Financial Crisis and Cross-Border Too Big to Fail Perception[1]

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ABSTRACT

The goal of this study is to examine if the perception of a too big to fail policy affects depositor behavior. We exploit a shock to the Brazilian banking system during the international turmoil following Lehman's demise in September 2008. Anecdotal evidence shows that an extensive amount of deposits flew from smaller banks to the largest banks of Brazil triggered by the bad news from the global banking industry. We investigate if depositor behavior is better explained by banks' fundamentals or by the perception of an implicit too big to fail policy. Our empirical strategy allows us to disentangle the continuous benefits of size from the discontinuous benefit of being perceived as too big to fail. Our unique database allows us to compare the behavior of uninsured depositors versus the total set of depositors. In addition, information on the type of holder of certificates of deposit allows us to identify differences in behavior of institutional investors, individual investors and non financial firms. Taken together, our results are consistent with the idea that depositors ran from smaller banks to the largest banks because they believed the largest banks were too big to fail. We also find that banks that had relatively more certificates of deposits held by institutional investors suffered more deposit outflows throughout the crisis. The evidence suggests that banks perceived as too big to fail have an important competitive advantage during a liquidity crisis because of the inflow of deposits they receive.

CONTENTS

> *"In trying to stabilize the financial system, we have led creditors of large financial institutions to expect that the Government will protect them from losses, which in turn means they need not monitor risk-taking by these firms."*
>
> Charles Plosse, President of the Federal Reserve Bank of Philadelphia at a policy forum sponsored by the Philadelphia Fed on Dec. 4, 2009[1].

The policy of bailing out systemically important banks, usually called too big to fail[2], is widely known to be harmful to the long-run financial market stability, because it distorts competition and weakens the incentives for creditors to monitor banks, leading to increased moral hazard (Kaufman, 1990; Stern and Feldman, 2004; Gropp, Hakenes and Schnabel, 2010; Keister, 2010). The usual justification for this kind of policy is that the failure of a systemically important bank can harm the whole financial system and possibly lead to a serious economic downturn.

The empirical literature has examined the effect of bailout policies on risk-taking behavior (Boyd and Runkle, 1993; Ennis and Malek, 2005; Schnabel, 2009; Gropp, Hakenes and Schnabel, 2010) and on capital markets' valuation (O'Hara and Shaw, 1990; Penas and Unal, 2004; Brewer and Jagtiani, 2009; Gormley, Johnson and Rhee, 2009). Despite its importance, little is known about depositor behavior in response to bailout policies.

The goal of this study is to identify if the perception of a too big to fail policy affects depositor behavior. Although the empirical literature on market discipline that has found that depositors favor larger banks (eg. Maechler and McDill, 2006; Imai, 2006), it does not differentiate between the too

[1] This quote can be seen in Sloan (2009).

[2] The term "too big to fail" was first used to characterize institutions that pose systemic risk in a US congressional hearing in 1984, right after the bailout of Continental Illinois, when the regulator of US national banks testified that 11 of the largest banks would receive a similar treatment if necessary (Mishkin, 2006). Nowadays, as Rajan (2009) points out that it is better to address these institutions as "too systemic to fail", because there are very large entities with transparent, simple structures that allow them to be failed easily, while there are relatively small entities whose distress caused substantial stress to build up through the system. For the sake of habit, we use the term too big to fail, although it should be understood in the broader meaning of systemic importance.

big to fail effect and other potential benefits of size. Our empirical strategy allows us to disentangle the continuous benefits of size from the discontinuous benefit of being perceived as too big to fail.

We exploit a shock to the Brazilian banking system during the international turmoil of late 2008 to examine the behavior of depositors. Anecdotal evidence shows that an extensive amount of deposits flew from smaller banks to the largest banks of Brazil triggered by the bad news from the global banking industry in late 2008. We investigate if depositor behavior is better explained by banks' fundamentals or by the perception of an implicit too big to fail policy. This study is related to the literature of bank runs (e.g. Levy-Yeyati, Peria and Schmukler, 2010; Chen, 1999; Chen and Hassan, 2008; Allen and Gale, 1998; Calomiris and Kahn, 1991) and to the literature of international transmission mechanisms (e.g. Bartram, Brown and Hund, 2007; Schnabl, 2011 and Cetorelli and Goldberg, 2011).

Our unique data set collected in close consultation with the financial supervisor of Brazil enables us to compare the behavior of uninsured depositors versus the total set of depositors. In addition, information on the type of holder of certificates of deposit allows us to identify differences in behavior of institutional investors, individual investors and non-financial firms.

We identify the set of banks that could be perceived as systemically important; therefore, possibly too big to fail (hereafter, big banks[3]), based on several cluster analyses and multidimensional scaling graphs that take into account of different aspects of banks' size and interconnectedness. In this sense, our study is related to those by Adrian and Brunnermeier, 2010; Acharya, Pedersen, Philippon and Richardson, 2010; Huang, Zhou and Zhu, 2001, who show that size, leverage and interconnectedness are important variables to measure systemic risk. In contrast to these studies, we

[3] As mentioned before, the characteristic of interest is systemic importance, not simply size. We use the term "big" in the meaning of having great significance, importance.

do not focus on developing a measure of systemic risk, but simply use variables related to these drivers of systemic importance that may be readily observed by depositors in order to distinguish between two sets of banks: systemically important and others.

Our results show that in normal times depositors do not show a special preference towards the big banks. During the international financial turmoil in 2008, we find that depositors ran to the big banks. As expected, the run is stronger for uninsured depositors than for the total set of depositors. Our estimates are both statistically and economically significant. After controlling for several sources of bank heterogeneity, including asset size and economic fundamentals, big banks increased uninsured deposits, on average, by approximately 44 percentage points *more* than smaller banks (hereafter, other banks) during the international financial turmoil. This expected additional increment amounts to approximately 35 percentage points for total deposits.

Our analysis of changes in certificates of deposit (CDs) held by different investor types show that the amount of CDs held by institutional investors in big banks increased around 30% in the last 6 months of 2008, while in the other banks there was a decrease of almost 35%. We also observe a similar movement for CDs of non-financial firms: an increase of 55% in big banks and a decrease of 11% in other banks. When we control for bank fundamentals and the degree of dependence on institutional investors, we find that big banks enjoyed a change in the amount of CDs held by institutional investors that was 58 percentage points larger than that of other banks during the crisis. The effect for the CDs held by non-financial firms is lower than for institutional investors, but still important: a 41 percentage point increase in the amount of certificates of deposits in big banks relative to the other banks. We also find that the run in deposits was in great part reverted after the crisis: other banks enjoyed a change in total deposits that was around 30 percentage points larger than that of big banks in the two semesters that followed the crisis, controlling for other features.

Since we observe no systematic difference in the change in deposits for big banks in normal times, as mentioned before, our research suggests that the competitive advantage of being too big to fail is most valuable during a crisis.

To the best of our knowledge, this is the first study to document a massive flow of deposits triggered by an exogenous shock that is better explained by depositors anticipating possible bailouts of the large banks rather than by worse fundamentals of smaller banks. The reversion of the run in 2009 strengthens the interpretation that it was not based on fundamentals.

Our inferences are robust to different specifications of the set of big banks. In addition to the set with the largest banks in Brazil, we test one that includes only the largest government-owned banks and one with the largest privately-owned banks. We also use a broader specification that includes global powerhouse banks that are not among the largest banks in Brazil and find similar results in all specifications. When we exclude the largest banks in Brazil from the sample in our robustness tests, we find that depositors favored the global powerhouse banks over banks that do not have such relevant (if any) international presence. Overall, our results imply that the largest banks in Brazil were preferred by depositors, followed by the globally largest banks.

Our findings contribute to the discussion of how to deal with systemically important financial institutions. First, we show that depositors preferred systemically important banks in turbulent times despite any explicit governmental policy. This finding complements previous evidence found by Gormley et al. (2009), when analyzing the largest non-financial Korean corporate groups' access to external finance during the Korean crisis of 1997-98. Second, our results suggest that it is important to address the competitive advantage of extra access to liquidity from depositors in the event of a crisis. In Brazil, the run to big banks was so significant that the Central Bank had to take several

measures to provide liquidity to the smaller banks. If History can be a good guide, it is likely that, during the next major crisis, depositors will put their moneys in systemically important banks, because they perceive these banks as too big to fail. By itself, this behavior harms non-systemically important banks and gives systemically important banks a unique competitive advantage. This competitive advantage of liquidity should be added to the academic and policy discussions, presently focused on how being perceived as too big to fail results in a lower cost of capital and in increased moral hazard (Keister, 2010; Gropp, Guettler and Gründl, 2010; Acharya and Richardson, 2009).

We also contribute to the financial crisis empirical literature by showing that the presence of institutional investors played an important role in the run in Brazil. We find that each incremental percent point of assets being funded by CDs of institutional investors resulted in an outflow of 3% of both uninsured and total deposits during the crisis (we find no such effect for the other periods). Interestingly, the flow in CDs held by non-financial firms was also negatively influenced by the reliance on institutional investors. This result is in line with the evidence from funds outflow found in Chen, Goldstein and Jiang (2010) and Wermers (2010) and with some features of the model for bank runs of Goldstein and Pauzner (2005).

Finally, since the run was triggered by the bad news from the global banking industry and our findings indicate that it did not quite reflect depositors' reassessment of bank fundamentals, our work supports the view that a run may occur when depositors learn information from other banking systems, which may serve as a noisy signal about domestic bank-specific information. This result is consistent with some features of the bank runs model of Chen (1999) and Chen and Hassan (2008).

The remainder of the paper proceeds as follows. Section I lays out the motivation for our study. Section II introduces the empirical strategy. Section III discusses the data and sample selection. Section IV presents the results, Section V describes some robustness checks and Section VI concludes.

I. The Effects of the Global Financial Crisis in Brazil

We begin our analysis by illustrating how the Brazilian financial system was affected by the global financial crisis[4]. The global financial crisis reached a turning point in September 2008, when Lehman's bankruptcy induced losses to several counterparties. Allen and Carletti (2010) argue that the most disruptive consequence of Lehman's bankruptcy was the signal it sent to the international markets that credit risk in the banking sector and financial industry was a serious concern. Investors reassessed risks previously overlooked, withdrew from the markets and liquidity dried up.

In an attempt to avoid bank runs, governments in Europe and the US strengthened deposit guarantee schemes in October 2008. Ireland, Greece, Germany, Denmark, France and others offered blanket guarantees (Willman, 2008; Hall, 2008). In the US, Congress raised the deposit insurance from $100,000 to $250,000 per depositor, per institution – although well-informed depositors already know they can have full coverage by putting their money in one institution under separately titled accounts. The UK raised deposit protection from £35,000 to £50,000 (Cumbo, 2008). The extended protection in the UK was not enough to stop a flight to safety by bank depositors: National Savings & Investments, a state-owned bank that offers 100 percent government guarantee, received record deposit inflows in the last quarter of 2008 (Warwick-Ching, 2009). HSBC, which seemed to be

[4] An overview of the events of the crisis can be seen in Brunnermeier (2009) and Taylor (2009).

perceived as safe due to its global operations, also had record inflows into its UK deposit accounts (Ross, 2008).

In Brazil, the largest banks also experienced record inflows at the time. Interestingly, none of the domestic banks (large or small) had exposure to US securitizations of subprime loans that could justify a contagion. Figure 1 provides a snapshot of the flow of funds from the smaller banks into the largest banks of Brazil (big banks) by showing daily data of the market share of certificates of deposit (CDs). From mid-September to December 2008 big bank's market share of certificates of deposit spiked almost 7 percentage points, reaching 82.5%. It remained in that level until mid-March 2009, when it began to go back to pre-crisis market share.

[Insert Figure 1 here]

Another way to see the run from smaller banks to the big banks is by looking at the market share of the big banks of insured and uninsured deposits. Figure 2 presents semiannual information on the share of total, uninsured and insured deposits of the set of big banks. The results are in line with those presented in Figure 1. There was a significant rise of 5 percentage points in the otherwise relatively stable share of total deposits of the big banks, during the exacerbation of the crisis. Most of this rise is due to a spike of 15 percentage points in the market share of uninsured deposits.

[Insert Figure 2 here]

The run put smaller banks at risk, which led the Brazilian Government to take several measures to provide them with liquidity, such as the reduction of reserve requirements for big banks to enter into interbank loans to small banks, and the design of a new certificate of deposit with a special

guarantee of BRL 20,000,000 (equivalent to around nine million US dollars at the time) in March 2009[5].

The exacerbation of the global financial crisis in late 2008 also affected the real economy of Brazil through basically two major channels: (i) an increase in risk aversion tightened external financing conditions and (ii) a significant decline in international investment, followed by lower demand for regional exports and a drop in commodity prices (IMF, 2009a, b).

The constraint in external financing led to a significant devaluation of the Brazilian currency, the Real, in the last quarter of 2008. Despite the devaluation, there was not a process of currency substitution in Brazil: the deposit base grew 24.7% during the third and fourth quarter of 2008, as can be seen in Figure 3.

[Insert Figure 3 here]

II. Testing the Perception of Too Big To Fail

As mentioned before, the flight to the big banks in Brazil during the most critical stage of the global financial crisis is an opportunity to observe depositor reaction to a shock that is exogenous to the domestic banking system, since domestic banks had no subprime securitized loans and insignificant exposure to foreign debt.

There are two important questions to be asked: (1) why was there a reaction of depositors in Brazil to the international financial turmoil?, and (2) why was the reaction a flight from the smaller banks to the big banks? Though the answer to the first question is not formally addressed in this paper, we

[5] The measures to reduce reserve requirements were taken along the following dates in 2008: September 24, October 2, 8, 13, 14, 15, 24 and 31, November 13 and 25 and December 19. Measures to change the discount window were taken in October 6, 9, 10 and 16. The creation of a new debt instrument with a special guarantee of BRL 20,000,000 (equivalent to around nine million dollars at the time) was taken in March 26 and 31/2009.

conjecture that the bad news from the global banking industry in late 2008 made depositors reassess risks in the domestic banking sector. In many aspects, this conjecture is closely related to the models of bank runs presented by Chen (1999) and Chen and Hassan (2008).

There are basically two types of models to explain the origins of bank runs. One is based on the classical work of Diamond and Dybvig (1983) where bank runs are self fulfilling prophecies. Given the assumptions of "first-come, first-served", and costly liquidation of some long-term assets, one possible equilibrium is that depositors should rationally withdraw their funds if they believe that other depositors will withdraw. Another equilibrium occurs when no one believes a banking panic is about to occur, so depositors only withdraw their funds according to their liquidity needs. Which of these two equilibria occurs depends on random shocks or "sunspots".

The second line of argument to explain the origins of banking panics is based on the business-cycle. This view asserts that crises are not random events, or the result of "sunspots", but a natural consequence of the business cycle. If depositors receive information about an upcoming downturn in the cycle, they try to withdraw their funds because they expect a reduction in the value of bank assets and a rise in the probability of bank failures. There are several theoretical models consistent with the business cycle view, such as Jacklin and Bhattacharya (1988), Chari and Jagannathan (1988), Gorton (1988) and Allen and Gale (1998). Calomiris and Kahn (1991) consider bank runs as a result of some depositors gathering information about economic fundamentals that would allow assessing the viability of the bank. If the informed depositors conclude that a bank is in trouble, they will withdraw their money and precipitate a run. The sudden withdrawals will force the bank to liquidate all of its assets.

