

# Are Banks Passive Liquidity Backstops?

## Deposit Rates and Flows during the 2007-2009 Crisis

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### Abstract

Can banks maintain their advantage as liquidity providers when they are heavily exposed to a financial crisis? The standard argument - that banks can - hinges on deposit inflows that are seeking a safe haven and provide banks with a natural hedge to fund drawn credit lines and other commitments. We shed new light on this issue by studying the behavior of bank deposit rates and inflows during the 2007-09 crisis. Our results indicate that the role of the banking system as a stabilizing liquidity insurer was disrupted in the first year of the crisis as aggregate deposit inflows weakened and loan to deposit shortfalls widened. Moreover, individual banks losing deposits and with increasing shortfalls were also those most exposed to liquidity demand shocks (as measured by their unused commitments). Such liquidity-short banks sought to attract deposit by offering higher rates. The results show that banks are not passive recipients of deposits, but in fact, active seekers, in financial crises when banks are themselves stressed.

**JEL Codes:** E4, G01, G11, G21, G28.

**Keywords:** Liquidity; Liquidity risk; Solvency risk; Financial crisis; Flight to safety.

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*“Citigroup representatives fanned out across San Francisco’s financial district on Oct. 17, handing out fliers promoting six-month certificates of deposit with 4 percent interest rates” – Bloomberg, “Citi Squeezed in Debt Market as JPMorgan, Wells Lure Deposits” October 20, 2008.*

*“The fact that Washington Mutual is now owned by Chase is very positive, because they were a huge outlier on rates,” Kenneth D. Lewis, then Chairman and CEO of Bank of America, as cited in American Banker, “Deposit-Gathering Pitches Evolving Amid Upheaval”, October 9, 2008.*

## 1. INTRODUCTION

In crises of the recent past, investors often withdrew from securities markets and placed their funds into safer assets, such as U.S. Treasuries and bank deposits. During such episodes, a wide range of businesses shut out of securities markets sought to fund their operations by drawing down credit lines established with banks during normal times. Awash with funds from depositors seeking a safe haven, banks had no difficulty meeting these increased credit demands (e.g., Gatev and Strahan, 2006). Thus, banks seem to have helped avoid financial disruptions and business liquidations that would have occurred in the absence of a liquidity backstop.

In 2007-09, however, banks were themselves at the center of the financial crisis. While significant risks were present in some other financial institutions, this crisis was special in that commercial banks were much more exposed to losses than in recent past crises. Aggregate risk also sharply increased, disrupting banks’ ability to diversify shocks across businesses and depositors. These two features of the crisis (and their interaction) cast doubt on the notion that banks can be taken for granted as a natural source of liquidity during financial crises. Were banks still viewed as a safe haven, and if not, how compromised was their ability to meet the demand for liquidity? And, what actions did banks take to ensure that inflows into deposit funds persisted as their funding sources were drying up?

To answer these questions, we investigate the behavior of bank deposit rates, flows, and lending during the recent financial crisis. As banks become weak or liquidity-constrained,

they may seek to attract deposits by offering higher rates.<sup>1</sup> More broadly, competition for deposits can be intense during a crisis.<sup>2</sup> Supporting these channels, Chart 1a shows the average deposit rates offered by *failed* banks and *nearly failed* banks (decline in stock price of 90% or more), as measured by the difference from the rates of *non-fail* banks (that is, banks that did not fail), over a one year period prior to failure, for failures occurring during the 1997-2009 period. For ease of comparison, the x-axis is the time to failure.<sup>3</sup> As is evident, the weak institutions offered substantially higher CD rates in the run-up to failure. For example, the differential between their 12-month CD rate and that of non-fail banks crept up from 10 basis points one year prior to failure to close to 60 basis points in the last two weeks before failure (and even their checking rates edged up). Chart 1b narrows the set to four prominent examples of banks and thrifts that failed (IndyMac, Washington Mutual) or nearly failed (Wachovia, Citi) in the crisis. Zooming in on these four large financial institutions, their average 12-month CD (60-month CD) differential reached 100 basis points (130 basis points).

Were institutions that later failed able to attract correspondingly greater deposit inflows? The descriptive evidence from the quarterly regulatory reports indicates that these institutions in fact lost deposits as they approached failure. Chart 2 shows that while they were able to initially maintain inflows of insured deposits, even insured deposits registered a negative growth rate in the last two quarters prior to failure (e.g., average insured deposit growth was roughly -1% in the quarter of the institution's final regulatory filing, and similarly, uninsured deposit growth reached -2%). A similar pattern characterized core deposits of weak

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<sup>1</sup> For example, Washington Mutual pitched above-market rates prior to its acquisition by JP Morgan Chase in 2008 as did Countrywide in 2007. See the *American Banker*, October 9, 2008, "Deposit-Gathering Pitches Evolving Amid Upheaval" and December 5, 2007, "Why Rate Cuts Aren't Helping on the Deposit Side".

<sup>2</sup> Indeed, there were several news reports of extensive deposit promotions despite significant cuts in the Federal funds rate during 2008 (e.g., Citibank introduced a 6-month CD offering 4% in October 2008 compared with an average rate of 2.9% that it paid on its deposits in the third quarter). See *Bloomberg*, October 20, 2008, "Citi Squeezed in Debt Market as JPMorgan, Wells Lure Deposits".

<sup>3</sup> By *failures*, we hereafter mean both actual and nearly failed banks (specifically, failure for the latter cases is recorded starting the first date when the 18-month return over the period 1997-2009 was worse than -90% using daily stock return data and following Acharya, Pedersen, Philippon, and Richardson, 2010). For example, the near-failure date for Wachovia was September 29, 2008 (coinciding with the date its acquisition was announced), and for Citi was November 20, 2008 (the U.S. government provided a package of guarantees, liquidity financing and capital on November 23).

institutions as these also fell five quarters prior to failure (core deposits exclude large time and foreign deposits and are commonly considered stable sources of funding).

This deposit funding pressure was not limited to banks that failed but was widespread and particularly acute in the first phase of the crisis from the ABCP “freeze” starting August 9, 2007 (as documented in Acharya, Schnabl and Suarez, 2009), until just before the Lehman failure on September 15, 2008. Although core deposits increased in the banking system by close to \$800 billion from end 2007 to early 2009 (Table 1 and He, Khang and Krishnamurthy, 2010), core deposits increased by just \$90 billion up until 2008:Q2 (an increase which did not exceed core deposit inflows in a comparable period just before the crisis). In other words, the sharp increase in core deposits only occurred in 2008:Q3, growing by \$272 billion in just one quarter – and occurred across both large and small banks and extended to large time deposits as well (Table 1).<sup>4</sup>

The deposit funding squeeze in the first year of the crisis– coupled with the wholesale funding shortage in the ABCP market – led banks to seek deposits by offering higher deposit interest rates. We document that banks offering higher rates were those most exposed to liquidity demand shocks (as measured by their unused commitments). Such banks were at a greater risk of credit line and other commitment drawdowns and we find that indeed their on-balance sheet loans increased. But crucially, despite scrambling for deposits by raising rates, they lost deposits and were forced to cut back on new credit originations. The widening shortfall between their on-balance sheet loans and deposits was funded by other borrowing including from the Federal Home Loan Banks (FHLBs) and the Federal Reserve. This result runs counter to the stabilizing role that banks with unused commitments played during previous periods of economic turmoil when banks were not themselves at the center of the turmoil.

Econometrically, our analysis suggests that deposit rates and quantities are jointly determined in equilibrium and must be analyzed as such. While banks seeking deposits offer higher deposit rates, those experiencing inflows or having a stable deposit base should in fact

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<sup>4</sup> While banks remained heavily exposed to losses even after 2008:Q3, the jump in aggregate uncertainty following the Lehman failure and a sudden shift in the perceived riskiness of money market funds and enacted measures of official support (including raising deposit insurance limits and recapitalizations) finally pushed funds into the banking system.

offer lower deposit rates. To disentangle these effects, we instrument deposits with two exogenous drivers of deposit quantities, controlling for local economic conditions. These instruments are the fraction of seniors in the population of the bank's local market (Becker, 2007) and the fraction of deposits in nearby failed banks (as these are expected to "fly" to safer nearby banks). We show that even after controlling for the contemporaneous effect that the supply of deposits has on rates, we continue to find that a bank's liquidity risk exerted upward pressure on its deposit rate in the first year of the financial crisis, indicative of an active seeking of deposits by liquidity-short banks.

We also extend the Gatev and Strahan (2006) results to the recent crisis, showing how deposits growth and real-sector lending were disrupted when market dislocations were the greatest, that is, when commercial paper spreads increased in this crisis, banks with a high exposure to liquidity demand shocks were at a disadvantage over other banks in attracting deposits and extending loans. In fact, we provide evidence that even in the previous market-wide stress not involving banks (such as in the 1998 LTCM crisis), exposed banks actively managed large-time deposit rates to attract funding inflows.

Finally, we document a number of other findings and also confirm the robustness of our results to the inclusion of other risk measures and the use of pre-crisis controls. Among the new findings, we show that banks that faced greater rollover risk (more short-term deposits) raised rates in the first part of the crisis, and the deposit maturity structure shortened for banks with higher liquidity demand risk. The second new finding is that banks exposed to liquidity demand realizations (measured using the pre-crisis level of undrawn commitments) and higher large-time deposit rates (also measured pre-crisis) were more likely to fail during the financial crisis, as were banks with fundamentally weak balance sheets from a capital or solvency standpoint.

We conclude that the role of the banking system as a stabilizing liquidity insurer during financial crises is often an active one. Equally importantly, when banks are themselves at the center of a financial crisis and households are withdrawing deposits from risky banks, then in spite of their active seeking of deposits, banks may fail to meet their stabilizing liquidity function as the shortfall between their credit commitments and available funding grows.

Finally, it may not necessarily be stabilizing even from a financial stability standpoint if due to the active seeking of deposits, funds are deposited at unhealthy banks with attractive rates or at banks with an unnatural advantage because of explicit or implicit guarantees, imposing an externality on the healthier banks in the system.

The rest of the paper is organized as follows: Section 2 begins with a brief review of the theory that banks can provide liquidity when financial markets and other financial institutions cannot—and why the theory might break down in a financial crisis. Section 3 investigates how bank fundamentals shaped deposit rates. The section begins by developing testable hypotheses for individual bank behavior when banks need funds to support increased loan demand but face deposit funding pressure. It then presents aggregate evidence showing that banks experienced increased loan demand but that deposit inflows were weak and not commensurate with lending needs, especially in the first year of the crisis. This narrative, therefore, provides support for the underlying environment assumed in our principal hypothesis, namely, that deposit funding was tight and banks had an incentive to actively manage deposit rates, especially banks exposed to heightened liquidity demand risk. The main part of section 3 provides empirical support using bank-level data. Section 4 reconciles our findings with those of Gatev and Strahan (2006). Section 5 relates our findings to the existing literature and presents some policy implications. Section 6 concludes.

## **2. BANKS AS LIQUIDITY PROVIDERS: THE TRADITIONAL VIEW AND ITS RECONSIDERATION**

### **2.1. The rationale for banks as liquidity providers**

Banks are considered to have an important advantage over other financial institutions in providing various forms of liquidity commitments such as corporate lines of credit and demandable deposits. This advantage relates to how they resolve the liquidity management problem that arises when commitments are converted into funded loans and immediacy is demanded on deposits. As described by Kashyap, Rajan and Stein (2002), banks combine deposit-taking with loan commitments. A synergy exists between these two activities to the extent that both services require banks to hold balances of liquid assets to provide liquidity on

demand to depositors as well as to credit line borrowers (as represented by the system shown in Panel A of Chart 3).<sup>5</sup> In particular, banks have a natural advantage in providing liquidity, but only if deposit withdrawals and commitment draw-downs are not too highly correlated.

Indeed, studies have shown that during past episodes of market stress, deposit withdrawals and commitment draw-downs were *negatively* related (Saidenberg and Strahan, 1999; Gatev and Strahan, 2006; Gatev, Schuermann, and Strahan, 2009). For example, when the commercial paper market encountered stress, the funds that investors pulled out of this market flowed primarily into the banking system. As a result, deposits flowed into banks just as borrowers resorted to drawing down their bank credit lines as shown in Panel B of Chart 3. In these episodes of market stress when banks were not at the center, households became concerned about directly lending to firms, for example, as an Enron accounting crisis led them to question the quality of financial accounting. Similarly, volatility in foreign bond and equity markets spilled over to domestic corporate bond markets as investors lost confidence in their ability to identify low- from high-risk firms (e.g., in the fall of 1998 following the Russian default). These studies argue that investors withdrew funds from markets at large, not just the commercial paper market, and deposited funds into banks because banks are viewed as safe havens due to government guarantees on deposits.<sup>6</sup> The view that government guarantees are responsible for the deposit inflows during crises is supported by evidence that such deposit inflows did not occur prior to the FDIC's inception in 1934. Pennacchi (2006) showed that during times of tight market liquidity from 1920 to 1933, no increases in bank deposits were observed and liquidity shocks were accompanied by declines in bank loans and investments.

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<sup>5</sup> We thank Charlie Kahn for the diagrams representing our results based on his discussion of our paper.

<sup>6</sup> One point of departure from Kashyap, Rajan and Stein (2002) that Gatev and Strahan (2006) take is on what drives deposit flows specifically in times of reduced market liquidity. The thesis in Kashyap, Rajan and Stein is that the coexistence of deposits and lending is due to real benefits and is not the result of historical or contemporary regulatory distortions. That is, they do not think it is an artificial synergy resulting from deposit insurance. Gatev and Strahan reason, instead, that banks “can insure firms against systematic declines in liquidity at lower cost than other institutions” precisely because of a general flight to safety, triggering inflows into the banking system. They conjecture that this mechanism is largely due to government support, both explicit through deposit insurance and implicit through expected bailouts. The two views are not necessarily orthogonal, however.

## 2.2. Why there may be limits to banks providing liquidity in a financial crisis

We argue, however, that the ability of banks to provide liquidity in a financial crisis can break down when banks are themselves at the center of the crisis. The main reason is that households question the safety of bank deposits when banks are directly exposed to the financial crisis, as represented in Panel C of Chart 3. Households, therefore, collectively withdraw deposits and shift savings to safer instruments such as government bonds. As a result, firms that have outstanding credit line facilities and need funding might find that their banks do not have the ability to make good on such loans. Banks will now run down liquid assets to provide liquidity on demand to depositors and to firms. They may also have to borrow directly from the government and the Federal Reserve. While it may still make sense for banks to ex ante combine deposit-taking with loan commitments when liquidity demand realizations of depositors and firms are idiosyncratic or not very positively correlated (as in Chart 3, Panels A or B), financial crises with banks at the center can consistently lead to the failure of stabilizing insurance provision by banks. This latter outcome was not unique to the U.S. subprime crisis of 2007-08. The banking-based ingredients are also present in the current financial crisis in the Eurozone periphery, leading to mass deposit withdrawals and freezes in real-sector credit lines.<sup>7</sup>

At the start of the U.S. financial crisis, households ran from deposits and debt issued by depository institutions and into Treasuries and discount notes issued by the FHLBs (Ashcraft, Bech, and Frame, 2010). Households' loss of confidence was illustrated by a depositor run at IndyMac in July 2008 in which the FDIC imposed losses on uninsured deposits. Most deposits in the system are over the deposit insurance limit (over 62% in 2007:Q2) and are not explicitly guaranteed in the event of a bank failure. This lack of guarantee can become especially important in a bank-centered crisis, when uncertainty about the condition of an individual bank may prompt depositors to run from the bank even if it turns out to be ex post fundamentally solvent.<sup>8</sup> Depositors may also worry that the government will not provide enough resources to make them whole in the event of a bank failure (e.g., risk-pricing of insured deposits occurred

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<sup>7</sup> See, for example, The *Financial Times*, Feb. 15, 2012, "Tumbling Rents Reflect Greece's Economic Collapse."

<sup>8</sup> For example, Iyer and Puri (2008) show that depositors "ran" from a fundamentally sound bank when a nearby bank failed and that deposit insurance was only partly successful at limiting outflows of insured deposits.

during the savings and loans crisis in the 1980s when the guarantor of savings and loans, the FSLIC, was approaching insolvency (Cook and Spellman, 1994)). In the recent crisis, uncertainty over the safety of insured deposits may have increased as the FDIC's reserves started to dip. By the end of 2008, the FDIC's ratio of reserves to total insured deposits had fallen to 0.4%, and the Treasury did not increase its backup line of credit to the FDIC until March 2009 (see the discussion in Acharya, Santos and Yorulmazer, 2010).

If market stress occurs at the same time as a banking-based financial crisis, the liquidity squeeze intensifies on banks (combined Panels B and C of Chart 3). For example, Acharya, Almeida and Campello (2010) consider that aggregate risk may rise during a crisis. When this happens, the ability of banks to diversify or smooth shocks across corporations and depositors falls. In anticipation, banks may raise costs for provision of liquidity insurance, e.g., increase spreads on corporate lines of credit. And, in response to reduced bank liquidity (outside of their model), depositors may leave banks, especially those that are heavily exposed to the rise in aggregate risk and the underlying economic shock.

Other factors can also contribute to weak deposit inflows and households' shift to other assets in Panel C. One factor during 2007-08 was that household wealth took a hit; U.S. households' net worth fell from \$65.8 trillion at the end of 2007:Q2 to \$48.8 trillion by 2009:Q1.<sup>9</sup> Moreover, households faced with increased liquidity constraints may have been more likely to withdraw deposits to cover consumption needs (see Chakrabarti et al, 2011, for supportive survey evidence from the crisis). An additional factor was that money market mutual fund accounts ( MMMF) were competing deposit collectors (Pennacchi, 2006). Investors saw MMMFs as safe up until the Lehman bankruptcy and the ensuing losses and redemption demands on the Reserve Primary Fund and other funds in September 2008. Regulations limit money funds to investing in only short-term, highly-rated, liquid securities. Some money funds, including Reserve Primary, exploited the rise in spreads on the most risky eligible securities starting in August 2007 and increased returns and assets under management (Kacperczyk and

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<sup>9</sup> These figures are from the Federal Reserve's Flow of Funds Z.1 Release, Table B.100.

