Internal Liquidity Management and Local Credit Provision

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Abstract

Using a unique branch-level dataset of Brazilian banks, this paper studies the patterns of internal liquidity management and how these business practices affect bank lending. Our results suggest first that net due to positions increase during times of financial stress, but this increase is driven by domestically-funded banks, in other words, by banks that are relatively isolated from the stress. Second, headquarter cities of banks tend to have negative due to positions implying that these areas lend money internally to other branches in the banking group. This result is consistent with the headquarter locations raising funds abroad or via wholesale markets and then supplying it to its branches. This negative correlation between the due to position and headquarter locality remains during a period of financial stress and is the same for private and government banks. Third, private banks shift their internal funds during a stress period to richer areas. Lastly, we find that internal liquidity management plays an important role for banks' ability to lend, especially for those exposed to financial stress. Taken together, this paper provides the first branch-level evidence of the way that banks ration liquidity both in normal times and in times of stress, and the impact this has on bank lending.

Keywords: Internal liquidity management, Brazil, bank lending

JEL Classification:

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1. Introduction

The wave of financial globalization that started in the 1980s transformed financial markets and institutions around the world. As a result of this trend of financial integration, global banks increased their footprint within their domestic markets and across both emerging and advanced economies. In this process, banks developed different business models to manage the funds raised from external sources (CGFS, 2010). One of those business models relies intensively on the management of liquidity within the banking organization.

This paper studies the patterns of internal liquidity management for large banks in Brazil and how these business practices affect bank lending to non-related borrowers. In particular, we try to answer two questions: How do banks manage liquidity within their organizations after suffering a liquidity shock? And what is the impact of liquidity management within the banking organization on bank lending and the real economy?

To answer these questions, we use a novel dataset with information on the Brazilian banking sector. The main advantage of these data is that they capture the balance sheets of branches that belong to the same banking organization aggregated by municipality. This information is recorded at a monthly frequency, which helps us investigate the effect of liquidity shocks on the aggregate balance sheet of the banking organization and of its local branches. More important, these data include the net lending of branches to other parts of the organization. This allows us to map, at the micro level, the degree of liquidity management that takes place within the organization as external factors change.

We need a second piece of information to answer our questions. More precisely,

we have to find an external shock that affects Brazilian banks' liquidity conditions, without this shock being correlated with the solvency of those banks or the economic activity of the municipalities in which these banks operate. In our particular sample period, the closest shock with these characteristics is the so called "taper tantrum" (Fischer, 2014). In the spring of 2013, the Chairman of the U.S. Federal Reserve announced that the pace of asset purchases that the central bank was conducting at the time would decelerate in the near future. Financial markets reacted strongly and flows moved quickly out of some emerging markets. Brazilian banks were not immune to this shock and they lost roughly $20 billion in external funding in two quarters. This shock allows us to identify the reaction of banks within Brazil to the change in liquidity conditions and in particular, their adjustment in net lending within their banking organization as a result of the reduction in external financing.

Figure 1 is a flow chart of how internal liquidity management works mechanically. In Municipality 1, the headquarter location will raise external funds, potentially from foreign sources. It will then lend internally to branches in Municipality 2 and Municipality 3 depending on the liquidity needs of the branches in those locations. It is also possible that Municipality 2 and Municpality 3 lend/borrow from each other. Our data allow us to see the intrabank assets and the intrabank liabilities for each bank in each municipality. We, thus, cannot observe whether Municipality 2 is a net lender to Municipality 3 and a net borrower from Municipality 1. We can observe that this bank in Municipality 2 is a net borrower from the overall banking group (Municipality 1 and Municipality 3 in this example). From this information, we calculate a net due to position for each bank in each location. This position is simply the size of intrabank liabilities net of intrabank assets scaled by total assets in that

location. A positive net due to position, then, implies that the bank operating in a specific location has more intrabank liabilities than assets, which means that it is a net borrower from the banking group. Conversely, a negative net due to position implies that the bank operating in a specific location is a net lender to the banking group.

In our first set of tests, we investigate whether banks follow specific liquidity management patterns across their network of branches. Our results suggest first that net due to positions increase during times of financial stress, but this increase is driven by domestically funded banks, in other words, banks relatively isolated from the stress. Second, our results suggest that headquarter cities of banks tend to have negative due to positions implying that these areas lend money internally to other banks in the banking group. This is consistent with the headquarters location raising money abroad and then supplying it to its branches. Third, that this negative correlation between the due to position and headquarter locality remains during a period of financial stress and is the same for private and government banks. Fourth, that private banks shifted their internal funds during a stress period to areas with higher per capita incomes.

We then test whether this impact on internal liquidity management of Brazilian banks had any effects on their lending to non-related customers. We find that banks with more intrabank liabilities tend to have more lending, consistent with the view that this intrabank funding is actually useful in providing additional credit to the real economy and risk sharing within the banking organization. This effect becomes significantly larger following the start of the taper for those banks particularly exposed to the Fed's taper. In future work we will examine the impact that liquidity

management has on real outcomes including employment and wages.

The study of liquidity management within banking organizations and its impact on the lending activities that these banks conduct has been an active field of research in recent years. Starting with the work of Campello (2002), several papers in the literature have found that risk sharing within banking organizations helps mitigate external shocks, such as changes in monetary policy. This is particularly true for banks that have a large global footprint that allows them to move funds between countries that face different sets of uncorrelated shocks (Cetorelli and Goldberg, 2012).

Another strand of the literature focuses on the real effects of having banking sectors with more geographically diversified banks (Morgan and E., 2004). This literature finds that as bank linkages across regions increase, the fluctuations in the business cycles of those states decrease, but at the same time, the fluctuations of these regions tend to converge.

