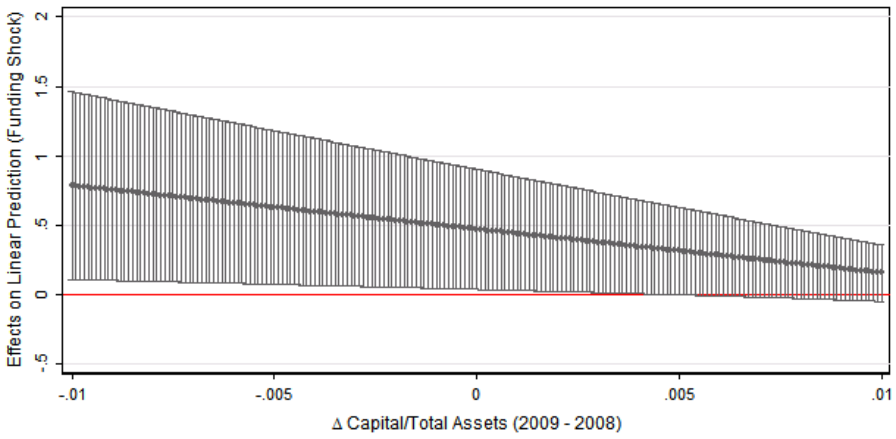
liquidity or wholesale ratios.

Table 4 provides descriptive statistics on FBHCs traits. Mirroring Figure 2 we split the reduced sample by the median shock size to define banks that where more (column (1)) and less (column (2)) affected by the foreign funding shock. All in all, 267 branches belong to shock-affected banks whereas 278 branches are within the group of non-affected banks. Column (3) in Table 4 reports the difference in the average numbers for each FBHC trait between the two groups of banks. Shock-affected foreign banks in Brazil belong on average to FBHCs that (i) reduced their capital ratio, (ii) reduced their active positions in the wholesale market, (iii) increased their reliance on interbank funding and (iv) reduced their liquidy ratios during the crisis. This descriptive evidence suggests that the size of the foreign funding shock, and therefore its own pass-through to local lending, might be related to overall financial vulnerabilities at the level of the global banking groups headquartered abroad.

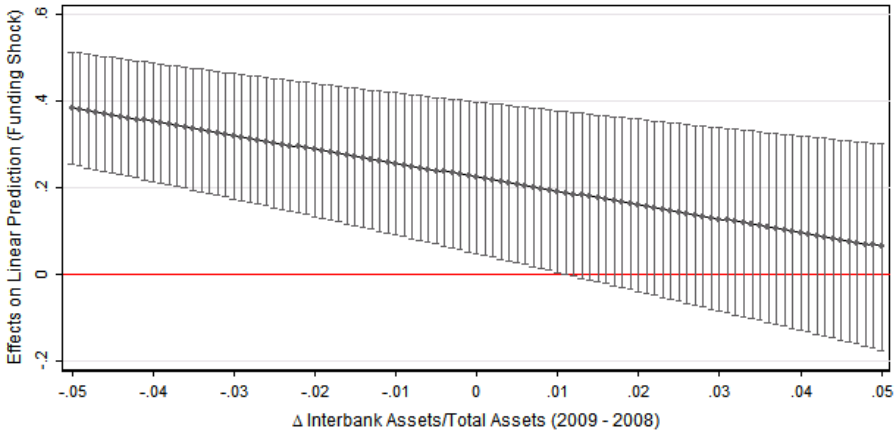
To formally explore this hypothesis we report the results of extending Equation [01] in Table A.2 in the Appendix. Our main variable of interest is the interaction term described above between FBHC traits and the log change in foreign liabilities. Δ Parent Trait identifies the respective FBHC performance measures describe at the top of columns (1) to (4). We do not find evidence that the effect of the foreign funding shocks is statistically significant at any point along the distribution of changes in liquidiy ratio. On the contrary we do find that the bank lending channel can be traced for banks whose FBHCs are reducing their capital ratios, reducing their active positions in the wholesale market and increasing their reliance on interbank funding.

To be more specific on this finding Figure 5 depicts the marginal effects of the foreign funding shock on lending growth along the distribution of changes in the capital ratio (panel A), in the wholesale assets ratio (panel b) and in the wholesale liabilities ratio (panel C). In line with the discussion above the pass-through of the foreign funding shock is more likely to occurr if FBHC face a negative capital shock, are pushed

A. Effect of $\Delta foreign\,liabilities_i$ *by* $\Delta Capital/Assets_i$



B. Effect of $\Delta foreign\,liabilities_i$ *by* $\Delta InterbankAssets/Assets_i$



C. Effect of $\Delta foreign\,liabilities_i$ *by* $\Delta InterbankLiabilities/Assets_i$

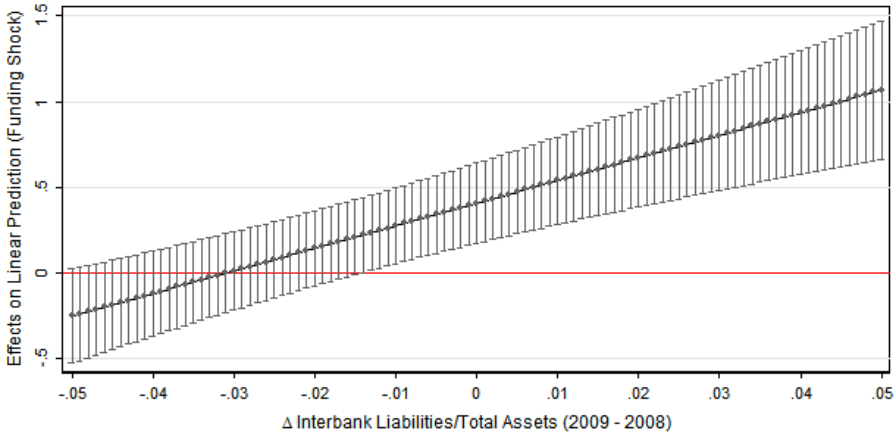


Figure 5: Marginal effects by foreign banks traits.