Schnabl, 2011).<sup>10</sup> This is also confirmed by large inflows of funds into MMMFs (exceeding inflows into deposit accounts) in 2007 and early 2008 (Federal Reserve Bulletin, 2010).

### 3. DEPOSIT RATES AND BANK FUNDAMENTALS

This section first develops testable hypotheses for how a bank facing funding pressure is expected to actively seek deposits. In much of this discussion, banks will be assumed to be short of deposits relative to lending and other asset funding needs, theoretical motivation for which was provided in Section 2.2 and whose veracity we establish for the 2007-09 crisis in the next subsection, 3.2. We then test whether liquidity-short and fundamentally weak banks promised higher rates.

#### 3.1. Hypotheses

First, banks most susceptible to funding pressure are those banks that are documented to have later failed. Therefore, in a bank-level regression capturing the relationship shown in Charts 1 and 2, we expect that banks lose deposits prior to failure (especially deposits that are not insured), that they react by raising deposit rates, and that this relationship gets stronger as the bank gets closer to failing. Specifically, the deposit rate offered by bank  $i$  at time  $t$  is modeled as follows:

$$Deposit\ Rate_{i,t} = \sum_{l=0}^L \beta_l Fail_{i,t+l} +$$

$$bank\ fixed\ effect_i + time\ fixed\ effect_t + other\ controls_{i,t} + e_{i,t},$$

where  $Fail$  is a dummy equal to one in the period that the bank fails and 0 otherwise (the time period is quarterly when using Call Report data). Up to  $L$  leads of the fail dummy are included. Other controls capture time-varying changes in a bank's local geographic market conditions such as deposit market concentration and district time trends. Standard errors are clustered at the bank level. More detail on the regressions is provided in Section 3.3 and the Appendix. We test

*Hypothesis 1:  $\beta_l > 0$ . And  $\beta_0 > \dots > \beta_L$ .*

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<sup>10</sup> Investigating fully the competitive effects of MMMFs on banks is an interesting topic for future research. The focus of our paper is on the cross-sectional differences between banks, showing that risky banks lost deposits and how they responded.

Second, if bank deposit funding was tight during the crisis, we expect that banks differed in their need for additional funding and that depositors were also discriminating between banks. While most banks did not fail, there was nonetheless considerable variation in a bank's vulnerability to the risk of liquidity demand, controlling for its wholesale funding, solvency measures and size. Therefore, banks at a greater risk of credit line drawdowns are expected to offer higher rates during the crisis (see the illustration in Panel A of Chart 4). The variable *crisis* represents a dummy variable indicating the period of the 2007-2009 financial crisis. We describe these measures and how they are empirically represented at greater length in Section 3.3. We estimate the model and test, respectively,

$$\begin{aligned} \text{Deposit Rate}_{i,t} = & \beta_1 \text{liquidity demand risk}_{i,t-1} + \\ & \beta_2 \text{liquidity demand risk}_{i,t-1} \times \text{crisis}_t + \\ & \text{bank fixed effect}_i + \text{time fixed effect}_t + \text{other controls}_{i,t} + e_{i,t} \end{aligned}$$

*Hypothesis 2:  $\beta_2 > 0$ .*

Third, in practice, deposit rates and deposit quantities are jointly determined. Weak banks can moderate a deposit drain by offering higher rates. At the same time, exogenous inflows of deposits can lead banks to reduce their rates.<sup>11</sup> By controlling for the contemporaneous effect of deposit quantities on rates, the independent effect of a bank's liquidity demand risk on its active choice to manage its rate can also be better identified (an upward shift in the "supply" curve in Panel A of Chart 4). Specifically, we estimate and test, respectively

$$\begin{aligned} \text{Deposit Rate}_{i,t} = & \beta_1 \text{Deposit}_{i,t} + \text{fundamentals}_{i,t-1} + \\ & \text{bank fixed effect}_i + \text{time fixed effect}_t + \text{other controls}_{i,t} + e_{i,t} \\ \text{Deposit}_{i,t} = & \beta_2 \text{Deposit Rate}_{i,t} + \text{fundamentals}_{i,t-1} + \\ & \text{bank fixed effect}_i + \text{time fixed effect}_t + \text{other controls}_{i,t} + e_{i,t} \end{aligned}$$

*Hypothesis 3:  $\beta_1 < 0, \beta_2 > 0$ .*<sup>12</sup>

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<sup>11</sup> The existing literature on depositor discipline looks at each of deposit rates and flows separately (see the discussion in Section 5.1), with the exception of Maechler and McDill (2006) whose primary interest was in estimating the positive response of deposit quantities to the deposit rate.

<sup>12</sup> Econometrically, it is harder to find instruments for the deposit rate that are exogenous to deposit demand. Hence, we test only the first of these two hypotheses.

In the absence of instruments, the observed relationship between deposit rates and quantities represents the set of equilibria resulting from the intersection of the two curves as shown in Chart 4. In order to trace out the downward sloping curve where greater deposit inflows depress rates, we use two instruments for a bank's deposits: the deposits of nearby failed banks and the fraction of seniors (65 and over) making up the local market's population (identifying the bank supply curve as illustrated in Panel B of Chart 4). That is, the more that deposits in a bank's geographic market were in deposit accounts at failed banks, the more likely a nearby surviving bank is to receive some of these funds. This variable is constructed using information on failed banks together with branch data from the Summary of Deposits (see Appendix).<sup>13</sup> Similarly, seniors have been shown by Becker (2007) to hold a larger share of their wealth in the form of bank deposits and this driver of deposit supply is independent of local demand conditions (we also control for variables capturing local economic conditions in these regressions). The fraction of seniors is taken from the 2000 census data and is matched to geographic areas for a bank's branches from the Summary of Deposits.

### **3.2. Aggregate Evidence from the 2007-09 Financial Crisis**

This section brings together evidence documenting that banks were indeed exposed to the financial crisis via credit losses and uncertainty surrounding these losses, which we assumed for the hypotheses in section 3.1. At the same time, the banking system faced an increased demand for liquidity via credit lines drawn by corporate borrowers and ABCP conduits. However, the banking system did not gain proportionate deposits to match its funding needs, especially prior to the Lehman failure.

#### ***3.2.1. The Exposure of the Banking System to the Financial Crisis***

First, we note that risks were more concentrated in the banking system than in other recent crises. The banking system's profitability fell as the aggregate return on assets dropped from 1% at an annual rate at the start of 2007 to nearly -1% by the end of 2008. In contrast,

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<sup>13</sup> Anecdotal evidence supports the use of this instrument. For example, North Carolina based BB&T Corp. managed to attract \$1.2 billion of deposits from Wachovia, also based in North Carolina, during the third quarter of 2008 and expected more inflows at the time of the report (Bloomberg, October 20, 2008). Wachovia was acquired by Wells Fargo at the end of that quarter.

return on assets had hovered around 1% during the earlier episodes of financial stress, like the 1998 LTCM crisis.

Second, commercial banks were especially affected in this crisis because of their exposure to real estate loans and mortgage-related securities, whose values sharply declined. As noted by Brunnermeier (2009) and Diamond and Rajan (2009), among others, a significant portion of new financial instruments found their way on to commercial and investment bank balance sheets. As a result, commercial banks' holdings of real estate loans and mortgage-backed securities accounted for about 40% of the total amount of such loans and securities outstanding in 2007 (Mora, 2010). Not only were banks directly holding mortgage-related securities but they had also offered liquidity and credit support to issuers of debt backed by mortgage securities. For example, banks like Bank of America and Citibank, were sponsors of many off-balance sheet vehicles issuing ABCP. In July 2007, outstanding ABCP equaled \$1.2 trillion, accounting for the largest part (55%) of the \$2.2 trillion commercial paper market, up from only 20% of the market in 1997. The first sign of a systemic liquidity freeze was the sharp tumble in outstanding ABCP by 17% from July to August 2007 (roughly \$200 billion). This drop was essentially a run by investors in ABCP that refused to reinvest when the ABCP matured and ABCP issuance came to a halt (Covitz et al, 2009). Even ABCP conduits that suffered material credit deterioration were brought on to sponsors' balance sheets beginning in August 2007. As a result, the recourse and credit guarantees provided by sponsors ended up covering 97% of maturing ABCP (Acharya, Schnabl and Suarez, 2009).

Third, all banks, not just banks with a concentrated exposure to mortgage-related securities, suffered in the crisis due to the panic that developed from a lack of information and loss of confidence (Gorton, 2008).<sup>14</sup>

Finally, in addition to banks' direct exposure via credit losses and support to ABCP conduits, banks experienced the standard drawdown of commitments from nonfinancial

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<sup>14</sup> Indeed, Rajan (2005) was prescient about the transmission of the 2007-2009 crisis. He argued that the reason banks were able to honor their credit lines when the commercial paper market dried up in 1998 was because banks were not perceived as credit risks themselves so that funds flowed into banks. But he went on to say that if "banks also face credit losses and there is uncertainty about where those losses are located, only the very few unimpeachable banks will receive the supply of liquidity fleeing other markets. If these banks also lose confidence in their liquidity-short brethren, the inter-bank market could freeze up, and one could well have a full blown financial crisis."

borrowers shut out of the commercial paper and other securities markets, in particular in August 2007 when the commercial paper spread first exceeded 100 basis points and later in September 2008 following the Lehman bankruptcy (Ivashina and Scharfstein, 2010, and Gao and Yun, 2009, provide empirical support based on firm-level data).

### *3.2.2. Deposit Inflows and Funding Pressure*

To examine deposit flows, we employ data from the Federal Reserve H8 release of balance sheet data for weekly commercial bank reporters. The deposit data, although aggregated, are sufficiently rich to support a number of stylized facts summarized in Charts 5-7.

First, as evident in Chart 5, net deposit inflows were not especially robust in the first phase of the financial crisis: from the ABCP freeze in the summer of 2007 to just before the Lehman failure on September 15, 2008.<sup>15</sup> That is, there was not a significant flight of deposits into the banking sector, even though aggregate risk (as proxied by the implied volatility index VIX in chart 5) rose from 10% to over 25%. Thus, it would be over-simplifying to lump together the 2007-09 crisis into one period and compare deposits before and after the crisis. Second, it would also be over-simplifying to conclude that core deposits were stable throughout the crisis even if non-core deposits (such as large time deposits) were not. Third, there was considerable heterogeneity across large and small banks. We take up these points in greater detail in what follows.

Table 1 shows an extract of cumulative growth statistics for insured, core and large-time deposits, respectively, based on the quarterly Call Report balance sheet data over the period 2007:Q3-2009:Q1 (see Appendix Table A2 for full detail). As first noted in the Introduction, core and insured deposit growth rates were, in fact, muted in the first year of the crisis. For example, insured deposits registered a cumulative growth of only 1% (1.7%) at small (large) banks over the four quarters, 2007:Q3 – 2008:Q2. Within the subset of small banks, core deposits fell in this period, where cumulative core deposit growth equaled -0.5%. The weak behavior of core deposit growth is striking in light of the substantial easing of monetary policy during the 2007-09 crisis. From September 2007 to April 2008, the federal funds target was

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<sup>15</sup> This is in contrast to deposit inflows into banks during the crisis of 1998 (see Table 7 and the evidence in section 4.1). Similar evidence of weak deposit growth in the first year from August 2007 and the contrast with 1998 is documented in Ashcraft, Bech and Frame (2010).

reduced by 3.25 percentage points, and the 3-month Treasury bill rate fell nearly three points. Such a reduction in market interest rates (the opportunity cost of deposits) usually leads to faster growth in core deposits.

In contrast, only in the aftermath of the Lehman failure did deposit funds sharply increase. For example, deposits shot up by \$188.6 billion dollars in the week of September 17, 2008 relative to the previous week. This deposit surge after the Lehman failure was visible across both types of deposits and at both large and small banks, though it was marked at the large banks (Charts 6-7). These deposit inflows reflected the acute flight to safety out of money market funds immediately after the Lehman failure. While banks remained heavily exposed to losses on real estate loans and mortgage-related securities, other institutions, especially money market funds, were suddenly perceived to be even riskier. For example, the Reserve Primary Fund, a prime money market mutual fund with close to \$800 million of exposure to Lehman commercial paper, managed to “break the buck” on September 16, 2008 when its net asset value fell below \$1. This event led to redemption demands across the money market mutual fund industry—in an amount close to \$200 billion—as well as to a reallocation of funds to safer Treasury-only funds (Kacperczyk and Schnabl, 2010; Federal Reserve Bulletin, 2009).<sup>16</sup> At the same time, households withdrew assets from the stock market and mutual fund shares, which also took a hit around the same time.

Deposit growth was then supported by the adoption of emergency measures by the government. The Emergency Economic Stabilization Act (TARP) that passed in Congress on October 3, 2008 provided greater explicit government support to the financial system, including an increase in the deposit insurance limit from \$100,000 to \$250,000 per depositor and bank recapitalization measures. This change was followed on October 14 with the FDIC’s announcement of its temporary liquidity guarantee program. The FDIC stood willing to guarantee newly issued senior unsecured debt of banks and thrifts and to fully cover

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<sup>16</sup> While only the Reserve Primary Fund halted redemptions on September 16, 2008, other funds were close to halting redemptions, which was averted by the U.S. Treasury announcement on September 19 of an explicit guarantee on all money market investments made prior to the Lehman failure. For example, a number of troubled funds (such as Columbia, Dreyfus, General, ING and Morgan Stanley) filed petitions with the SEC, which in turn issued no-action letters, indicating that the sponsor provided financial support to its fund (see Kacperczyk and Schnabl, 2011).

noninterest bearing deposit transaction accounts, largely held by businesses. Together with other implicit guarantees of the financial system, these measures assured depositors that the banking system would hold up. As a result, deposits poured into banks.

However, in the first year of the crisis, there was deposit funding pressure relative to lending needs, which we take up at the bank-level in the next section. First, bank loans increased in the first year of the crisis reflecting loan commitment takedowns and mortgage loans that were warehoused because they could no longer be securitized (large banks also appreciably increased their holdings of MBS and ABS securities and trading assets as shown in Table A2 and He, Khang and Krishnamurthy, 2010). Second, this lending growth outpaced core deposit funding growth (Chart 7 and Table A2). Banks, especially small banks, drew down liquid asset buffers to support lending and the buildup of assets (Chart 7 and Table A2). Loan growth would have had to slow even more if banks had not also turned to other sources of funds to make up for the shortfall in deposit growth, which included borrowing from the FHLB System and the Federal Reserve System.<sup>17</sup> In summary, the increased demands on bank liquidity starting August 2007 and the lack of proportionate gain in deposits contributed to funding pressure on banks and created a motive for them to offer higher deposit interest rates.

### 3.3. Bank-Level Evidence from the 2007-09 Financial Crisis

We now turn to empirical tests of the hypotheses sketched out in Section 3.1 concerning the factors that are expected to influence a bank's decision to actively manage its deposit rates. As discussed in Section 3.2, deposit funding pressure appears to have been more intense in the first part of the crisis. Therefore, the variable *crisis* in the testable hypotheses is empirically represented by two dummy variables, *crisis1* and *crisis2*. *Crisis1* refers to the period from 2007:Q3 to 2008:Q2, while *crisis2* refers to the period from 2008:Q3 to 2009:Q2. That is,

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<sup>17</sup> Federal Home Loan Banks are government-sponsored entities able to issue debt at cheaper rates than banks (at least in the first year of the crisis) and re-intermediate these funds by lending them to commercial banks and thrifts (Ashcraft et al, 2010). Indicative of the extent to which the U.S.-chartered commercial banking system was reliant on federal sources of funds, Federal Reserve loans rose \$559 billion from 2007:Q4 to 2008:Q4, compared with a total net increase in bank liabilities of \$1,421 billion. The FHLB stepped in earlier, with their loans increasing \$261 billion from 2007:Q3 to 2008:Q3 (Federal Reserve's Flow of Funds Table F.110 for U.S. chartered commercial banks). Bord and Santos (2011) show that liquidity-short banks (as proxied by reliance on FHLBs and the Fed discount window) imposed a cost on their borrowers in the form of higher fees on new lines of credit.

the regressions allow bank behavior to differ in the early and late stages of the recent crisis, as represented by the interaction terms between bank fundamentals and *crisis1* or *crisis2*.

### **3.3.1. Data and variable description**

The Appendix provides a detailed description of regression variables, and summary statistics follow in Table A1. Most bank-level variables are from the quarterly Reports of Condition and Income that banks file with regulators (Call Reports). Banks belonging to a common holding company are aggregated to the top holder and treated as a single banking organization (following Kashyap, Rajan and Stein, 2002; Gatev and Strahan, 2006). Therefore, any reference to a “bank” in the remainder of this discussion should be taken to mean a banking organization. The panel of roughly 7,000 banks is unbalanced and merger effects are controlled for by excluding observations when the quarterly growth rate of a bank’s total assets exceeds a certain threshold—in this case, 10% (e.g., Gatev and Strahan, 2006). The sample excludes the smallest banks with assets less than \$100 million. Growth rates as well as implicit deposit rates calculated from the Call Reports are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles to mitigate the effect of outliers. The regressions include fixed effects for both banks and time (quarterly time dummies), although robustness checks are also carried out on a pooled sample without bank fixed effects. Standard errors are clustered at the bank level.

The primary deposit rates used in the analysis are the rates on large-time deposits and the rates on core deposits. These are implicit rates based on quarterly Call Report data (expressed in percent annual terms), defined as interest expenses on deposits divided by the quarterly average of the respective interest-bearing deposits.