The models of Chen (1999) and Chen and Hassan (2008) may be understood as being related to both the sunspot view, because of the role of first-come, first-served; and to the business cycle view, more particularly to a strand of the business cycle explanation that emphasizes the role of information asymmetry in triggering runs. Chen (1999) shows that failures of a few banks may serve as a noisy signal to depositors who are not able to value their own bank's assets. These uninformed depositors respond to this negative signal by withdrawing. Since uninformed depositors will withdraw early, the informed depositors are compelled to do the same, even though it would be otherwise better to wait for more precise bank-specific information. Chen and Hassan (2008) extend Chen (1999) to show that expectations about the quality and amount of bank-specific information that will be revealed can affect depositors' incentives to withdraw. Specifically, panic runs can be triggered not only by bank-specific information, but by depositors running when they expect that more noisy information about banks will be revealed, or when they expect that precise information about banks will not be revealed. In their model, panic runs are more likely to occur when the banking industry is weaker. Therefore, we argue that a possible that a possible explanation for the reaction observed in Brazil is that the noisy signal originating from the international financial turmoil increased the uncertainty and fears about the health of the domestic banking system.

The second question is the core of our paper: to understand why there was a flight of deposits from the smaller banks to the big banks. One possible explanation is that depositors thought the largest banks were too big to fail. This is a plausible interpretation in face of the international context and also of the recent history of Brazil. As mentioned before, Lehman's demise caused turmoil in the global financial system and led to a long list of bailouts with Citibank, Bank of America, AIG, ABN Amro, Royal Bank of Scotland, and others. It would be reasonable to think that the Brazilian Government would act in accordance to US and Europe and bailout the big banks should there be

any trouble. Moreover, although Brazil does not have an explicit list of too big to fail banks, the country's recent history implied such policy. After the inflation stabilization in 1994, several banks were not able to adjust to the new environment and became distressed. In order to address the banking system fragility, the Brazilian Government launched three major official bank restructuring programs that included government capital injections to the largest private and federally-owned banks of the country. Small private and state-owned banks were allowed to fail. The perception of a too big to fail policy from depositors may have come from the observation of such policy taking place in the US and Europe and from the Brazilian recent history.

To interpret the run to the largest banks as a result of the perception by depositors of an implicit too big to fail policy may be unwarranted, though. An alternative explanation could be that those big banks were in a better shape than the smaller ones. In this case, the run would be in line with the business-cycle view.

There is wide empirical evidence supporting the business-cycle view, such as Calomiris and Gorton (1991), Gorton (1988), Mishkin (1991) and Calomiris and Mason (2003). In our context, one possible interpretation for deposits flying to the big banks in the midst of the crisis would be that depositors were running from banks with worse fundamentals. We take into account this alternative explanation by using several control variables related to bank fundamentals. The first set of variables includes traditional measures of bank risk: equity ratio, the ratio of low quality loans to assets, and the ratio of liquid assets to total assets. A second set of variables aims to control for the effects of the financial crisis in the Brazilian economy. As mentioned before, the worst period of the crisis tightened external financing conditions, so one could argue that bank's dependence of foreign capital to fund its assets became an important risk factor when the financial crisis reached its peak. Also, we mentioned that the crisis led to a decline in international trade that slowed down the

Brazilian economy, so it is plausible that depositors could be concerned with particular types of assets that banks held on their balance sheets. For instance, loans to middle market firms may be perceived as particularly risky if these firms have a higher probability of being financially distressed during the economic downturn. We control for the effects of the financial crisis in several robustness checks detailed in section V.

Finally, to understand why there was a flight of funds from the smaller banks to the big banks during the crisis, it is necessary to control for the other features of size that may be seen as beneficial to depositors. For instance, larger banks are usually more diversified, either by having a large customer base or offering a wide array of financial services and products. There may be other features, such as depositors thinking that larger banks have more cutting-edge technology and risk management techniques. We use the continuous variable log of assets to control for these features.

One potential limitation of this strategy comes from the possibility that depositors value the size discontinuity of the big banks for reasons other than being too big to fail. For instance, depositors might think that big banks are safer because they are widely known, better managed, less subject to information asymmetries and perhaps more closely monitored by the Central Bank. If depositors value the size discontinuity for these other subjective reasons, our interpretation of the too big to fail perception would be confounded. However, these hypotheses do not seem very plausible for at least three reasons. First, the subjective perceptions of safety should be less important for sophisticated institutional investors and our results show that they are precisely the type of depositor who ran more heavily to the big banks. Second, several banks went down despite official supervision from the Fed, FDIC, FSA, etc. Third, as far as monitoring is concerned, Brazilian prudential regulation allows no distinction between the largest banks and other banks.

A. Identification and Empirical Strategy

To analyze if the anecdotal observation of deposit concentration in the hands of big banks during the crisis is consistent with depositors' perception of a too big to fail policy, we estimate five models with changes in deposits on the left hand size: for uninsured deposits, total deposits, certificates of deposits held by institutional investors, non-financial firms and individual investors. This allows us to examine potential differences in behavior by type of depositors.

To disentangle the other potential benefits of size other than government protection calls for a discontinuity approach, applied by using as one right hand side variable the interaction of an indicator of the worst stage of the financial crisis, ($Crisis$) and an indicator that the bank is part of the set of big banks, ($BigBank$) (the selection of these banks is further detailed in section II-B), together with appropriate controls. The test for the perception of a too big to fail policy during the crisis consists of estimating the sensitivity of the change in banks' deposits to this variable. In other words, the perception of a too big to fail policy during the crisis is tested by estimating the coefficient ω of $BigBank \times Crisis$, our main variable of interest.

The baseline specification is:

$$\begin{aligned}\Delta Deposits_{i,t} = {} & \alpha + \phi \Delta Deposits_{i,t-1} + \lambda \Delta Premium\ Paid\ on\ Deposits_{i,t} + \beta' Risk_{i,t-1} \\ & + \delta Regional\ Economic\ Activity_{i,t} + \theta Size_{i,t} + \vartheta Crisis_t + \gamma BigBank_i \\ & + \omega(BigBank_i \times Crisis_t) + \tau'\left(Risk_{i,t-1} \times Crisis_t\right) + \eta MechChange_{i,t} + \mu_i + d_t \\ & + \varepsilon_{i,t}\end{aligned} \quad (1)$$

Where μ_i represents the i-th bank's time invariant unobserved features that might influence the change in deposits, d_t stands for time fixed effects (i.e., the common effect of any shock to $\Delta Deposits$ in time t) and ε is the error term.

On the right hand side we have the lagged dependent variable ($\Delta Deposits$), to account for possible momentum or mean reversion effects in the dynamics of the change in deposits; the change in interest rate premium paid on deposits ($\Delta Premium\ Paid\ on\ Deposits$), to account for possible joint determination with change in deposits and avoid an omitted variable bias; a vector of bank fundamentals traditionally found in the literature ($Risk$), the growth in retail sales, as a proxy for regional economic activity ($Regional\ Economic\ Activity$); the natural logarithm of the assets of the bank ($Size$), to disentangle the effect of being a big bank from the other features continuously related to size, such as brand equity and convenience; an indicator of the global financial crisis ($Crisis$); along with the necessary interactions. The model specification also deals with a regulatory change of the amount of insured in August, 2006, with a deterministic variable, $MechChange$. All variables used in this study are formally described in the Appendix.

The variables used in the $Risk$ vector are: the equity ratio, to evaluate leverage ($Equity\ ratio$); the ratio of low quality loans to assets, to evaluate the risk of the loan portfolio ($Low\ Quality\ Loans$); and the ratio of liquid assets to total assets, to assess liquidity risk ($Liquidity$).

Table 4 presents the estimation results of this baseline specification for uninsured and total deposits and Table 12 for certificates of deposits held by institutional investors, non-financial firms and individual investors.

The models are estimated using Pooled Ordinary Least Squares (POLS) and the system Generalized Method of Moments (GMM-Sys) procedure described in Blundell and Bond (1998).

The system GMM allows us to explicitly model the bank unobserved fixed effect represented by μ_i and consistently include the lagged dependent variable among the regressors, unlike other panel data estimators, such as the traditional Fixed Effects and Random Effects procedures. In addition, GMM-

Sys enables us to deal with the plausible endogenous relationship between bank fundamentals, change in interest rate premium, and change in deposits, by using suitable lagged values of the regressors as instrumental variables. A similar procedure permits us to tackle the issue of dynamic endogeneity (e.g., see Wintoki, Linck and Netter, 2010) caused by the potential influence of shocks to the change in deposits over bank fundamentals in future periods (e.g., governance or management changes that affect deposits contemporaneously and the bank risk profile in subsequent periods). The plausibility of our identifying assumptions (i.e., the appropriateness of the set of lagged variables that we choose as instruments) is formally tested by the Hansen/Sargan test of overidentifying restrictions and the Arellano-Bond test for error autocorrelation. In all regressions reported in our baseline specification (Table 4) and robustness tests (Tables 5 to 14) we cannot reject the null hypotheses, suggesting that our identifying assumptions are acceptable. Finally, with both POLS and GMM-Sys we control for time fixed effects by using time dummy variables.

As mentioned before, we also estimate other seven specifications to take control for alternative explanations of the run that are detailed in Section V - Robustness checks. Tables 5 to 11 present the estimation results of these alternative specifications.

B. Big Banks

We identify the set of systemically important banks based on their importance to the Brazilian market, combining outstanding size, substitutability and interconnectedness. These criteria are in line with the guidance of the International Monetary Fund, Bank for International Settlements and Financial Stability Board (2009). We base our selection procedure on several cluster analyses and multidimensional scaling graphs. For these formal data analyses we use five variables that may be

readily observed by depositors: (i) total assets plus brokerage, (ii) total assets, (iii) total deposits, (iv) number of branches, and (v) number of clients.

The amount of total assets is the most commonly used aspect of size in the literature. Total assets plus brokerage is a proxy for substitutability and interconnectedness. Total deposits, number of branches and number show other aspects to size, mostly related to a transmission channel to the real economy.

Table 1-A shows the classification suggested by two clustering algorithms, known as *K-means* and *K-medians* (for details, see Kaufman and Rousseeuw, 2005). In both cases we specify the number of nonoverlapping groups (k) to be formed through an iterative process. In other words, we determine the number of groups to be formed and the algorithm chooses how many banks and which banks to assign to each group. Specifically, the *K-means* procedure assigns each bank to the group whose (multivariate) mean is closest, whereas the *K-medians* does the same, but using medians instead of means to represent the group centers. The algorithms begin with k randomly chosen seed values, which act as the k group means or medians in the first step. Then, based on the initial categorization, new group means/medians are computed. This procedure is repeated until no observations change groups. Table 1-A shows that, when $k = 2$, the first cluster is composed by eight banks that are distinctively larger (in terms of the five variables we employ) than the remaining banks. The result is the same with both algorithms.

[Insert Table 1-A here]

To visualize these clustering patterns we perform a classical multidimensional scaling analysis, which is a technique that allows us to represent high-dimensional space dissimilarities between observations in a lower-dimensional space. Specifically, we use the Euclidean distance between

banks in the two-dimensional space to approximate the actual distances in the five-dimensional space (since we use five variables). The multidimensional scaling configuration graph is shown in Figure 4. Figure 4 reveals that the eight banks selected by the cluster analysis are somewhat distinct from other banks, taking into consideration the five dimensions of systemic importance defined above.

[Insert Figure 4 here]

We also test if the subsidiaries of systemically important institutions that do not fit the aforementioned big bank criteria were also perceived as too big to fail by depositors. This set of banks, shown in Table 1-B, is based on a list published by the Financial Times (Jenkins and Davies, 2009) and includes nine banks. The idea behind this test is that depositors in Brazil may have favored these global powerhouse banks not because they would be eligible to a bailout by the Brazilian Government but because they would be bailed out (and most of them actually were) by the government of their home countries.

III. Data and Sample Selection

This section provides a quick description of the distinguishing features of the Brazilian Financial System and presents the data and sample selection.

The Brazilian banking system is formed mostly of universal banks, regulated and supervised exclusively at the federal level. The Central Bank of Brazil and the National Monetary Council[6] (CMN, for its acronym in Portuguese) are in charge of regulation and the Central Bank is also in charge of authorizations and supervision.

[6] The National Monetary Council is formed by the President of the Central Bank and two State Secretaries.

In certain aspects, regulatory restrictions are more stringent than in developed economies. For instance, Brazilian banks are required to have a capital adequacy ratio of at least 11%, larger than the 8% Basel requirement and tier II capital may not exceed tier I. Also, the Central Bank operates a real-time gross settlement (RTGS) payment system since April 2002, which avoids the possibility of overdrafts in reserves at any time.

Almost all types of deposits in Brazil are in local currency and eligible for deposit insurance[7]. The insurance is provided by the Brazilian Deposit Insurance Fund (Fundo Garantidor de Crédito – FGC, in Portuguese), a privately-funded institution founded in 1995, in the aftermath of the restructuring programs mentioned before. The FGC covers the amount held by each person against one financial conglomerate up to BRL 60,000 – around USD 30,000. Initially it covered up to BRL 20,000 but the amount of coverage was extended in June 2006, during a calm period for the Brazilian banking system.

The distribution of deposits is shown in Panel A of Table 2. Checking account deposits, savings deposits and time deposits accounted for around 93% of the funds deposited in Brazilian banks during the sample period. The remaining 7% include interbank deposits and other deposits, such as those related to litigations. Checking account deposits pay no interest and, on average, accounted for 16% of total deposits over the sample period. Savings deposits pay an interest rate determined by law: a floating interest rate of 6 percentage points over a fraction of a specific inflation index. On average, savings deposits accounted for 28% of total deposits. Checking and savings deposits may be withdrawn on demand by the customer without notice or penalty. Time deposits (mostly

[7] Deposits in foreign currency account for less than 2% of total deposits in Brazil and are allowed only to very specific types of investors (non-resident persons and companies). Some other types of deposits are not eligible for deposit insurance, such as: i) deposits, loans or any other type of funding raised abroad; ii) deposits related to litigations; iii) time deposits authorized to compose Tier-2 of the regulatory capital. These ineligible-for-insurance deposits account for less than 10% of the overall amount of deposits in the Brazilian Financial system.

certificates of deposits) pay interest, and the rate may be fixed or floating. Around 70% of the time deposits in Brazil allow early withdrawal (eventually with a penalty rate). Throughout the sample period, time deposits accounted for 49% of total deposits on average.

Our primary database consists of semiannual observations of all deposit-taking banks in Brazil in the database of the Central Bank of Brazil between December/2001 and December/2009 (17 periods). We exclude from our sample banks that do not appear among the top 50 in either deposit taking or total assets in any of the 17 periods. We also exclude banks that were under Central Bank intervention. We require that the ratio of deposits over assets be higher than 1% and that all observations have nonmissing data for book assets, while all multivariate analysis implicitly requires nonmissing data for the relevant variables. To mitigate the impact of data errors and outliers on our analysis, we Winsorize all variables at the 5^{th} and 95^{th} percentiles.

Panel B of Table 2 lays out the representativeness of the sample. We have a total of 74 banks in the beginning of the sample period, and end up with 53 banks.(the number decreases over time due to mergers and acquisitions and only one bank failure occurred in 2004). This sample of banks hold from 96.1 to 99.1% of the deposits eligible for deposit insurance in the Brazilian Financial System along the studied period. Panel B also shows a large increase in the amount of deposits holdings by Brazilian banks: in less than 8 years, the amount of deposits has increased fourfold in Brazil. During the same period, the cumulative inflation rate was almost 70%. This rise can be attributed to a series of factors, such as nominal GDP growth of 141% in the sample period, the sharp increase in credit operations, the inclusion of the lower classes of the population into the banking system and the maintenance of high interest rates by the Central Bank in the period.