Notes: This figure illustrates the marginal effects at the 95% confidence level of a non-linear extension of Equation [01] estimated for the subsample of foreign-owned banks. The marginal effects are retrieved from a regression of the form $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i \times Parent\,Trait_i + ...$, where the variable $Parent\,Traint_i$ corresponds to characteristics of the bank holding company headquartered abroad. Panel A shows the effect for the change in the capital-assets ratio between 2008 and 2009. Panel B shows the effect of the change in the ratio of wholesale assets to total assets. Panel C reports the effect of the change in ratio of wholesale funding to total assets. The underlying regression includes regional fixed effects; SE are clustered at the parent-bank level. Foreign parent bank traits are obtained from BankScope. The first-stage regressions are reported in Table A.2 in the appendix.

to withdraw their assets in the interbank market (e.g. fire sales) or report larger funding needs from other banks. These are likely to be FBHCs facing relatively more from the global shock triggered by the Lehmans' collapse. Even though we do not observe the counterparty of Brazilian banks' foreign liabilities, our estimation suggests a high sensitivity of foreign bank affiliates funding from abroad at the crisis performance of their bank holding companies.

A final extension of our baseline model is the analysis of the role played by large liquidity injections in the U.S. since the outbreak of the crisis. FBHCs in our sample are relatively large global banks that had also access to the Term Auction Facility programm (TAF), a Federal Reserve auctioned term fund from which depository institutions in the U.S. were able to borrow once interbank markets started to evidence the first signals of financial distress. These 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 et al. (2015) has shown that TAF-access translated into credit interest rates adjustments by banks in Germany with an affiliated bank in the U.S. Nevertheless no evidence exists on the way TAF access affected lending adjustments by foreign banks in emerging countries during the crisis.

We obtain monthly data for the individual access of FBHCs in our sample to the TAF programm from Bloomberg. We compute an index of the relative size of the TAF resources obtained by each bank as the average ratio of TAF balances to total assets between September 2008 and December 2009. We follow the same approach as with the FBHC-traits analized above in order to assess whether the lending channel can be identified for a given portion of the distribution of the TAF index. Preliminarly Table 4 shows that more affected foreign banks did in fact belong to FBHCs with a more restricted access to TAF liquidity facilities. This is also true when weighting the average TAF balances with the size of the foreign funding shock.

The formal results of this analysis are reported in columns (5) and (6) in Table

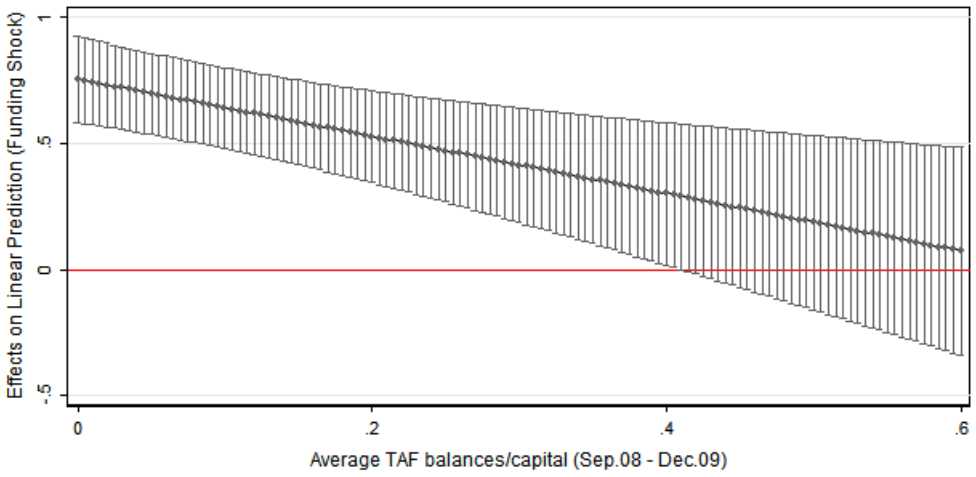


Figure 6: Marginal effects of access to the TAF programm (%).

Notes: This figure illustrates the marginal effects at the 95% confidence level of a non-linear extension of Equation [01] estimated for the subsample of foreign-owned banks. The marginal effects are retrieved from a regression of the form $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i \times Parent\,TAF_i + ...$, where the variable $Parent\,TAF_i$ corresponds to the extent to which the foreign parent bank of bank i was able to access liquidity via the TAF program during the crisis. Data from Bloomberg on banks' access to the TAF is used to compute the average ratio of TAF balances to banks' equity for each parent bank abroad. The average is computed from monthly data between September 2008 and December 2009 (reported in %). The graph shows that the effect of the funding shock on lending was somewhat mitigated by foreign parent banks access to the TAF: the coefficient on foreign funding growth is positive only for foreign banks whose foreign parent had a relatively low access to liquidity from the TAF program. The first-stage regressions are reported in Table A.2 in the appendix.

A.2 in the Appendix. While column (5) reports the results by using the TAF index. The marginal effects of log foreign liabilities along the distribution of the TAF index is reported in Figure 6. We observe that the estimated coefficient for the foreign funding shock turns positive and statistically significant for banks in Brazil whose FBHCs abroad had a relatively low access to the TAF program. In other words a wider access to the TAF program was able to partially offset the negative consequences of foreign funding shocks in Brazilian foreign bank affiliates. As a robustness test column (6) in Table A.2. further weights the index by the size of the foreign funding shock faced by the Brazilian affiliate of each FBHC. The size of the shock in this exercise is computed as the change in log foreign liabilities between September 2008 and June 2009. This alternative specification confirms our main finding.

This latter restult is important in at least to central aspects. First, it documents

to the best of our knowledge for the first time that the access to liquidity facilities by global banks during the crisis had internal effects in those institutions worldwide. Brazilian banks whose FBHCs were able to obtain more resources from the TAF program benefited in terms of having an alternative to compensate for the foreign funding shock. Second and related to this, the evidence from Figure 6 shows that countries might potentially benefit from a better coordination of liquidity interventions in a context of global financial distress. The fact that interventions in one country can affect the worlwide banking network of global banks implies that coutries might benefit by coordinating the timing, size and target of large liquidity intervention making this measures a more effective policy tool.

5 Real Effects of the Bank Lending Channel.

The most relevant aspect of a bank lending channel is whether it transmits to the real economy or whether borrowers can compensate a shortfall in credit from one affected bank by tapping another less affected bank. We therefore 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 therefore include all bank branches that were active in the municipalities from our baseline analysis in Section 4 at each point in time. This is important to allow for the possibility that borrowers might have been offsetting the lending restriction by shock-affected banks by accessing credit in other banks, even in 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.[4] With this data set we run the following regression:

4 If a bank has missing data related to their foreign funding position we impose the assumption of that bank experiencing a growth in "virtual" foreign funding of 0 between the two periods analyzed.

$$\Delta\text{Log outcome}_j = \alpha_0 + \alpha_1 \Delta\text{Log foreign liabilities}_j + \sum_{k=2}^{K} \alpha_k x_{jt} + \epsilon_j \quad [2]$$

Outcome is short-hand for five real outcome variables on the municipality level j: the total amount of credit (monthly), the number of jobs created (monthly), the difference between jobs created and terminated (monthly) and real GDP (yearly).