As briefly outlined in Section 3.1, deposit rates are expected to be sensitive to a bank’s liquidity demand risk especially when funding conditions are stressed. Exposure to liquidity demand is measured by a bank’s unused commitments ratio, which is defined as the ratio of unused loan commitments to the sum of loans and unused commitments. Unused loan commitments are the parts of credit lines that have not been drawn down, and include, for example, support to ABCP program conduits that the bank does not consolidate on its balance sheet (as described in the notes to schedule RC-L on the Call Reports). The rationale for measuring a bank’s liquidity demand exposure by the unused commitment ratio is that the

more commitments a bank has outstanding, the more exposed it will be to a drawdown of commitments when market conditions tighten. But the key finding of previous studies is that more exposed banks are not, in fact, more fragile but instead serve as liquidity backstops. While these banks converted a lot of the off-balance sheet commitments to on-balance sheet loans, they experienced a more than offsetting inflow of funds into deposit accounts in times of market stress. The crucial question is whether this remained true in the bank-based financial crisis.

We control for a bank's other liquidity and solvency measures including net wholesale funding, nonperforming loans, capital, and size. Briefly, net wholesale funds are liabilities excluding core deposits less liquid assets. This variable, therefore, measures net wholesale borrowing including gross federal funds purchased less gross federal funds sold and repos less reverse repos. Nonperforming loans are loans 90 days past due and nonaccruing loans. Capital is measured by the book capital-to-asset ratio. Finally, perceived solvency risk is driven by implicit guarantees of certain banks. For example, large banks may be big enough to be considered by investors as "too-big-to-fail" (TBTF). Large banks are captured in the regressions by an indicator for the 25 largest banks as measured by asset size.<sup>18</sup>

One caveat on deposit rates is that U.S. bank regulations exist to restrict the rates that less than well-capitalized banks can offer (Federal Deposit Insurance Act section 29, and FDIC rules and regulations section 325.103 for capital category definitions). These deposit rate caps are, therefore, expected to dampen the sensitivity of a bank's deposit rates to its riskiness. This effect, once a bank is under prompt corrective action, should however go against finding statistically and economically significant effects.<sup>19</sup> It is, nonetheless, possible that a bank anticipating that it will soon be classified as less than well-capitalized may have an incentive to be "active" earlier by raising its rates to attract deposits.

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<sup>18</sup> This cutoff follows the H8 criteria. Results are very similar if the cutoff is based on total deposits instead of total assets. Results are also similar for other cutoffs, such as the largest 10 banks.

<sup>19</sup> We find that the results of the next section are not sensitive to excluding banks meeting the prompt corrective action criteria. It is worth pointing out, however, that the rule applies to a small group of financial institutions: For example, only 248 out of more than 8200 banks were less than well-capitalized as of 2009:Q1 (see <http://www.fdic.gov/news/news/press/2009/pr09082.html>). In particular, none of IndyMac, WaMu or Wachovia were less than well-capitalized with the possible exception of IndyMac based on its final quarterly statement. Also, the rule governing deposit rate restrictions was ambiguous allowing banks leeway in their interpretation of the local market. As a result, the FDIC amended section 29 of the act in May 2009, effective January 2010.

### 3.3.2. Deposit Rates and Bank Fundamentals

This section focuses on the results of the first two hypotheses laid out in Section 3.1. Table 2 shows the results for subsequent bank failure and Table 3 focuses on a bank's vulnerability to liquidity demand shocks. Deposit rate behavior surrounding the time of failure is in Panel A of Table 2 and deposit flows are in Panel B. The first three columns of Panel A are for the rates on large time deposits, the next three columns are for the rates on core deposits, and the last three columns are for the rates offered on 12 month CDs. Each dependent variable is associated with three models that differ in how the explanatory variable, *failure*, is defined: First, failure is limited to regulatory-assisted failures ("formal fail"). Second, failure is inclusive of "formal fails" and "near-fails" (the latter are as defined in the Introduction and for Chart 1 – the first period in which a bank's equity return was worse than -90% over the previous 18 months using daily CRSP data). Finally, the third model is limited to near-fails in order to determine the behavior of rates and flows after "failure". Because "formal fails" drop out of the sample after failure, this model is evaluated on near-fails only. In total, there are 517 unique bank "formal" failures represented in the Call Report sample covering the period 1991-2009, and 91 near-fails, of which 16 overlap as both near-fails and subsequent formal fails (note that bank failures, in particular the near-fails, are concentrated in the 2007-2009 crisis).

The results in panel A of Table 2 are supportive of the first hypothesis: Premiums on deposit rates were positive in the period leading up to a bank's failure. And these premiums typically increased as the bank was about to fail. For example, as shown in column (2), the premium on large-time deposits steadily rose from an insignificant 3.9 basis points (bp) four quarters before failure to a significant 26.3 bp one quarter before failure (where failure is inclusive of formal and near-fails). Note that these coefficients can be interpreted as premiums above average rates as the panel regressions include quarterly time dummies, in addition to controlling for District-time trends, geographic deposit market concentration, and bank fixed effects. What is interesting is that higher deposit rates were not limited to large time deposits, but also characterized core deposit rates. For example, the premium reached 34.7 bp on core deposits in the period of failure (column (5)). Moreover, higher rates persisted after the quarter of near-failure. For example, banks like Citibank that experienced large drops in market

value at the end of 2008 continued to pay out higher rates in the ensuing quarters (column (6)). Premiums also rose to 30 bps on the CD promotions of a smaller subset of bank failures based on a participatory weekly survey (columns (7)-(9)).

In Panel B of Table 2, overall deposit quantities are in the first three columns and insured deposits are in the last three columns. Depositors withdrew total deposits leading up to a bank's failure. For example, as shown in column (2), quarterly deposit growth decreased from about -0.5 percentage point to -3.4 percentage points in the last quarter for inclusive fails (and more so for formal fails as shown in column (1)). A key difference is in the behavior of insured deposits: Despite an overall deposit drain prior to failure, these banks were able to attract insured deposit inflows. This attests to the role of deposit guarantees in weakening depositor discipline. However, this inflow was overturned in the last quarter before failure (columns (4) and (5)), and interestingly, persistent outflows from insured deposit accounts were seen after failure in the case of near-fails (column (6)). Overall, therefore, the results presented in Table 2 are in line with the hypothesis that banks about to fail experienced increasingly large deposit outflows and reacted by raising deposit rates in an effort to stem the loss.

The second hypothesis outlined in Section 3.1 is that deposit funding pressure during the crisis should show up across different banks. While most banks did not fail, considerable variation existed in, for example, a bank's vulnerability to the risk of illiquidity. To test this hypothesis, the specifications in Table 3 examine the relation between deposit rates and the bank's preexisting unused commitments, while the specifications in Tables 4 and 5 examine the relation between deposit inflows and lending shortfalls and the bank's unused commitments. The sample is quarterly from 1994 through 2009 (this sample period also applies for the regressions in the subsequent tables, unless otherwise noted). Unused commitments are available from 1990 but the deposit market concentration control is from the FDIC's Summary of Deposits, available from 1994. In addition, liquid assets are defined to exclude MBS and ABS securities, and the latter are only reported from 1994. The first two columns of Table 3 report the results for large time deposits followed by core deposits in columns (3) and (4).

The results indicate that banks that raised deposit rates were those vulnerable to liquidity risk, especially in the first year of the crisis. The key coefficient of interest, for

example, is the interaction term of unused commitments with the dummy variable indicating the first year of the crisis, *unused commitment ratio x crisis1*. For example, banks with a greater amount of unused commitments outstanding offered significantly higher deposit rates in that period: columns (1) and (2) show that a 0.1 increase in the unused commitment ratio (roughly a one-standard deviation) raised the large time deposit rate by 6.1-7.4 bp. Banks exposed to liquidity demand even raised rates on core deposits in this phase of the crisis in a specification without bank fixed effects in column (4). In the second year of the crisis, funding pressures eased and these banks offered significantly lower rates.

The controls enter with the expected effects overall. For example, banks reliant on net wholesale funding increased deposit rates, particularly in the first year of the crisis. Banks enjoying implicit support such as the TBTF institutions generally pay lower rates, and were also associated with lower deposit rates during the crisis, particularly during the first year. For example, large banks lowered rates by 15-66 basis points in the first year of the crisis and the effect is statistically significant for core deposits (columns (3) and (4)).

The upshot of the results in Table 3 is that banks actively respond to their deteriorating liquidity positions by offering higher deposit rates.

### ***3.3.3. Deposit Inflows and Lending***

We next turn to evaluating the responsiveness of deposit flows to a bank's liquidity risk. Results of deposit growth regressions are shown in Table 4 for several deposit types, including total deposits and a measure of "stable" deposits (core deposits). The motivating question is whether deposit inflows respond to bank illiquidity and whether the association changed in the crisis. The data on aggregate deposits suggested that the banking system as a whole was not particularly successful in attracting deposits in the first phase of the crisis. Such a shortfall in overall deposit inflows would be of special concern if deposit inflows at banks with high exposure to liquidity demand did not increase as much relative to other banks as in past events of turmoil (despite their offering higher rates as shown in the previous section).

The regression results confirm that such a shift in relative deposit growth occurred in the first phase of the recent crisis. For example, the interaction term of unused commitments with the first year of the crisis, *unused commitment ratio x crisis1*, enters negatively for both

total and core deposit growth in columns (1) and (2) (implying that a 0.1 increase in the exposure to unused commitments was associated with a 0.11-0.12 percentage point decline in quarterly deposit and core deposit growth). This decline is economically significant when compared to an average quarterly deposit growth of 1.1 percentage point and core deposit growth of 0.8 percentage point (Appendix Table A1). Therefore, banks with unused commitments did not have a systematic advantage at gaining deposits, unlike previous episodes of stress (as explored further in Section 4.1).

Consistent with these findings, banks seeking brokered deposits and choosing to participate in the FDIC's transaction account guarantee program at the end of 2008 were those that had a high unused commitment ratio (columns (3) and (4)). This program was part of the FDIC's temporary liquidity guarantee program announced on October 14, 2008. The FDIC stood willing to guarantee newly issued senior unsecured debt of banks and thrifts and to fully cover noninterest bearing deposit transaction accounts, largely held by businesses. Those banks choosing to participate paid an extra premium for the additional insurance (the results control for the share of transaction deposits).

Other results are mostly in line with priors; banks less reliant on wholesale funding gained deposits as did better capitalized and large banks. For example, large banks experienced 1 percentage point greater deposit growth (column (1)). Collectively, these findings imply that banks were not indiscriminately seen as safe havens during this crisis.

The final step is to test how liquidity-exposed banks adjusted lending in reaction to the shock in the first part of the crisis. The results in column (1) of Table 5 show that banks with preexisting commitments increased on-balance sheet loan growth in the first year. This result reflects involuntary lending that occurred when off-balance sheet commitments were converted to loans. At the same time, these banks significantly reduced overall credit (the sum of loans and commitments), as they cut back on the extension of new loan commitments and new term loans. For example, a 0.1 increase in the unused commitment ratio led to a 0.21 percentage point fall in new credit growth compared with a typically positive credit growth of 1.1 percentage point. Similar evidence of drawdowns displacing new credit originations are

documented by Cornett, McNutt, Strahan, and Tehranian (2011) and Ivashina and Scharfstein (2010).

While exposed banks managed to fund credit line drawdowns, the shortfall between on-balance sheet lending and deposits widened in the first year as shown in columns (3) and (4) of Table 5. For example, a 0.1 increase in undrawn commitments led to a 0.23 percentage point increase in the quarterly shortfall between lending and deposit growth (column (4)), compared to a typical zero shortfall. These results show that the synergy broke down in the first year so that banks were unable to meet their lending needs with deposit funding alone and turned to other borrowing. For example, we find that a 0.1 increase in undrawn commitments led to a significant 0.12 percentage point increase in other borrowing in the first year, primarily from the FHLBs (a 0.09 percentage point increase) (results are available upon request). That is, almost the entire increase in on-balance sheet lending growth for liquidity-exposed banks (0.13 percentage point in column (1)) was funded with other borrowing.

#### ***3.3.4. Joint Determination of Deposit Rates and Flows***

Next, we examine the endogeneity of deposit rates and flows in a test of the third hypothesis from Section 3.1. Table 6 traces out the downward sloping curve with the deposit rate as a function of deposits, the “bank supply” curve. As discussed in Section 3.1, in order to tease out this effect, deposits of nearby failed banks and seniors in the local population are used to instrument deposits. The results of the first stage indicate that, as expected, the failed deposit share positively influences deposits, particularly insured deposits as shown, which are arguably more sensitive to deposit inflows from failed banks seeking a safe haven (similar effects for core deposits). Similarly, a larger fraction of seniors is associated with a higher insured (and core) deposit share as this population seeks to hold its savings in safe assets. The latter significant effect implies that a 0.1 increase in the fraction of seniors leads to a 0.084 increase in the share of a bank’s insured deposits (column (2)).

The second stage regression is shown in column (3) for the large-time rate and in column (4) for the core deposit rate. In line with the hypothesis, rates go down as insured deposits pour into banks: so that the 0.084 increase in insured deposits lowers the large-time

deposit rate by close to 16 bps and the core deposit rate by 11 bps.<sup>20</sup> Finally, the coefficients on the other terms capturing bank's liquidity and solvency are robust and similar to Table 3. Note that these results are also robust to controlling for local economic shocks that can affect bank competition (in addition to deposit market concentration already controlled for).<sup>21</sup>

#### 4. REVISITING GATEV AND STRAHAN (2006) AND OTHER ROBUSTNESS

The results of our paper indicate that the role of the banking system as a stabilizing liquidity insurer can break down in a financial crisis. Banks most vulnerable to greater liquidity demand may not be able to attract sufficient deposit inflows to fund commitments and other asset funding needs even by actively offering higher rates, as the findings of Section 3.3 illustrate. Exposed banks were forced to cut back on new credit originations and funded drawn commitments almost entirely with non-deposit borrowing from the FHLBs and the Federal Reserve.

##### 4.1. Revisiting Gatev and Strahan (2006)

One open question is how can these results be reconciled with previous studies' support for banks' advantage in liquidity provision in crises? That is, if banks have a natural advantage in providing liquidity in crises as posited by this literature, then banks with the greatest exposure to liquidity demand are expected to experience the highest growth in deposits and loans in a crisis. The regression results discussed in this section confirm that such a relationship existed in previous episodes of market stress originating outside the U.S. banking system but broke down in the 2007-09 financial crisis.

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<sup>20</sup> Note that the instruments are strongly correlated with the endogenous variable. For example, the F-statistic for joint significance is 39.8, above the value of ten that has become a benchmark for weak instruments. Second, because there is more than one instrument, one can test overidentifying restrictions. The null that the instruments and the model are correctly specified cannot be rejected. The IV-estimated effects in columns (3) and (4) are also similar if only the seniors instrument is used.

<sup>21</sup> These shocks, defined for the bank's geographic market, include percentage change in house prices, employment and the number of establishments, which together with a higher deposit concentration are generally associated with lower deposit rates as shown in Table 6. Moreover, to the extent that weaker economic conditions are correlated with both nearby bank failures and with the surviving bank's vulnerability to failure, controlling for these shocks helps to isolate the favorable contemporaneous effect that nearby failures have on a surviving bank's deposit funding.

Table 7 presents some descriptive statistics of average weekly deposit and loan growth comparing the 1998 LTCM crisis with the 2007-09 crisis. The liquidity squeeze that followed the Russian sovereign debt default and the failure of the LTCM hedge fund in the fall of 1998 also meant that many companies could no longer renew maturing commercial paper. For example, commercial paper spreads reached over 100 bps and outstanding commercial paper issued by nonfinancial companies fell roughly 7%, by \$16 billion (Saidenberg and Strahan, 1999). These companies turned to the commercial banking system as a backstop, and weekly C&I loan growth doubled (from a weekly average of 0.027% in the five years preceding the crisis to 0.048% in the fall of 1998). At the same time, deposits flowed into U.S. banks from foreign banks and overseas offices largely because that crisis had its origins outside the U.S. as discussed by Saidenberg and Strahan (1999) (e.g., core deposit growth shot up from a weekly average of 0.042% to 0.173% in the fall of 1998 as shown in Table 7).<sup>22</sup> In contrast and as already described at great length in Section 3.2, deposit growth was muted in the first year of this crisis as C&I loans went up.

In order to ensure that differences in model specification are not driving the results, the specifications in Table 8 follow very closely those reported in Gatev and Strahan (2006). The key coefficient of interest is the interaction term of unused commitments with the commercial paper spread, which proxies for financial market stress. The coefficients on *unused commitments x stress* are positive and statistically significant in both the deposit growth (column (1)) and loan growth equations (column (4)) for a sample period over 1991-2000 as in Gatev and Strahan. These results confirm that before the recent crisis, banks most at risk of liquidity demand realizations experienced the greatest increase in deposit growth and loan growth when financial markets became stressed.

The model is extended by allowing for a different effect stemming from a bank's unused commitments on its deposits and loans in this crisis compared with previous episodes of high commercial paper spreads and the sample period is, therefore, extended to 2009. The change

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<sup>22</sup> This translated to an increase of about \$35 billion between end-August and October 1998, further increasing by over \$100 billion by year end. Similar evidence of a strong deposit inflow into the domestic banking system occurred after the 9/11 attacks as market liquidity dried up and commercial paper spreads rose. For example, total deposits shot up by over \$200 billion in the week immediately following September 11, 2001.

in the influence of financial stress on banks' ability to provide liquidity in the recent crisis is captured by the triple interaction *unused commitments x stress x crisis*. The results in columns (3) and (6) show that the coefficients on *unused commitments x stress x crisis* are mostly negative and statistically significant.<sup>23</sup> These results generally support the view that banks with high exposure to liquidity demand had less of an advantage (a disadvantage in some cases) over other banks in attracting deposits and making loans in the recent crisis than in past crises. For example, before the recent crisis, an increase in the CP spread by 100 basis points raised deposit growth 0.22 percentage point more at a bank with a high unused commitment ratio than at a bank with a low unused commitment ratio (where high unused commitments are taken at the 75<sup>th</sup> percentile (0.17) and a low unused commitments are taken at the 25<sup>th</sup> percentile (0.07)). In contrast, when market liquidity was highly stressed in the first phase of this crisis, deposit growth *contracted* 0.17 percentage point more at a bank with a high unused commitment ratio than at a bank with a low ratio.