[Insert table 2 here]

The data we use in this study has three sources. The first set of data is available to the public, provided by the Central Bank of Brazil. It comprises detailed balance sheet, income and earnings reports, as well as data on the number and location of branches, and selected regulatory indicators, such as the capital adequacy ratio for all Brazilian banking firms.

The second source for our data is private, and comes from the Brazilian Deposit Insurance Fund, (Fundo Garantidor de Crédito – FGC). This is a unique bank level data on the number of depositors and volume of deposits in several different deposit-size brackets for all Brazilian banking firms. This novel data allow us to compute the volume of insured and uninsured deposits of each bank in each period[8].

Third, we use private data provided by the Central Bank of Brazil that comprises daily balances of certificates of deposits in the hands of institutional investors, non-financial firms and individual investors; and semiannual information on the different types of bank loans outstanding.

Fourth, we also use data from the retail sales index provided the Brazilian Institute for Geography and Statistics (IBGE, for its acronym in Portuguese), which provides the growth in retail sales for each state of the federation[9] as well as the resulting national growth in retail sales. This is the most used indicator of regional economic activity in Brazil.

We treat merged banks (or acquisitions in which two different banks start consolidating their balance sheets) as new banking entities. For example, if Bank A acquires Bank B (or even if Bank A and Bank B merge into bank AB), we treat the merged bank as a new bank, Bank C. There were two mergers among the largest banks in Brazil during the exacerbation of the global financial crisis, in

[8] The periods range from January 1st to June 30th and July 1st to December 31st.

[9] Brazil has 27 states.

the end of 2008. In this case, the change in deposits was calculated based on the sum of deposits of the two merging banks.

A. Summary Statistics

Summary statistics are shown in Table 3 for dates Dec/2001, Jun/2008 and Dec/2009. We split the statistics into big banks and other banks.

[Insert table 3 here]

Overall, both big banks and other banks have notably increased asset size and equity during the sample period. Most deposits in the other banks are uninsured, probably because they do not have many branches and rely mostly on middle market, corporate and institutional depositors. Big banks have slightly lower equity ratio and higher ratio of low quality loans to assets, on average. In the beginning of the sample period, big banks had slightly higher liquidity than the other banks. In the period immediately before the crisis, we note that both sets of banks had experienced a decrease in liquidity, especially big banks, which ended up less liquid than the other banks. The same pattern remains in the last sample period. The most striking difference between big banks and other banks is deposit concentration (the portion of a bank's asset being funded by each depositor on average). The ratio of deposit concentration of other banks to big banks is over 9,800 in December/2009.

Figures 5.A and 5.B compare big banks to other banks by showing the change in total and uninsured deposits in each semester for each set of banks. While there is no clear distinction between the two sets in normal times (up to the first semester of 2008), big banks experienced a significant change in both uninsured and total deposits compared to other banks during the international turmoil in the

second half of 2008. Throughout 2009 there seems to be a reversal, with other banks receiving more deposits (both total and uninsured) compared to big banks.

IV. Results

Our main parameter of interest is the coefficient (ω) of the interaction of the global financial crisis dummy with our big bank dummy ($BigBank \times Crisis$). It captures the expected difference in the percent change in bank deposits between big banks and other banks during the most critical stage of the financial crisis, controlling for fundamentals, change in interest rate paid on deposits, size of assets and macro effects. In other words, a positive and significant ω in the uninsured deposits regression indicates that depositors behave consistently with the perception of a too big to fail policy. In contrast, we expect a lower ω in the total deposits regression.

Table 4 – Panels A, B and C show the estimation results for the models of uninsured and total deposits, using Pooled Ordinary Least Squares (POLS) and the System Generalized Method of Moments (GMM-Sys).

Table 4 – Panel A shows the baseline model where the set of big banks is based on their distinctiveness within the Brazilian financial system. We find a positive and statistically significant ω for the deposits regressions under both estimation procedures (in all cases, at the 1% level). These estimates are also economically large, corresponding to a predicted increase of approximately 44 percentage points in uninsured deposits for the big banks group in comparison with other banks during the critical stage of the crisis. In addition, as expected, we find a positive but much lower ω for total deposits regression under all estimation procedures (predicting approximately 35 percentage point additional increase in deposits for big banks during the crisis).

The coefficient of the $Big\ bank$ dummy is not statistically significant, at conventional levels, in any regression. This means that, during normal times, the percentage change of both uninsured and total deposits is unrelated to whether the bank is in our big bank group or not. Thus, our evidence suggests that investors might perceive a too big to fail policy and that such perception is relevant only in times of crisis. The coefficient of $Size$ is nonsignificant in the uninsured and total deposits models, no matter the estimation procedure.

All of the other controls shown in Table 4 – Panel A (equity ratio, low quality loans and liquidity) and their interactions with the crisis dummy have non-significant coefficient estimates. These widely used proxies for bank fundamentals are not relevant for explaining the behavior of depositors neither in normal times nor during the financial crisis. The results indicate that interest rates paid on deposits have little or no power to explain the change in deposits, which is consistent with the idea that money markets are risk intolerant. The fact that traditional control variables have little explanatory power is intriguing, because it suggests that depositors are not sensitive to bank fundamentals both in normal times and during the crisis. Since previous empirical research has found evidence supporting runs based on fundamentals, we investigate other risk factors specifically related to the international financial crisis in the next section.

[Insert table 4 (Panels 4.A, 4.B and 4.C) here]

Overall, the estimates shown in Table 4 – Panel A suggest that the positive spike in deposits of big banks during the financial crisis cannot be explained by the heterogeneity in bank fundamentals, by a simple size effect or by a general propensity (i.e., a propensity in and out of the financial crisis) of such banks to attract more deposits than their competitors.

Table 4 – Panel B uses a broader definition of big banks, which includes not only the most important banks in Brazil, but also the subsidiaries of large global powerhouse banks. As mentioned before, it is possible that depositors perceive the subsidiaries of large global powerhouse banks as enjoying implicit guarantees, not so much because they would be eligible to a bailout by the Brazilian Government but by the government of their home countries. For the sake of differentiation from our previous definition, we call this group *Big + Powerhouse Banks*. Note that two banks (Santander and HSBC) are both big in Brazil and listed as Powerhouse Banks.

The results shown in Table 4 – Panel B indicate that, during normal times, depositors favor other banks relative to the set of *Big + Powerhouse Banks*, with a predicted difference of 4 percentage points for uninsured deposits (not statistically significant) and 5 percentage points for total deposits (statistically significant at the 5% level). However, during the crisis there was a clear run to the set of *big + powerhouse banks*. The effect on uninsured deposits, a predicted increase of approximately 41 percentage points for the set of *big + powerhouse banks* group in comparison with other banks during the crisis was a little bit smaller than the ones observed in Table 4 – Panel A, and still economically important. The effect for total deposits (a predicted increase of 36 percentage points) was about the same as the one observed in Table 4 – Panel A. However, caution is in order in interpreting the results, for two reasons: i) the crisis dummy coefficient assumes a negative and statistically significant value of 35-39 percentage points (depending on the estimation procedure and whether we focus on total or uninsured deposits); ii) the 4-5 percentage points difference in favor of other banks during normal times. With these two points in mind, we conclude that the crisis caused a similar **relative** impact in the change in deposits, irrespective of our definition of big banks (whether we consider only the banks that are big in Brazil, or a broader set of banks that includes Global Powerhouse Banks), but the positive change in deposits itself was smaller for Global Powerhouse

Banks compared to the Brazilian big banks. In this set of regressions, liquidity during the crisis also seems to have played a role in depositors' decisions, an effect that was not captured by the regression shown in Table 4 – Panel A.

Although consistent with the idea of a potential bailout (be it in Brazil or elsewhere), the results obtained using this broad set of *Big + Powerhouse Banks* could be mostly driven by the big Brazilian banks. To test for this possible issue, we also run our baseline specification excluding Brazilian big banks from the sample, in order to investigate whether depositors preferred Global Powerhouse banks over other (non big) banks.

Table 4 – Panel C shows that other banks are preferred to Powerhouse Banks in normal times. There is respectively a 5 (statistically insignificant) and 6 (significant at 5%) percentage points difference for uninsured and total deposits respectively against Powerhouse Banks. During the crisis, the difference in favor of Powerhouse Banks is both statistically and economically important for both uninsured and total deposits: a predicted difference of 38 and 37 percentage points, respectively. While the economic significance for uninsured deposits is smaller for Powerhouse Banks compared to our original definition of big banks (i.e., banks that are big in Brazil), the coefficients for ω on the total deposits regressions are similar in Panels A and C of Table 4. Again it is important to note that, with the exclusion of the Brazilian big banks from the sample, the crisis dummy assumed a negative value of 42 percentage points for uninsured deposits and 37 p.p. for total deposits (respectively compared to a negative 39 and 34 in Panel B), showing that the banks excluded from the sample were the ones who gained more deposits during the crisis. The results in Table 4 Panels B and C also confirm that investors have preferred banks with more liquid assets during the crisis.

The findings reported in Table 4 allow us to draw the conclusion that during the crisis, depositors favored: i) banks that are systemically important in Brazil (*Big Banks*); ii) banks that have systemic importance on a global level (*Powerhouse Banks*) over other banks, in this order of preference. We infer that depositors favored global powerhouse banks because of the implicit (and in many cases explicit) guarantees those banks received during the worst period of the financial crisis.

V. Robustness Checks

In this section, we (a) test alternative explanations for the run to big banks observed during the financial crisis, (b) check if depositors favor government-owned banks against privately-held banks, (c) investigate the behavior of different types of depositors, (d) investigate how deposit growth evolved for different banks in the post-crisis period, (e) check stability of the results using changes of bank fundamentals, rather than levels and (f) check our results employing alternative estimators and/or identifying assumptions.

We report our robustness tests using the original definition of big banks, since this is a less restrictive classification (i.e., it would be empirically easier to refute the implicit guarantee hypothesis in favor of the alternative explanations for this set of banks).

A. Isolating the impacts of the Global Financial Crisis on the Brazilian Financial System

Previous research suggests that most runs are based on bank fundamentals. Our results using fundamentals traditionally found in the literature show otherwise. However, it is possible that depositors considered big banks safer not because they would be bailed out, but because depositors believed those big banks would be more resilient to the crisis effects. In this section, we investigate other risk factors specifically related to the international financial crisis.

1. Types of loans

We take a deeper look at bank loans, since it is plausible that depositors could be concerned with particular types of assets that banks were exposed to on their balance sheets. We are especially interested in banks that engage in trade finance loans, middle market operations (loans made to small and medium-sized firms). Trade finance loans are very collateralized by import/export contracts, have typically very low delinquency rate and loss given default, and are thus expected to be safe during the crisis. On the other hand, middle market loans have typically low collateral and are held to maturity by the lender bank (instead of being securitized and traded in the secondary market) and thus we could expect depositors to percept these loans to be riskier during the financial crisis, since small and medium firms have a higher probability of being financially distressed during the economic downturn. We define the exposure to trade finance as the ratio between the amount of trade finance loans and total assets. Exposure to other types of loans are defines analogously. We only have data on the types of loans for the periods Dec/2004 and after (so the number of observations relative to the previous specifications is reduced).

[Insert table 5 here]

The results shown in Table 5 show that the signs of the coefficients estimates for the interactions of these types of asset exposure with the crisis dummy (*trade finance x crisis* and *middle market x crisis*) are consistent with the above rationale. The negative coefficient for the later variable indicates that banks that carried loans to middle market firms on their balance sheets during the crisis were penalized by depositors. It indicates that a 1% increase in the exposure to middle market loans during the crisis caused a .25 percentage point decrease in the change in uninsured deposits, and .28 p.p. for total deposits (both statistically significant at the 5% level). Still, the other

coefficients (especially *big bank x crisis*) are practically unchanged by the addition of these variables to our baseline specification

2. Liquidity freeze

[Insert Table 6 here]

As mentioned before, one of the effects of the financial turmoil was tight external financing conditions. After Lehman's bankruptcy the interbank market virtually froze, so banks that depended more heavily on external financing would probably suffer the most and could become distressed. Additionally, the Brazilian Real suffered a depreciation of 45% relative to the US dollar in the second semester of 2008, so banks that hat a net short position in US dollars could suffer from this sharp movement in the FX markets[10]. We use the ratio of foreign funds to total assets as a proxy for bank's dependence on external financing on the right hand side of our model. However, we find no evidence that depositors favored banks with lower dependence on foreign funding, as we show on Table 6. Our coefficient for *Big Bank x crisis* also remains practically unchanged.

3. Deposit concentration and reliance on institutional depositors

Another indirect measure of exposure on the liabilities side is depositor concentration, measured as the fraction of assets being funded by each depositor on average. Banks that have a narrower depositor base, where few depositors hold a large share of the total deposits, may be in impending distress. For instance, if some of these depositors had to withdraw their funds at the same time due to liquidity reasons (related or not to the global financial crisis), the bank might lose a significant share of its funding. This would be exacerbated under the Goldstein and Pauzner (2005) model, that

[10] Our data do not allow us to estimate net positions of each bank in the FX market. However, it is plausible that banks were only partially hedged from the FX exposure in their liabilities.

states that when noisy information is revealed, depositors would tend to run because the bank could be in trouble if only a few depositors decide to run first. Therefore, in order to control for this feature, we use the natural logarithm of the ratio of the average deposit size to total assets as a right hand side variable that accounts for deposit concentration. We use logs to mitigate the extreme right-tail asymmetry of this variable. Results shown in Table 7 indicate that there is no evidence that depositor concentration affects the growth in deposits.

[Insert Table 7 here]

Under the rationale above, the first-come, first-serve issue is even more exacerbated if depositors assume one (or both) of the two hypotheses: i) that other depositors have superior information; ii) that other depositors are extremely risk-averse and thus will run when noisy information is expected. Institutional investors (such as pension and mutual funds) are the typical case of well informed and, in some cases, risk-averse depositors. As mentioned before, Chen, Goldstein and Jiang (2010) find evidence that the behavior of institutional investors depends on whether they are surrounded by other institutional investors or by retail investors in mutual funds. To account for this factor, we use a measure of reliance on institutional investors for funding, which is the ratio between the amount of certificates of deposit held by institutional investors and total assets. Table 8 shows that the reliance on institutional investors has a negative effect on deposits growth (economically and statistically significant for uninsured deposits) in normal times. This effect is very exacerbated during the crisis. We verify very significant negative impact of relying on deposits of institutional investors during the financial crisis for both uninsured and total deposits, which is consistent with the empirical findings of Chen, Goldstein and Jiang (2010) and Wermers (2010). During the financial crisis, a 1 percentage point increase in the reliance on institutional investors would decrease uninsured deposits by over 3.0 percentage points (2.66 plus 0.34) and slightly less for total deposits. In

addition, when reliance on institutional investors is considered in our regressions, the coefficient of the interaction of liquidity and crisis turns out to show a positive and significant (at the 10% level) effect on deposits. The inclusion of these additional controls slightly changes the magnitude and standard errors of some coefficients but it does not significantly alter our inferences. In particular, the estimates for the *big bank x crisis* interaction lowers to the 38-40 percentage points range for uninsured deposits and 26-29 percentage points range for total deposits. The results in Table 8, however, could simply mean that institutional investors were the ones who ran from deposits, so that the higher the concentration of deposits held by institutional investors in a certain bank, the more it lost deposits (or the less it gained deposits). We show that this was not the case, when we return to this issue in section C below.