From Equation [02] it becomes clear that the credit-demand control described in Equation [01] can not be implemented in this second stage of the analysis. This occurrs because all variables are by construction aggregated at the municipality level. Recall that we discuss in the previous section the correlation between foreign funding shocks and demand shocks that arise from our results. We confirmed that an OLS estimation of Equation [01] actually underestimate the true effect of the lending channel, since largely shock-affected banks in our sample tend to experience contemporaneously relative large positive credit-demand shocks. Furthermore we discussed in Section 3 that shock-affected banks served more profitable firms in the pre-crisis period, resulting in a larger average profitability of the credit portfolio. With these arguments at hand we believe that an OLS estimation of Equation [01] should provide conservative estimates of the real adjustments triggered by the bank lending channel identified so far.

To ensure that this analysis of the borrowers' perspective of the foreign funding shock mirrors the one of the previous section we keep all control variables as in

Alternatively we follow Khwaja and Mian (2008) in considering these latter banks as experiencing a foreign funding growth equal to the sample's average, with no variation on the results. We require banks that do not report regularly active positions of foreign liabilities to be in the sample in order to obtain conservative estimates of the borrowing channel of financial contagion. Considering only the 41 banks of the baseline sample will imply that we only allow within the model customers to switch-off their funding sources across these banks. The final sample including all banks has 100 banks and 11,134 bank branches in the same 1768 municipalities analyzed in the previous section. This latter restriction is important to ensure a reasonable and consistent comparison between the two body of results provided in the paper.

Equation [01]. For example, the virtual deposit ratio of a given municipality will be defined as the credit market-share weighted deposit ratio of all bank branches active in that municipality at a given point in time. As in the previous section the time dimension is collapsed to avoid concerns of serial correlation. As municipality-level control variables we include their size (GDP in log US$ Mill.) and the ratio of total credit to GDP. This latter variable should capture the role of financial deepness and financial dependence in affecting regional economic performance during the crisis. The data on municipality GDP is reported on a yearly basis by the Brazilian Institute of Geography and Statistics, the statistical office of the Brazilian government. Aggregated credit is computed from the branch level data.

A first step in the analysis concerns the borrowing channel of financial contagion. 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 by estimating the effect of the (market-share weighted) shock on the change in log aggregated outstanding credit in each municipality. The results reported in column (1) of Table 5 confirm that this condition is fullfilled: municipalities facing a larger market-weighted shock in their banks experience a lower credit growth, a result that is statistically significant. This provides us with a first evidence that borrowers were unable to offset the shock, opening the window for further consequences in the local economies.

5.1 The lending channel and labor market performance.

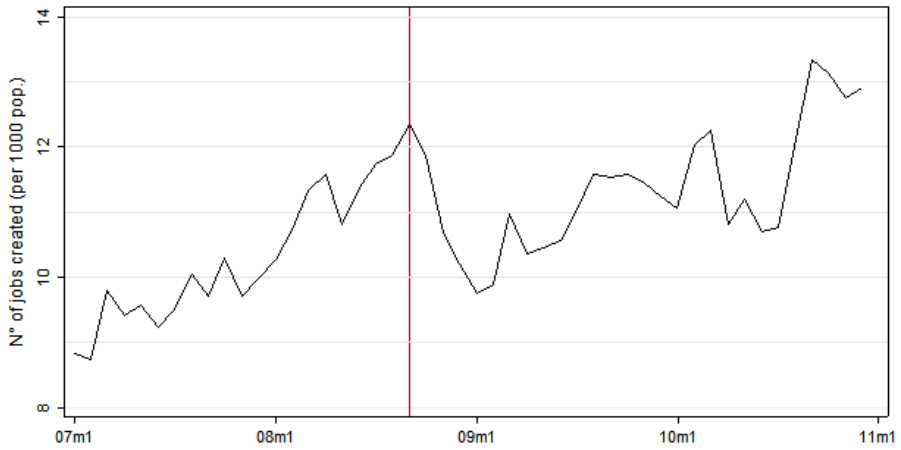
The main outcome of interest in our analysis are the number of jobs created in a each municipality per month. We hand-collected this data from the website of the Brazilian Ministry of Labor, which reports these statistics under the CAGED - General Survey of Employed and Unemployed (Cadastro-Geral de Empregados e Desempregados). These statistics are the official tool employed by the Brazilian

government in order to assess the developments in the labor market. Firms must report all new labor contracts and terminated contracts at the end of each month to the Ministry of Labor. The results are then made publicly available aggregated at the municipality level. Since these measures only cover the official labor market, we are not able to observe the trends in the informal labor market. The Ministry of Labor has conducted studies to assess the real coverage of the labor statistics concluding that it represents around 73% of total hirings and firings occuring per month. Although we can not confirm this evaluation by ourselves, we believe that relying on data of the official labor market provides a reasonable laboratory to understand the relationship between credit and labor markets, especially because rather informal and less institutionalized firms are likely to be excluded from the formal credit markets.

We construct two measures of labor market outcomes. The first is the change in the log of the average jobs created in the post-crisis period minus the average in the pre-crisis period. We call this measure "job creation". The second measure mirrors the first one but is based on the net number of jobs created (number of jobs created minus number of jobs destroyed) in each region. We call this measure "net job creation". Since the absolute number of jobs created is directly related to the size of each municipality, we add regressions in which the measure of (net) job creation is weighted by the municipalities' population and reported in terms of jobs created per 1000 inhabitants. This time series is ploted in Figure 7, which shows a large desruption in job creation (panel A) and net job creation (panel B) coinciding with the outbreak of the global financial crisis.