Similar evidence exists in the economic development literature of risk-sharing across households, where a households' consumption varies less with its own income than with the average income of other households in its village, caste, or ethnic group. Townsend (1994), for example, finds that while income is highly variable across households within Indian villages, consumption is not, with households reallocating income to equalize the marginal utility of consumption. Udry (1994) examines the channels by which such reallocations occur. In his study of households in Northern Nigeria, he finds that households extensively borrow and lend to one another. When a household experiences a negative shock, it will demand payments on loans that it has made while delaying payments on its debts, and thereby smooths income and consumption.

This paper is related to these three strands of the literature, as we examine whether

lending by bank branches within bank networks varies more depending on their own deposits or on the deposit base of their parent banks. We further examine the channels by which any smoothing in lending occurs. Namely, we can observe the interbranch transfers within a bank to determine whether branches are obtaining resources from their branch network or lending resources to their branch network.

2. Brazilian Banking Sector

Brazil's modern banking history dates back to the early-1800s, with the establishment of foreign banks and domestic banking houses that helped finance the initial debts of the country. During several early banking crises, both national and state governments acted as "insurers against failure" (Musacchio and Lazzarini, 2014) and assumed control of troubled, private banks. The role of Brazil's government banks expanded during the twentieth century to include the promotion of state-level development projects, the generation of employment, and the distribution of patronage (Ribeiro and Guimaraes, 1967) (Triner, 2000) (Beck and Summerhill, 2005).

Government banks were so politically valuable that by the 1970s, the federal government owned five of them and every state at the time owned at least one of them.[1] State-owned banks were historically mismanaged. Brazil's monetary authority

[1]The five national banks are Banco do Brasil, which was founded in 1808, served as Brazil's monetary authority until the creation of the Central Bank of Brazil in 1964, and was officially part of the National Treasury until 1987; Caixa Economica Federal, which was established in 1861 as a savings institution; Banco da Amazonia, founded in 1942 to finance rubber cultivation and later re-organized to provide general banking services to the Amazon region; Banco do Nordeste do Brasil, established in 1952 to provide banking services and promote development in the Northeast region; and Banco Nacional de Desenvolviment Economico e Social (BNDES), a wholesale development bank founded in 1952 to provide long-term financing to infrastructure and strategic sectors. Banks owned by individual state governments were present in all but two of Brazil's 27 states (including the Federal District), and these two states were formed only more recently.

intervened 71 times in the state-owned banks of 18 states between 1955 and 1996. Given the history of mismanagement, the Brazilian federal government incentivized the recapitalization and privatization of state-owned banks, beginning in 1996, and now only seven states have these institutions.

The location decisions of state and government bank branches also do not appear to react to changes in localities' economic or social characteristics over time. While the initial entry of government bank branches into a locality likely corresponds to the locality's contemporaneous economic and social circumstances, government bank branches almost never exit a locality. This suggests that while a locality's economic and social characteristics evolve, it is not necessarily the case that its bank branch composition evolves with it.

Given their development objectives, a plausible hypothesis is that government banks might lend differently and allocate intrabank funds in a different manner than private-sector banks, especially during times of crisis. With consolidated data for all of a bank's branches in each municipality in Brazil, we are able to examine how intrabank funds flow across different types of localities. Particularly, we can assess whether government banks differentially capture resources from or lend resources to poorer localities or localities with greater external financial dependence, as measured by their employment composition.

3. Data and Empirical Framework

This section discusses the sample selection, the data, and provides summary statistics.

3.1. Sample

For our analysis, we focus on the period between 2011Q1 and 2014Q4 and divide the sample into a pre- and post-"taper" period. Our "taper" variable takes a value of 1 starting in 2013Q2 when the Federal Reserve's Federal Open Market Committee's (FOMC) began publicly discussing plans to scale down its quantitative easing program.

Brazil has 5,565 municipalities, which subdivide the states into smaller administrative entities. Because municipalities split and recombine over time, we collapse municipalities into spatially constant units, which we term "localities." More specifically, we use municipal borders from 1970 and then further combine municipalities that are part of the same urban agglomeration (metropolitan area). Our final sample includes the 2,214 localities that have at least one bank branch, roughly corresponding to individual labor and credit markets.

Currently, approximately one-third of Brazil's nearly 20,000 bank branches belong to federal government banks, approximately half to private sector banks, and the remainder to state-government banks. Collectively, state and federal government banks account for approximately 45% of total bank assets in Brazil (Barth and Levine, 2013). Our sample of 28 banks consists of government banks and privately-owned domestic and foreign banks. Wanting to exclude some smaller and economically unimportant banks that could drive the results, we first trim the sample to include only those banks that make up the top 99% of assets in the banking sector. Without any reporting errors, we would expect internal borrowing and lending between branches to equal one another when aggregating across all branches for a given bank. We exclude a small number of banks that are believed to be inaccurate reporters when the difference in

these net positions are nontrivial (greater than 1% of consolidated bank assets).

3.2. Data and Summmary Statistics

3.2.1. Data

Due to data limitations, previous research has been unable to provide a robust analysis of intrabank funding and how it is used in times of funding stress. For example, the U.S. Summary of Deposits data include information on branch locations and deposits but does not provide broader balance sheet information at the branch or locality level. We overcome this shortcoming in the literature by using a rich database for Brazilian banks, which includes comprehensive financial statements at various levels of aggregation. We utilize both consolidated bank balance sheets and bank balance sheets disaggregated by municipality, which are published by the Central Bank of Brazil at a monthly frequency. For our analysis, we collapse the data to quarterly averages. In the context of internal liquidity management, the granularity of the data allow us observe how different branches within a banking network shift deposits between each other in response to an external funding shock or changes in local economic conditions.