[Insert table 8 here]

B. Government-owned banks

In this section, we investigate if depositors favor government-owned banks against privately-held banks. 10 banks in our sample are controlled by the government (4 by the Federal Government and 6 by states of the federation), 2 of which are included in our list of big banks. It is plausible to assume that depositors perceive government-owned banks as enjoying some kind of additional guarantee to depositors, so that these banks could be considered not only too big to fail, but also *too-protected-to-fail*. To account for this possibility, we include a dummy variable for banks that are controlled by the government, but do not belong to our list of big banks, and also interact it with the financial crisis dummy. The results shown in Table 9 indicate that these banks do not enjoy higher deposit growth during normal times. The coefficient of the interaction variable (*government-owned*

bank x crisis) shows some evidence, although weak, that the increase in both uninsured and total deposits during the financial crisis was higher for government-owned banks.

[Insert Table 9 here]

To further investigate an implicit protection to government-owned banks, we check whether the *big bank x crisis* effect was larger for the 2 government-owned banks of our big bank group than for privately-owned banks in the group. We do that by first excluding big private banks from the sample (results in Table 10) and then excluding big government-owned banks (results in Table 11). The results of Table 10 and 11 show that there is virtually no difference in our estimates of the *big bank x crisis* coefficient for uninsured deposits between private and government-owned banks (either of them enjoy circa 45 percentage points more growth in uninsured deposits compared to the other banks). When we turn our attention to total deposits, the results also show little difference: we observe a coefficient of 34 percentage points for government-owned banks and 37 percentage points for private banks.

[Insert Table 10 here]

[Insert Table 11 here]

C. The behavior of different types of depositors

In this section we investigate the behavior of different types of holders of certificates of deposit[11]. Certificates of deposits may be held by each of the three classes of investors: 1) institutional; 2) non-financial firms and; 3) individuals. It is reasonable to conjecture that institutional investors are the

[11] We only have data on the types of holders of certificates of deposits that account for roughly half of the total deposits in teh Brazilian Financial System. Unfortunately, there is no data comprising the holders of checkings and savings deposits.

ones with superior information and higher degree of sophistication among the 3 classes, while individuals would be less informed and less sophisticated. We then run our baseline specification for each of the different classes of investors.

The results of Table 12 show that, during normal times, institutional investors are sensitive to banks' equity ratio. Our estimates imply that a 1 percentage point increase in the equity ratio predicts an increase in the growth rate of certificates of deposit held by institutional investors of around 1.1 to 1.3 percentage points (depending on the specification). Institutional investors are sensitive to banks' exposure to trade finance during normal times and during the crisis. In normal times, a greater exposure is mildly penalized by institutional investors: a 1 percentage point increase in exposure predicts a fall in the growth rate of deposits of 0.11 percentage point. However, during the financial crisis, the same increase of 1 percentage point in exposure predicts a rise in the growth rate of deposits of 0.68 percentage points (0.789 minus 0.106). One possible explanation is that, in normal times, a higher diversification of the loan portfolio is preferred, but during the crisis, banks that have higher concentration on the safer types of loans are better off.

[Insert Table 12 here]

Regarding our main variable of interest (*big bank x crisis*), we find very large coefficients for institutional investors although with different degrees of statistical significance, depending on the model specification (2 at the 5% level and 2 at the 10% level). For non-financial firms coefficients are always significant at the 1% level, but smaller in magnitude (still, very significant economically), while for individuals the coefficients are positive, but not statistically significant at the usual levels. This more pronounced run observed for institutional investors is consistent with the findings of Wermers (2010) for money funds in the US.

We control for the presence of institutional investors in specifications (4) and (8) and find that the magnitude of the coefficients of the *big bank x crisis* lowers for both types of depositors (institutional investors and non-financial firms). These findings suggest that some part of the run could be explained by incentives to withdraw depending on whether depositors fear others will withdraw first, which is consistent with the features of Goldstein and Pauzner (2005), since the presence of institutional investors influences not only their own behavior, but also the actions of non-financial firms.

There is also some weak evidence that regional activity where the bank has most of its operations impacts positively the amount of CDs held by non-financial firms. This is consistent with the notion that some of these firms may be inclined to invest in local banks (this could be due to relationship motives).

The estimates shown in columns (9) to (12) weakly suggests that individual investors increased their amount of CDs during the crisis. However, we cannot reject the hypothesis that individuals did not have a special preference towards big banks. Finally, the estimation results in column (9) of Table 12 show that that exposure to middle market firms during the crisis implies comparatively less deposits from individuals. The amount of CDs held by institutional investors and non-financial firms, however, were not materially affected by this type of exposure. Since individuals seemed not to be sensitive to any other bank fundamentals, it seems implausible that these investors were screening these banks as riskier for holding middle market loans on their balance sheets. It is more plausible that the fact that individuals make comparatively less deposits in banks exposed to middle market loans is driven by some unobservable feature of these banks, which is correlated to the exposure itself (for example, banks that lend to middle market firms may focus their marketing efforts towards local firms and small businesses but not individuals).

D. The post-crisis period

The previous tests have shown that depositors favored big banks, banks that relied less on the funding of institutional investors during the crisis and that the bulk of these results was driven by the behavior of both institutional investors and non-financial corporations. We now investigate how deposit growth evolved for different banks in the post-crisis period, which we define as the first and second semesters of 2009 (Jun-09 and Dec-09). Both the OLS and the GMM regressions reported on table 13 show that the change in total deposits during the post-crisis period (*big bank x post crisis*) for other banks was 14 percentage points larger compared to big banks (5% statistical significance). For uninsured deposits, a similar effect is observed (11%, although not statistically significant at the usual levels).

[Insert Table 13 here]

These results reveal important information on the behavior of depositors. Indeed, there is some evidence that more than half of the "run to big banks" identified during the critical stage of the financial crisis is partially reverted for total deposits in the post crisis period (note that there are 2 periods considered *post crisis*). This evidence is in some sense consistent with the hypotheses that relate bank runs to noisy information that is revealed (or expected) during crises and the too big to fail hypothesis.

[Insert Table 14 here]

We also look at how different types of depositors (institutional investors, non financial companies and individuals) behaved after the crisis. The results in Table 14 show that the coefficients for *big bank x post crisis* are negative and statistically and economically significant for all types of

depositors (institutional, non-financial firms and individuals), whilst the coefficients of the other variables of interest (including *big bank x crisis*) remain practically unchanged. In fact, the positive change in CDs of institutional investors observed for big banks during the crisis is more than reverted after the crisis and almost entirely reverted for non-financial firms[12]. It is important to note that this evidence is not inconsistent with the results shown in Table 13 (in which the run during the crisis was not entirely reverted). While the results in Table 13 concern all types of deposits (including CDs), the specifications in Table 14 refer only to Certificates of Deposits. Therefore, taken together, the combined results of Tables 13 and 14 indicate that the run in CDs was more than reverted after the crisis, while for other types of deposits (mainly checking and savings deposits), the reversal, if any, was not complete.

These results clearly indicate that institutional investors and non-financial firms performed a "flight-to-big-banks" movement during the crisis (and **only** during the crisis). This reversal-movement to other banks observed in the post crisis period can also be attributed, at least in part, to the creation of a special CD with guarantee of up to BRL20 million (around USD 9 million) in March 2009 as mentioned before. In fact, there is anecdotal evidence reporting that institutional investors account for a great portion of this special guaranteed CD. Unfortunately, there is no available data that would allow us to test how much these specially guaranteed CDs contribute to the observed reversal after the crisis.

E. Changes of bank fundamentals

We implement several other robustness tests to check the stability of our main results. Our baseline specification uses bank fundamentals in level, in accordance to the market discipline literature.

[12] Again note that our definition of post crisis includes 2 semesters, and the coefficients of *big bank x.post crisis* is more than half the coefficient of *big bank x crisis*.

However, it is possible that depositors are indeed interested in trends of bank fundamentals. Thus, we substitute $\Delta R_{i,t-1}$ for $R_{i,t-1}$ in equation (1), meaning that we now control for the *change* in bank fundamentals (i.e., capital adequacy, asset quality, management quality, earnings, and liquidity) from $t-2$ to $t-1$. This alternative specification addresses the possibility that clients are mainly sensitive to improvements or deteriorations of bank fundamentals instead of their level when deciding to withdraw or expand their deposits. In these regressions (results not reported), the coefficients estimated for ΔR turn out to be nonsignificant in all cases. However, our coefficient of interest (ω in equation (1)) again remains practically unchanged.

F. Alternative estimators and identifying assumptions

We also check our results employing alternative estimators and/or identifying assumptions. First, we use the GMM fixed effects panel data estimator proposed by Arellano and Bond (1991) with identifying assumptions regarding the endogeneity of some regressors similar to those used in the GMM regressions reported in Table 4, namely, allowing the bank fundamentals contained in vector R, plus $\Delta Deposits$, $\Delta IntRatePremium$, and $Size$ to be only sequentially exogenous (i.e., potentially correlated with the error term ε in some time periods). Specifically, by using suitable lagged values as instruments, we let bank fundamentals and size to be correlated with past shocks, thus allowing for feedback effects running from the change in deposits to those variables. Similarly, we let $\Delta Deposits$ and $\Delta IntRatePremium$ to be correlated with past as well as contemporaneous values of ε, thus accounting for the likely simultaneous determination of the volume and price of deposits. We also rerun all regressions using the two-step GMM estimator instead of the one-step procedure reported in Table 4. Finally, we employ alternative identifying assumptions, such as allowing the bank fundamentals to be correlated with ε contemporaneously, as well. For the benefit

of space, we do not report the results of these exercises. In all cases, our main inferences are not materially affected, though.

VI. Concluding remarks

This study shows that the perception of an implicit too big to fail policy affects depositor behavior during a crisis. Specifically, we analyze a run from smaller banks to the largest banks in Brazil during the international financial turmoil triggered by Lehman Brother's demise in September 2008. Brazilian banks had no exposure to subprime securitized loans, and we show that depositors' response to bank fundamentals was relatively weak. Taken together, our results indicate that depositors moved their funds from smaller banks primarily to the largest banks of the country and secondarily to the subsidiaries of global powerhouse banks because depositors thought those banks would not be allowed to fail. Uninsured depositors' reaction was stronger than the overall depositors'. Likewise, institutional investors' reaction was stronger than non-financial firms'.

We also find that banks that relied on institutional investors for funding suffered more deposit outflows, not only from institutional investors themselves, but also from non-financial firms. This result is consistent with the evidence in Chen, Goldstein and Jiang (2010), Wermers (2010) and with some features of the model for bank runs of Goldstein and Pauzner (2005).

Our results indicate that too big to fail beliefs are enough to drive depositor behavior regardless of any governmental policy, which complements previous evidence in Gormley et al. (2009). Additionally, our findings suggest that depositor behavior give banks perceived as too big to fail a significant competitive advantage of extra liquidity during a crisis. To the best of our knowledge, this issue has not yet been addressed in academic or policy discussions, presently focused on moral hazard and cost of capital issues.

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Figure 1. Market Share of Certificates of Deposits (CDs)

The purple solid line shows the daily evolution of the market share of CDs of the big banks. The green dotted line shows the daily evolution of the market share of CDs of the other banks.

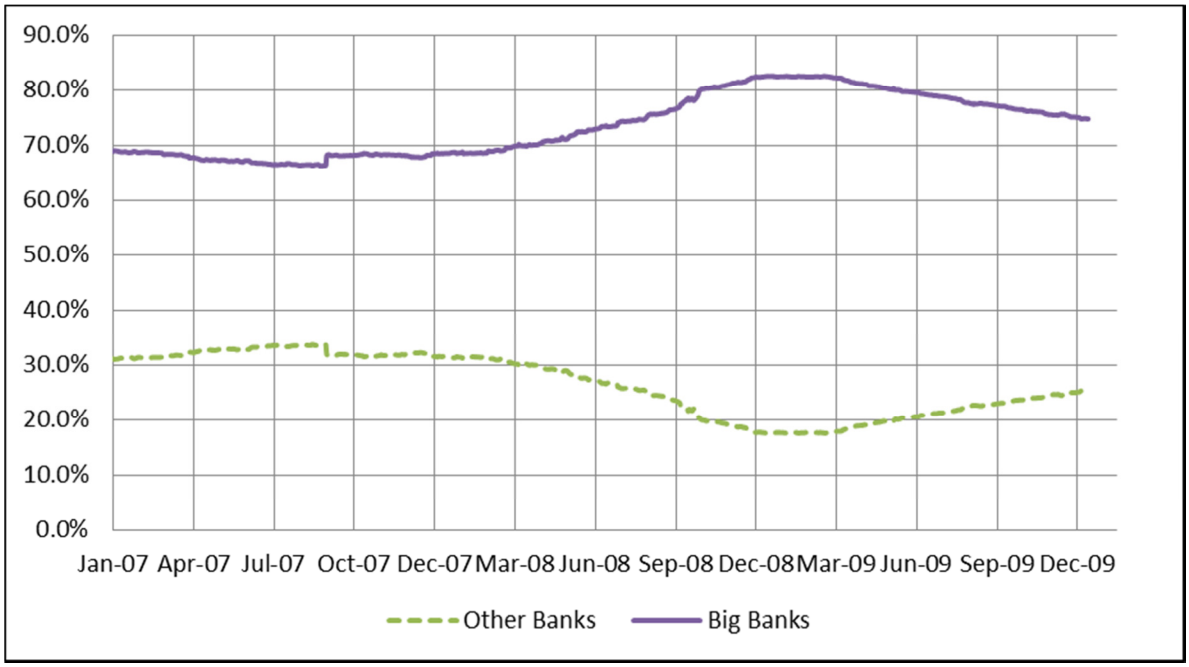
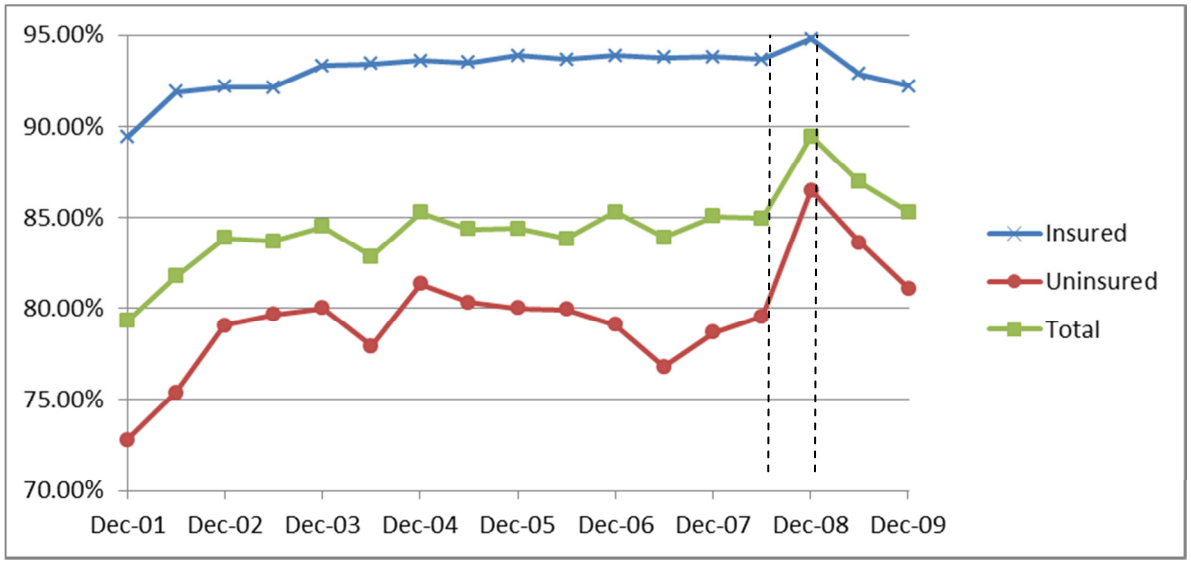