The results of estimating Equation [02] are reported in columns (2) to (6) in Table 5. The baseline results in columns (2) and (3) show a significant effect with the expected positive sign of the funding shock on job creation, whereas no effect is identified for net job creation. Since we believe these results to be potentially affected by the heterogeneity in municipalities' size, we next weight our output measures by

A. Aggregated job creation per 1000 population



B. Aggregated net job creation per 1000 population

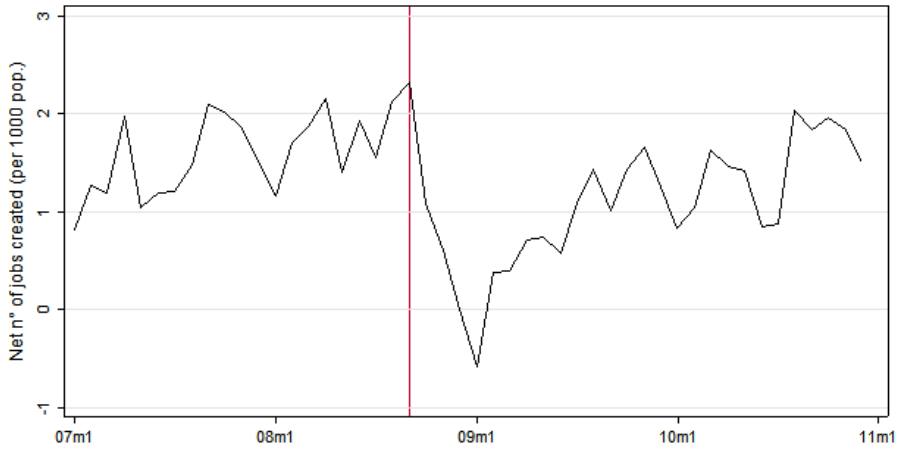


Figure 7: Time series of job market performance in Brazil.

Notes: Aggregated job creation (panel A) and net job creation (panel B) 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 substracting 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). Source: Brazilian Ministry of Labor, authors' calculations.

the municipalities' population obtained from the yearly statistics of the Brazilian Institute of Geography and Statistics. This extension is reported in columns (4) and (5), showing a significant effect of the lending channel on local job market outcomes. The results on the population-weighted net job creation, the specification delivering more economically meaningfull results, show that a decrease in 1% in the growth rate of foreign liabilities translates into a 0.17% lower growth rate in net job creation in the post-crisis period.

Table 5

Real effects of the lending channel

	(1) Aggregated ΔCredit	(2) Δ Job Creation	(3) Δ Net Creation	(4) Δ Job Creation p.p.	(5) Δ Net Job Creation p.p.	(6) Δ GDP 08-09
Δ log foreign funding	0.356***	0.296**	0.111	0.276**	0.173***	0.327**
	(0.136)	(0.178)	(0.092)	(0.113)	(0.065)	(0.131)
Bank-level						
Branch Size	−0.011	0.038**	0.036***	0.015	0.031***	−0.034***
	(0.015)	(0.018)	(0.010)	(0.013)	(0.008)	(0.009)
Branch Liquidity Ratio	7.078***	12.427***	8.128***	4.456**	7.694***	−1.562
	(2.222)	(3.164)	(2.168)	(1.972)	(1.292)	(1.368)
Branch Deposit Ratio	0.675***	0.122	0.028	0.100	0.025	−0.071
	(0.132)	(0.180)	(0.110)	(0.126)	(0.075)	(0.086)
Foreign Ownership	0.361*	−0.994***	−0.174	−0.544**	−0.213*	−0.642***
	(0.204)	(0.304)	(0.160)	(0.220)	(0.121)	(0.121)
Capital Ratio	−9.039	24.880**	0.968	17.657**	0.648	−10.727**
	(7.268)	(10.816)	(6.709)	(8.414)	(5.011)	(4.433)
Bank Liquidity Ratio	−6.924***	−15.505***	−7.106***	−10.762***	−6.231***	−0.512
	(2.561)	(2.953)	(2.086)	(2.208)	(1.659)	(1.740)
Bank Deposit Ratio	6.039***	3.755*	6.080***	3.746**	4.870***	−1.732
	(1.542)	(2.152)	(1.412)	(1.479)	(1.067)	(1.078)
Bank Size	−0.064***	−0.003	−0.034***	−0.014	−0.028***	0.040***
	(0.013)	(0.014)	(0.008)	(0.010)	(0.006)	(0.008)
Mun-level						
Size (GDP)	0.051***	0.013	−0.012	0.021**	−0.011*	0.039***
	(0.011)	(0.013)	(0.007)	(0.010)	(0.006)	(0.006)
Credit/GDP Ratio	−0.012***	0.008	0.004	0.010**	0.004	−0.003
	(0.004)	(0.006)	(0.004)	(0.005)	(0.003)	(0.003)
Obs.	1768	1768	1768	1768	1768	1768
R-squared	0.176	0.056	0.048	0.041	0.063	0.071

Notes: This table reports the results of estimating Equation [02] for different real economic outcomes at the muncipality-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 11134 bank branches. This dataset is aggregated at the municipality-level as described by Equation [02]. 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. The estimation method is OLS. 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. Variables are winsorized at the 1st and 99th percentiles. *** indicates significante at the 1% level; ** at the 5%; * at the 10%.

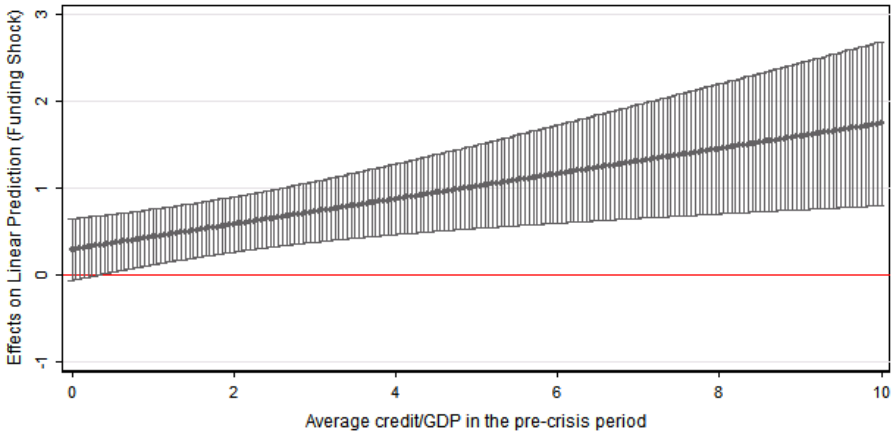
Column (6) shows that the economic fragilities triggered by the funding shock are not restricted to the job market in particular: GDP (measured as the change in log GDP between 2008 and 2009) is also weaker as a consequence of the funding shock. These results show that a cross-border lending channel like the one identified in Section 4 is by no means innocuous. When borrowers fail to access alternative funding sources to substitute their reliance on affected banks the lending channel can have significant effects on the real economy.