After identifying the link between an external funding shock, intrabank lending, and external credit provision, we can examine how these changes in bank operations translate into effects on real outcomes. To measure the local economic impact of these changes in lending, we utilize the Brazilian yearly employment census, Relacao Anual de Informacoes Sociais (RAIS). The RAIS identifies all employees on the payroll of formal sector firms as well as the self-employed who pay into the social security system. The data cover approximately 2.5 million establishments and 36 million workers. Finally, we use information on locality-level GDP and control variables including

measures of urbanization, education, income, population, and exports, which all come from Brazil's Institute of Applied Economic Research (IPEA).

3.2.2. Summmary Statistics

Figure 2 shows the Brazilian banking sector CDS spread. During this time period, the U.S. Federal Reserve announced a series of unconventional monetary policies. The figure reveals that the stress in the banking sector increased significantly following the announcement of the decision to taper the Federal Reserve's unconventional monetary policy.

In Table A1 (in appendix), we present the summary statistics for total assets, loans (net of loss provisions), deposits, and intrabank funding flows for a given bank i, in municipality j, at time t. Altogether, the branch networks of the 28 banks in our sample span 2,214 Brazilian municipalities. Between 2011 and 2014, the median bank branch held roughly 29.2 million Brazilian reais in total assets. The median branch also respectively held 20.8 million in loans and 21.4 million in deposits. Net due to measures the internal transfer of funds between branches within a single bank's branch network. Thus, net due to, which is calculated as liabilities less assets, provides a net measure of the branch's interbranch, intrabank borrowing (or lending) position. When we focus on the subsample of "net borrowers," branches that borrow more from their bank's network than they lend out, the median branch's internal borrowing (net of internal lending) is roughly 38 percent of total assets. Similarly, for the median branch in the subsample of "net lenders", the amount of funds lent out to other branches (net of internal borrowing) is roughly 32 percent of total assets.

In Table B1 (also in appendix), we report sample means for a similar set of variables when dividing the sample into separate subgroups. For example, when differ-

entiating between branches in municipalities that are above and below our sample's median municipality per capita GDP in 2010 (4,922 Brazilian reais), we find that branches in "high income" municipalities are both larger and rely more heavily on internal borrowing, on average. We find similar trends for branches in population centers relative to counterparts in less populated municipalities. The results in Panel C show that branches in non-headquarter locations lend more internally (net of borrowed funds) to other branches, on average, as a share of total assets than headquarter locations. Lastly, Panel E presents an interesting trend that the average branch of a government-owned bank is a net borrower whose net internal borrowing accounts for 9 percent of total assets. In contrast, the average branch of a privately-owned bank is a net lender with net internal lending accounting for 30 percent of total assets. The summary statistics from Table 1B suggest that there is some heterogeneity in internal funding flows and other balance sheet characteristics across banks and municipalities, motivating the need to examine these relationships econometrically.

3.3. Empirical Framework

This paper aims to understand the impact that bank funding stress has on the intrabank market and how this, in turn, impacts local lending and real economic outcomes. To attribute a causal impact, we use the so-called "Taper tantrum" event when the market began to anticipate the Federal Reserve's shift away from accommodative monetary policies as an exogenous shock to bank funding conditions in Brazil. In this section we describe our econometric methodology.

We first are interested in understanding the impact of changes in liquidity provision through the interbranch network following the start of the Federal Reserve's taper. In our analysis, we treat the taper as an exogenous shock to the ability of banks

to access funding in international markets, and thus may require banks to rely more heavily on their branch networks. To test this, we run the following specification:

$$y_{ijt} = \alpha + \beta_1 Post_t + \beta_2 PostXForeignFunded_{ijt} + \delta_i + \theta_t + \epsilon_{ijt} \quad (1)$$

where y_{ijt} is the net due to position, calculated as:
$[intrabankliabilities_{ijt} - intrabankassets_{ijt}]/[totalassets_{ijt}]$ for bank i, in locality j, in quarter t. A positive net due to position implies that a bank branch is a net borrower from other bank branches within the banking organization, and a negative position implies that the bank branch is a net lender from other bank branches. Figure 3, for example, shows the distribution of net borrower and net lender localities for the Bank of Brazil. This regression includes bank fixed effects, δ_i, and we additionally include time fixed effects, θ_t, in alternative specifications. Note that the dummy variable for being a government bank is omitted as it is collinear with the bank fixed effect. In all of our estimations in this and the following sections, we cluster at the bank level.

Because the headquarter office of a bank is likely to have greater access to external funding, we can differentiate bank branches as being either in the headquarter city or not. Figure 4 shows the geographic distribution of the headquarters of banks in Brazil. In particular, our sample's headquarter locations are largely concentrated in Sao Paulo and Brasilia.

To test how banks changed their liquidity management with respect to its headquarter location during the Federal Reserve's taper, we run the following specification:

$$y_{ijt} = \alpha + \beta_1 Post_t + \beta_2 headquarters_{ij} + \beta_3 PostXheadquarters_{ij} + \delta_i + \sigma_j + \theta_t + \epsilon_{ijt} \quad (2)$$

where again y_{ijt} is the net due to position as calculated above. In these regressions we include either bank and locality fixed effects or bankXlocality fixed effects in al-

ternative specifications. We additionally run regressions where instead of including a dummy for the headquarter locality of a bank, we include an indicator of economic development. In these regressions, we are interested in understanding whether intrabank transfers flow from rich to poor localities or vice-versa.

We ultimately aim to test what impact this shock to bank funding has on lending at the locality level. To test this, we run the following specification:

$$y_{ijt} = \alpha + ... + \beta_1 PostXNetDueToXForeignFunded_{ijt} + \delta_i + \sigma_j + \theta_t + \epsilon_{ijt} \quad (3)$$

where y_{ijt} is the natural logarithm of total credit operations for bank i in locality j in time t. We include controls at the bank-by-locality level, at the banking group level, and at the locality level. We additionally include the size of the intrabank positions for each branch over time. Our hypothesis is that bank branches will lend more if their intrabank liabilities are higher ($\beta > 0$) because it is precisely these liabilities that will allow them to continue their credit expansion if they run out of deposits to lend. The last test that we run expands equation (3) to include the "Post" dummy to see if these relationships held in the environment with higher bank funding stress. We will be expanding this analysis to see if the differential changes in lending caused by the taper had any impact on local employment, wages, and firm growth.