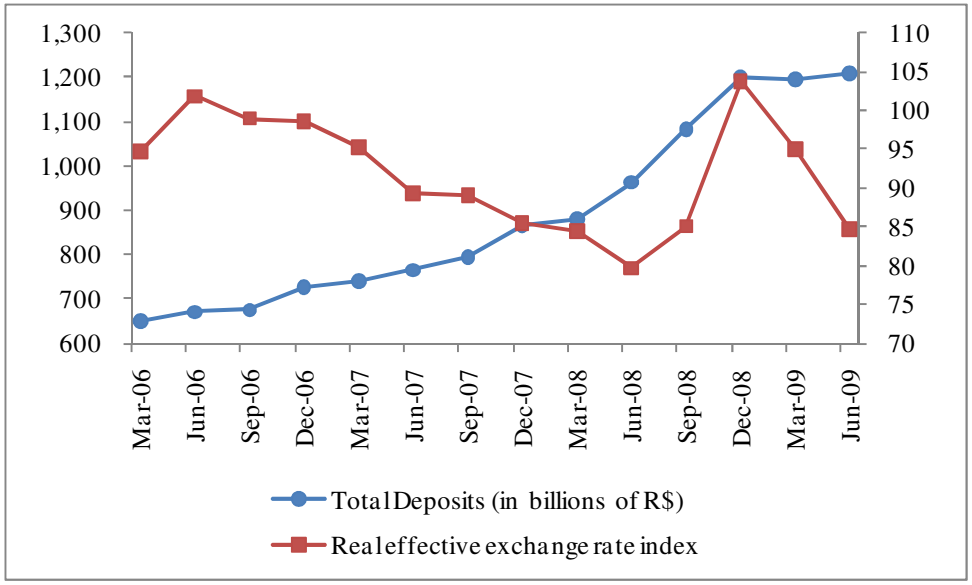
Figure 2. Total deposits market share of the set of Big Banks



Source: Central Bank of Brazil

Figure 3. Total Deposits and Real Effective Exchange Rate Index

The blue line shows the evolution of total deposits (in billions of BRL – left axis) and the real effective exchange rate index.



Source: Central Bank of Brazil

Figure 4. Multidimensional Scaling Configuration Graph

The graph below represents the Euclidian distances between banks in two-dimensional space as an approximation of the original distances computed for the following five variables (in standardized form): (i) total assets plus brokerage, (ii) total assets, (iii) total deposits, (iv) number of branches, and (v) number of clients.

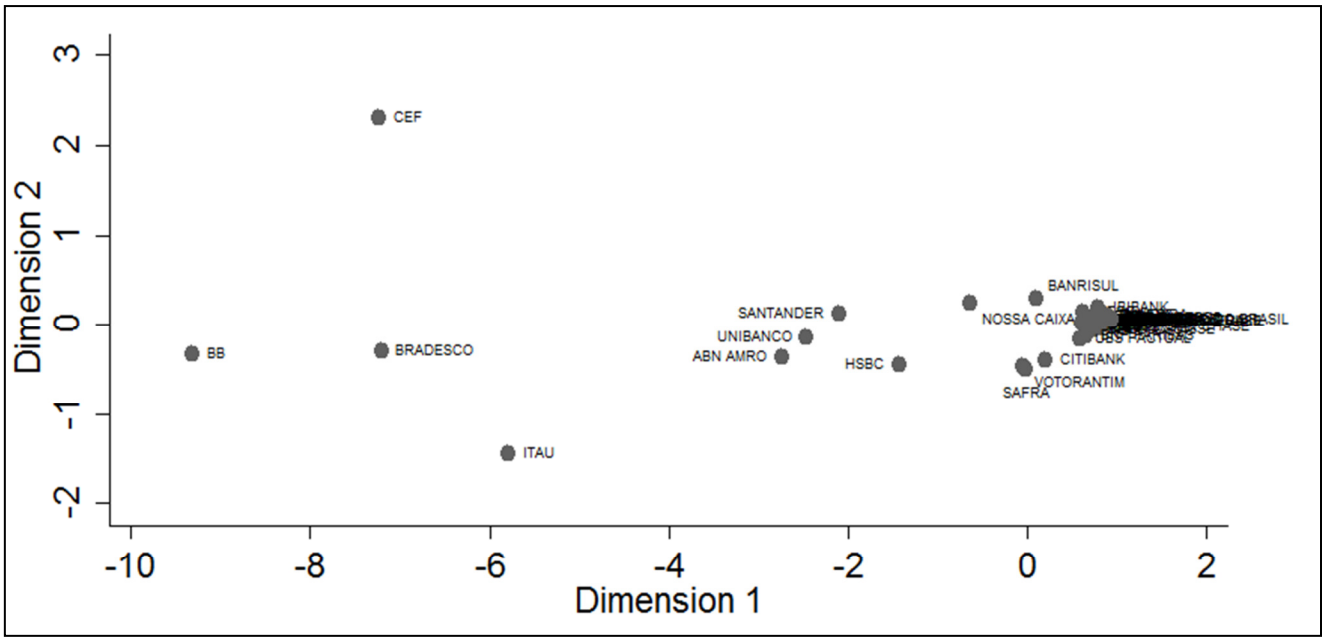
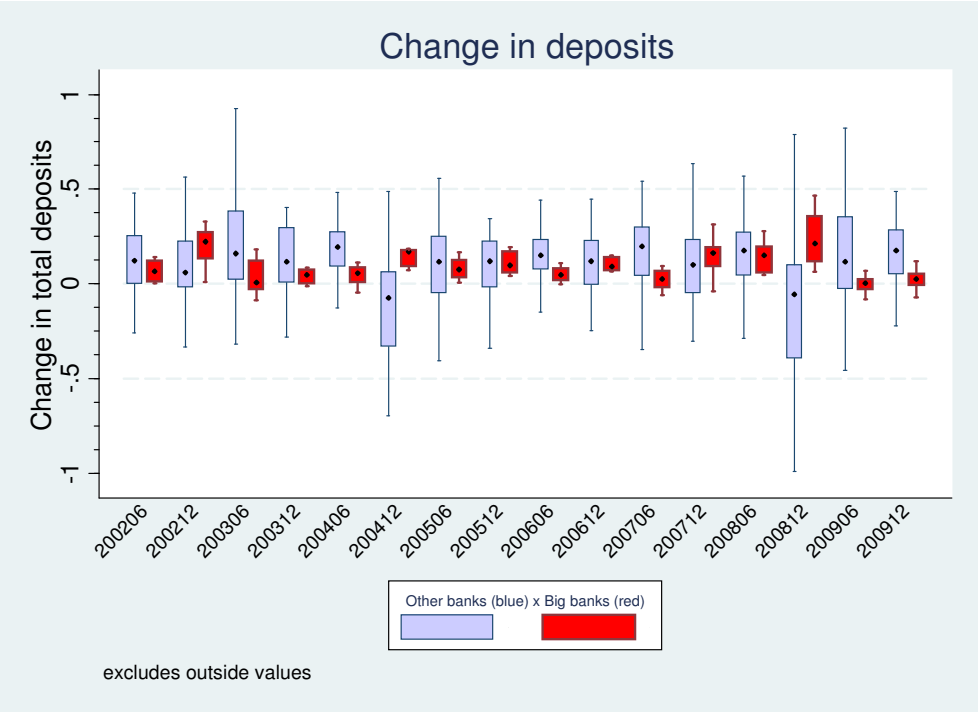


Figure 5. Change in total deposits – Big banks vs. other banks

Figures 5.A and 5.B show respectively the change in total and uninsured deposits of Big banks (in red) and other banks (in blue) in each period. For each box, the dot indicates the median value, while the upper and lower extremes of the boxes indicate the 3rd and 1st quartiles. The lower and upper ends of the vertical lines delimit the 5th and 95th percentile.

5.A – Total Deposits



5.B – Uninsured Deposits

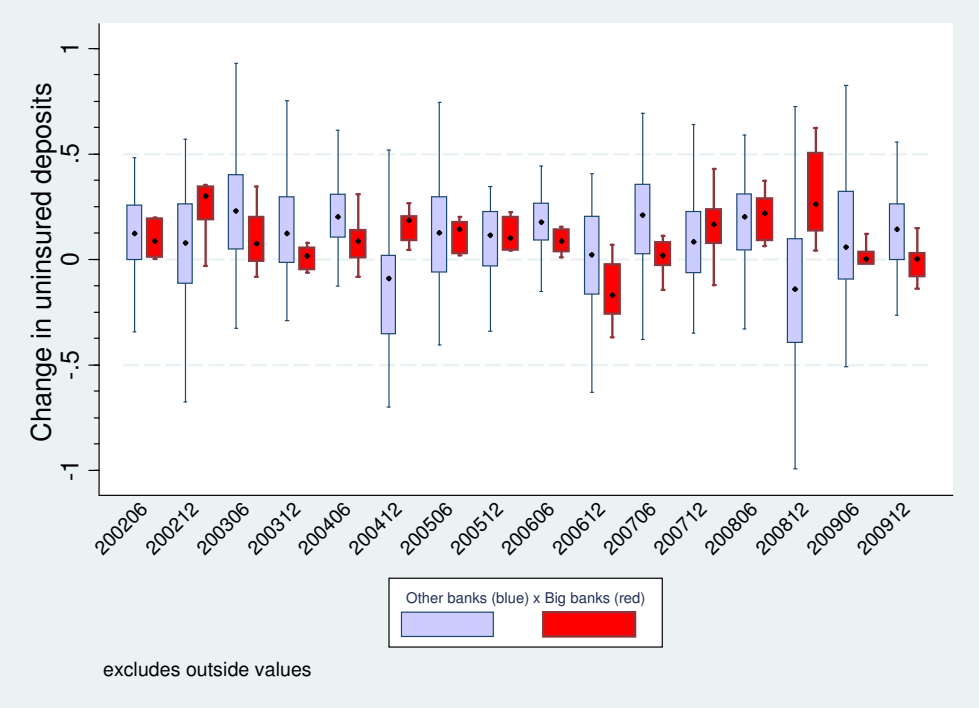


Table 1- A – Big banks – Results from the cluster analysis

The groups shown in this table were suggested by the cluster analysis algorithms *K-means* and *K-medians*, setting the number of clusters to $k = 2$. Five variables were used for clustering: (i) total assets plus brokerage, (ii) total assets, (iii) total deposits, (iv) number of branches, and (v) number of clients. The algorithms search iteratively for the best partition using the squared Euclidean distance as the dissimilarity measure. We use only pre-crisis data, from December/2001 through June/2008.

Cluster	Bank
Cluster 1 (Big Banks)	ABN AMRO BB Bradesco CEF HSBC Itau Santander Unibanco
Cluster 2 (Other Banks)	ABC-Brasil Alfa Bancoob Banese Banestes Banif Banpara Banrisul Bansicredi Basa BBM Besc BGN BIC BMG BNB BNP Paribas Bonsucesso Brascan BRB BTMUB BVA Citibank Credit Suisse Cruzeiro do Sul Daycoval DBB BM Deutsche Fibra Ibibank Industrial do Brasil Indusval ING J. Malucelli John Deere JP Morgan Chase Mercantil do Brasil Nossa Caixa SS Pine Prosper Rabobank Rural Safra Schahin SMBC Societe Generale Sofisa UBS Pactual Votorantim WestLB

Table 1- B – Alternative specification: Big banks + Global Powerhouse banks

	Bank
Big Banks	ABN AMRO BB Bradesco CEF HSBC Itau Santander Unibanco
Global Powerhouse Banks that were not clustered as Big Banks	BNP Paribas BTMUB (Tokyo-Mitsubishi) Citibank Credit Suisse Deutsche ING JP Morgan Chase SMBC (Sumitomo Mitsui) Societe Generale

Table 2 – Sample

Panel A – Distribution of deposits in the sample

Rows [A] to [E] show the proportion of each type of deposit in relation to total deposits in financial institutions of our sample as of December of each year from 2001 to 2009.

	Dec/ 2001	**Dec/ 2002**	**Dec/ 2003**	**Dec/ 2004**	**Dec / 2005**	**Dec/ 2006**	**Dec/ 2007**	**Dec/ 2008**	**Dec/ 2009**
[A] Checking account deposits	16%	18%	16%	16%	15%	16%	20%	14%	14%
[B] Savings deposits	34%	32%	31%	30%	26%	26%	27%	23%	26%
[C] Time Deposits	45%	46%	46%	48%	51%	50%	46%	56%	55%
[D] Interbank Deposits	2%	2%	3%	3%	3%	3%	3%	4%	3%
[E] Other Deposits	3%	3%	3%	4%	4%	5%	5%	4%	2%
[F] Total Deposits (**[A] + [B] + [C] + [D] +[E])**	100%	100%	100%	100%	100%	100%	100%	100%	100%

Panel B – Representativeness of sample

Row [A] shows the number of deposit-taking financial institutions as of December of each year from 2001 to 2009, while row [B] shows the number of banks considered in our sample in the same period. In row C, we show the total amount of deposits eligible to receive deposit insurance in the Brazilian Financial System, while in row [D] we show the amount of deposits eligible for deposit insurance for the banks in our sample. In row [E], it is shown the proportion of deposits considered in this study relative to the overall deposits of the Brazilian Financial System.

	Dec/ 2001	**Dec/ 2002**	**Dec/ 2003**	**Dec/ 2004**	**Dec / 2005**	**Dec/ 2006**	**Dec/ 2007**	**Dec/ 2008**	**Dec/ 2009**
[A] Number of deposit-taking financial institutions	121	111	110	108	104	104	101	101	100
[B] Number of banks in the sample	74	71	68	65	64	61	60	57	53
[C] Total Deposits (billions of BRL)	313	365	400	470	546	624	740	1,003	1,252
[D] Total Deposits of sample (billions of BRL)	304	357	395	465	535	600	712	986	1,240
[E] Representativeness of sample ([D] / [C])	97.3	97.7	98.9	98.9	97.9	96.1	96.3	98.3	99.1

Table 3 – Summary statistics

Means and standard deviations (in brackets) are reported for Dec/2001, Jun/2008 and Dec/2009. Big banks are defined as in Section II-B.