5.2 Are all regions equally vulnerable?

As it was the case at the bank-level, we could expect different municipalities to differ in terms of their adjustment to the funding shock. Although several vulnerabilities might come into play one that has deserve a large attention in the literature is the fragility arising from a large procyclicality of credit (Borio et al., 2001). If our results on the real economic consequences of the lending channel are correctly interpreted, we would expect the results to be also associated with more structural underlying fragilities in the financial sectors of the individual municipalities. A large procyclicality has been associated with information asymmetries and moral hazard faced by financial institutions. If the current risk of a borrower can not be assessed effectively, then this uncertainty will lead banks to overreact both in times of booms and crisis. By finding evidence that our results are driven by municipalities where this particular fragility is historically stronger, we would confirm that the effect of the funding shock is transmitted to the real economy when banks operate under higher degrees of uncertainty. Moreover this would have important policy implications, since instead of a foreign funding shock stemming exogenously from abroad the local procyclicality of credit can be indeed addressed by local macroprudential policies.

In order to provide a more widespread analysis of regional ex-ante vulnerabilities we further address the role of other characteristics that have been indetified in the literature as affecting the transmission of financial shocks to the real sector. First we interact the shock with our measure of credit to GDP ratio. Following Rajan and Zingales (1998) we would 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 can be obtained at the regional level, with smaller municipalities facing larger troubles to offset the size of the funding shock. Finally a natural question es whether we can replicate our results concerning the role of foreign

A. Effect of $\Delta log foreign\, liabilities_j$ by $Credit/GDP_j$



B. Effect of $\Delta log foreign\, liabilities_j$ by credit and job market correlation

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

Notes: This figure illustrates the marginal effects at the 95% confidence level of a non-linear extension of Equation [02]. The dependent variable $\Delta Net\, Job_j$ captures the log change in net job creation per 1000 population between the pre- and post-crisis periods. In panel A the marginal effects are retrieved from a regression of the form $\Delta Net\, Job_j = \Delta Foreign\, liabilities_j + \Delta Foreign\, liabilities_j \times Credit/GDP_j + ...$ The variable $Credit/GDP_j$ represente the pre-crisis average of the ratio of total credit to GDP in each municipality j. This panel shows that the positive coefficient estimated in Table 4 increases with the size of the local credit market relative to GDP. In panel B the marginal effects are obtained from a regression of the form $\Delta Net\, Job_j = \Delta Foreign\, liabilities_j + \Delta Foreign\, liabilities_j \times Corr(\Delta Credit, \Delta NJC)_j + ...$, where the variable $Corr(\Delta Credit, \Delta NJC)_j$ 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. Panel B shows that the effect of the foreign funding shock reported in Table 4 increases in the cases where the credit market shows a more pronounced procyclicality. The first-stage regressions are reported in Table A.3 in the appendix.

banks from Section 4 when analyzing real economic outcomes. For this purpose we interact the funding shock with foreign banks market shares in each municipality.

We conduct this final exercise by estimating a variation of Equation [02] of the

following form: $\Delta Net\,Job_j = \Delta Foreign\,liabilities_j + \Delta Foreign\,liabilities_i \times MunTrait_j + ...$ Here the variable $MunTrait_j$ corresponds to the credit to GDP ratio, log GDP, average market share of foreign banks or 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. For this purpose we rely on the earliest observations available to us for credit and job market credit dating back to 2005. The dependent variable is the change in net job creation per 1000 population used in the regression reported in Table 5, column (5).

The results are reported in Table A.3 in the Appendix where the vulnerability measures correspond to one of the aforementioned variables related to expected characteristics of municipalities that might affect the pass-through of the foreign funding shock. In line with the hypotheses discussed above we find that this pass-through is stronger when municipalities report a large credit to GDP ratio, a large market share of foreign banks and a large historical correlation between credit and job markets. The effect of the shock is also stronger in smaller municipalities, probably due to a lack of alternatives to offset the negative shock.

The marginal effect of the funding shock on net job creation along the distributions of credit to GDP ratio (panel A) and credit vs. job market correlation (panel B) are depicted in Figure 8. The results confirm our conjecture that the effects are driven by municipalities with a large financial dependence as measured by the credit to GDP ratio and historically large procyclical banking sectors. The real effect on net job creation of the funding shock increases with the historical procyclicality of local financial systems.

6 Conclusion

In this paper we document how the turbulence of international interbank markets after the collapse of Lehman Brothers affected the Brazilian financial system. Using a similar identification setup as Khwaja and Mian (2008) we find robust evidence for a bank lending channel, i.e., that banks in Brazil that saw a decrease of foreign interbank funding after September 2008 reduced credit issued by their local municipal branches. The pass-through of the foreign funding shock to local credit markets was specially pronounced for foreing-owned banks. We find that this latter conclusion relates to the fact that 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, with bank affiliates in Brazil whose parent banks reported a wider access this program being less affected by the foreign funding shock.

Our results regarding the existence of a bank lending channel are very similar to those of Khwaja and Mian (2008), Schnabl (2012) or Ongena et al. (2015). In contrast to 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 occuring within the network of regional bank branches in a large emerging country adds to the literature in terms of providing new insights on how a shock can be transmitted via retail banking networks. All in all our results suggest that a funding shock generated abroad can be transmitted across the border and across regions when large financial fragilities exist. We think that this result can contribute to achieve a better balance between the benefits and risks of banking globalization.

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Appendix

This appendix provides further details on the data and results of the article.

Data Construction

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

To account for valuation effects and to facilitate interpreting the information we converted the data from its original definition in nominal local currency to real December-2013 millions of U.S. dollars. For this purpose end-of-month data on the respective exchange rates was collected from the website of the Federal Reserve Bank of St. Louis. From the same source we obtained end-of-month inflation data for the U.S. This data was used to compute a Dollar deflator where 100% is set at December 2013. The original data was extended by including information on banks' ownership status. This latter set of information was collected mainly from banks' websites and from the Claessens and van Horen (2015) Banks Ownership Database.

Tables and Figures

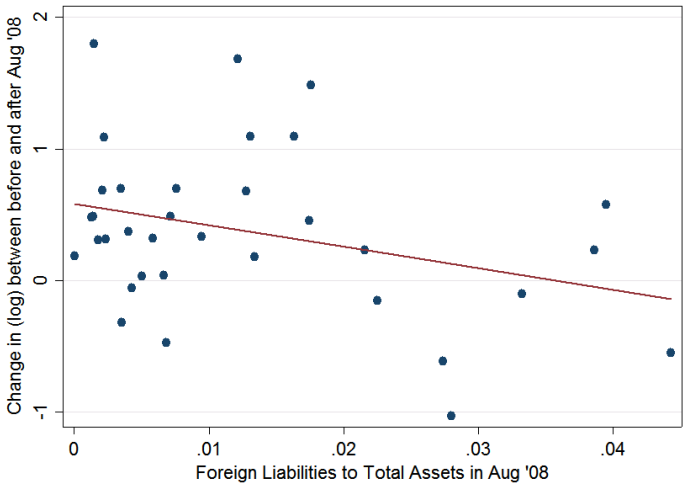

Figure A.1: Change in foreign liabilities vs. pre-crisis exposure to foreign liabilities.