Together, the deposit and lending results suggest that the very banks that had offered insurance to businesses and households before the crisis in the form of commitments were not as well positioned to deliver the promised liquidity. Lending growth was anemic in this crisis compared with earlier episodes of high commercial paper spreads.

Finally, the deposit rate specifications in the last two columns of Table 8 show that even in the period before the 2007-09 crisis when banks were relatively untouched by market turbulence, there is evidence that banks exposed to liquidity demand shocks offered higher rates (at least on large time deposits) in order to secure adequate deposit inflows in times of market stress. This helps reconcile the findings of Gatev and Strahan that liquid assets increased universally at *all* banks when commercial paper spreads rose (regardless of loan commitment exposure) but that deposit inflows were pronounced at banks with high levels of loan commitments outstanding. Our results clarify that – even before this crisis – banks exposed most to liquidity demand shocks were actively managing deposit rates to attract deposit inflows rather than being purely passive recipients of deposits due to flight to safety.

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<sup>23</sup> Columns (3) and (6) also include double interaction terms as a robustness check. The coefficients of interest are those on the triple interaction terms. (See Bertrand, Schoar and Thesmar, 2007, for a similar triple interaction model).

## 4.2. Other Results and Robustness

### 4.2.1. *Effects on maturity structure of deposits*

We evaluate whether and how the maturity structure of time deposits was affected by the crisis, and whether a change in the maturity structure can explain our findings. We show that banks with a deposit maturity structure tilted toward short-term deposits have a greater rollover risk, and offered significantly higher rates in the first year of the crisis to ensure continued funding. For example, column (1) of Table 9 shows that a one standard deviation increase in the share of large-time deposits maturing or repricing in less than one year raised the large-time deposit rate by over 20 bp. Moreover, the results in column (3), where the dependent variable is the share of short-term large-time deposits, indicate that the maturity structure shortened for banks more susceptible to liquidity demand risk. For example, banks with more unused commitments appear to have increased their share of short-term deposits. There is also evidence (not shown) that banks about to fail significantly increased short-term deposits as a share of their deposits. Therefore, it seems unlikely that riskier banks lengthened their maturity structure during the crisis (so that the higher deposit rates they paid would reflect that maturity shift rather than being an outcome of banks actively seeking deposits for a given maturity profile).

### 4.2.2. *Predictors of bank failure*

Another question we take up is whether banks vulnerable to liquidity and solvency risk were indeed more likely to fail during the financial crisis. The results in Table 10 show that both liquidity and solvency measures (measured pre-crisis because banks later took defensive actions) affected the likelihood of failure in the expected direction. For example, banks with more unused commitments outstanding before the crisis were more likely to fail (commitments were a more important predictor of failure when failure includes stock return near-fails in addition to regulatory fails as shown by comparing column (1) with column (2)). Note also that the evidence is not just supportive of asset-side runs (drawdowns on lines of credit) but also supportive of liability-side runs (as proxied by wholesale funding dependence and the inability to raise retail deposits as shown in column (4)). A more detailed analysis falls outside the

immediate scope of this paper but the results control for local economic conditions, deposit market structure, and the pre-crisis deposit rate (the latter is also associated with a higher likelihood of failure).

#### *4.2.3. Alternative data source for bank deposit rates*

We also arrive at compatible results for the relationship between deposit rates and bank fundamentals when using an alternative data source, which is based on a proprietary survey of current rates (mostly on CDs) of banks and thrifts conducted at the weekly frequency by Bank Rate Monitor (Bank Rate Monitor®, N. Palm Beach, FL 33408, all rights reserved). This survey has a number of advantages and disadvantages: Its main advantage is that the reported rates are current (not average balance) rates. However, the survey is on a selection of banks and is largely participation based. As a result, the sample covers only about 214 bank holding companies of more than 4,000 in the Call Reports, and these have a larger average asset size and are concentrated in metropolitan areas (and the included banks may choose to stop reporting rates during the sample).<sup>24</sup>

The results using the Bank Rate Monitor data are shown in Appendix Table A3; where the panel is a bank-week panel over the period 1997-2009 and the liquidity and solvency measures are as before (lag values are nonetheless quarterly because bank characteristics are from the Call Reports). The results indicate that, particularly for those banks with a high insolvency risk, liquidity demand exposure has a statistically significant effect on offered rates in times of market stress. For example, a 0.1 increase in undrawn commitments pushed up 24 (60) month CD rates by 7.7 (14.3) bps in the crisis. In addition, large banks paid up to 25 basis points lower CD rates in this crisis and a 0.01 increase in the fraction of nonperforming loans pushed up rates by close to 20 basis points (see columns (1), (2), (5) and (6)). Afonso, Kovner, and Schoar (2010) find evidence of pricing and rationing in the federal funds market that is also parallel to our evidence from the retail deposit funding market. For example, using daily transaction-level data on the federal funds segment of the wholesale funding market, they find

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<sup>24</sup> The data are also subject to a number of irregularities as noted by Driscoll and Judson (2009); these include duplicates for the same branch and missing observations input as zeros. The data are, therefore, cleaned as best as possible to correct for these discrepancies. A second caveat is that the rate data represent the lower end of rates offered by deposit type.

that banks with high nonperforming loans were more likely to be rationed and pay higher spreads.

#### ***4.2.4. Deposit rates during the Fall of 2008***

The Bank Rate Monitor weekly data can also be used to evaluate how deposit rates responded to bank insolvency and illiquidity risk in three narrowly defined regimes around the Lehman failure: the weeks immediately preceding the Lehman event, the weeks after Lehman but before TARP, and the weeks just after TARP (and recapitalization) was approved. The sample period in Appendix Table A4 corresponds to a five-month window surrounding the Lehman event. There is some evidence that sensitivity to insolvency risk (as proxied by nonperforming loans) increased in the post-Lehman pre-TARP period (columns (1) and (3)). However, this finding may reflect compositional changes during that interval because the survey is participation-based. The results are, therefore, more consistent with a strong effect of insolvency risk on rates throughout the stressed period as shown in Table A3. But what is interesting, is that illiquidity risk was most acute in the period before Lehman and eased after Lehman and then more after TARP (as proxied by unused commitment in columns (5) to (8)). This finding is compatible with the large flight of deposit funds into the banking system following Lehman as previously shown.

#### ***4.2.5. Alternative bank risk measures***

Next, we assess how banks responded to additional risks of illiquidity and insolvency that were revealed by the 2007-2009 financial crisis. The first two columns of Table A5 include two measures closely related to the proximate causes of the financial crisis. First, we include the share of real estate lending in a bank's loan portfolio. Second, in the period before the crisis, banks increasingly relied on liquid loan sale and securitization markets to offload real estate loans. As a result, banks more involved in this activity would be expected to face funding pressure once these markets froze. Therefore, we also include a measure capturing the extent of residential mortgages sold (available from 2006). These two real estate dependence variables have the hypothesized positive effect on deposit rates during the crisis (e.g., a one standard deviation in a bank's real estate lending increased its core deposit rate by 6.2 bp in the

second year of the crisis, column (2)). The last four columns of Table A5 include market equity returns and volatility for the subset of publicly traded banks, which enter with the expected effects.

#### ***4.2.6. Endogeneity of bank risk measures***

Finally, we address the concern that the use of liquidity and solvency measures during the crisis (even with a lag) may be confounded by regulatory changes and bank-specific actions. We include their pre-crisis values in the specifications shown in Table A6. That is, lagged values are used up to 2007:Q2 and from then on, the values of these variables as of 2007:Q2 are used. Pre-crisis (2007:Q2) characteristics are least likely to be contaminated by regulatory and bank actions taken after the beginning of the crisis in order to change risk profiles. The results are robust to this change.

## **5. RELATION TO THE LITERATURE AND POLICY IMPLICATIONS**

### **5.1 Related literature**

The findings in this paper help understand the nature and importance of deposit funding shocks for banks in the recent crisis. There is a well-developed strand of the market discipline literature that shows that various types of bank claimholders are able to identify risky banks in a timely manner and penalize them by withdrawing funds and raising the costs of additional funds. In turn, if a financial firm finds that it cannot borrow additional funds or that the additional funds come at very costly terms, it will be forced to adjust its corporate structure and risk-profile.

Flannery (1998) provides a good review of the capacity of such market mechanisms to supervise and remedy excessive risk taking by financial firms. But to cite just a few most relevant empirical papers on market discipline, Hannan and Hanweck (1988) find evidence that rates on partially insured CDs reflect bank riskiness; Ashcraft (2008) finds evidence of discipline in subordinated debt markets; Goldberg and Hudgins (2002) and Maechler and McDill (2006) find that riskier financial institutions pay higher interest rates and attract smaller amounts of uninsured deposits. Interestingly, even when deposit insurance is credible, there is evidence of

discipline by insured depositors. For example, using proprietary account-level data for a bank that failed in 2002, Davenport and McDill (2006) show that most of the withdrawn deposits were, in fact, from fully insured deposit accounts.

There is also historical evidence of depositor discipline from the U.S. before the introduction of deposit insurance and other regulatory standards. For example, Calomiris and Wilson (2004) shows that depositors were able to differentiate between banks, as deposit withdrawals in the 1920s and 1930s were related to a bank's risk of default. Saunders and Wilson (1996) also find that failing-bank deposit outflows one year prior to failure still exceeded those at a matched control sample of non-failing banks, even during the bank run contagion of the early 1930s. This finding, together with our findings on deposit outflows in the run-up to a bank's failure, indicate that deposit withdrawals can be one interesting predictor of bank failures and distressed acquisitions.

Recently, deposit funding shocks for banks have been shown to be of wider relevance by Liu (2011) that analyzed the effect of financial crises over the past 20 years globally on banks operating with branches in crisis-affected and non-crisis countries. She finds that banks with deposit exposure cut back lending significantly in branches outside the crisis country (funding shock); and the magnitude of this effect is twice as large as that stemming from non-depository asset exposure only (capital shock).

## **5.2 Policy Implications**

The main policy implication of our results is that banks are not necessarily able to adequately fulfill their role as a liquidity backstop since their own risks may materialize leading to the outflow of deposits. This finding implies that policymakers need to design other – or alternative – mechanisms to ensure an uninterrupted supply of credit to creditworthy borrowers. Ex post, such mechanisms could include direct interventions in markets, such as the Federal Reserve's Commercial Paper Funding Facility that helped support issuance of short-term paper by businesses. Moreover, federal funding of temporary programs to avoid critical disruptions in credit and liquidity may be justified, provided they are suitably priced and contingent on bank quality.

A part of this improvement should feature better charging for deposit insurance to align premiums with still-existing implicit guarantees which encourage banks to take excessive risks.<sup>25</sup> Pennacchi (2006) and Acharya, Santos and Yorulmazer (2010) argue that the premium charged should not just be actuarially fair (so the fund breaks even on average) but also reflect an additional component to discourage moral hazard. Some new reforms in this direction have been proposed by the FDIC, following the Dodd-Frank Act of 2010, to make deposit insurance premiums more sensitive to the systemic risk of an institution and not just to its idiosyncratic risk. It may also be desirable to tie deposit insurance premiums to deposit rates offered by the bank, to the extent that higher rates are used by weak banks to load up on insured deposits at the potential expense to the deposit insurer.

In the same spirit, another part of the improvement could feature revisions to capital requirements whereby banks' funding as well as insolvency risks are suitably charged, especially when they are correlated with an aggregate shock (as proposed in Acharya, 2009, and Acharya, Pedersen, Philippon and Richardson, 2010). In particular, our results suggest that when bank insolvency fears are sufficiently deep, funding risk in the form of drawing down of credit lines and depositor runs can arise. This risk is ignored in the current capital requirements (though some attempt is being made to capture funding risk under the Basel III requirements).

## 6. CONCLUDING REMARKS

The main message of this paper is that in spite of their perceived safe haven status, bank deposit funds cannot be assumed to be robust to all types of market liquidity stress. In the crisis of 2007-09, depositors shunned banks as there was greater uncertainty about the health of banks themselves, greater aggregate uncertainty, and uncertainty over whether the government would support the financial system. These findings—together with the weak lending growth and loan to deposit shortfalls during the crisis, especially at banks most vulnerable to liquidity drawdowns—suggest that banks were not as able to provide liquidity as would be implied by theory and evidence from other crises. Though we focused on banks in

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<sup>25</sup> Indeed, risk shifting may be exacerbated if the heightened competition for deposits during a bank-centered crisis further lowers bank charter values and induces more risk taking on the asset portfolio when combined with deposit insurance (see Keeley, 1990).

the U.S., due in part to it being the epicenter of the crisis and in part given the better availability of banking data, evidence from Europe and the UK appears to conform to our findings. Given that many large European banks were also exposed to the ABCP freeze starting August of 2007 (Acharya, Schnabl, and Suarez, 2009), the funding risks of these banks were similar to their U.S. counterparts (in most cases worse, as these banks had limited access to the U.S. deposit market and government funding such as FHLB advances). For instance, there was (and remains) a depositor flight from the European periphery to stronger German banks (perceived to have a stronger government backing them).<sup>26</sup> Similarly, while many British depositors increased their funds in Irish banks, drawn by higher rates after the Irish government full guarantee was announced in 2008 (roughly half of total deposits were held by non-residents), several large Irish banks including Bank of Ireland and Allied Irish Banks eventually experienced a deposit flight in November 2010. This shows how when the aggregate shock risks the sovereign itself, the standard argument that banks function well as liquidity providers can fail due to the poor quality of deposit insurance.

In this sense, the financial crisis of 2007-09 was closer to the banking panics of the pre-Federal Reserve era in the United States, i.e., it raised concerns about bank funding and solvency to the point where we witnessed depositor flight away from banks, but different from crises of that era in that we witnessed depositor flight from banks *in spite* of the presence of deposit insurance up to some limits, an extensive apparatus for bank supervision, and somewhat ineffective prudential capital requirements.

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<sup>26</sup> See for example, the *New York Times*, May 26, 2010, "Doubts Grow on Central Bank's Ability to End Crisis", and the *Economist*, November 27, 2010, "Plugging the Hole" and December 3, 2011, "The Dash for Cash".

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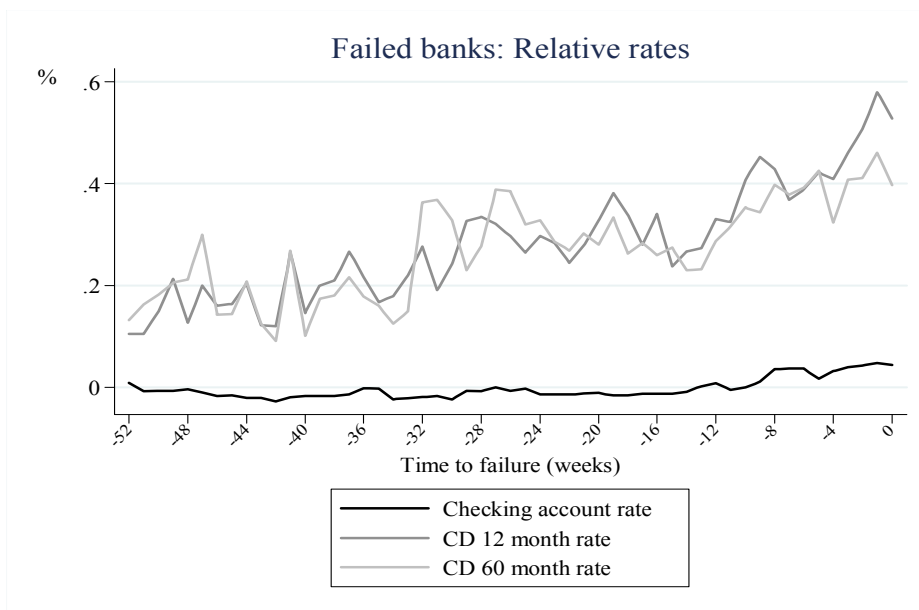
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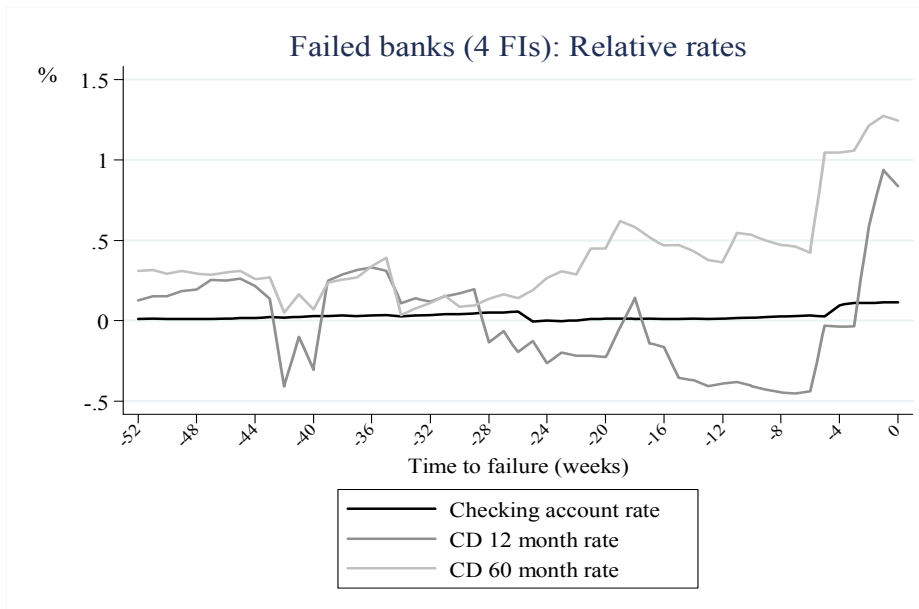
**Chart 1. Relative Deposit Rates of Failed Banks**

These two charts plot the deposit rates of failed banks (and nearly failed banks) adjusted for the rates of banks that did not fail over the period 1997-2009. The underlying data are current rates from a weekly survey from Bank Rate Monitor (BRM), available from 1997. The top panel is for all failed banks with available BRM data, and the lower panel focuses on four prominent financial institutions that failed (IndyMac, Washington Mutual) or nearly failed Wachovia, Citi) in the crisis. Specifically, relative rates in Chart 1a are the average of the difference between rates for 43 failed banks (FDIC regulatory-assisted failures and CRSP near-fails) and rates of non-fail banks. Note that following Acharya, Pedersen, Philippon and Richardson (2010), these near-fails correspond to the first date when the 18-month return was worse than -90% using daily CRSP equity data (e.g., the result was September 29, 2008 for Wachovia, which was also the date that its acquisition was announced). The x-axis is the time to failure in weeks. The failure date is the last available weekly (Friday) survey date prior to failure.