	Dec/2001		**Jun/2008**		**Dec/2009**	
	Big banks	Other banks	Big banks	Other banks	Big banks	Other banks
Total assets (BRL Millions)	74,009 [45,274]	4,165 [6,351]	245,128 [115,449]	10,288 [14,557]	368,581 [169,431]	10,511 [14,575]
Total equity (BRL Millions)	6,335 [3,025]	427 [541]	21,606 [12,659]	1.159 [1.305]	35,819 [22,210]	1,270 [1,468]
# of depositors (thousands)	10,048 [7,279]	195 [653]	16,282 [9,989]	246 [771]	23,939 [12,094]	138 [337]
Uninsured deposits / total deposits	58.6% [13.8%]	87.6% [17.4%]	62.98% [15.5%]	87.0% [19.7%]	61.8% [14.1%]	76.8% [24.3%]
Equity ratio	9.7% [4.3%]	14.7% [8.3%]	8.54% [1.97%]	14.56% [8.1%]	9.8% [5.6%]	15.0% [7.9%]
Low quality loans	2.6% [0.7%]	2.5% [3.7%]	2.3% [0.3%]	1.9% [3.5%]	3.2% [0.5%]	2.3% [2.1%]
Liquidity	34.5% [9.5%]	32.2% [19.2%]	19.2% [9.2%]	27.0% [16.4%]	19.8% [8.1%]	27.8% [18.3%]
Exposure to trade finance	-	-	6.8% [3.6%]	9.5% [16.2%]	5.3% [3.1%]	10.8% [15.2%]
Exposure to middle market	-	-	25.0% [7.0%]	33.2% [27.4%]	29.1% [7.2%]	39.2% [27.7%]
Foreign funding	10.71% [6.1%]	11.68% [13.8%]	4.4% [2.1%]	9.0% [10.3%]	2.5% [1.8%]	8.5% [8.5%]
Reliance on institutional investors	0.9% [0.9%]	5.1% [6.4%]	4.0% [3.9%]	7.0% [9.2%]	1.7% [1.8%]	8.3% [10.8%]
Deposit concentration (x1000)	0.00007 [0.00005]	1.60 [8.10]	0.00005 [0.00006]	0.49 [1.35]	0.00004 [0.00006]	0.98 [3.65]
Observations	8	65	8	51	6	46
Exchange Rate (BRL/USD)	2.32		2.34		1.74	

Table 4 – Change in deposits, financial crisis and big banks

This table shows the results of the estimation of equation (1) for the change in uninsuredand total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and MechChange (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

Panel A – Big Banks defined as in Section II.B (banks that are big in Brazil)

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.207	-0.250	-0.236	-0.210
		(-1.343)	(-1.498)	(-1.488)	(-1.255)
Size		0.001	0.001	-0.005	-0.005
		(0.060)	(0.060)	(-0.561)	(-0.559)
Big bank dummy		-0.004	-0.004	-0.005	-0.005
		(-0.146)	(-0.136)	(-0.179)	(-0.168)
Big bank x crisis		0.440***	0.440***	0.352***	0.351***
		(3.610)	(3.603)	(3.448)	(3.437)
Control Variables					
Change in uninsured deposits	L	0.043	0.041		
		(0.725)	(0.686)		
Change in total deposits	L			0.045	0.043
				(0.760)	(0.718)
Premium paid on deposits	D	-0.663	-0.755	-0.868	-1.029
		(-0.468)	(-0.550)	(-0.624)	(-0.759)
Equity ratio	L	0.284	0.286	0.265	0.266
		(1.552)	(1.561)	(1.418)	(1.423)
Low quality loans	L	-0.094	-0.100	-0.301	-0.307
		(-0.168)	(-0.180)	(-0.553)	(-0.567)
Liquidity	L	0.004	0.004	-0.008	-0.008
		(0.061)	(0.068)	(-0.140)	(-0.136)
Regional economic activity		0.194	0.198	0.037	0.042
		(0.601)	(0.596)	(0.138)	(0.152)
Equity ratio x crisis		-0.636	-0.638	-0.928	-0.930
		(-0.967)	(-0.972)	(-1.439)	(-1.444)
Low quality loans x crisis		-1.507	-1.500	-1.639	-1.634
		(-0.405)	(-0.404)	(-0.458)	(-0.458)
Liquidity x crisis		0.404	0.402	0.388	0.385
		(1.073)	(1.067)	(1.068)	(1.060)
Constant		-0.014	0.030	0.201	0.175
		(-0.087)	(0.178)	(1.260)	(1.083)
Observations		854	854	854	854
R-squared		0.105		0.084	
F		5.383	5.387	4.095	4.101
F_p		.	4.93e-09	.	1.04e-06
hansen		.	55.87	.	51.35
hansenp		.	1	.	1
# of cross sections			74		74

Panel B – Big Banks include banks that are big in Brazil and Global Powerhouse Banks (*Big + Powerhouse Banks*)

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.350**	-0.394**	-0.373**	-0.349**
		(-2.426)	(-2.602)	(-2.431)	(-2.237)
Size		0.006	0.006	0.002	0.002
		(0.886)	(0.891)	(0.326)	(0.333)
Big bank + Powerhouse dummy		-0.041	-0.041	-0.051**	-0.051**
		(-1.590)	(-1.588)	(-2.000)	(-1.998)
(Big bank + Powerhouse) x crisis		0.414***	0.414***	0.374***	0.374***
		(3.570)	(3.573)	(3.290)	(3.293)
Control Variables					
Change in uninsured deposits	L	0.038	0.036		
		(0.668)	(0.630)		
Change in total deposits	L			0.038	0.036
				(0.666)	(0.623)
Premium paid on deposits	D	-0.665	-0.752	-0.866	-1.014
		(-0.480)	(-0.560)	(-0.639)	(-0.765)
Equity ratio	L	0.314*	0.316*	0.301	0.303
		(1.691)	(1.698)	(1.599)	(1.603)
Low quality loans	L	-0.318	-0.325	-0.582	-0.590
		(-0.604)	(-0.618)	(-1.154)	(-1.172)
Liquidity	L	-0.009	-0.009	-0.025	-0.025
		(-0.155)	(-0.150)	(-0.426)	(-0.424)
Regional economic activity		0.083	0.088	-0.059	-0.051
		(0.260)	(0.269)	(-0.223)	(-0.186)
Equity ratio x crisis		-0.690	-0.691	-0.934	-0.935
		(-1.229)	(-1.234)	(-1.634)	(-1.640)
Low quality loans x crisis		1.769	1.778	1.156	1.165
		(0.532)	(0.535)	(0.370)	(0.373)
Liquidity x crisis		0.570*	0.568*	0.535*	0.533
		(1.732)	(1.722)	(1.670)	(1.660)
Constant		-0.077	-0.035	0.120	0.094
		(-0.519)	(-0.242)	(0.838)	(0.684)
Observations		854	854	854	854
R-squared		0.115		0.095	
F		5.887	5.875	4.720	4.726
F_p		.	8.12e-10	.	8.26e-08
hansen		.	46.03	.	51.59
hansenp		.	1	.	1
# of cross sections			74		74

Panel C – Excludes banks that are big in Brazil from the sample

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.423***	-0.424***	-0.374**	-0.372**
		(-2.716)	(-2.721)	(-2.330)	(-2.334)
Size		0.003	0.003	-0.002	-0.002
		(0.303)	(0.303)	(-0.266)	(-0.264)
Global Powerhouse bank dummy		-0.053	-0.053	-0.065*	-0.065*
		(-1.440)	(-1.445)	(-1.798)	(-1.802)
Powerhouse bank x crisis		0.386**	0.386**	0.373**	0.373**
		(2.523)	(2.530)	(2.419)	(2.421)
Control Variables					
Change in uninsured deposits	L	0.043	0.042		
		(0.694)	(0.673)		
Change in total deposits	L			0.046	0.045
				(0.754)	(0.734)
Premium paid on deposits	D	-0.786	-1.042	-0.922	-1.160
		(-0.547)	(-0.726)	(-0.652)	(-0.819)
Equity ratio	L	0.313	0.313	0.299	0.300
		(1.640)	(1.640)	(1.555)	(1.556)
Low quality loans	L	-0.413	-0.418	-0.689	-0.694
		(-0.777)	(-0.787)	(-1.374)	(-1.385)
Liquidity	L	-0.007	-0.007	-0.020	-0.021
		(-0.105)	(-0.112)	(-0.323)	(-0.326)
Regional economic activity		0.121	0.129	-0.046	-0.041
		(0.376)	(0.392)	(-0.173)	(-0.151)
Equity ratio x crisis		-0.665	-0.666	-0.957*	-0.964*
		(-1.204)	(-1.211)	(-1.720)	(-1.740)
Low quality loans x crisis		1.444	1.455	1.201	1.189
		(0.432)	(0.435)	(0.379)	(0.376)
Liquidity x crisis		0.626*	0.625*	0.593*	0.587*
		(1.808)	(1.801)	(1.765)	(1.753)
Constant		0.032	0.033	0.175	0.176
		(0.190)	(0.194)	(1.055)	(1.063)
Observations		743	743	743	743
R-squared		0.121		0.109	
F		6.823	6.883	7.003	7.035
F_p		.	1.97e-10	.	1.69e-10
hansen		.	36.70	.	42.06
hansenp		.	1	.	1
# of cross sections			63		63

Table 5 – Exposure to trade finance, middle market loans and personal loans

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and MechChange (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.204	-0.377**	-0.132	-0.296*
		(-1.176)	(-2.137)	(-0.772)	(-1.670)
Size		0.001	0.001	-0.002	-0.002
		(0.110)	(0.110)	(-0.183)	(-0.183)
Big bank dummy		-0.007	-0.007	-0.011	-0.011
		(-0.199)	(-0.190)	(-0.328)	(-0.317)
Big bank x crisis		0.482***	0.482***	0.381***	0.381***
		(3.680)	(3.654)	(3.430)	(3.400)
Control variables					
Exposure to trade finance	L	-0.026	-0.026	-0.038	-0.037
		(-0.966)	(-0.955)	(-1.427)	(-1.415)
Exposure to middle market	L	0.033	0.033	0.023	0.022
		(0.956)	(0.953)	(0.670)	(0.664)
Trade finance x crisis		0.158	0.157	0.132	0.131
		(1.316)	(1.316)	(1.101)	(1.098)
Middle market x crisis		-0.145	-0.145	-0.167	-0.167
		(-1.334)	(-1.339)	(-1.556)	(-1.562)
Change in uninsured deposits	L	0.039	0.039		
		(0.671)	(0.668)		
Change in total deposits	L			0.048	0.049
				(0.860)	(0.855)
Premium paid on deposits	D	-0.732	-1.110	-0.764	-1.219
		(-0.506)	(-0.768)	(-0.537)	(-0.853)
Equity ratio	L	0.295	0.294	0.265	0.264
		(1.538)	(1.531)	(1.424)	(1.415)
Low quality loans	L	-0.018	-0.018	-0.392	-0.392
		(-0.032)	(-0.032)	(-0.708)	(-0.710)
Liquidity	L	0.001	0.000	-0.015	-0.016
		(0.020)	(0.007)	(-0.231)	(-0.247)
Regional economic activity		0.200	0.202	0.028	0.028
		(0.615)	(0.609)	(0.102)	(0.100)
Equity ratio x crisis		-0.296	-0.295	-0.591	-0.590
		(-0.427)	(-0.427)	(-0.864)	(-0.865)
Low quality loans x crisis		-0.808	-0.816	-1.390	-1.400
		(-0.218)	(-0.221)	(-0.380)	(-0.383)
Liquidity x crisis		0.546	0.544	0.503	0.501
		(1.462)	(1.459)	(1.345)	(1.342)
Constant		-0.133	0.041	-0.015	0.150
		(-0.751)	(0.215)	(-0.089)	(0.824)
Observations		858	858	858	858
R-squared		0.108		0.091	
F		4.723	4.700	3.216	3.203
F-p		.	2.53e-08	.	2.54e-05
Hansen		.	44.27	.	42.62
Hansen-p		.	1	.	1
# of cross sections			75		75

Table 6 – Exposure to foreign funding

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and *mechanical change in deposits* (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.279*	-0.319*	-0.296*	-0.268
		(-1.926)	(-1.984)	(-1.952)	(-1.643)
Size		0.001	0.001	-0.005	-0.005
		(0.083)	(0.083)	(-0.520)	(-0.519)
Big bank dummy		-0.009	-0.009	-0.008	-0.008
		(-0.267)	(-0.267)	(-0.272)	(-0.270)
Big bank x crisis		0.468***	0.468***	0.375***	0.375***
		(3.817)	(3.815)	(3.657)	(3.649)
Control variables					
Foreign funding	L	-0.118	-0.118	-0.093	-0.094
		(-1.002)	(-1.002)	(-0.773)	(-0.774)
Foreign funding x crisis		0.858	0.855	0.713	0.709
		(1.644)	(1.642)	(1.362)	(1.358)
Change in uninsured deposits	L	0.040	0.040		
		(0.698)	(0.698)		
Change in total deposits	L			0.042	0.042
				(0.727)	(0.728)
Premium paid on deposits	D	-0.657	-0.681	-0.860	-0.937
		(-0.463)	(-0.487)	(-0.618)	(-0.680)
Equity ratio	L	0.284	0.284	0.265	0.265
		(1.510)	(1.510)	(1.388)	(1.386)
Low quality loans	L	-0.206	-0.207	-0.393	-0.394
		(-0.359)	(-0.361)	(-0.697)	(-0.699)
Liquidity	L	-0.004	-0.004	-0.015	-0.015
		(-0.060)	(-0.064)	(-0.234)	(-0.240)
Regional economic activity		0.119	0.132	-0.027	-0.014
		(0.353)	(0.386)	(-0.092)	(-0.047)
Equity ratio x crisis		-0.796	-0.795	-1.062*	-1.062*
		(-1.292)	(-1.292)	(-1.730)	(-1.730)
Low quality loans x crisis		-0.542	-0.539	-0.833	-0.832
		(-0.148)	(-0.148)	(-0.239)	(-0.238)
Liquidity x crisis		0.423	0.423	0.403	0.403
		(1.184)	(1.185)	(1.162)	(1.162)
Constant		0.011	0.049	0.222	0.192
		(0.066)	(0.291)	(1.387)	(1.175)
Observations		854	854	854	854
R-squared		0.109		0.087	
F		5.260	5.262	3.776	3.776
F_p		.	4.67e-09	.	2.77e-06
hansen		.	53.68	.	55.16
hansenp		.	1	.	1
# of cross sections			74		74

Table 7 – Deposit concentration

This table shows the results of the estimation of equation (1) for the change in uninsuredand total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and *mechanical change in deposits* (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.362	-0.367	-0.437	-0.440*
		(-1.376)	(-1.398)	(-1.658)	(-1.679)
Size		-0.008	-0.008	-0.012	-0.012
		(-0.773)	(-0.774)	(-1.223)	(-1.224)
Big bank dummy		-0.033	-0.033	-0.026	-0.026
		(-0.912)	(-0.906)	(-0.755)	(-0.748)
Big bank x crisis		0.401***	0.399***	0.258**	0.257**
		(2.725)	(2.708)	(2.097)	(2.083)
Control variables					
Deposit concentration	L	-0.009	-0.009	-0.007	-0.007
		(-1.648)	(-1.653)	(-1.378)	(-1.384)
Deposit concentration x crisis		-0.010	-0.010	-0.021	-0.021
		(-0.496)	(-0.511)	(-1.067)	(-1.082)
Change in uninsured deposits	L	0.044	0.045		
		(0.745)	(0.745)		
Change in total deposits	L			0.045	0.046
				(0.762)	(0.765)
Premium paid on deposits	D	-0.702	-1.083	-0.912	-1.292
		(-0.499)	(-0.774)	(-0.659)	(-0.933)
Equity ratio	L	0.327*	0.326	0.295	0.294
		(1.672)	(1.664)	(1.485)	(1.478)
Low quality loans	L	-0.519	-0.521	-0.641	-0.642
		(-0.870)	(-0.873)	(-1.130)	(-1.132)
Liquidity	L	-0.017	-0.018	-0.025	-0.026
		(-0.257)	(-0.275)	(-0.400)	(-0.417)
Regional economic activity		0.197	0.208	0.071	0.083
		(0.595)	(0.620)	(0.263)	(0.301)
Equity ratio x crisis		-0.399	-0.394	-0.514	-0.511
		(-0.566)	(-0.559)	(-0.734)	(-0.733)
Low quality loans x crisis		-2.684	-2.702	-3.710	-3.725
		(-0.661)	(-0.666)	(-0.950)	(-0.955)
Liquidity x crisis		0.370	0.368	0.323	0.320
		(0.975)	(0.972)	(0.900)	(0.896)
Constant		0.080	0.081	0.222	0.223
		(0.453)	(0.460)	(1.325)	(1.331)
Observations		854	854	854	854
R-squared		0.109		0.088	
F		5.671	5.665	4.429	4.422
F-p		.	9.96e-10	.	1.75e-07
Hansen		.	49.72	.	52.05
Hansen-p		.	1	.	1
# of cross sections			74		74