Notes: This figure illustrates the relationship between the change in log foreign liabilities between the pre- and post-crisis periods and the pre-crisis ratio of foreign liabilities to total assets for the banks in the sample. The change in foreign liabilities is computed as the log difference of average foreign liabilities in the periods between January 2007-August 2008 and September 2008-December 2010. The pre-crisis ratio is computed as of August 2008. The negative relationship between the two variables evidenced in the graphic is statistically significant at the 5% level.

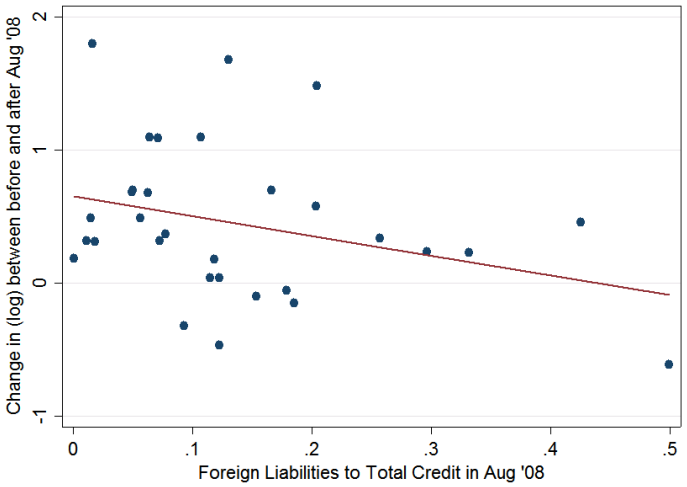

Figure A.2: Change in foreign liabilities vs. pre-crisis exposure to foreign liabilities.

Notes: This figure replicates the excercise depicted in Figure A.1 by using the pre-crisis ratio of foreign liabilities to total outstanding credit as of August 2008 as the pre-crisis exposure variable. The negative relationship between the two variables evidenced in the graphic is statistically significant at the 5% level.

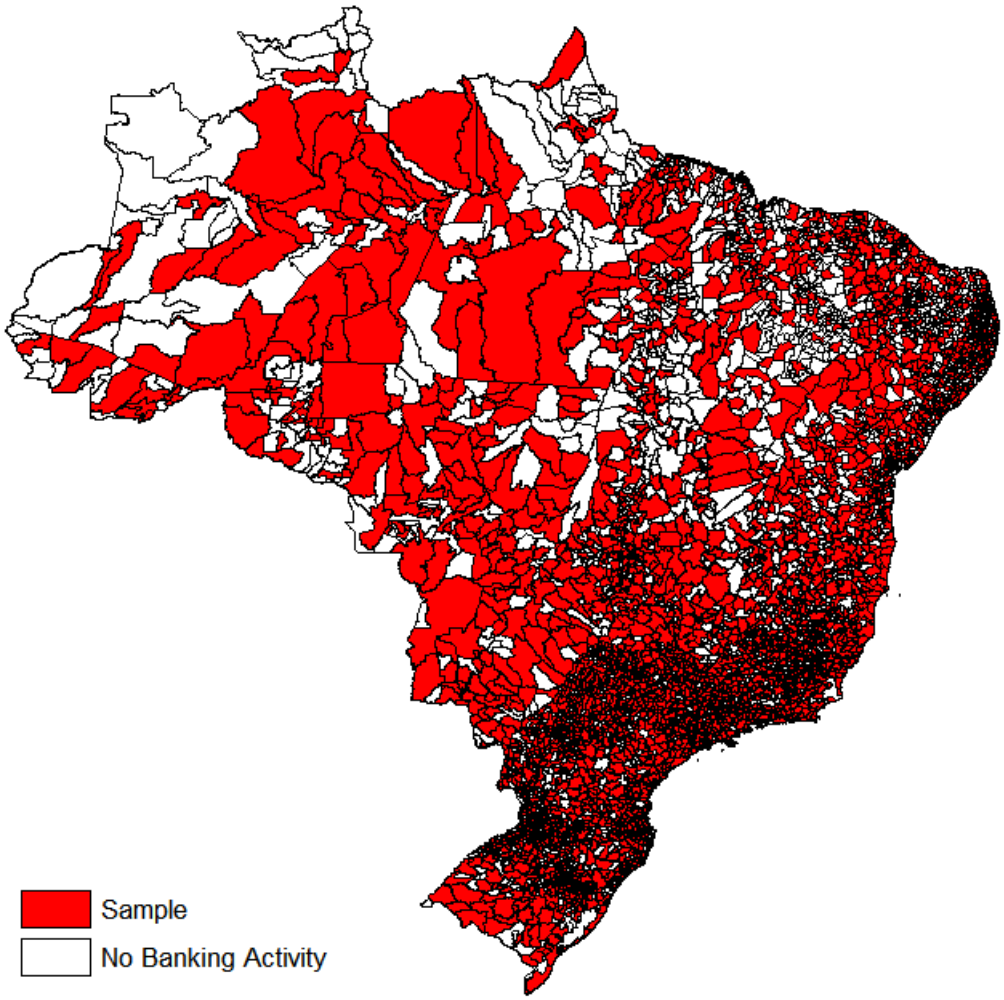

Figure A.3: Geographical distribution of the sample.

Notes: This figure depicts the geographical distribution of the baseline sample. Regions in red represent municipalities reporting banking activity via local bank branches between 2007 and 2010. The regions in white are the ones where 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 3242 out of a total of 5570 municipalities in Brazil. This corresponds to 58% of total municipalities, representing 87% of Brazilian GDP in 2008. The graph shows a relatively homogeneous geographical distribution of banks across the different regions in Brazil.