**Chart 1a**



**Chart 1b**



### Chart 2. Insured and Uninsured Deposits of Failed Banks

These two charts plot insured and uninsured deposits at failed banks (and nearly failed banks) over the period 1990-2009. The underlying deposit data are from the quarterly Call Reports, which include over 500 bank failures. The x-axis is the time to failure in quarters, where failure covers both regulatory-assisted failures and near-fails, as measured by large negative returns on the market value of equity (specifically, the first date when the 18-month return was worse than -90% using daily CRSP data following Acharya, Pedersen, Philippon, and Richardson, 2010). Chart 2a plots average insured and uninsured deposit growth at failed banks, and similarly Chart 2b plots the ratio of insured and uninsured deposits to beginning of period assets; plots account for mergers and the change in insured deposit reporting thresholds in 2009:Q3. Also shown in Chart 2b are the average deposit ratios for banks that did not fail, which are plotted over the period 2007:Q1 to 2009:Q1, where 2009:Q1 also corresponds to the quarter with the most failures over the sample period.

Chart 2a

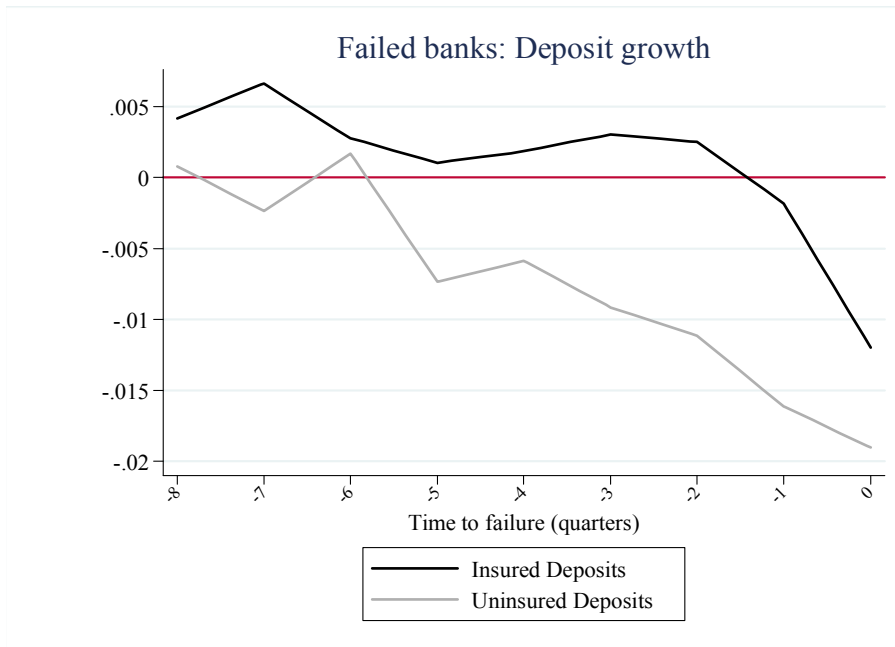
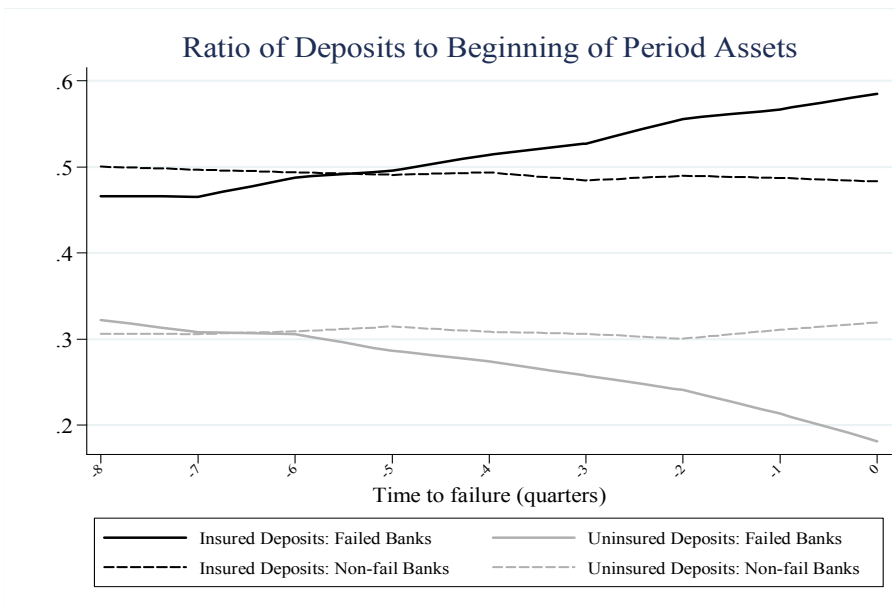


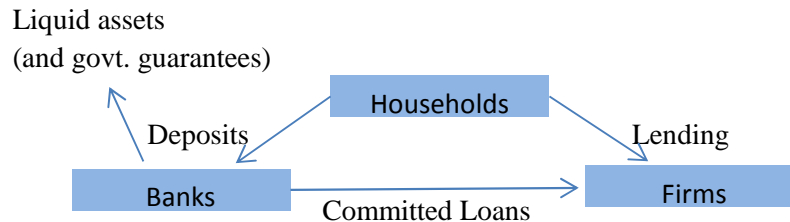
Chart 2b



### Chart 3. Banks as Liquidity Providers

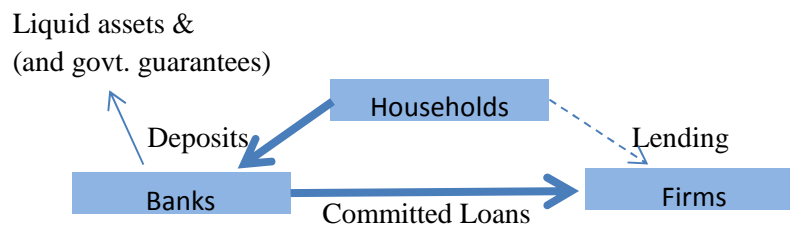
#### Panel A. The Initial System

This diagram represents the initial system in which banks have off balance sheet committed loans to firms. Banks also hold liquid assets to support lending and deposit withdrawals by households (and have backup government support). Households deposit their savings at banks and also lend directly to firms (for example, through commercial paper securities).



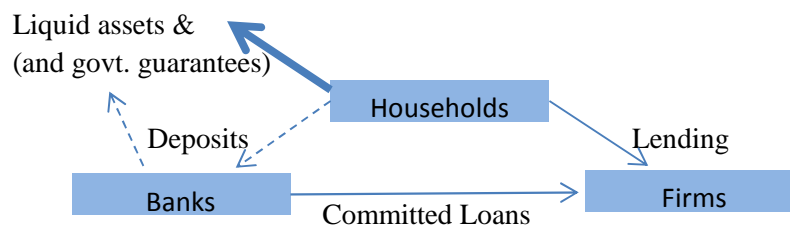
#### Panel B. Market Stress With Banks Not at the Center

In a crisis with banks not at the center, direct household lending to firms is disrupted. Securities markets such as commercial paper experience stress when households (investors) lose confidence in their ability to identify low-risk firms. A general flight to safety and quality ensues. Banks gain deposits because they are perceived to be safe and are, therefore, able to intermediate needed funds to firms without running down liquid asset buffers.



#### Panel C. Financial Crisis with Banks at the Center

In a crisis with banks at the center, banks are no longer perceived to be safe. Banks experience stress when households lose confidence in their bank deposits and shift savings to instruments guaranteed by the U.S. Treasury (e.g., T-bills, Federal Home Loan Banks discount notes). Banks run down liquid assets to provide liquidity on demand to depositors and to firms. They might be forced to resort to backup borrowing from the government. If combined with market stress on the securities issued by firms (an aggregate crisis), banks further run down liquid assets and increase government borrowing.

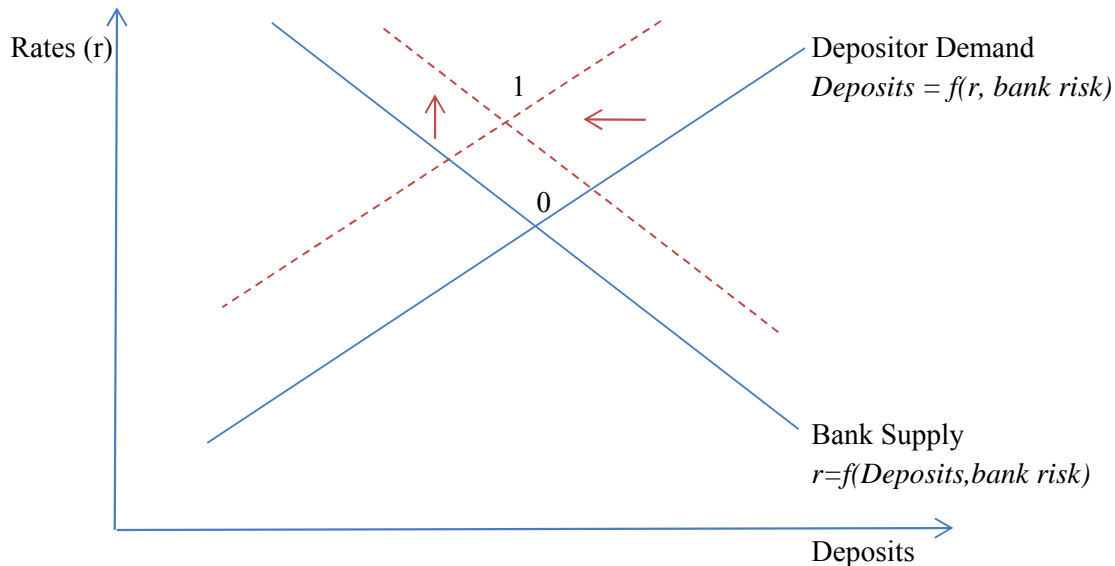


#### Chart 4. Equilibrium Deposit Rates and Quantities

##### Panel A. Illustrating the Effect of an Increase in a Bank's Riskiness

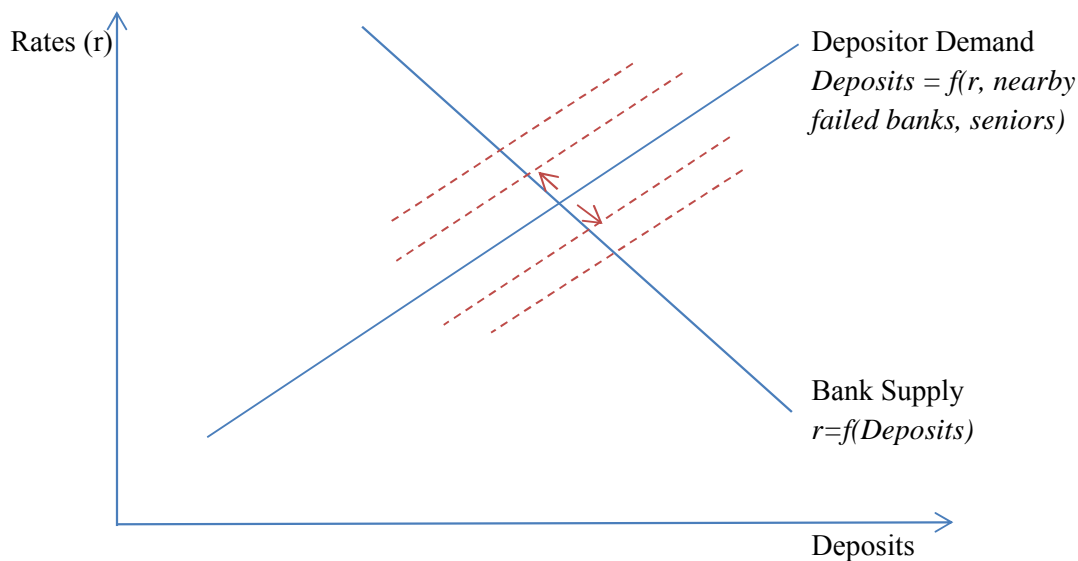
This chart plots the joint determination of deposit rates and quantities as the outcome of depositors' "demand" (the upward sloping curve) and bank "supply" (the downward sloping curve).

An increase in a bank's riskiness is expected to shift both curves as illustrated. First, depositors are thought to discipline banks for risk-taking behavior by withdrawing funds from deposit accounts, as well as by demanding higher deposit rates. Second, banks exposed to liquidity demand shocks and at a greater risk of insolvency actively seek deposits by raising rates.



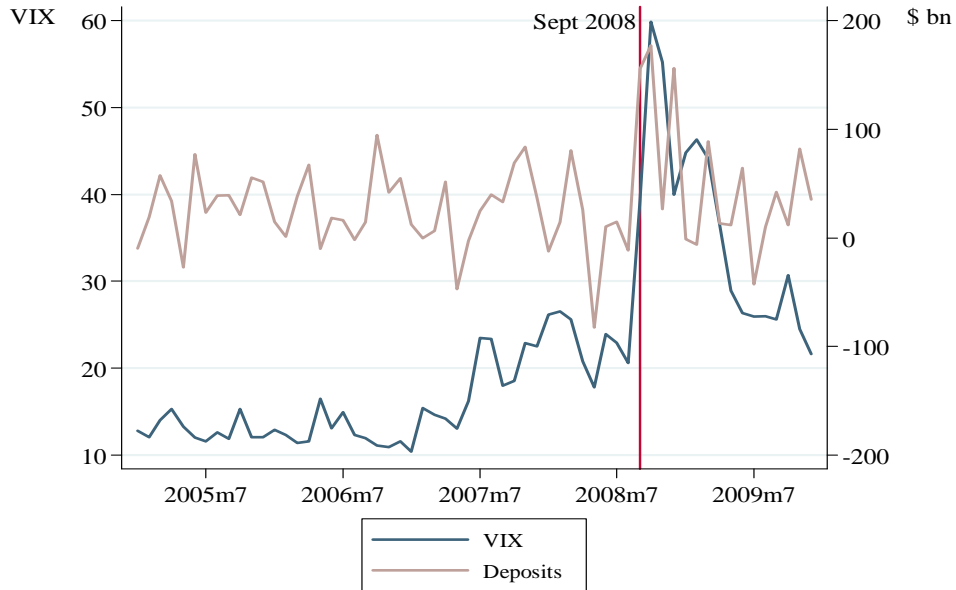
##### Panel B. Illustrating the Identification Strategy

This chart illustrates our method for identifying the bank supply curve. We use the share of deposits in a bank's local geographic market belonging to failed banks and the share of seniors in the local population as instruments for a bank's contemporaneous deposits. The failed bank variable is constructed using information on dates of bank failures together with branch-level deposit data from the Summary of Deposits. Similarly, the seniors variable is constructed from Census information. Exogenous shifts in depositor demand stemming from local market variation in seniors and bank failures thus identify the bank supply curve.



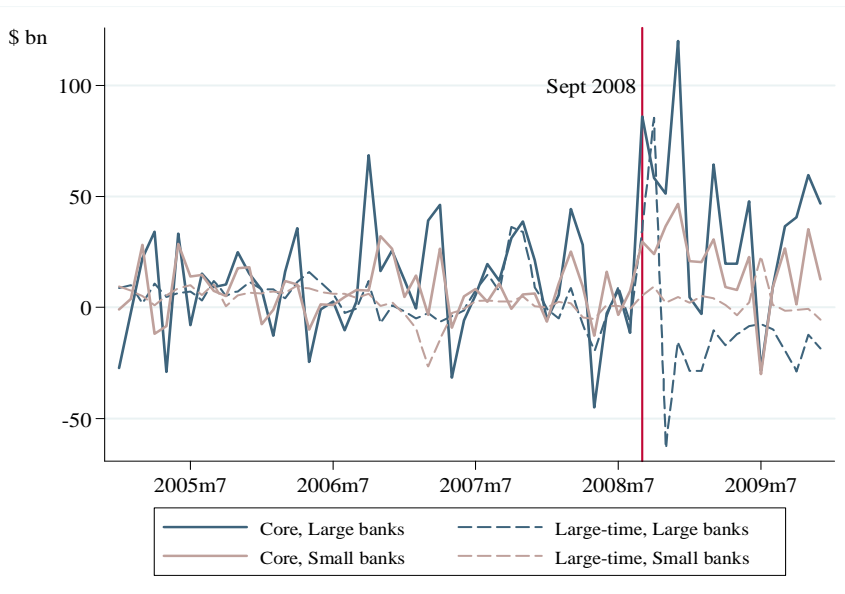
**Chart 5. VIX and Net Flows into Deposits at Commercial Banks**

This chart plots the VIX index (left-axis) and net flows into deposit accounts at commercial banks (right-axis) over the period 2005-2009. The underlying data are the Chicago Board Options Exchange for VIX (month-end), and the Federal Reserve H8 release for deposits at domestically chartered commercial banks. The latter deposit flows data are aggregated from weekly to monthly frequency. These deposit flows are also corrected for the artificial impact of JP Morgan Chase's acquisition of the large thrift, WaMu, reflected in the H8 release of October 1, 2008.