4. Results

We first present results that show how the net due to positions of bank branches vary following the "Taper tantrum." We allow for a differential impact on foreign funded and domestically funded banks as foreign funded banks are more exposed to the United States' financial sector. Instead of simply using a dummy for the

"tantrum," we additionally use the Brazilian bank CDS spread index which will capture the stress of the Brazilian banking sector at any given moment. We then test whether there are differences between branches located in the headquarters city or in wealthy cities to understand whether it is money being transfered from the country side to cities or vice versa. Our last set of results looks at the impact of the net due to position on lending by bank branches in Brazil.

4.1. Net Due To Position

Table 1 shows the results from estimating equation (1) for quarterly net due to positions at the bank-by-locality level on a *Post* period dummy for the "Taper tantrum," and the interaction between *Post* and a dummy variable for whether the bank is foreign funded. The even number columns alternatively report results using a dummy for a bank being privately owned (instead of government owned) which in subsequent tables we use as our proxy for foreign exposure.

Column (1) includes bank and quarter fixed effects and shows that net due to positions increase during the taper tantrum but this effect is driven by domestically funded banks. Column (2) shows the same results but uses private banks as an indicator for foreign exposure as opposed to foreign funding, and we find the same to be true. These results are consistent with banks that are internationally exposed being less able to fund themselves and thus needing to reduce their intrabank exposures. Columns (3) and (4) show the same results including bank, city, and time fixed effects and we find the same results. Lastly, to control for local demand conditions, we include bank and cityXtime fixed effects in columns (5) and (6) and find similar results.

Instead of using a dummy variable for the "Taper tantrum" to proxy for stress

in the Brazilian banking sector as in Table 1, one could instead use a bank-wighted credit default swap spread to provide a more contemporaneous measure of stress. The aggregate CDS index is shown in Figure 2 with a vertical line indicating the beginning of the "Taper tantrum." We see that following the start of the "tantrum" bank CDS spreads increase significantly, suggesting an increase in banking system stress in Brazil.

Table 2 presents the results of Table 1 but using the Brazilian banking sector CDS spread instead of the "*Post*" dummy. Again, we find positive, and marginally statistically significant coefficients on the CDS spread implying that as banking system stress increases, banks fund themselves through internal liquidity management more prominently. This effect, though, is again driven by the domestically funded banks (in columns (1), (3), and (5)) and through private banks (in columns (2), (4), and (6)).

One innovation of this paper is that we are able to see the net due to position of banks at the locality level. We are thus able to see from where banks are moving funds in times of stress. Are banks moving internal funds from the headquarter location, where they may have been able to obtain funds through capital markets? Are banks moving internal funds from poorer areas with few viable investment opportunities to richer areas with more plentiful investment uses?

Table 3 reports results of the net due to positions of banks and how they vary by time and international exposure. For the remainder of the analysis we compare private banks with domestic banks as they provide a cleaner proxy for foreign exposure than our constructed measure of foreign funding; the two measures yield the same qualitative results.

We find consistent evidence that there is a negative relationship between being a headquarters of a bank and net due to positions in Brazil. This means that the headquarter city has higher intrabank assets than it has intrabank liabilities implying that headquarters locations manage liqudity through lending money to branches not located in the headquarter city. We do not, however, find that this negative relationship changed during the period of bank stress. This result is consistent whether we include bank, city, and quarter fixed effects, as we do in columns (1)-(3) or bank and locality-by-time fixed effects as we do in columns (4)-(6). Even though we added some additional controls and interactions, the negative effect on private banks during the "Taper tantrum" persists.

Table 4 shows results consistent with Table 3, but using the Brazilian banking sector CDS spreads as the measure of bank stress instead of the dummy for the "Taper tantrum" period. The results overall are similar, namely that headquarter locations are net lenders of internal liquidity, but this did not change markedly during the period of greater bank stress. Private banks decreased their internal liquidity management during this period, but there was no difference in the use of headquarter locations between private and government banks during the period of bank stress.

Our rich dataset also allows us to see whether banks manage internal liquidity by shifting money from rich to poor areas or vice-versa. Tables 5 and 6 explore this issue. In Table 5, we find that private banks in high income areas, defined as above the median per capita gross municpal product, have higher net due to positions meaning that private banks shift their internal liquidity to richer areas, presumably because investment prospects are higher in these areas. In the regressions with locality-by-time and bank fixed effects, we find that this effect increased, relative to poorer

areas, during the stress period. Private banks overall reduced the extent to which funds were re-allocated across branches within their bank network during the stress period, however.

We present the same qualitative picture in Table 6 where we replace the "Post" dummy with the Brazilian bank CDS spreads. The coefficients in this table have the same sign as in Table 5 but with less statistical significance. Tables 7 and 8 report similar results to those in Tables 5 and 6 using a continuous measure of income instead of a dummy for being above or below the median per capita income level, and we find the results still hold.

As a robustness check, we show an alternative to our baseline results reported in Tables 1-8 where we cluster at the bank level. Because the sample size of banks in Brazil is limited, a concern is small sample clustering. In Table 9 columns (1) and (2), we provide results of the net due to positions of banks regressed on "Post," "PostXForeign Funded," and "PostXPrivate Bank" and clustered at the bank level which are the same regressions as in Table 1. Columns (3) and (4) replace "Post" with the CDS spreads as in Table 2. Columns (5)-(8) provide bootstrapped results. As expected, the coefficient estimates are identical as we are only adjusting the standard errors, but we additionally find that the significance of our results remains even after the bootstrapping procedure.