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
Δ Log foreign funding	4.899***	−0.257	37.797***	0.707
	(1.509)	(0.870)	(12.132)	(0.538)
Parent-level				
Foreign	−0.048	−0.109	−0.028	0.003
	(0.092)	(0.150)	(0.100)	(0.017)
Size (log Assets)	0.025	0.092*	0.024	−0.010
	(0.035)	(0.049)	(0.036)	(0.009)
Capital Ratio	1.552	5.872	0.971	−1.324
	(2.636)	(4.400)	(2.805)	(1.187)
Liquidity Ratio	−1.681	−1.453	−1.781	−0.518
	(2.192)	(2.307)	(2.244)	(0.516)
Deposit Base	2.272**	2.806**	2.442**	−0.158
	(0.889)	(1.269)	(0.944)	(0.247)
Credit Risk	−0.008	−0.003	0.003	0.000*
	(0.019)	(0.024)	(0.020)	(0.000)
Branch-level				
Size (log Assets)	0.036	0.041	0.033	−0.012
	(0.026)	(0.025)	(0.026)	(0.010)
Liquidity Ratio	−1.741	−2.074	−1.729	−0.758***
	(1.278)	(1.372)	(1.311)	(0.251)
Deposit Base	−0.127	−0.115	−0.123	0.088
	(0.226)	(0.243)	(0.228)	(0.058)
Obs.	6640	6640	6640	6640
R-squared	0.366	0.332	0.362	0.245

Notes: This table reports the results of estimating Equation [01] by changing the definition of the foreign funding shock. To ensure that the baseline results are capturing the effect of the crisis and not an overall changing trend in banks' foreign liabilities, 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) is based on defining 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, whereas the pre-crisis period is defined between January 2007 and July 2007. This latter regression is estimated using the FE model from Table 2. All regressions include regional fixed effects, whereas standard errors are clustered at the parent-bank level. Variables are winsorized at the 1st and 99th percentiles to control for outliers. *** indicates significante at the 1% level; ** at the 5%; * at the 10%.

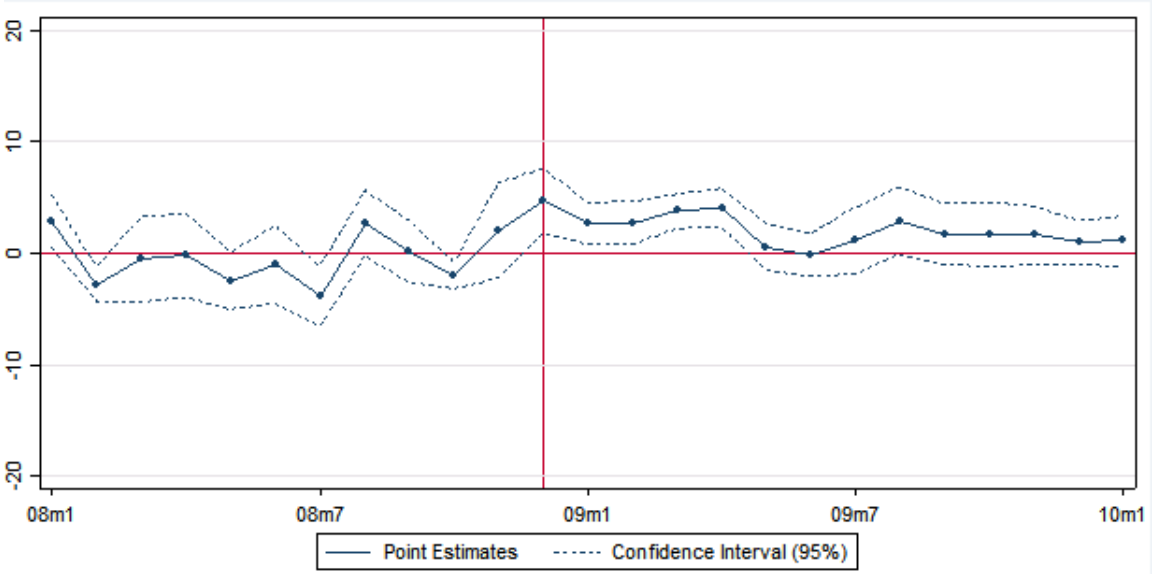

Figure A.4: Alternative definitions of the crisis period.

Notes: This figure illustrates the estimated coefficients when running the same regression reported in Table A.1, column (1), for multiple alternative time windows. Since the peak-to-trough of the foreign funding shocks depicted in Figure 1 lasts for around 7 months, we compute the 6-month change in log foreign liabilities for all 7-months rolling time windows between January 2008 and January 2010. Each coefficient depicted in the graph represents the point estimates with their respective confidence intervals for regressions where the shock is defined as the change in log foreign liabilities between 3 months before and 3 months after each date. The vertical line is set at December 2008, capturing the effect of the change in foreign liabilities between September 2008 and March 2009. The graph evidences that the positive and significant coefficient reported in Table A.1, column (1), can be only retrieved from the data when defining the shock as occuring within aprox. 10 months after the actual date of the Lehman's collapse.

Table A.2

The effect of foreign parent banks headquartered abroad

	(1) ΔCapital Ratio	(2) ΔWholesale Assets Ratio	(3) ΔWholesale Funding Ratio	(4) ΔLiquidity Ratio	(5) Relative TAF	(6) Shock-weighted TAF
Δ Log foreign funding	0.472*	−0.095	0.118	−0.051	0.057	0.041
	(0.246)	(0.113)	(0.099)	(0.134)	(0.087)	(0.082)
Δ Parent Trait	−0.303	−1.199**	−1.595**	1.407	−0.070	0.003
	(1.732)	(0.490)	(0.620)	(0.929)	(0.049)	(0.003)
Δ Log foreign funding	−31.393**	−1.520**	4.414*	−1.727	−0.534***	−0.022**
x Δ Parent Trait	(14.225)	(0.547)	(2.096)	(2.219)	(0.139)	(0.009)
Parent-level						
Size (log Assets)	−0.002	0.041**	0.024	0.034	0.048**	0.045**
	(0.032)	(0.019)	(0.035)	(0.028)	(0.021)	(0.020)
Capital Ratio	−0.333	0.614	−1.255	−0.522	0.358	−0.688
	(1.360)	(2.091)	(1.730)	(2.158)	(1.947)	(1.790)
Liquidity Ratio	−3.833	−3.914	−3.229	−3.588	−3.257	−2.253
	(2.736)	(3.534)	(2.994)	(3.144)	(3.153)	(3.004)
Deposit Base	−0.970	−2.108	−3.084***	−4.173***	−3.164**	−3.483***
	(1.339)	(1.593)	(0.772)	(1.010)	(1.186)	(0.965)
Credit Risk	−0.314	−0.394*	−0.528**	−0.363*	−0.272	−0.430*
	(0.203)	(0.203)	(0.217)	(0.196)	(0.167)	(0.216)
Branch-level						
Size (log Assets)	0.094*	0.096*	0.094*	0.096*	0.097*	0.095*
	(0.052)	(0.052)	(0.053)	(0.052)	(0.053)	(0.052)
Liquidity Ratio	4.585	5.072	5.023	4.864	4.867	5.211
	(4.989)	(4.847)	(4.914)	(5.037)	(4.868)	(4.837)
Deposit Base	0.465*	0.492*	0.473*	0.497*	0.479*	0.481*
	(0.249)	(0.251)	(0.253)	(0.257)	(0.246)	(0.247)
Obs.	545	545	545	545	545	545
R-squared	0.375	0.374	0.375	0.374	0.376	0.374