**Chart 6. Net Flows into Deposits at Commercial Banks:  
Large and Small Banks, Core and Large-Time Deposits**

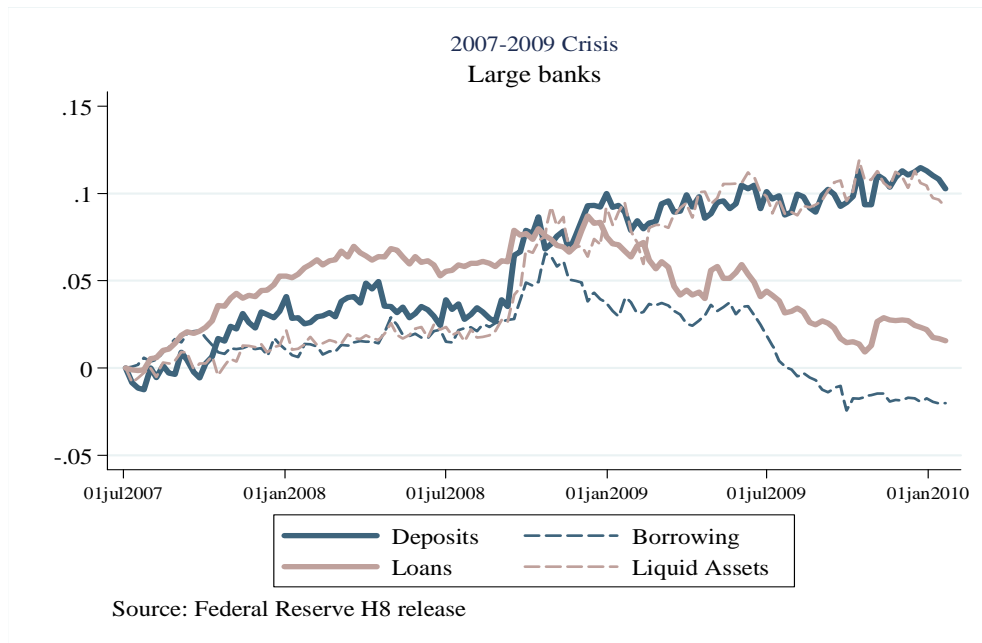
This chart plots net flows into deposit accounts at commercial banks over the period 2005-2009, disaggregated by large and small banks, and by core and large-time deposits. The underlying data are the Federal Reserve H8 release for deposits at domestically chartered commercial banks. The latter deposit flows data are aggregated from weekly to monthly frequency. Large banks in the H8 release are the largest 25. For example, inclusion as of mid-2009 was \$65 billion asset size. Combined, large banks held 66% of domestically chartered assets and 60% of deposits. The deposit flows at the large banks are also corrected for the artificial impact of JP Morgan Chase's acquisition of the large thrift, WaMu, reflected in the H8 release of October 1, 2008.



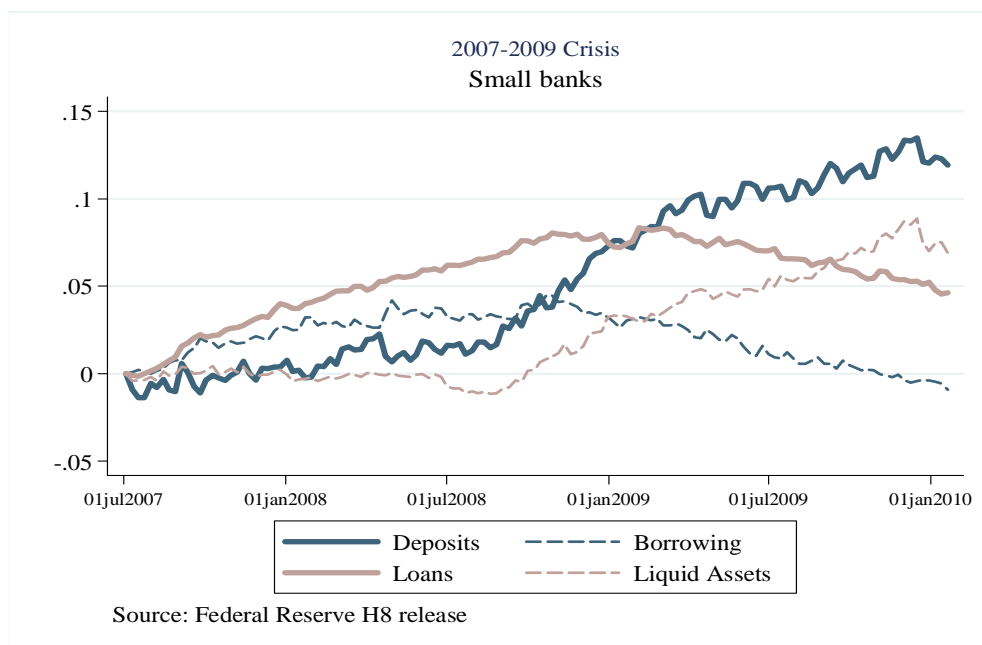
### Chart 7. Cumulative Growth of Balance Sheet Components

These two charts plot the cumulative growth of key balance sheet assets and liabilities at the weekly frequency from July 2007 through the end of 2009 (growth figures are relative to the first week of July 2007). The four key series are total deposits, non-deposit borrowing, loans and leases, and liquid assets (the sum of cash assets, securities, and interbank loans extended). Panel A is for large domestically chartered banks and Panel B is for small domestically chartered banks. The underlying data are the Federal Reserve H8 release for deposits at domestically chartered commercial banks. Large banks in the H8 release are the largest 25. For example, inclusion as of mid-2009 was \$65 billion asset size. Combined, large banks held 66% of domestically chartered assets and 60% of deposits. The balance sheet series at the large banks are also corrected for the artificial impact of JP Morgan's acquisition of the large thrift, WaMu, reflected in the H8 release of October 1, 2008.

**Panel A**



**Panel B**



**Table 1. Cumulative Deposit Growth During the 2007-2009 Financial Crisis (in %)**

	2007Q3	2007Q4	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1
<b>Panel A. Large Banks (Largest 25 banks, H8 criteria)</b>							
Insured deposits	0.1	0.8	1.7	1.7	3.9	4.6	5.6
Core deposits	0.2	2.4	3.8	3.4	6.3	9.7	10.8
Large time deposits	0.6	1.5	1.8	1.3	2.8	2.0	1.2
<b>Panel B. Small Banks</b>							
Insured deposits	0.0	0.0	0.7	1.0	2.3	3.0	2.0
Core deposits	-0.4	-0.7	-0.7	-0.5	0.0	0.9	0.5
Large time deposits	1.7	2.4	3.4	3.8	2.7	-0.2	-0.1
<hr/>							
All Banks, Core							
All Banks, Large-Time							

This table shows an extract of cumulative growth statistics for certain deposit accounts based on the quarterly Call Reports over the period from 2007:Q3 to 2009:Q1 (see Appendix Table A2 for full balance sheet detail). Panel A shows the growth in insured deposits, core deposits, and large-time deposits over the period relative to initial 2007:Q2 levels for large banks. Similarly, Panel B shows the deposit growth figures for small banks, and the bottom panel summarizes overall deposit inflows into the banking system in billions of dollars over the period 2007:Q4-2009:Q1. These aggregate flow of funds match the data reported in He, Khang, and Krishnamurthy (2010) for the corresponding period (where core deposits are reported to have increased by roughly \$800 billion, while large-time deposits decreased by \$200 billion).

**Table 2. Deposit Interest Rates and Deposit Flows in the Run-up to Bank Failures**

Formal Fails are regulatory-assisted failures, where the FDIC is typically appointed the receiver of the failed bank.  
CRSP Fails are the period associated with market equity returns worse than -90% over 18-month period (Acharya et al, 2010).

	Panel A. Deposit Rates										
	(1)	(2)	(3) Implicit Rate on Deposits, % annual (Call Reports) Time Period Unit is One Quarter			(6) Core			(7) Offered Rate (Bank Rate Monitor) Time Period Unit is One Week		
	Large Time Formal Fail	Large Time All Fail (Formal and CRSP)	Large Time CRSP Fail	Core Formal Fail	Core All Fail (Formal and CRSP)	Core CRSP Fail	12 month CD Formal Fail	12 month CD All Fail (Formal and CRSP)	12 month CD CRSP Fail		
4 Periods prior to Failure	0.039 (0.073)	0.019 (0.055)	0.025 (0.086)	0.349*** (0.065)	0.261*** (0.049)	0.167** (0.066)	0.225 (0.168)	0.159* (0.093)	0.135 (0.111)		
3 Periods prior to Failure	0.142** (0.059)	0.104** (0.045)	0.063 (0.063)	0.327*** (0.051)	0.250*** (0.040)	0.169*** (0.051)	0.353 (0.215)	0.228** (0.107)	0.171 (0.116)		
2 Periods prior to Failure	0.229*** (0.068)	0.155*** (0.054)	0.040 (0.083)	0.349*** (0.050)	0.279*** (0.040)	0.223*** (0.057)	0.360* (0.214)	0.309*** (0.119)	0.287** (0.141)		
1 Period prior to Failure	0.263*** (0.073)	0.204*** (0.055)	0.175 (0.109)	0.329*** (0.064)	0.297*** (0.045)	0.296*** (0.051)	0.360 (0.228)	0.316** (0.131)	0.300* (0.161)		
Period of Failure	0.236*** (0.091)	0.140** (0.067)	0.012 (0.089)	0.350*** (0.070)	0.347*** (0.053)	0.415*** (0.078)	0.276 (0.206)	0.250** (0.126)	0.240 (0.153)		
1 Period after Failure			0.038 (0.079)			0.416*** (0.072)			0.109 (0.114)		
2 Periods after Failure			0.150 (0.097)			0.336*** (0.060)			0.091 (0.114)		
3 Periods after Failure			0.017 (0.083)			0.292*** (0.063)			0.013 (0.105)		
4 Periods after Failure			-0.090 (0.111)			0.289*** (0.083)			0.122 (0.095)		

The sample period of the regressions is from 1994 to 2009, using quarterly Call Report data in columns (1) to (6) and weekly Bank Rate Monitor data in columns (7) to (9).

All specifications are panel regressions with fixed effects for bank organizations and time dummies (quarterly or weekly).

All regressions control for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits), and for District time trends.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 2. Deposit Interest Rates and Deposit Flows in the Run-up to Bank Failures**

Formal Fails are regulatory-assisted failures, where the FDIC is typically appointed the receiver of the failed bank.  
 CRSP Fails are the period associated with market equity returns worse than -90% over 18-month period (Acharya et al, 2010).

<b>Panel B. Deposit Flows</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
	Deposit Flows (Call Reports)					
	Time Period Unit is One Quarter					
	$\Delta \text{Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Insured Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Insured Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Insured Deposits}_t / \text{Assets}_{t-1}$
	Formal Fail	All Fail (Formal and CRSP)	CRSP Fail	Formal Fail	All Fail (Formal and CRSP)	CRSP Fail
4 Periods prior to Failure	-0.006 (0.004)	-0.005* (0.003)	-0.009** (0.004)	0.003 (0.004)	0.004 (0.003)	0.003 (0.003)
3 Periods prior to Failure	-0.012*** (0.004)	-0.007** (0.003)	-0.001 (0.004)	0.006* (0.004)	0.007** (0.003)	0.007 (0.004)
2 Periods prior to Failure	-0.012*** (0.004)	-0.005* (0.003)	0.003 (0.004)	0.001 (0.004)	0.005* (0.003)	0.009** (0.004)
1 Period prior to Failure	-0.028*** (0.004)	-0.018*** (0.003)	-0.001 (0.004)	0.000 (0.004)	0.006* (0.003)	0.018*** (0.005)
Period of Failure	-0.048*** (0.005)	-0.034*** (0.004)	-0.013*** (0.004)	-0.018*** (0.005)	-0.006 (0.004)	0.013** (0.005)
1 Period after Failure			-0.001 (0.005)			-0.003 (0.004)
2 Periods after Failure			-0.012** (0.006)			-0.011** (0.005)
3 Periods after Failure			-0.014*** (0.005)			-0.008** (0.004)
4 Periods after Failure			-0.035*** (0.008)			-0.022*** (0.008)

The sample period of the regressions is from 1994 to 2009, using quarterly Call Report data.

All specifications are panel regressions with fixed effects for bank organizations and time dummies (quarterly).

All regressions control for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits), and for District time trends.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 3. The Relationship between the Deposit Interest Rate and Liquidity Demand Risk in the Crisis  
(Allowing for Two Phases of the Crisis: 2007Q3-2008Q2 and 2008Q3-2009Q2)  
Implicit Rate on Deposits, % annual (Call Reports)**

	(1) Large Time	(2) Large Time	(3) Core	(4) Core
Unused commitment ratio <sub>t-1</sub>	0.135 (0.095)	-0.858*** (0.110)	-0.331*** (0.092)	-1.796*** (0.116)
Unused commitment ratio <sub>t-1</sub> × Crisis1	0.606*** (0.120)	0.741*** (0.140)	0.017 (0.094)	0.723*** (0.217)
Unused commitment ratio <sub>t-1</sub> × Crisis2	-0.629*** (0.129)	-0.858*** (0.154)	-0.698*** (0.101)	-0.647*** (0.173)
<b>Controls</b>				
Net wholesale funding <sub>t-1</sub>	0.312*** (0.043)	0.525*** (0.036)	0.017 (0.037)	0.890*** (0.044)
Net wholesale funding <sub>t-1</sub> × Crisis1	0.107** (0.046)	0.160*** (0.052)	0.472*** (0.039)	0.574*** (0.062)
Net wholesale funding <sub>t-1</sub> × Crisis2	0.038 (0.049)	0.092 (0.057)	0.290*** (0.036)	0.323*** (0.058)
NPL to Loans <sub>t-1</sub>	1.077*** (0.236)	0.611* (0.313)	0.268 (0.171)	1.135*** (0.347)
NPL to Loans <sub>t-1</sub> × Crisis1	-0.578 (0.465)	0.442 (0.520)	0.818*** (0.270)	2.285** (0.946)
NPL to Loans <sub>t-1</sub> × Crisis2	1.166*** (0.316)	2.088*** (0.395)	1.167*** (0.213)	2.389*** (0.459)
Capital ratio <sub>t-1</sub>	-0.830** (0.327)	-0.161 (0.223)	-1.815*** (0.261)	0.389 (0.260)
Capital ratio <sub>t-1</sub> × Crisis1	0.780*** (0.219)	0.683*** (0.233)	0.368 (0.304)	0.173 (0.418)
Capital ratio <sub>t-1</sub> × Crisis2	-0.445 (0.315)	-0.804** (0.352)	0.341 (0.216)	-0.555* (0.333)
Large Bank Indicator	-0.244* (0.146)	-0.229* (0.134)	-0.039 (0.123)	-0.389*** (0.088)
Large Bank Indicator × Crisis1	-0.153 (0.137)	-0.203 (0.164)	-0.320*** (0.073)	-0.664*** (0.091)
Large Bank Indicator × Crisis2	-0.162 (0.102)	-0.148 (0.143)	-0.048 (0.071)	-0.156* (0.093)
Bank Fixed Effects	Yes	No	Yes	No
Observations	196124	196124	196151	196151
R <sup>2</sup>	0.74	0.71	0.89	0.76

The sample period of the regressions is from 1994 to 2009, using quarterly Call Report data.

All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies (unless otherwise noted).

The reported R<sup>2</sup> is the within R<sup>2</sup>. All regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits). Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 4. The Relationship between Deposit Inflows and Liquidity Demand Risk in the Crisis  
(Allowing for Two Phases of the Crisis: 2007Q3-2008Q2 and 2008Q3-2009Q2)**

	(1)	(2)	(3)	(4)
	$\Delta \text{Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Core Deposits}_t / \text{Assets}_{t-1}$	$\Delta \text{Brokered Deposits}_t / \text{Assets}_{t-1}$	TAG Deposits (2008Q4) / $\text{Assets}_{t-1}$
Unused commitment ratio <sub>t-1</sub>	0.035*** (0.004)	0.025*** (0.003)	0.008*** (0.001)	0.190*** (0.016)
Unused commitment ratio <sub>t-1</sub> × Crisis1	-0.011* (0.006)	-0.012** (0.005)	0.006*** (0.002)	
Unused commitment ratio <sub>t-1</sub> × Crisis2	0.016*** (0.006)	0.005 (0.005)	0.017*** (0.002)	
<b>Controls</b>				
Net wholesale funding <sub>t-1</sub>	0.067*** (0.002)	0.065*** (0.002)	0.008*** (0.000)	-0.027*** (0.006)
Net wholesale funding <sub>t-1</sub> × Crisis1	-0.013*** (0.002)	-0.0004 (0.002)	0.003*** (0.001)	
Net wholesale funding <sub>t-1</sub> × Crisis2	0.006*** (0.002)	0.010*** (0.002)	0.006*** (0.001)	
NPL to Loans <sub>t-1</sub>	-0.193*** (0.014)	-0.140*** (0.010)	-0.040*** (0.004)	0.054 (0.040)
NPL to Loans <sub>t-1</sub> × Crisis1	0.003 (0.017)	0.016 (0.015)	0.015 (0.010)	
NPL to Loans <sub>t-1</sub> × Crisis2	0.061*** (0.019)	0.043*** (0.015)	0.003 (0.006)	
Capital ratio <sub>t-1</sub>	0.185*** (0.012)	0.155*** (0.009)	0.018*** (0.003)	-0.027 (0.028)
Capital ratio <sub>t-1</sub> × Crisis1	0.031** (0.013)	0.030*** (0.011)	0.006* (0.003)	
Capital ratio <sub>t-1</sub> × Crisis2	0.075*** (0.014)	0.055*** (0.012)	0.021*** (0.004)	
Large Bank Indicator	-0.006** (0.003)	-0.005** (0.002)	-0.002** (0.001)	0.021** (0.009)
Large Bank Indicator × Crisis1	0.011*** (0.004)	0.005* (0.003)	-0.001 (0.001)	
Large Bank Indicator × Crisis2	-0.005 (0.005)	0.010*** (0.003)	-0.006*** (0.001)	
Bank Fixed Effects	Yes	Yes	Yes	No
Observations	197198	197198	196655	3522
R <sup>2</sup>	0.07	0.08	0.04	0.13

The sample period of the regressions is from 1994 to 2009, using quarterly Call Report data.