Our internal liquidity management results suggest the following: First, net due to positions increase during times of financial stress, but this increase is driven by domestically funded banks, in other words, by banks that are relatively isolated from the stress. Second, headquarter cities of banks tend to have negative due to positions implying that these areas lend money internally to other banks in the banking

group. This is consistent with the headquarter locations raising money abroad or via wholesale markets and then supplying it to its branches. Third, this negative correlation between the due to position and headquarter locality remains during a period of financial stress and is the same for private and government banks. Fourth, private banks shift their internal funds during a stress period to richer areas. These results hold whether we used a dummy for the "Taper tantrum" or the CDS spreads, control for various specifications of fixed effects, or bootstrap standard errors.

4.2. Lending

The previous section showed how the net due to positions of bank branches changed when bank funding became stressed. This section presents results on how lending is related to the net due to positions of banks and then how it was impacted by the taper.

Table 10 presents our first results on how lending is related to the net due to positions of bank branches. In columns (1) and (2) we see that the net due to position is positively correlated with locality level lending which implies that bank branches that are net borrowers are using that money to increase lending beyond what would be possible using only local deposits. We do not find for the overall sample that this dependence on internal liquidity becomes more important during the stress period. We do, however, find that banks that are more exposed to the international financial system rely more heavily on internal liquidity management for their lending and that this dependence became stronger during the "Taper tantrum."

5. Discussion and Conclusion

Using a unique dataset that allows us to see the interbranch operations of bank networks, we analyze how banks utilize their intrabank market to raise funding, e.g., take deposits from certain locations and transfer them to other branches within their banking group. As far as we know, this is the first analysis that has been able to use bank balance sheets at the city level which allows us to clearly identify the dynamics of internal bank liquidity provision.

Our internal liquidity management results suggest first that net due to positions increase during times of financial stress, but this increase is driven by domestically funded banks, in other words, banks relatively isolated from the stress. Second, that headquarter cities of banks tend to have negative due to positions implying that these areas lend money internally to other banks in the banking group. This is consistent with the headquarters location raising money abroad and then supplying it its branches. Third, that this negative correlation between the due to position and headquarter locality remains during a period of financial stress and is the same for private and government banks. Fourth, that private banks shifted their internal funds during a stress period to richer areas. These results hold whether we used a dummy for the "Taper tantrum" or the CDS spreads, control for various specifications of fixed effects, or bootstrap standard errors. We additionally find that internal liquidity mangement plays an important role for banks' ability to lend, especially for those exposed to financial stress.

Taken together, this paper provides the first branch-level evidence of the way that banks ration liquidity both in normal and in stressful times and the importance of this for banks to continue lending.

Citations: (Barth and Levine, 2013) (Beck and Summerhill, 2005) (Bernanke and Blinder, 1988) (Cetorelli and Goldberg, 2012) (Coleman and Feler, 2015) (CGFS, 2010) (I.M.F., 2013) (Jimenez and Saurina, 2014) (Kashyap and Stein, 2000) (Khwaja and Mian, 2008) (Morgan and E., 2004) (Musacchio and Lazzarini, 2014) (Ribeiro and Guimaraes, 1967) (Townsend, 1994) (Triner, 2000) (Udry, 1994)

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6. Tables

Table 1: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
Post	22.356*	29.698***				
	(10.855)	(6.778)				
Foreign FundedXPost	-49.648**		-82.927***		-89.027**	
	(20.242)		(27.808)		(36.244)	
Private BankXPost		-62.322***		-89.068***		-97.863***
		(17.939)		(23.392)		(29.181)
R^2	0.83	0.83	0.89	0.89	0.90	0.90
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City			✓	✓		
Quarter	✓	✓				
Time			✓	✓		
CityXTime					✓	✓

Notes: Table 1 reports regressions of the net due to position of a bank in a given locality on a dummy, *Post*, equal to 1 during the "Taper tantrum" period and interactions of *Post* with a dummy for being *ForeignFunded* (odd numbered columns) and for being a *PrivateBank* (even numbered columns). The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 2: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
CDS Spread	0.149	0.236*				
	(0.103)	(0.117)				
Foreign FundedXCDS Spread	-0.421**		-0.672**		-0.692**	
	(0.189)		(0.231)		(0.305)	
Private BankXCDS Spread		-0.577***		-0.775***		-0.835***
		(0.189)		(0.195)		(0.256)
R^2	0.83	0.83	0.89	0.89	0.90	0.90
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City			✓	✓		
Quarter	✓	✓				
Time			✓	✓		
CityXTime					✓	✓

Notes: Table 2 reports regressions of the net due to position of a bank in a given locality on the 5 year CDS spread of the aggregate Brazilian banking sector and interactions of the CDS spread with a dummy for being $ForeignFunded$ (odd numbered columns) and for being a $PrivateBank$ (even numbered columns). The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 3: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
Post	-14.696	37.062***	36.980***			
	(15.875)	(7.896)	(7.911)			
Headquarters	-521.909***	-549.733***	-557.644***	-538.891***	-561.586***	-549.761***
	(124.052)	(124.927)	(132.970)	(147.759)	(152.674)	(164.050)
HeadquartersXPost	-33.826	-33.316	-14.886	13.234	2.548	-25.500
	(31.599)	(26.847)	(35.967)	(56.195)	(54.103)	(46.012)
Private BankXPost		-70.634***	-70.520***		-97.718***	-98.015***
		(18.430)	(18.548)		(29.267)	(29.493)
Private BankXHeadquarters		145.186	161.989		141.174	114.249
		(96.465)	(108.021)		(121.053)	(145.667)
Private BankXHQRsXPost			-38.713			61.318
			(53.685)			(127.526)
R^2	0.89	0.89	0.89	0.90	0.90	0.90
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City	✓	✓	✓			
Quarter	✓	✓	✓			
CityXTime				✓	✓	✓