Notes: This table reports the results of estimating Equation [01] for the subsample 16 foreign-owned banks. To ensure consistency, the sample is restricted to the 545 municipalities hosting at least two foreign-owned banks. Under this setup municipality fixed-effects capture credit demand dynamics affecting bank lending. The regressions take the form of $\Delta Credit_{ij} = \Delta Foreign\,liabilities_i + \Delta Foreign\,liabilities_i^2 \times Parent\,Trait_i + ...$, where the variable $Parent\,Trait_i$ corresponds to characteristics of the bank holding company headquartered abroad. This information was restrieved from Bankscope and the variables where computed as changes between end-2008 and end-2009, due to the yearly structure of the Bankscope data. The variable $Parent\,Trait_i$ is subsequently defined by the change in the capital-asset ratio (column 1), the change in the ratio of wholesale assets to total assets (column 2), the change in the ratio of wholesale funding to total assets (column 3) the change in the ratio of liquid holdings to total assets (column 4), the average ratio of TAF balances to total assets (column 4) and the latter ratio weighted by the size of the peak-to-trough foreign funding shock (column 5). The TAF-variable is computed as the average ratio of TAF balances to total assets between September 2008 and December 2009. All regressions include regional fixed effects, standard errors are clustered at the parent-bank level. Variables are winsorized at the 1st and 99th percentiles to control for outliers. *** indicates significante at the 1% level; ** at the 5%; * at the 10%.

Table A.3

Effect of ex-ante municipalities' vulnerabilities

	(1) Credit to GDP	(2) Log GDP	(3) Foreign Share	(4) Av. Correlation (ΔCred, ΔNJC)
Δ Log foreign funding	0.053	0.381***	0.150**	0.197**
	(0.084)	(0.128)	(0.065)	(0.079)
Vulnerability	−0.002	−0.005	−1.067***	−0.019
	(0.003)	(0.006)	(0.317)	(0.022)
Δ Log foreign funding X	0.083**	−0.083*	5.320***	0.340*
Vulnerability	(0.035)	(0.044)	(1.764)	(0.184)
Bank-level				
Branch Size	0.026***	0.030***	0.033***	0.026***
	(0.008)	(0.008)	(0.008)	(0.008)
Branch Liquidity Ratio	8.063***	7.619***	7.531***	9.869***
	(1.304)	(1.292)	(1.280)	(1.725)
Branch Deposit Ratio	0.081	0.021	0.020	−0.020
	(0.080)	(0.075)	(0.074)	(0.080)
Foreign Ownership	−0.173	−0.204*		−0.265**
	(0.123)	(0.121)		(0.112)
Capital Ratio	1.035	0.039	−0.336	5.805
	(5.013)	(5.000)	(4.946)	(4.606)
Bank Liquidity Ratio	−6.547***	−6.258***	−5.788***	−8.084***
	(1.657)	(1.646)	(1.661)	(1.826)
Bank Deposit Ratio	5.087***	5.026***	4.703***	5.504***
	(1.071)	(1.070)	(1.063)	(1.158)
Bank Size	−0.031***	−0.028***	−0.029***	−0.034***
	(0.006)	(0.006)	(0.006)	(0.007)
Mun-level				
Size (GDP)	−0.007		−0.012**	−0.009
	(0.006)		(0.006)	(0.006)
Credit/GDP		0.003	0.003	0.004
		(0.003)	(0.003)	(0.003)
Obs.	1768	1768	1768	1768
R-squared	0.066	0.065	0.069	0.076

Notes: This table reports the results of estimating Equation [02] including an interaction term between the foreign funding variable and four alternative variables describing ex-ante vulnerabilities at the municipality level. The regressions take the form $\Delta Net\,Job_j = \Delta Foreign\,liabilities_j + \Delta Foreign\,liabilities_i \times Mun-Trait_j + ...$, where the variable $Mun-Trait$ corresponds either to the average pre-crisis Credit to GDP ratio (column (1)), log GDP as of 2007 (column (2)), the average market share of foreign banks (column (3)) or 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 dependent variable $\Delta Net\,Job_j$ captures the log change in net job creation per 1000 population between the pre- and post-crisis periods. Variables are winsorized at the 1st and 99th percentiles. *** indicates significante at the 1% level; ** at the 5%; * at the 10%.

Table A.4

Variables Definitions

Variable	Definition	Unit
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.	%
Branch-level		
Foreign	Dummy equal to 1 if a bank is foreign owned.	1/0
Size (log Assets)	Log of total assets of an individual bank branch.	Log US$ Mill.
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.	%
Parent-level		
Size (log Assets)	Log of total assets of a bank holding company.	Log US$ Mill.
Capital Ratio	Ratio of total equity to total assets.	%
Liquidity Ratio	Ratio of liquid assets (cash, bank deposits, gold and central bank reserves) 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.	%
Banks Abroad		
Δ Capital Ratio	Change in capital ratio between 2009 and 2008.	%
Δ Wholesale Assets	Change in the ratio of wholesale credits to total assets between 2009 and 2008.	%
Δ Wholesale Liabilities	Change in the ratio of wholesale funding to total assets between 2009 and 2008.	%
Δ Liquidity	Change in the ratio of liquid assets to total assets between 2009 and 2008 .	%
Relative TAF	Average of the ratio of TAF balances to total assets between September 2008 and December 2009.	%
Shock-weighted TAF	Relative TAF divided by the absolute value of the foreign funding shock. The shock is defined as the change in log foreign liabilities between September 2008 and June 2009.	%
Municipality-level		
Size (GDP)	Annual GDP of a given municipality reported as of December of each year.	Log US$ Mill.
Credit / GDP Ratio	Ratio of GDP to total aggregated credit by all branches in a municipality.	%
Job Creation	Number of signed job contracts reported to the ministry of labor.	#
Net Job Creation	Job creation minus the number of job contracts terminated in a given month.	#

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 foreign banks' traits).