Specifications in columns (1) to (3) are panel regressions with fixed effects for bank organizations. The reported R<sup>2</sup> is the within R<sup>2</sup>. The specification in column (4) is cross-sectional for 2008Q4 when the Transaction Account Guarantee (TAG) was introduced. Also controlled for in column (4) is the share of transaction deposits. Regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits). Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2. The standard errors used in calculating significance levels are clustered at the bank organization level. See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 5. The Relationship between Lending, Loan to Deposit Shortfalls and Liquidity Demand Risk in the Crisis  
(Allowing for Two Phases of the Crisis: 2007Q3-2008Q2 and 2008Q3-2009Q2)**

	(1) $\Delta \text{ Loans}_t /$ $\text{Assets}_{t-1}$	(2) $\Delta (\text{Loan} +$ $\text{Commitments})_t /$ $(\text{Assets} +$ $\text{Commitments})_{t-1}$	(3) $(\text{Loans} - \text{Deposits})_t /$ $\text{Assets}_{t-1}$	(4) $\Delta (\text{Loans} - \text{Deposits})_t /$ $\text{Assets}_{t-1}$
Unused commitment ratio $_{t-1}$	0.134*** (0.006)	-0.016*** (0.004)	-0.043*** (0.016)	0.098*** (0.006)
Unused commitment ratio $_{t-1} \times \text{Crisis1}$	0.013*** (0.005)	-0.021*** (0.005)	0.108*** (0.019)	0.023*** (0.007)
Unused commitment ratio $_{t-1} \times \text{Crisis2}$	-0.005 (0.006)	-0.051*** (0.006)	0.082*** (0.017)	-0.022*** (0.007)
<b>Controls</b>				
Net wholesale funding $_{t-1}$	-0.012*** (0.001)	-0.020*** (0.001)	0.516*** (0.008)	-0.083*** (0.002)
Net wholesale funding $_{t-1} \times \text{Crisis1}$	-0.005*** (0.002)	-0.011*** (0.002)	0.035*** (0.006)	0.007*** (0.002)
Net wholesale funding $_{t-1} \times \text{Crisis2}$	-0.014*** (0.002)	-0.027*** (0.002)	0.020*** (0.007)	-0.021*** (0.003)
NPL to Loans $_{t-1}$	-0.303*** (0.017)	-0.382*** (0.020)	-0.249*** (0.035)	-0.106*** (0.012)
NPL to Loans $_{t-1} \times \text{Crisis1}$	-0.067*** (0.017)	-0.089** (0.038)	-0.058 (0.050)	-0.069*** (0.018)
NPL to Loans $_{t-1} \times \text{Crisis2}$	0.022 (0.020)	-0.016 (0.020)	-0.055 (0.038)	-0.045*** (0.016)
Capital ratio $_{t-1}$	0.016 (0.010)	0.021* (0.011)	0.736*** (0.052)	-0.171*** (0.014)
Capital ratio $_{t-1} \times \text{Crisis1}$	0.041*** (0.010)	0.041*** (0.011)	0.028 (0.039)	0.019 (0.018)
Capital ratio $_{t-1} \times \text{Crisis2}$	0.052*** (0.011)	0.048*** (0.012)	-0.003 (0.050)	-0.025 (0.017)
Large Bank Indicator	0.001 (0.003)	-0.002 (0.003)	-0.005 (0.026)	0.007* (0.004)
Large Bank Indicator $\times$ Crisis1	0.007*** (0.003)	0.011*** (0.003)	-0.065*** (0.015)	-0.003 (0.004)
Large Bank Indicator $\times$ Crisis2	0.010*** (0.003)	0.012*** (0.003)	-0.048*** (0.014)	0.016*** (0.005)
Bank Fixed Effects	Yes	Yes	Yes	Yes
Observations	197198	197198	197198	197198
R <sup>2</sup>	0.15	0.11	0.50	0.10

The sample period of the regressions is from 1994 to 2009, using quarterly Call Report data.

All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies. The reported R<sup>2</sup> is the within R<sup>2</sup>.

Regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposit Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2).

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 6. The Joint Determination of a Bank's Deposit Rates and Quantities: An IV Approach**  
Instrumenting for deposits in the interest rate equation (identifying "Bank Supply")

	(1) Large Time Rate	(2) Deposits to Assets (insured)	(3) Large Time Rate	(4) Core Rate
		First Stage	IV	IV
<b>Instruments</b>				
Share of failed deposits in a bank's geographic market <sub>t</sub>	-0.612*** (0.195)	0.176*** (0.026)		
Seniors as share of population in a bank's geographic market (Senior <sub>t</sub> )	-1.309 (0.856)	0.840*** (0.147)		
<b>Instrumented variable</b>				
Deposits to Assets (insured) <sub>t</sub>			-1.870** (0.930)	-1.268* (0.745)
<b>Unused commitments</b>				
Unused commitment ratio <sub>t-1</sub>	0.128 (0.098)	-0.148*** (0.015)	-0.146 (0.174)	-0.428*** (0.138)
Unused commitment ratio <sub>t-1</sub> × Crisis1	0.596*** (0.119)	-0.012 (0.016)	0.573*** (0.118)	-0.033 (0.098)
Unused commitment ratio <sub>t-1</sub> × Crisis2	-0.599*** (0.129)	0.020 (0.015)	-0.567*** (0.137)	-0.711*** (0.102)
<b>Controls</b>				
Net wholesale funding <sub>t-1</sub>	0.294*** (0.042)	-0.189*** (0.009)	-0.062 (0.183)	-0.265* (0.148)
Net wholesale funding <sub>t-1</sub> × Crisis1	0.096** (0.046)	-0.007 (0.005)	0.098** (0.047)	0.447*** (0.040)
Net wholesale funding <sub>t-1</sub> × Crisis2	0.035 (0.049)	0.010* (0.006)	0.062 (0.052)	0.292*** (0.038)
NPL to Loans <sub>t-1</sub>	0.760*** (0.243)	0.438*** (0.034)	1.559*** (0.484)	0.611 (0.383)
NPL to Loans <sub>t-1</sub> × Crisis1	-0.522 (0.463)	-0.033 (0.066)	-0.568 (0.479)	1.002*** (0.383)
NPL to Loans <sub>t-1</sub> × Crisis2	1.301*** (0.311)	0.081* (0.047)	1.461*** (0.323)	1.309*** (0.257)
Capital ratio <sub>t-1</sub>	-0.953*** (0.336)	-0.410*** (0.055)	-1.913*** (0.535)	-2.601*** (0.393)
Capital ratio <sub>t-1</sub> × Crisis1	0.747*** (0.219)	0.127*** (0.029)	1.148*** (0.269)	0.319 (0.319)
Capital ratio <sub>t-1</sub> × Crisis2	-0.447 (0.318)	0.138*** (0.038)	-0.043 (0.378)	0.547** (0.258)
Large Bank Indicator	-0.083 (0.127)	0.0004 (0.015)	-0.078 (0.131)	0.031 (0.031)
Large Bank Indicator × Crisis1	-0.178 (0.139)	0.023*** (0.009)	-0.139 (0.143)	-0.286*** (0.073)
Large Bank Indicator × Crisis2	-0.191* (0.103)	0.014 (0.011)	-0.166 (0.112)	-0.036 (0.070)
<b>Local conditions controls</b>				
Percentage change in house prices in a bank's geographic market <sub>t</sub>	-0.865*** (0.187)	-0.098*** (0.024)	-1.043*** (0.218)	-1.061*** (0.182)
Percentage change in employment in a bank's geographic market <sub>t</sub>	0.075 (0.084)	-0.020*** (0.007)	0.045 (0.087)	-0.091 (0.056)
Percentage change in establishments in a bank's geographic market <sub>t</sub>	-0.478*** (0.092)	-0.040*** (0.008)	-0.556*** (0.099)	-0.190*** (0.071)
Bank Fixed Effects	Yes	Yes	Yes	Yes
Observations	178857	178481	178481	178481
R <sup>2</sup>	0.76	0.61	0.76	0.89

The sample period of the regressions is from 1996 to 2009, using quarterly Call Report data.

All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies. The reported R<sup>2</sup> is the within R<sup>2</sup>.

All regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits). Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2. The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 7. Average Weekly Funding and Asset Growth  
(All Domestically Chartered Banks, in %)**

	1998 LTCM Crisis		2007-2009 Financial Crisis			
	Previous 5 years to crisis	Fall 1998	Previous 5 years to crisis	July 4 2007 - Sept 10 2008 (pre-Lehman failure)	Period immediately following Lehman failure (last 2 weeks of September 2008)	Oct 8 2008 - July 1 2009
<b>Liabilities</b>						
Deposits	0.060	0.194	0.095	0.071	0.952	0.085
of which, Core deposits	0.042	0.173	0.077	0.051	0.564	0.115
Other borrowings	0.033	0.149	0.026	0.038	0.448	-0.063
of which, Other borrowings not from banks in U.S.	0.021	0.103	0.026	0.029	0.405	-0.067
<b>Assets</b>						
Loans	0.095	0.181	0.112	0.103	0.564	-0.049
of which, C&I loans	0.027	0.048	0.010	0.033	0.159	-0.024
Liquid assets	0.017	0.170	0.032	0.028	0.632	0.083

The sample is weekly reporters in the Federal Reserve H8 Release for all domestically chartered banks (exclude the branches and agencies of foreign banks). The weekly growth rates are defined as the weekly change in the variable divided by total assets in the previous week, and then averages are taken within the different time periods shown (1993-1998 and 2002-2009). Note that the H8 Release reports total loans as "loans and leases in bank credit"; core deposits are reported as "other deposits" where total deposits are the sum of "other deposits" and "large-time deposits"; and we take liquid assets as the sum of cash assets, securities, and interbank loans extended.

**Table 8. The Relationship between Market Stress and Growth in Deposits and Loans:  
Was it Different in the 2007-2009 Crisis? Revisiting Gatev and Strahan (2006)  
Stress is Proxied by the Commercial Paper Spread**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\Delta \text{Deposits}_t / \text{Assets}_{t-1}$			$\Delta \text{Loans}_t / \text{Assets}_{t-1}$			Rates, % annual	
	Gatev and Strahan sample 1991-2000	1990-2009	1990-2009	Gatev and Strahan sample 1991-2000	1990-2009	1990-2009	Large Time	Core
Unused commitment ratio $_{t-1}$	-0.021*** (0.007)	0.025*** (0.003)	0.025*** (0.003)	0.087*** (0.010)	0.110*** (0.007)	0.113*** (0.007)	-1.735*** (0.161)	-1.291*** (0.117)
<b>Unused commitment ratio<math>_{t-1} \times \text{Stress}</math></b>	<b>0.041*** (0.011)</b>	<b>0.007 (0.005)</b>	<b>0.022*** (0.008)</b>	<b>0.047*** (0.012)</b>	<b>0.004 (0.005)</b>	<b>0.032*** (0.009)</b>	<b>0.549* (0.281)</b>	<b>-0.588*** (0.198)</b>
<b>Unused commitment ratio<math>_{t-1} \times \text{Stress} \times \text{Crisis1}</math></b>			<b>-0.039** (0.017)</b>			<b>-0.020 (0.018)</b>	<b>1.000** (0.441)</b>	<b>2.053*** (0.328)</b>
<b>Unused commitment ratio<math>_{t-1} \times \text{Stress} \times \text{Crisis2}</math></b>			<b>0.018 (0.013)</b>			<b>-0.023* (0.013)</b>	<b>0.101 (0.341)</b>	<b>0.667*** (0.238)</b>
Unused commitment ratio $_{t-1} \times \text{Crisis1}$			0.004 (0.014)			-0.004 (0.013)	-0.196 (0.308)	-1.040*** (0.212)
Unused commitment ratio $_{t-1} \times \text{Crisis2}$			-0.011 (0.007)			-0.021*** (0.006)	0.168 (0.168)	-0.146 (0.129)
<b>Controls</b>								
Capital ratio and interactions with stress and crisis	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and interactions with stress and crisis	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114323	252526	252526	114323	252526	252526	235491	235532
R <sup>2</sup>	0.05	0.04	0.04	0.05	0.08	0.08	0.73	0.91

The sample period of the regressions is from 1990 to 2009, except for the Gatev and Strahan sample period (1991-2000). The data are from the quarterly Call Reports.

All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies. The reported  $\hat{R}^2$  is the within  $R^2$ .

Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy equal to 1 from 2008Q3 to 2009Q2. Following Gatev and Strahan, the interaction of the 3 month Treasury bill rate with unused commitment ratio is also controlled for. The standard errors used in calculating significance levels are clustered at the bank organization level. See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 9. Additional Measures: Maturity Structure of Large-Time Deposits**

	(1) Large Time Rate	(2) Core Rate	(3) Share of Large Time Deposits Maturing in One Year or Less
<b><i>Maturity Structure</i></b>			
Share of large-time deposits maturing in 1 year <sub>t-1</sub>	-0.696*** (0.030)	-0.037* (0.022)	
Share of large-time deposits maturing in 1 year <sub>t-1</sub> × Crisis1	0.995*** (0.055)	0.248*** (0.042)	
Share of large-time deposits maturing in 1 year <sub>t-1</sub> × Crisis2	-0.301*** (0.059)	-0.074* (0.041)	
<b><i>Unused commitments</i></b>			
Unused commitment ratio <sub>t-1</sub>	0.147 (0.100)	-0.271*** (0.077)	-0.012 (0.018)
Unused commitment ratio <sub>t-1</sub> × Crisis1	0.324*** (0.118)	-0.054 (0.095)	0.061*** (0.023)
Unused commitment ratio <sub>t-1</sub> × Crisis2	-0.505*** (0.126)	-0.693*** (0.099)	0.034 (0.022)
<b><i>Controls</i></b>			
Net wholesale funding <sub>t-1</sub>	0.251*** (0.042)	-0.049 (0.040)	-0.037*** (0.009)
Net wholesale funding <sub>t-1</sub> × Crisis1	0.124*** (0.044)	0.474*** (0.038)	0.045*** (0.009)
Net wholesale funding <sub>t-1</sub> × Crisis2	0.074 (0.048)	0.295*** (0.035)	0.033*** (0.009)
NPL to Loans <sub>t-1</sub>	0.847*** (0.241)	0.040 (0.189)	0.052 (0.045)
NPL to Loans <sub>t-1</sub> × Crisis1	-0.289 (0.435)	1.101*** (0.357)	-0.056 (0.084)
NPL to Loans <sub>t-1</sub> × Crisis2	1.328*** (0.304)	1.239*** (0.231)	0.026 (0.062)
Capital ratio <sub>t-1</sub>	-0.858*** (0.323)	-2.116*** (0.297)	0.025 (0.072)
Capital ratio <sub>t-1</sub> × Crisis1	0.581*** (0.217)	0.212 (0.288)	-0.077 (0.047)
Capital ratio <sub>t-1</sub> × Crisis2	-0.426 (0.312)	0.444** (0.221)	-0.052 (0.052)
Large Bank Indicator	-0.038 (0.147)	0.058 (0.095)	0.014 (0.019)
Large Bank Indicator × Crisis1	-0.185 (0.136)	-0.322*** (0.069)	0.003 (0.013)
Large Bank Indicator × Crisis2	-0.195** (0.098)	-0.057 (0.068)	-0.034** (0.015)
Bank Fixed Effects	Yes	Yes	Yes
Observations	163450	163167	166477
R <sup>2</sup>	0.78	0.89	0.21

The sample period of the regressions is from 1997 to 2009 (maturity information available from 1997), using quarterly Call Report data. All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies.

The reported R<sup>2</sup> is the within R<sup>2</sup>. All regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits). Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table 10. Predictors of Bank Failure in the Crisis**  
**(Regressions control for local economic conditions and deposit market concentration)**

	(1)	(2)	(3)	(4)
	All Fail	Formal Fail	All Fail	All Fail
	Linear probability model	Linear probability model	Proportional Hazards Cox model	Proportional Hazards Cox model
	Cross-sectional (failure over post-2007Q3 period)	Cross-sectional (failure over post-2007Q3 period)	Pooled (failure is time-specific within post-2007Q3 period)	Pooled (failure is time-specific within post-2007Q3 period)
<b><i>Bank risk measures and controls</i></b>				
Unused commitment ratio (pre-crisis)	0.200*** (0.045)	0.086** (0.036)	5.793*** (0.774)	4.928*** (0.765)
Net wholesale funding (pre-crisis)	0.136*** (0.019)	0.096*** (0.017)	3.648*** (0.420)	3.583*** (0.415)
NPL to Loans (pre-crisis)	2.140*** (0.401)	1.786*** (0.371)	26.874*** (3.203)	20.962*** (3.596)
Capital ratio (pre-crisis)	-0.096** (0.042)	-0.086** (0.038)	-5.824** (2.410)	-4.896* (2.514)
Large Bank Indicator (pre-crisis)	0.164* (0.092)	-0.082*** (0.012)	0.523 (0.490)	0.553 (0.529)
Large-time deposit rate (pre-crisis)	0.002* (0.001)	0.001* (0.001)	0.279*** (0.074)	0.287*** (0.074)
Deposit growth <sub>t</sub>				-14.027*** (2.295)
Deposit growth <sub>t-1</sub>				-3.325** (1.521)
Deposit growth <sub>t-2</sub>				-0.747 (1.157)
Observations	4218	4218	36462	36444
R <sup>2</sup>	0.09	0.07	-	-
Likelihood ratio test $\chi^2_{(model\ degrees\ of\ freedom)}$			488.1	516.95

The sample period of the regressions is from 2007Q3 to 2009Q4, using quarterly Call Report data. The regressions are cross-sectional in columns (1) to (2), where the dependent variable is failure occurring at any point during the crisis (post-2007Q3 period).