Notes: Table 3 reports regressions of the net due to position of a bank in a given locality on a dummy, *Post*, equal to 1 during the "Taper tantrum" period, a dummy for that location being the headquarter location of a given bank, $Headquarters$, and interactions of *Post* and $Headquarters$ with a dummy for being a $PrivateBank$. The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 4: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
CDS Spread	-0.163	0.279**	0.277**			
	(0.170)	(0.118)	(0.117)			
Headquarters	-425.650**	-458.210***	-521.437**	-529.721**	-539.730***	-517.784**
	(159.733)	(147.985)	(183.868)	(190.875)	(184.659)	(223.519)
HeadquartersXCDS Spread	-0.576	-0.561	-0.231	-0.016	-0.116	-0.231
	(0.397)	(0.344)	(0.428)	(0.684)	(0.654)	(0.579)
Private BankXCDS Spread		-0.669***	-0.667***		-0.834***	-0.835***
		(0.196)	(0.197)		(0.257)	(0.260)
Private BankXHeadquarters		147.235	281.303		144.239	95.688
		(96.032)	(189.300)		(120.178)	(340.431)
Private BankXHQRsXCDS Spread			-0.699			0.253
			(0.688)			(1.537)
R^2	0.89	0.89	0.89	0.90	0.90	0.90
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City	✓	✓	✓			
Quarter	✓	✓	✓			
CityXTime				✓	✓	✓

Notes: Table 4 reports regressions of the net due to position of a bank in a given locality on the 5 year CDS spread of the aggregate Brazilian banking sector, a dummy for that location being the headquarter location of a given bank, $Headquarters$, and interactions of the CDS spread and $Headquarters$ with a dummy for being a $PrivateBank$. The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 5: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
High IncomeXPrivate Bank	95.864***	95.017***	81.994***	98.152***	97.511***	77.430***
	(19.955)	(19.798)	(21.729)	(24.671)	(24.641)	(25.397)
Post		35.427***	41.766***		224.991	223.239
		(8.496)	(7.485)		(208815.636)	(208096.585)
PostXPrivate Bank		-69.747***	-86.140***		-96.585***	-121.619***
		(19.188)	(24.000)		(29.038)	(23.491)
PostXHigh Income		1.824	-10.966		-95.834	719.076
		(10.471)	(12.979)		(25479337.168)	(25507476.479)
PostXPrivate BankXHigh Income			28.029			42.204*
			(26.825)			(21.522)
R^2	0.89	0.89	0.89	0.91	0.91	0.91
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City	✓	✓	✓			
Quarter	✓	✓	✓			
CityXTime				✓	✓	✓

Notes: Table 5 reports regressions of the net due to position of a bank in a given locality on a dummy equal to 1 if it is above the median per capita GDP, $HighIncome$, a dummy, $Post$, equal to 1 during the "Taper tantrum" period and interactions of $HighIncome$ and $Post$ with a dummy for being a $PrivateBank$. The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 6: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
High IncomeXPrivate Bank	95.864***	95.269***	44.518	98.152***	97.514***	7.001
	(19.955)	(19.800)	(63.719)	(24.671)	(24.599)	(55.574)
CDS Spread		0.297*	0.357**		0.782	0.971
		(0.142)	(0.166)		(3150.059)	(3137.609)
CDS SpreadXPrivate Bank		-0.646***	-0.802**		-0.808***	-1.095***
		(0.203)	(0.279)		(0.253)	(0.177)
CDS SpreadXHigh Income		-0.046	-0.163		-88.076	-50.272
		(0.111)	(0.172)		(352627.641)	(352912.821)
CDS SpreadXPrivate BanksXHigh Income			0.262			0.465
			(0.329)			(0.275)
R^2	0.89	0.89	0.89	0.91	0.91	0.91
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City	✓	✓	✓			
Quarter	✓	✓	✓			
CityXTime				✓	✓	✓

Notes: Table 6 reports regressions of the net due to position of a bank in a given locality on a dummy equal to 1 if it is above the median per capita GDP, $HighIncome$, the 5 year CDS spread of the aggregate Brazilian banking sector and interactions of $HighIncome$ and the CDS spread with a dummy for being a $PrivateBank$. The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 7: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
Private BankXIncome Per Capita	47.744***	47.300***	40.749**	49.199***	48.841***	39.242**
	(11.461)	(11.399)	(16.542)	(12.944)	(12.896)	(18.184)
Post		36.325***	36.431***		223.721	215.672
		(7.701)	(7.481)		(166081.746)	(165577.266)
PostXPrivate Bank		-69.898***	-72.751***		-96.499***	-100.696***
		(19.278)	(18.452)		(29.103)	(27.008)
PostXIncome Per Capita		1.266	-4.999		-271.798	-406.075
		(5.373)	(7.141)		(15068160.970)	(15107399.681)
PostXPrivate BankXIncome Per Capita			13.932			19.781
			(13.769)			(12.668)
R^2	0.89	0.89	0.89	0.91	0.91	0.91
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City	✓	✓	✓			
Quarter	✓	✓	✓			
CityXTime				✓	✓	✓

Notes: Table 7 reports regressions of the net due to position of a bank in a given locality on per capita GDP, a dummy, *Post*, equal to 1 during the "Taper tantrum" period and interactions of per capita GDP and *Post* with a dummy for being a *PrivateBank*. The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 8: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To
Private BankXIncome Per Capita	47.744***	47.430***	24.681	49.199***	48.844***	10.162
	(11.461)	(11.432)	(42.039)	(12.944)	(12.866)	(43.201)
CDS Spread		0.275**	0.277**		1.149	1.123
		(0.116)	(0.115)		(2944.712)	(2936.035)
CDS SpreadXPrivate Bank		-0.645***	-0.672***		-0.806***	-0.858***
		(0.204)	(0.199)		(0.250)	(0.221)
CDS SpreadXIncome Per Capita		-0.024	-0.076		-6.042	-11.783
		(0.057)	(0.092)		(249542.418)	(249809.495)
CDS SpreadXPrivate BankXIncome Per Capita			0.117			0.198
			(0.172)			(0.167)
R^2	0.89	0.89	0.89	0.91	0.91	0.91
N	103264	103264	103264	103264	103264	103264
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City	✓	✓	✓			
Quarter	✓	✓	✓			
CityXTime				✓	✓	✓