Table 8 – Reliance on institutional investors for funding

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and *mechanical change in deposits* (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.282**	-0.332**	-0.307**	-0.285**
		(-2.224)	(-2.426)	(-2.317)	(-2.097)
Size		-0.007	-0.007	-0.011	-0.011
		(-0.823)	(-0.822)	(-1.291)	(-1.289)
Big bank dummy		0.006	0.006	0.004	0.005
		(0.208)	(0.215)	(0.150)	(0.159)
Big bank x crisis		0.384***	0.384***	0.296***	0.296***
		(3.605)	(3.585)	(3.389)	(3.366)
Control variables					
Reliance on institutional investors	L	-0.356**	-0.357**	-0.240	-0.241
		(-2.370)	(-2.379)	(-1.570)	(-1.583)
Reliance on inst. investors x crisis		-2.666***	-2.661***	-2.669***	-2.662***
		(-5.978)	(-5.974)	(-6.130)	(-6.124)
Change in uninsured deposits	L	0.052	0.052		
		(0.875)	(0.877)		
Change in total deposits	L			0.053	0.054
				(0.909)	(0.913)
Premium paid on deposits	D	-0.550	-0.782	-0.741	-1.029
		(-0.388)	(-0.561)	(-0.535)	(-0.751)
Equity ratio	L	0.349*	0.349*	0.300	0.300
		(1.814)	(1.809)	(1.555)	(1.550)
Low quality loans	L	0.120	0.120	-0.129	-0.129
		(0.211)	(0.211)	(-0.233)	(-0.233)
Liquidity	L	-0.026	-0.027	-0.030	-0.030
		(-0.400)	(-0.409)	(-0.454)	(-0.466)
Regional economic activity		0.346	0.340	0.180	0.177
		(1.182)	(1.146)	(0.734)	(0.709)
Equity ratio x crisis		0.993	0.992	0.672	0.671
		(1.550)	(1.548)	(1.072)	(1.070)
Low quality loans x crisis		-0.109	-0.114	-0.267	-0.271
		(-0.057)	(-0.059)	(-0.139)	(-0.142)
Liquidity x crisis		0.453*	0.452*	0.427*	0.426*
		(1.762)	(1.758)	(1.748)	(1.743)
Constant		0.092	0.144	0.288*	0.267
		(0.577)	(0.874)	(1.789)	(1.650)
Observations		848	848	848	848
R-squared		0.141		0.119	
F		14.59	14.68	16.10	16.27
F-p		.	0	.	0
Hansen		.	47.93	.	55.15
Hansen-p		.	1	.	1
# of cross sections			72		72

Table 9 – The effect of government-owned banks

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and MechChange (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.208	-0.253	-0.236	-0.212
		(-1.374)	(-1.539)	(-1.507)	(-1.286)
Size		0.000	0.000	-0.005	-0.005
		(0.023)	(0.023)	(-0.563)	(-0.562)
Big bank dummy		-0.004	-0.004	-0.004	-0.004
		(-0.134)	(-0.127)	(-0.150)	(-0.140)
Big bank x crisis		0.411***	0.411***	0.323***	0.323***
		(3.545)	(3.540)	(3.217)	(3.210)
Control variables					
Government-owned bank dummy		0.016	0.016	-0.016	-0.016
		(0.745)	(0.748)	(-0.877)	(-0.871)
Government-owned bank x crisis		0.146	0.146	0.168*	0.168*
		(1.466)	(1.472)	(1.874)	(1.881)
Change in uninsured deposits	L	0.041	0.040		
		(0.693)	(0.664)		
Change in total deposits	L			0.044	0.042
				(0.745)	(0.707)
Premium paid on deposits	D	-0.654	-0.748	-0.827	-0.966
		(-0.465)	(-0.548)	(-0.598)	(-0.716)
Equity ratio	L	0.294	0.295	0.251	0.252
		(1.562)	(1.569)	(1.333)	(1.338)
Low quality loans	L	-0.212	-0.216	-0.189	-0.195
		(-0.352)	(-0.360)	(-0.318)	(-0.329)
Liquidity	L	-0.013	-0.012	0.007	0.007
		(-0.184)	(-0.181)	(0.101)	(0.102)
Regional economic activity		0.244	0.244	0.134	0.136
		(0.762)	(0.743)	(0.504)	(0.500)
Equity ratio x crisis		-0.438	-0.439	-0.719	-0.720
		(-0.627)	(-0.629)	(-1.050)	(-1.052)
Low quality loans x crisis		-2.814	-2.809	-3.071	-3.064
		(-0.742)	(-0.741)	(-0.841)	(-0.839)
Liquidity x crisis		0.275	0.273	0.239	0.237
		(0.677)	(0.673)	(0.607)	(0.602)
Constant		-0.013	0.033	0.187	0.164
		(-0.079)	(0.193)	(1.165)	(1.001)
Observations		854	854	854	854
R-squared		0.107		0.086	
F		5.023	5.020	4.233	4.244
F-p		.	1.21e-08	.	3.69e-07
Hansen		.	45.17	.	51.24
Hansen-p		.	1	.	1
# of cross sections			74		74

Table 10 – The effect on big government-owned banks (excluding privately-owned big banks from the sample)

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Government-Owned Bank; and Big Government-Owned Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and MechChange (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.262	-0.263	-0.220	-0.218
		(-1.541)	(-1.544)	(-1.291)	(-1.288)
Size		0.001	0.001	-0.004	-0.004
		(0.162)	(0.161)	(-0.472)	(-0.473)
Big government-owned bank dummy		-0.019	-0.019	-0.013	-0.012
		(-0.663)	(-0.652)	(-0.437)	(-0.423)
Big gov. bank x crisis		0.449**	0.449**	0.335**	0.335**
		(2.251)	(2.236)	(2.078)	(2.068)
Control Variables					
Change in uninsured deposits	L	0.049	0.047		
		(0.773)	(0.743)		
Change in total deposits	L			0.052	0.051
				(0.842)	(0.813)
Premium paid on deposits	D	-0.757	-0.971	-0.920	-1.155
		(-0.516)	(-0.670)	(-0.636)	(-0.804)
Equity ratio	L	0.289	0.289	0.267	0.268
		(1.532)	(1.536)	(1.393)	(1.396)
Low quality loans	L	-0.122	-0.127	-0.317	-0.320
		(-0.215)	(-0.224)	(-0.573)	(-0.581)
Liquidity	L	0.001	0.001	-0.010	-0.010
		(0.013)	(0.009)	(-0.162)	(-0.160)
Regional economic activity		0.205	0.208	0.038	0.038
		(0.634)	(0.630)	(0.142)	(0.139)
Equity ratio x crisis		-0.662	-0.662	-0.951	-0.957
		(-0.995)	(-0.997)	(-1.458)	(-1.470)
Low quality loans x crisis		-1.501	-1.487	-1.605	-1.616
		(-0.397)	(-0.393)	(-0.441)	(-0.445)
Liquidity x crisis		0.411	0.411	0.401	0.392
		(1.061)	(1.058)	(1.073)	(1.056)
Constant		0.027	0.028	0.173	0.175
		(0.158)	(0.164)	(1.034)	(1.045)
Observations		772	772	772	772
R-squared		0.110		0.094	
F		6.347	6.345	6.243	6.242
F-p		.	5.85e-10	.	1.08e-09
Hansen		.	44.05	.	46.83
Hansen-p		.	1	.	1
# of cross sections			66		66

Table 11 – The effect on big privately-owned banks (excluding big government-owned banks from the sample)

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Government-Owned Bank; and Big Government-Owned Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and MechChange (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.261	-0.266	-0.224	-0.225
		(-1.592)	(-1.552)	(-1.305)	(-1.310)
Size		0.001	0.001	-0.005	-0.005
		(0.062)	(0.062)	(-0.563)	(-0.561)
Big private bank dummy		-0.000	0.000	-0.003	-0.003
		(-0.010)	(0.000)	(-0.098)	(-0.087)
Big private bank x crisis		0.443***	0.443***	0.374***	0.374***
		(3.842)	(3.838)	(3.794)	(3.790)
Control Variables					
Change in uninsured deposits	L	0.044	0.042		
		(0.726)	(0.689)		
Change in total deposits	L			0.047	0.045
				(0.792)	(0.753)
Premium paid on deposits	D	-0.678	-0.850	-0.861	-1.066
		(-0.477)	(-0.609)	(-0.617)	(-0.773)
Equity ratio	L	0.279	0.280	0.262	0.263
		(1.509)	(1.516)	(1.392)	(1.396)
Low quality loans	L	-0.086	-0.092	-0.299	-0.305
		(-0.154)	(-0.165)	(-0.547)	(-0.561)
Liquidity	L	0.006	0.006	-0.008	-0.008
		(0.091)	(0.092)	(-0.123)	(-0.123)
Regional economic activity		0.202	0.211	0.041	0.050
		(0.622)	(0.636)	(0.151)	(0.180)
Equity ratio x crisis		-0.647	-0.648	-0.942	-0.943
		(-0.985)	(-0.990)	(-1.460)	(-1.465)
Low quality loans x crisis		-1.403	-1.395	-1.520	-1.511
		(-0.372)	(-0.370)	(-0.419)	(-0.417)
Liquidity x crisis		0.465	0.463	0.443	0.441
		(1.169)	(1.164)	(1.153)	(1.148)
Constant		0.027	0.027	0.175	0.175
		(0.161)	(0.160)	(1.067)	(1.068)
Observations		825	825	825	825
R-squared		0.104		0.085	
F		6.542	6.593	5.208	5.222
F-p		.	1.09e-10	.	1.74e-08
Hansen		.	49.74	.	49.99
Hansen-p		.	1	.	1
# of cross sections			72		72

Table 12 – Institutional investors, corporations and individuals

This table shows the results of the estimation of equation (1) for the change in the amount of certificates of deposits held by institutional investors (specifications 1 to 4), non-financial firms (5 to 8) and individuals (9 to 12) using (one-step) system GMM estimators, in which we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; and Big Bank x Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the following variables are omitted: the first lag of the dependent variable, time dummies, premium paid on deposits (lagged difference) and *mechanical change in deposits* (see Appendix) and the intercept. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Institutional investors				Non-financial firms				Individuals			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables of interest													
Crisis dummy		0.177	-0.309	0.122	0.007	-0.129	-0.077	-0.156	-0.207	0.237*	0.279	0.216	0.233*
		(0.419)	(-0.841)	(0.268)	(0.019)	(-0.696)	(-0.378)	(-0.861)	(-1.326)	(1.709)	(1.646)	(1.576)	(1.667)
Size		-0.011	-0.008	-0.013	-0.022	-0.023*	-0.021	-0.023*	-0.023*	0.000	-0.000	0.000	0.001
		(-0.811)	(-0.500)	(-0.902)	(-1.389)	(-1.876)	(-1.567)	(-1.849)	(-1.763)	(0.024)	(-0.038)	(0.007)	(0.101)
Big bank dummy		0.087	0.081	0.095	0.100*	0.068	0.064	0.070	0.073*	0.049	0.052	0.049	0.050
		(1.597)	(1.281)	(1.639)	(1.684)	(1.575)	(1.390)	(1.574)	(1.667)	(1.075)	(1.141)	(1.028)	(1.092)
Big bank x crisis		0.714**	0.720*	0.740**	0.584*	0.454***	0.447***	0.448***	0.412***	0.172	0.143	0.181	0.162
		(2.102)	(1.808)	(2.137)	(1.967)	(3.063)	(3.065)	(2.962)	(2.785)	(1.440)	(1.196)	(1.496)	(1.347)
Control variables													
Equity ratio	L	1.133***	1.100***	1.121***	1.308***	-0.089	-0.100	-0.095	-0.158	-0.010	-0.031	-0.026	-0.071
		(4.181)	(4.039)	(4.094)	(4.197)	(-0.363)	(-0.417)	(-0.386)	(-0.652)	(-0.066)	(-0.200)	(-0.164)	(-0.466)
Low quality loans	L	-0.949	-1.310	-0.850	-0.697	0.165	0.018	0.154	0.065	-0.070	0.008	-0.013	-0.053
		(-1.066)	(-1.475)	(-0.903)	(-0.705)	(0.266)	(0.028)	(0.249)	(0.105)	(-0.173)	(0.020)	(-0.033)	(-0.141)
Liquidity	L	0.034	0.004	0.041	-0.027	0.109	0.097	0.109	0.124	0.018	0.022	0.021	0.033
		(0.274)	(0.033)	(0.329)	(-0.207)	(1.382)	(1.173)	(1.427)	(1.430)	(0.357)	(0.458)	(0.412)	(0.650)
Regional economic activity		-0.519	-0.619	-0.563	-0.136	0.426	0.459	0.504*	0.543*	0.204	0.188	0.176	0.226
		(-0.773)	(-0.902)	(-0.819)	(-0.210)	(1.441)	(1.477)	(1.679)	(1.861)	(1.069)	(0.980)	(0.939)	(1.205)
Equity ratio x crisis		-2.196	-1.401	-2.391	1.166	-0.694	-0.441	-0.656	0.373	-0.924	-0.407	-0.979	-0.714
		(-1.447)	(-0.902)	(-1.649)	(0.714)	(-0.903)	(-0.539)	(-0.860)	(0.554)	(-1.440)	(-0.658)	(-1.477)	(-1.223)
Low quality loans x crisis		-5.603	-1.007	-4.645	-2.692	0.169	-1.011	-0.023	1.168	-1.072	-2.459	-0.763	-0.886
		(-0.660)	(-0.144)	(-0.523)	(-0.547)	(0.063)	(-0.365)	(-0.008)	(0.414)	(-0.583)	(-1.102)	(-0.400)	(-0.462)
Liquidity x crisis		-0.707	-0.095	-0.696	-0.611	0.206	0.117	0.203	0.199	0.012	-0.062	0.016	0.001
		(-0.783)	(-0.125)	(-0.772)	(-0.794)	(0.553)	(0.297)	(0.554)	(0.614)	(0.062)	(-0.247)	(0.085)	(0.007)
Other variables													
Exposure to trade finance			-0.106**				-0.042				0.001		
			(-2.123)				(-1.200)				(0.031)		
Exposure to middle market			0.052				0.029				0.006		
			(0.839)				(0.833)				(0.289)		
Trade finance x crisis			0.789***				-0.004				-0.005		
			(3.271)				(-0.040)				(-0.061)		
Middle market x crisis			-0.271				-0.159				-0.242***		
			(-1.047)				(-1.552)				(-3.022)		
Foreign funding				0.087				0.030				-0.010	
				(0.443)				(0.180)				(-0.078)	
Foreign Funding x crisis				0.805				-0.217				0.271	
				(0.763)				(-0.435)				(0.753)	
Reliance on instit. investors	L				-0.759**				0.196				0.151
					(-2.195)				(0.785)				(1.089)