Notes: Table 8 reports regressions of the net due to position of a bank in a given locality on per capita GDP, the 5 year CDS spread of the aggregate Brazilian banking sector and interactions of per capita GDP and the CDS spread with a dummy for being a *PrivateBank*. The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 9: Net Due To

	(1) Net Due To	(2) Net Due To	(3) Net Due To	(4) Net Due To	(5) Net Due To	(6) Net Due To	(7) Net Due To	(8) Net Due To
Post	22.356*		29.698***		22.356*		29.698***	
	(10.855)		(6.778)		(.07)		(0.000)	
Foreign FundedXPost	-49.648**				-49.648*			
	(20.242)				(.07)			
Private BankXPost			-62.322***				-62.322***	
			(17.939)				(.005)	
CDS Spread		0.149		0.236*		0.149*		0.236*
		(0.103)		(0.117)		(.095)		(.07)
Foreign FundedXCDS Spread		-0.421**				-0.421*		
		(0.189)				(.06)		
Private BankXCDS Spread				-0.577***				-0.577*
				(0.189)				(.005)
R^2	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
N	103264	103264	103264	103264	103264	103264	103264	103264
Fixed Effects:								
Bank	✓	✓	✓	✓	✓	✓	✓	✓
Quarter	✓	✓	✓	✓	✓	✓	✓	✓
Standard Errors:								
Clustered at Bank	✓	✓	✓	✓				
Bootstrapped					✓	✓	✓	✓

Notes: Table 9 reports baseline results both clustering at the bank level (columns (1)-(4)) and bootstrapping the standard errors (columns (5)-(8)). All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls, and also include bank and quarter fixed effects. Note that columns (1) and (2) are the same as columns (1) and (3) in Table 1 and columns (3) and (4) are the same as in columns (2) and (4) in Table 2.

Table 10: Total Lending

	(1) Ln(Lending)	(2) Ln(Lending)	(3) Ln(Lending)	(4) Ln(Lending)	(5) Ln(Lending)	(6) Ln(Lending)
Post	-0.012	-0.025	-1.739	-1.936	-0.333	-0.331
	(0.038)	(0.029)	(874.303)	(855.795)	(325.213)	(322.503)
Net Due To	1.659***	1.659***	1.417***	1.427***	1.497***	1.506***
	(0.181)	(0.188)	(0.149)	(0.143)	(0.163)	(0.161)
PostXNet Due To	-0.058	-0.088	-0.067	-0.085*	-0.097*	-0.108**
	(0.060)	(0.072)	(0.039)	(0.047)	(0.050)	(0.043)
PostXForeign Funded	0.043		0.079		0.098	
	(0.074)		(0.078)		(0.085)	
PostXPrivate Bank		0.096		0.129		0.154
		(0.084)		(0.085)		(0.093)
Net Due ToXForeign Funded	0.301***		0.271***		0.262*	
	(0.079)		(0.086)		(0.140)	
Net Due ToXPrivate Bank		0.274***		0.240***		0.225*
		(0.079)		(0.076)		(0.124)
PostXNet Due ToXForeign Funded	0.188		0.189*		0.204**	
	(0.132)		(0.107)		(0.095)	
PostXNet Due ToXPrivate Bank		0.287*		0.271**		0.292**
		(0.158)		(0.121)		(0.101)
R^2	0.97	0.97	0.98	0.98	0.98	0.98
N	103118	103118	103118	103118	103118	103118
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City			✓	✓		
Quarter	✓	✓				
Time			✓	✓		
CityXTime					✓	✓

Notes: Table 10 reports regressions of total lending at the bank-by-locality level on the net due to position of the bank in that locality, a dummy, *Post*, equal to 1 during the "Taper tantrum" period, and interactions of these with being a *ForeignFunded* bank (odd numbered columns) or being a *PrivateBank* (even numbered columns). The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

Table 11: Total Lending

	(1) Ln(Lending)	(2) Ln(Lending)	(3) Ln(Lending)	(4) Ln(Lending)	(5) Ln(Lending)	(6) Ln(Lending)
Net Due To	1.789***	1.848***	1.571***	1.615***	1.752***	1.781***
	(0.116)	(0.166)	(0.090)	(0.091)	(0.122)	(0.093)
CDS SpreadXNet Due To	-0.001	-0.001	-0.001	-0.001*	-0.002**	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CDS SpreadXForeign Funded	0.000		0.000		0.000	
	(0.001)		(0.001)		(0.001)	
CDS SpreadXPrivate Bank		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)
Net Due ToXForeign Funded	-0.003		-0.061		-0.144	
	(0.208)		(0.168)		(0.202)	
Net Due ToXPrivate Bank		-0.215		-0.240		-0.335*
		(0.251)		(0.186)		(0.165)
CDS SpreadXNet Due ToXForeign Funded	0.002		0.002*		0.003**	
	(0.001)		(0.001)		(0.001)	
CDS SpreadXNet Due ToXPrivate Bank		0.003*		0.003**		0.004***
		(0.002)		(0.001)		(0.001)
Fixed Effects:						
Bank	✓	✓	✓	✓	✓	✓
City			✓	✓		
Quarter	✓	✓				
Time			✓	✓		
CityXTime					✓	✓
R^2	0.97	0.97	0.98	0.98	0.98	0.98
N	103118	103118	103118	103118	103118	103118

Notes: Table 11 reports regressions of total lending at the bank-by-locality level on the net due to position of the bank in that locality, the 5 year CDS spread of the aggregate Brazilian banking sector, and interactions of these with being a *ForeignFunded* bank (odd numbered columns) or being a *PrivateBank* (even numbered columns). The net due to position at the bank-by-locality level is calculated as 1,000 times intrabank liabilities net of intrabank assets scaled by total assets of that bank in that particular locality. All regressions include controls at both the banking group level and the bank-by-locality level (including total assets, deposit to assets ratio, return on assets, and a liquidity ratio) and locality-level controls. All regressions are clustered at the bank level.

7. Figures

Figure 1: Internal Liquidity Management

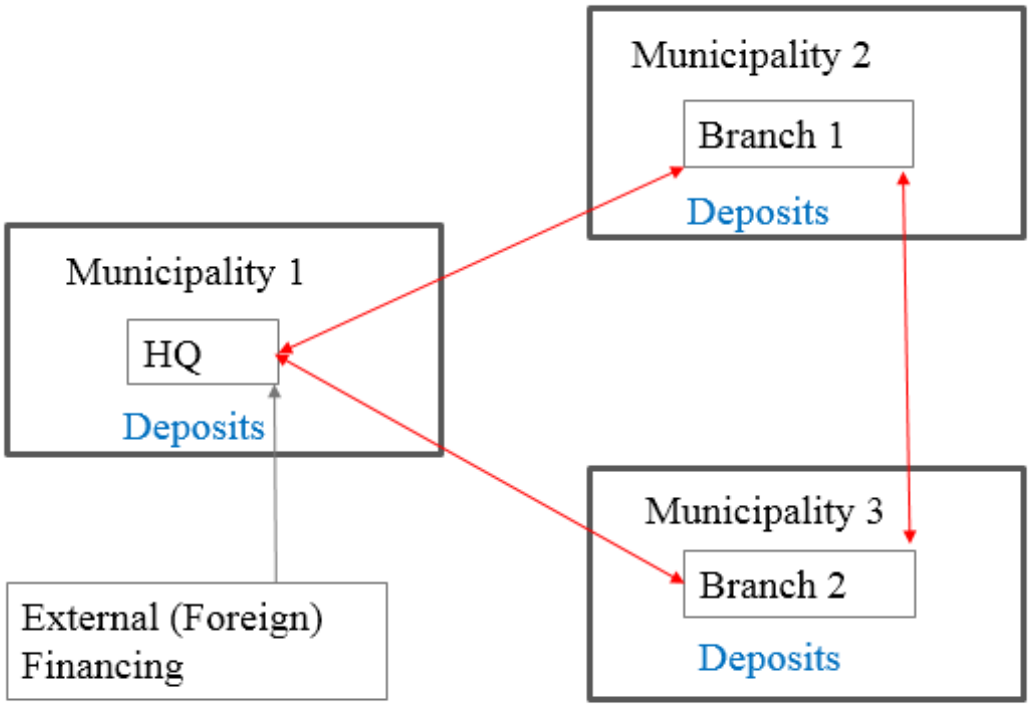
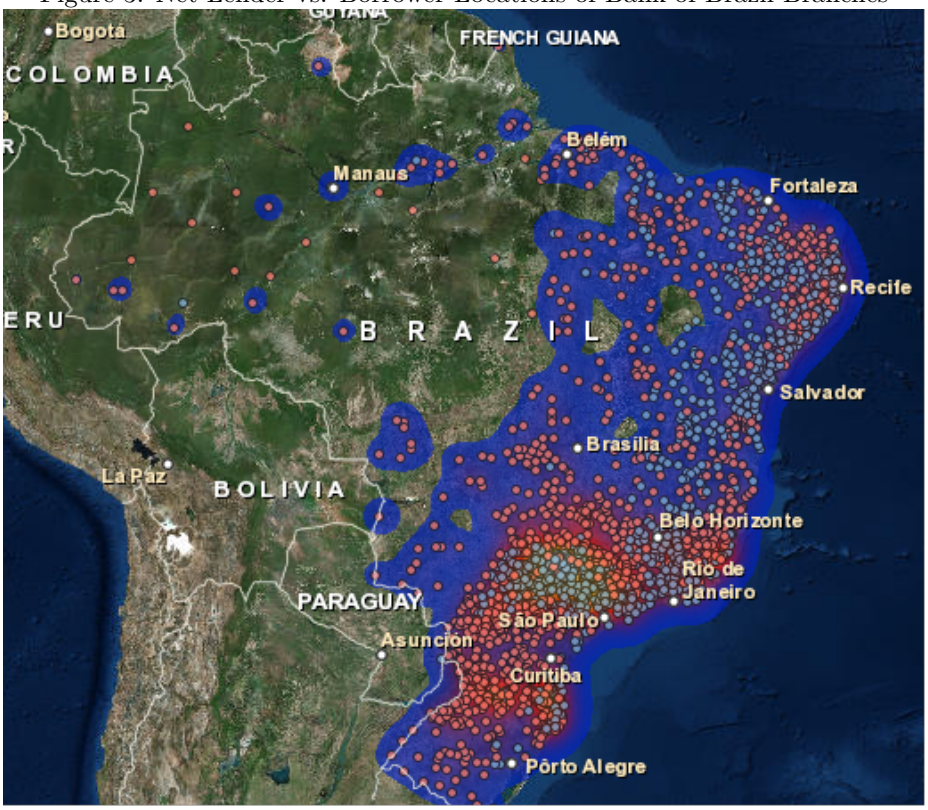


Figure 2: CDS Spreads of Brazilian Banks

Figure 3: Net Lender vs. Borrower Locations of Bank of Brazil Branches



Notes: This map shows which localities are net lenders and which are net borrowers for the Bank of Brazil.

Figure 4: Bank Headquarters

Notes: This map shows the headquarters locations of the banks in our sample.