Instit. Investors x crisis				-5.493***				-1.946***				-0.426
				(-5.396)				(-3.880)				(-0.868)
Observations	944	944	944	944	944	944	944	944	944	944	944	944
F	4.360	6.967	3.825	10.95	8.623	8.389	8.476	10.68	9.352	10.87	8.970	8.997
F-p	3.12e-07	0	2.00e-06	0	0	0	0	0	0	0	0	0
Hansen	47.27	41.46	47.36	46.29	48.44	45.99	46.44	41.72	46.46	38.78	46.92	50.19
hansenp	1	1	1	1	1	1	1	1	1	1	1	1
# of cross sections	73	73	73	73	73	73	73	73	73	74	73	73

Table 13 – Change in deposits, post-financial crisis and big banks

This table shows the results of the estimation of equation (1) for the change in uninsured and total deposits using the pooled ordinary least squares (POLS) and (one-step) system GMM estimators. In the GMM regressions, we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; Big Bank x Crisis and Big Bank x Post-Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the time dummies and *mechanical change in deposits* (see Appendix) are omitted. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy and the post-crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Uninsured Deposits		Total Deposits	
		(1)	(2)	(3)	(4)
		OLS	GMM-Sys	OLS	GMM-Sys
Variables of interest					
Crisis dummy		-0.096	-0.303*	-0.052	-0.233
		(-0.625)	(-1.850)	(-0.345)	(-1.447)
Post-Crisis dummy		0.232**	0.025	0.114	-0.067
		(2.219)	(0.258)	(1.112)	(-0.759)
Size		-0.002	-0.002	-0.001	-0.001
		(-0.277)	(-0.277)	(-0.118)	(-0.102)
Big bank dummy		0.016	0.016	0.072	0.071
		(0.526)	(0.531)	(1.539)	(1.523)
Big bank x crisis		0.427***	0.427***	0.337***	0.337***
		(3.519)	(3.514)	(3.298)	(3.288)
Big bank x post-crisis		-0.116	-0.116	-0.139**	-0.139**
		(-1.568)	(-1.563)	(-2.132)	(-2.125)
Control variables					
Premium paid on deposits	D	-0.612	-0.699	-0.833	-0.992
		(-0.429)	(-0.507)	(-0.595)	(-0.727)
Equity ratio	L	0.254	0.256	0.165	0.166
		(1.241)	(1.251)	(0.856)	(0.863)
Low quality loans	L	-0.269	-0.275	-0.668	-0.675
		(-0.476)	(-0.487)	(-1.221)	(-1.236)
Liquidity	L	0.040	0.040	0.013	0.013
		(0.615)	(0.622)	(0.212)	(0.215)
Regional economic activity		0.197	0.201	0.049	0.055
		(0.622)	(0.618)	(0.188)	(0.204)
Constant		-0.080	0.128	0.071	0.253
		(-0.555)	(0.766)	(0.502)	(1.618)
Lagged dependent variable	L	Yes	Yes	Yes	Yes
Bank fundamentals controls x crisis		Yes	Yes	Yes	Yes
Bank fundamentals x post-crisis		Yes	Yes	Yes	Yes
Observations		854	854	854	854
R-squared		0.112		0.097	
F		5.582	5.539	3.949	3.927
F-p		.	9.64e-10	.	9.80e-07
Hansen		.	49.43	.	46.86
Hansen-p		.	1	.	1
# of cross sections			74		74

Table 14 – Institutional investors, corporations and individuals – post-crisis

This table shows the results of the estimation of equation (1) for the change in the amount of certificates of deposits held by institutional investors (specifications 1 to 4), non-financial firms (5 to 8) and individuals (9 to 12) using (one-step) system GMM estimators, in which we allow all variables to be only sequentially exogenous, employing suitable lagged values as their instruments, except for the following regressors, which are assumed to be strictly exogenous: time dummies; *Regional economic activity; Big Bank dummy; Big Bank x Crisis and Big Bank x Post-Crisis*. Coefficient estimates and autocorrelation/heteroskedasticity-robust t-tests are shown in parentheses. Estimates for the following variables are omitted: the first lag of the dependent variable, time dummies, premium paid on deposits (lagged difference) and *mechanical change in deposits* (see Appendix) and the intercept. D stands for first difference and L stands for first lag. Variables interacted with the crisis dummy are lagged according to the variable that appears without interaction (for example, *equity ratio x crisis* is the interaction of the crisis dummy with the first lag of the equity ratio, since equity ratio, by itself, is also in first lag). *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

		Institutional investors				Non-financial firms				Individuals			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables of interest													
Crisis dummy		0.106	-0.383	0.034	-0.055	-0.321*	-0.268	-0.302	-0.347**	-0.018	0.020	-0.043	-0.021
		(0.264)	(-1.104)	(0.077)	(-0.156)	(-1.732)	(-1.342)	(-1.610)	(-2.123)	(-0.118)	(0.115)	(-0.292)	(-0.137)
Post-Crisis dummy		-0.097	-0.121	-0.133	-0.125	-0.302**	-0.274*	-0.255*	-0.289**	-0.144*	-0.102	-0.165*	-0.135*
		(-0.320)	(-0.414)	(-0.454)	(-0.416)	(-2.357)	(-1.861)	(-1.945)	(-2.194)	(-1.952)	(-1.167)	(-1.932)	(-1.815)
Size		-0.017	-0.014	-0.018	-0.028*	-0.026**	-0.024*	-0.026**	-0.026*	-0.001	-0.001	-0.001	-0.000
		(-1.219)	(-0.947)	(-1.182)	(-1.728)	(-2.105)	(-1.805)	(-2.058)	(-1.968)	(-0.102)	(-0.072)	(-0.083)	(-0.014)
Big bank dummy		0.151***	0.149**	0.153**	0.161***	0.096**	0.092*	0.097**	0.101**	0.071	0.070	0.070	0.071
		(2.693)	(2.338)	(2.561)	(2.698)	(2.086)	(1.913)	(2.084)	(2.147)	(1.523)	(1.463)	(1.425)	(1.500)
Big bank x crisis		0.664*	0.671	0.694*	0.537*	0.435***	0.425***	0.428***	0.391***	0.153	0.125	0.163	0.145
		(1.926)	(1.660)	(1.971)	(1.777)	(2.989)	(2.979)	(2.888)	(2.714)	(1.265)	(1.029)	(1.329)	(1.187)
Big bank x post-crisis		-0.501**	-0.499**	-0.473**	-0.481**	-0.202*	-0.210*	-0.240**	-0.206*	-0.195***	-0.205***	-0.181***	-0.194***
		(-2.290)	(-2.160)	(-2.042)	(-2.225)	(-1.728)	(-1.729)	(-2.063)	(-1.730)	(-4.448)	(-4.221)	(-3.684)	(-4.632)
Control variables													
Equity ratio	L	0.953***	0.937***	0.948***	1.127***	-0.211	-0.209	-0.212	-0.267	0.040	0.040	0.038	0.014
		(2.971)	(2.864)	(2.932)	(3.136)	(-0.810)	(-0.810)	(-0.812)	(-1.044)	(0.240)	(0.237)	(0.221)	(0.084)
Low quality loans	L	-1.303	-1.674*	-1.320	-1.077	-0.163	-0.284	-0.128	-0.214	-0.095	-0.087	-0.147	-0.124
		(-1.469)	(-1.840)	(-1.362)	(-1.079)	(-0.273)	(-0.453)	(-0.206)	(-0.348)	(-0.224)	(-0.215)	(-0.346)	(-0.306)
Liquidity	L	0.063	0.036	0.063	-0.006	0.114	0.104	0.115	0.130	0.040	0.039	0.037	0.047
		(0.487)	(0.267)	(0.483)	(-0.044)	(1.300)	(1.160)	(1.380)	(1.321)	(0.722)	(0.725)	(0.651)	(0.809)
Regional econ. act.		-0.540	-0.704	-0.648	-0.166	0.434	0.463	0.528*	0.470	0.198	0.220	0.144	0.205
		(-0.810)	(-1.041)	(-0.929)	(-0.257)	(1.447)	(1.486)	(1.748)	(1.565)	(1.043)	(1.151)	(0.736)	(1.061)
Int. controls x crisis		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Int. controls x post-crisis		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other variables													
Exp. trade finance			-0.120**				-0.015				0.003		
			(-2.393)				(-0.354)				(0.117)		
Exp. middle market			0.039				-0.022				0.001		
			(0.594)				(-0.533)				(0.034)		

Trade finance x crisis		0.804***				-0.011				-0.006		
		(3.379)				(-0.118)				(-0.075)		
Middle market x crisis		-0.265				0.010				-0.238***		
		(-1.020)				(0.142)				(-3.068)		
Foreign funding			-0.028				0.042				-0.048	
			(-0.126)				(0.203)				(-0.335)	
Foreign Fund x crisis			0.946				-0.225				0.318	
			(0.890)				(-0.447)				(0.913)	
Rel. on instit. invest.				-0.771**				0.177				0.091
				(-2.179)				(0.629)				(0.613)
Instit. Invest. x crisis				-5.494***				-1.930***				-0.369
				(-5.395)				(-3.715)				(-0.769)
Observations	944	944	944	944	944	944	944	944	944	944	944	944
F	6.074	10.13	5.869	16.16	8.249	8.937	7.788	9.208	10.24	10.60	9.725	11.15
F-p	1.51e-10	0	1.56e-10	0	0	0	0	0	0	0	0	0
Hansen	41.20	36.40	41.79	32.78	49.72	39.03	42.35	39.17	44.91	29.35	37.28	29.65
hansenp	1	1	1	1	1	1	1	1	1	1	1	1
# of cross sections	73	73	73	73	73	73	73	73	73	73	73	73

APPENDIX

Operational Definitions of Variables Used in the Tests

1 – Independent Variables

$\Delta Deposits_{i,t}$ is the change in deposits of bank *i* in period *t*, measured by the first difference of the log of deposits.

The database from the FGC provides the amount of insured and uninsured deposits.

2 – Dependent Variables

Our right-hand-side variables are defined as below. Some are used in levels (contemporaneous and/or lagged) and others are used in first differences, as explained in section I.

2.1 Risk

The bank-specific risk indicators chosen are commonly used in the literature. The operational definition of all the variables is described below.

Equity: we measure the ratio of equity to total assets to examine capital adequacy.

Low quality loans: the assessment of the quality of assets can be made using several indicators. To a great extent, empirical studies use the ratio of nonperforming loans and total assets. We prefer a more forward looking metric: the ratio of low quality loans to total assets. Brazilian banks must rate their credit operations in an ascending order of risk, on levels AA, A, B, C, D, E, F, G and H and report the volume of credit in each of these ratings in their financial statements. Low quality loans are those that fall into one of the ratings E to H. Resolution 2.682 from the Brazilian National Monetary Council states that loans due for more than 90 days should be rated E or worse.

Liquidity: We use as a proxy for liquidity *(cash + tradable securities + net interbank) / assets.*

2.2 Control Variables

Size: we measure size as the *natural log of assets*. We include this variable as a fundamental in order to disentangle the pure effect of size on deposits from the special characteristics that may cause a bank to be too big to fail.

Regional economic activity: although bank legislation allows banks to open branches and have operations throughout all Brazilian states, many banks focus on specific states to do business. Deposits may thus be influenced by the economic activity of individual states. We use data from the retail sales survey done by the Brazilian Institute for Geography and Statistics (IBGE, for its acronym in Portuguese), which provides the growth in retail sales for each state of the federation as well as the resulting national growth in retail sales[1]. This is the most used indicator of regional economic activity in Brazil. To assign a state to each bank, we use the following procedure: if a bank has branches in more than 10 states[2] and no single state accounts for more than 50% of its branches, we consider it a nationwide bank, and use the national index. Otherwise we use the index for the state where the bank has more branches. Thus: $Regional\ Economic\ Activity_{i,t}$ is the change in retail sales index of the state in which the bank has more branches (considers heterogeneous macro-effects over depositors-base).

Exposure on Loans: loans are classified into 9 different categories: 1) trade finance (import and export); 2) short-term (less than 12 months) loans to non-financial companies; 3) agricultural; 4) real estate; 5) consumer goods (including auto vehicles); 6) infrastructure; 7) personal loans (loans made to individuals without specifying a particular purpose) not collateralized on salary; 8) personal loans collateralized on salaries; 8) others. Exposure to each of these classes of loans is measured as the ratio between the amount of loans in that class and total assets. For example, exposure to trade finance is measured as the amount of loans qualified as trade finance and total assets. We are especially interested in classes 1 (trade finance) and 2 (working capital). Trade finance loans are very collateralized by import/export contracts, have typically very low delinquency rate and loss given default and are thus expected to be very safe during the crisis. On the other hand, working capital loans have typically low collateral and are mostly issued by small and

[1] The index is released on a monthly basis. We use the 12-month compound growth in retail sales (which does not need to be adjusted for seasonality) for June and December to match with the rest of our data.
[2] Brazil has 27 states.

medium-sized firms (since in Brazil these firms have little access to long term debt markets) and held to maturity by the lender bank (instead of being securitized and traded in the secondary market) and thus we can expect these loans to be riskier during the financial crisis.

Deposit concentration: a bank with a larger depositor base is naturally more diversified than another that relies on few depositors to fund its assets. In addition, deposit concentration may create incentives for depositors to "run first" during periods in which informational asymmetry is higher. Deposit concentration is measured as the portion of a bank's asset being funded by each depositor on average, i.e., *total deposits / (total assets * number of depositors)* in each semester.

Reliance on institutional investors: Chen, Goldstein and Jiang (2010) find evidence that the behavior of institutional investors depends on whether they are surrounded by other institutional investors or by retail investors. We use the ratio between the amount of certificates of deposit held by institutional investors and total assets to account for the reliance on institutional investors.

Reliance on foreign funds: banks that rely on foreign funds may be more likely to struggle to obtain funding during episodes that reduce the amount of foreign capital to emerging markets in general or to Brazil in particular. We define the reliance on foreign funds as the proportion of assets being funded by sources obtained abroad, i.e., *total foreign funds / total assets*.

Mechanical Change in deposits: We also compute for each bank the change occurred in insured and uninsured deposits due to the change in the amount insured in September 2006 ($MechChange$). This computation is based on an unique bank level data on the number of depositors and volume of deposits in several different deposit-size brackets for all Brazilian banking firms. Since the change took place in September 2006, we compute, based on the data of Jun/2006 the amount of uninsured deposits that became insured due to the simple fact that the amount insured was increased. Had we neglected this change, we would end up with a measurement error in our left-hand-side variables (*change in insured deposits* and *change in uninsured deposits*) in the period Dec/2006, since these are not changes derived from depositors moving their resources from one bank to another, which is ultimately what we want to measure. It is also important that, since the change in the amount insured affects

each bank differently (because they have different depositor profiles) it is not simply a change in level that could be captured by time fixed effects. As such, in order to correct this measurement error, we create a variable that assumes the value of the change in uninsured deposits due to the increase in the amount insured in Dec/2006 and 0 in all other periods[3]. We create an analogous variable for insured deposits.

2.3 Identification variables

We use two different variables that allow us to perform our identification strategy.

Big Bank: This is a dummy that assumes 1 for the banks that could be perceived as too big to fail and 0 otherwise. As explained above, these are the eight largest banks up to Jun/2008. In Dec/2008 there are six banks, because there were two mergers between banks belonging to this group in the second semester of 2008. The reasons for choosing these eight banks are described in section I-B.

Crisis: This is a Crisis dummy that assumes 1 for period ending in Dec/2008 and 0 in all other periods.

Post-Crisis: This is an indicator of the period that followed the crisis. It assumes 1 for periods ending in Jun/2009 and Dec/2009 and 0 in all other periods.

[3] As expected, the coefficient of this variable is equal to 1 in our regressions, with significance of less than 1%.