The regressions are pooled cross-sectional and time-series for the hazard analysis in columns (3) and (4), where failure is bank-time specific and the model allows for time-varying covariates. Columns (3) and (4) report the parameter estimates  $\beta$  from the Cox proportional hazards analysis. Failure covers both regulatory-assisted failures and near-fails, as measured by large negative returns on the market value of equity (specifically, the first date when the 18-month return was worse than -90% using daily CRSP data following Acharya, Pedersen, Philippon, and Richardson, 2010), with the exception of column (2) which is for regulatory failure only.

All regressions also control for the deposit concentration, fractions of seniors in the local market, as well as for local economic conditions (percentage change in house prices, employment and establishments - both pre-crisis (2006Q1-2007Q2 average) and during the crisis).

The standard errors used in calculating significance levels are robust and also clustered at the bank organization level in columns (3) and (4). See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

## Appendix. Variable Definitions

### Dependent variables (Call Reports)

	Bank panel data are from the quarterly Reports of Condition and Income, (FFIEC 031 for banks with domestic and foreign offices; FFIEC 041 for banks with domestic offices only). Banks are aggregated to top holder level (RSSD9348). Bank organizations with assets less than \$100 million are excluded, as are non-U.S. domiciled banking organizations. As a merger control, bank organizations with asset growth greater than 10% during a quarter are excluded in that quarter. Growth rates are defined as the quarterly change in the variable divided by beginning of period assets (RCFD2170). Growth rates are also winsorized at the 1st and 99th percentiles to mitigate the effect of outliers.
Interest rate, large time deposits (implicit)	Interest expense on large time deposits: RIADA517 (RIAD4174 before 1997Q1) (adjusted year-to-date reporting to within quarter) divided by quarterly average of large time deposits: RCONA514 (RCON3345 before 1997Q1). Expressed as % annual rate.
Interest rate, core deposits (implicit)	Interest expense on core deposits: RIAD4508 + RIAD0093 (RIAD4509 + RIAD4511 before 2001Q1) + RIADA518 (RIAD4512 before 1997Q1), (adjusted year-to-date reporting to within quarter) divided by quarterly average of core deposits: RCON3485 + RCONB563 (RCON3486 + RCON3487 before 2001Q1) + RCONA529 (RCON3469 before 1997Q1). Expressed as % annual rate.
Quarterly growth in deposits	Deposits: RCFD2200.
Quarterly growth in core deposits	Core deposits are the sum of transaction deposits, saving deposits, and time deposits less than \$100,000: RCON2215 + RCON6810 + RCON0352 + RCON6648.
Quarterly growth in insured deposits	Insured deposits are accounts of \$100,000 or less (include retirement accounts of \$250,000 or less after 2006Q2). Note that from 2009Q3, reporting thresholds on non-retirement deposits increased from \$100,000 to \$250,000. Insured deposits: RCON2702 (before 2006Q2); RCONF049 + RCONF045 (from 2006Q2).
Quarterly growth in brokered deposits	Brokered Deposits (received from brokers or dealers): RCON2365.
Transaction account guarantee program deposit share (2008Q4)	Non-interest bearing transaction accounts of more than \$250,000 for banks participating in the FDIC transaction account program (RCONG167). The share at the start of the program (2008Q4) is defined as a share of beginning of period assets.
Quarterly growth in loans	Loans: RCFD1400.
Quarterly growth in credit (loans+commitments)	Credit is the sum of loans (RCFD1400) and unused commitments (RCFD3814 + RCFD3816 + RCFD3817 + RCFD3818 + RCFD6550 + RCFD3411). The denominator in the growth rate is the sum of beginning of period assets and commitments.

### Dependent variables (Bank Rate Monitor 1997-2009)

	A weekly bank (and thrift) panel data set of current checking and CD rates based on a weekly survey of branches of financial institutions carried out by Bank Rate Monitor (data are proprietary). The panel is unbalanced with 1250 bank-branch cross-sectional observations on average over the period 9/19/1997 - 12/25/2009. This set corresponds to 358 banks and 214 banking organizations on average, respectively (these are a small subset of banks filing Call Reports, which are over 6000 organizations on average). The data are aggregated to top holder by taking the average rate within a banking organization (after cleaning the data for duplicates and missing observations). For branch-level analysis, each branch is matched to the relevant geographic area in the Summary of Deposits.
Interest checking rate	Reported rate on interest checking account.
CD 12 month rate	Reported rate on 12 month CD. Similarly for CD 24 month and CD 60 month.

### Covariates

Bank failure indicator	Indicator equal to 1 in the quarter corresponding to a bank failure, and 0 otherwise. Failure can be regulatory-assisted (denoted 'formal' fail in Table 2), near-fail based on market equity data (denoted CRSP fail in Table 2), or both. In total based on Call Report sample, there are 517 formal fails and 91 near-fails (of which 16 result in formal fail later). Specifically, regulatory-assisted failure is if RSSD9061 = 4 or 5. And cross-checked/merged with FDIC's failed bank list as of 4/16/2010. Regulatory failure is at the bank level. Indicator assigned to top holder if failed bank asset share at time of failure was over 10% of holding company assets. CRSP near-fails are the period first associated with market equity returns worse than -90% over an 18-month period (Acharya et al, 2010). The CRSP data are matched to bank identifiers using the CRSP-FRB link: <a href="http://www.newyorkfed.org/research/banking_research/datasets.html">http://www.newyorkfed.org/research/banking_research/datasets.html</a>
Unused commitment ratio	Unused commitments divided by the sum of unused commitments and loans. Unused commitments are: RCFD3814 + RCFD3816 + RCFD3817 + RCFD3818 + RCFD6550 + RCFD3411.
Liquidity ratio (liquid assets to assets, excludes MBS/ABS)	Liquid assets are cash, federal funds sold & reverse repos, and securities excluding MBS/ABS securities: Cash: RCFD0010; Federal funds sold: RCFD1350 (before 2002Q1) and RCONB987 + RCFDB989 (from 2002Q1). Securities excl. MBS/ABS before 2009Q2: RCFD1754+RCFD1773 - (RCFD8500+RCFD8504+RCFDC026+RCFD8503+RCFD8507+RCFDC027). And from 2009Q2: RCFD1754 + RCFD1773 - (RCFDG300 + RCFDG304 + RCFDG308 + RCFDG312 + RCFDG316 + RCFDG320 + RCFDG324 + RCFDG328 + RCFDC026 + RCFDG336 + RCFDG340 + RCFDG344 + RCFDG303 + RCFDG307 + RCFDG311 + RCFDG315 + RCFDG319 + RCFDG323 + RCFDG327 + RCFDG331 + RCFDG339 + RCFDC027 + RCFDG339 + RCFDG343 + RCFDG347).
Wholesale funding to asset ratio	Wholesale funds (also known as managed liabilities in the Federal Reserve Bulletin) are the sum of: large-time deposits, deposits booked in foreign offices, subordinated debt and debentures, gross federal funds purchased, repos, and other borrowed money: RCON2604 + RCFN2200 + RCFD3200 + RCFD2800 (RCONB993+RCFDB995 from 2002q1) + RCFD3190.
Net wholesale funding to asset ratio	Wholesale funds less liquid assets to asset ratio.
Nonperforming loans to loans	Loans past due 90 days or more and nonaccruals: RCFD1407 + RCFD1403.
Capital ratio (book capital to assets)	Book capital to asset ratio. Capital: RCFD3210.
Indicator for Large Banks	Indicator equal to one for the largest 25 commercial banking organizations by asset size (time-varying).
Real Estate Loan Share	Loans secured by real estate (RCFD1410) divided by total loans.
Residential Mortgages Sold	Closed-end 1-4 family residential mortgages sold in the quarter, including first and junior liens: RCFDF070 + RCFDF071, divided by assets.
Volatility of daily equity returns (quarterly)	The standard deviation of market-adjusted daily returns, where both bank and market returns incorporate dividends. The market return is the SNL bank index. Daily return data are from CRSP.
Equity Return (quarterly, market-adjusted)	Return on equity, calculated based on end of quarter and beginning of quarter market prices, and adjusted for market return.
Quasi market capital to asset ratio (end quarter)	Defined as: Market equity/(Book assets - Book equity + Market equity), where market equity equals Shares outstanding*Price end of quarter. Book assets and book equity are from Call Reports, where book assets are RCFD2170 and book equity is total equity capital (RCFD3210) minus the book value of preferred stock and related surplus (RCFD3838).
Share of large-time deposits maturing in 1 year	Large-time deposits with a remaining maturity or next repricing date of 3 months or less and 3-12 months: RCONA584 + RCONA585, divided by total large-time deposits (RCON2604).
Geographic market deposit concentration (HHI)	The branch deposit-weighted geographic market deposit concentration (annual from the FDIC's Summary of Deposits (SOD)). The geographic market is defined as the MSA (CBSA_METROB) if urban or the county (STCNTYBR) if rural.
Geographic market share of failed deposits	The share of deposits belonging to failed banks and thrifts in a bank's geographic market (branch deposit weighted). See above details on Summary of Deposits and the failed financial institution information above (latter is merged into SOD).
Geographic market senior share	Seniors (65 and over) as a share of population in bank's geographic market (branch deposit-weighted). Data from 2000 census matched to SOD areas)
Geographic market % change house prices	Quarterly percentage change in housing price index (all-transaction) in a bank's geographic market (branch deposit-weighted). Source: FHFA.
Geographic market % change in employment	Change in total private employment, log differences, year-on-year, in a bank's geographic market (branch deposit-weighted). Source: QCEW.
Geographic market % change in establishments	Change in total private establishments, log differences, year on year, in a bank's geographic market (branch deposit-weighted). Source: QCEW.
District time trends	Regional time trends based on the Federal Reserve district the main bank in a banking organization is located (RSSD9170).

### Aggregate characteristics

Commercial paper spread (%)	The CP spread is the 3 month commercial paper rate for high grade nonfinancial borrowers - 3 month T-bill rate.(Federal Reserve H.15 release)
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**Table A1. Summary statistics for regression bank panel 1990Q1-2009Q4**

	Mean	Standard Deviation	25th Percentile	Median	75th Percentile	Observations
<i>Dependent variables (Call Reports)</i>						
Interest rate, large time deposits (implicit, % annual)	4.526	1.571	3.344	4.567	5.538	238557
Interest rate, core deposits (implicit, % annual)	3.406	1.443	2.265	3.397	4.295	238543
Quarterly growth in deposits	0.011	0.031	-0.006	0.008	0.028	253492
Quarterly growth in core deposits	0.008	0.028	-0.006	0.006	0.023	253492
Quarterly growth in insured deposits	0.007	0.029	-0.005	0.003	0.015	244002
Quarterly growth in brokered deposits	0.001	0.008	0.000	0.000	0.000	236763
Transaction account guarantee program deposit share (2008Q4)	0.033	0.045	0.004	0.021	0.044	21674
Quarterly growth in loans	0.010	0.029	-0.003	0.010	0.025	253492
Quarterly growth in credit (loans + commitments)	0.011	0.032	-0.004	0.010	0.027	253492
Loan-deposit Shortfall	-0.154	0.240	-0.290	-0.176	-0.057	253492
Quarterly growth in loan-deposit shortfall	0.000	0.038	-0.021	0.000	0.021	253492
<i>Dependent variables (Bank Rate Monitor 1997-2009)</i>						
Interest checking rate (%)	0.610	0.601	0.150	0.400	1.000	107466
CD 12 month rate (%)	3.170	1.540	1.740	3.200	4.500	107298
CD 24 month rate (%)	3.448	1.412	2.230	3.444	4.640	104874
CD 60 month rate (%)	4.023	1.153	3.200	4.020	4.890	97235
<i>Covariates</i>						
Regulatory-assisted failure dummy (formal fail)	0.0009	0.029	0.000	0.000	0.000	258108
Market-equity < -90% failure dummy (CRSP near-fail)	0.0003	0.018	0.000	0.000	0.000	258108
All fail dummy (formal and near-fails)	0.0012	0.034	0.000	0.000	0.000	258108
Unused commitment ratio	0.127	0.087	0.070	0.117	0.170	257078
Liquidity ratio (excludes MBS/ABS)	0.242	0.144	0.141	0.218	0.312	215100
Wholesale funding ratio	0.198	0.144	0.103	0.171	0.255	258108
Net wholesale funding ratio (wholesale - liquid)	-0.030	0.219	-0.163	-0.031	0.099	215100
Nonperforming loans to loans	0.012	0.020	0.002	0.007	0.014	228042
Capital ratio (book capital to assets)	0.091	0.045	0.076	0.089	0.106	258108
Indicator for Large Banks	0.007	0.084	0.000	0.000	0.000	258108
Real Estate Loan Share	0.642	0.235	0.527	0.682	0.809	257015
Residential Mortgages Sold (normalized by assets)	0.008	0.056	0.000	0.000	0.000	52964
Volatility of daily equity returns (quarterly)	0.027	0.022	0.015	0.022	0.031	28528
Equity Return (quarterly, market-adjusted)	-0.002	0.333	-0.085	-0.005	0.078	28528
Quasi market capital to asset ratio (end of quarter)	0.138	0.074	0.095	0.132	0.171	28544
Share of large-time deposits maturing in 1 year or less	0.756	0.215	0.678	0.810	0.902	175410
Geographic market deposit concentration (HHI, branch deposit-weighted)	0.175	0.108	0.102	0.148	0.213	200761
Geographic market share of failed deposits (branch deposit-weighted)	0.001	0.007	0.000	0.000	0.000	200761
Geographic market senior share (branch deposit-weighted)	0.133	0.031	0.112	0.129	0.150	200761
Geographic market percentage change in house prices (branch deposit-weighted)	0.009	0.017	0.003	0.010	0.017	198192
Geographic market percentage change in employment (branch deposit-weighted)	0.002	0.036	-0.013	0.007	0.022	180754
Geographic market percentage change in establishments (branch deposit-weighted)	0.011	0.027	-0.002	0.011	0.025	180795
<i>Aggregate characteristics</i>						
Commercial paper spread (%)	0.37	0.23	0.20	0.37	0.47	80

**Pairwise Correlation Coefficients for Key Covariates in Regression Bank Panel 1990Q1-2009Q4**

	1	2	3	4	5
1 Unused commitment ratio	1.000				
2 Net wholesale funding ratio	0.053	1.000			
3 Nonperforming loans to loans	-0.036	0.044	1.000		
4 Capital ratio (book capital to assets)	0.059	-0.214	0.053	1.000	
5 Indicator for Large Banks	0.225	0.087	0.009	0.003	1.000

Source: Call Reports, National Information Center, FDIC, Bank Rate Monitor, Summary of Deposits, CRSP, SNL Financial, HAVER Analytics, Federal Reserve H.15 release, 2000 Census, Federal Housing Finance Agency (FHFA), and Quarterly Census of Employment and Wages.

Note: Summary statistics are calculated over the regression sample (thus exclude mergers, non-U.S. domiciled banking organizations, and those below \$100 million in total assets). See Appendix for variable definitions.

**Table A2. Aggregate Balance Sheet for Banks During the 2007-2009 Financial Crisis**

This table shows the aggregate balance sheet of large banks and small banks, respectively. The second column reports the balance sheet item as a share of total assets in 2007Q2 (in %), and the following columns report the evolution over 2007Q3 to 2009Q4. For each balance sheet item, we report two figures (both in %). The first is the cumulative change of the balance sheet item normalized by 2007Q2 total assets  $(X_t - X_{2007Q2})/Total\ Asset_{2007Q2}$ . The second row (in gray italics) is the cumulative percent change of the balance sheet item from its level in 2007Q2  $(\ln X_t - \ln X_{2007Q2})$ . The source of the data is bank-level quarterly Call Report data, aggregated to the top holder level, for U.S.-domiciled banks.

Panel A. Large Banks (Largest 25 banks, H8 criteria)													
	Average quarterly change 2006Q1-2007Q2	Share of Assets, 2007Q2	Cumulative Change										Share of Assets, 2009Q4
			2007Q3	2007Q4	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2	2009Q3	2009Q4	
<b>Assets</b>													
Cash	0.1	4.3	-0.1	0.3	0.5	0.6	2.7	5.7	5.3	3.9	4.6	4.6	7.6
	<i>3.6</i>		<i>-2.8</i>	<i>6.6</i>	<i>11.9</i>	<i>13.2</i>	<i>48.2</i>	<i>84.1</i>	<i>80.1</i>	<i>64.6</i>	<i>72.8</i>	<i>73.2</i>	
Securities	0.3	12.3	0.1	0.0	0.5	1.3	2.3	2.3	3.8	5.3	5.8	7.1	16.5
	<i>1.8</i>		<i>1.1</i>	<i>0.2</i>	<i>3.8</i>	<i>10.0</i>	<i>16.8</i>	<i>17.2</i>	<i>26.9</i>	<i>35.8</i>	<i>38.8</i>	<i>45.3</i>	
MBS and ABS	0.2	9.2	0.0	0.2	1.0	1.6	2.6	2.0	2.4	3.5	3.4	3.9	11.2
	<i>2.4</i>		<i>0.1</i>	<i>2.5</i>	<i>10.2</i>	<i>16.1</i>	<i>24.8</i>	<i>19.8</i>	<i>23.3</i>	<i>32.1</i>	<i>31.2</i>	<i>35.1</i>	
Fed Funds and Repos	0.2	5.4	0.4	1.2	1.9	1.8	2.1	2.3	1.3	0.6	-0.1	-0.9	3.8
	<i>3.7</i>		<i>7.6</i>	<i>20.9</i>	<i>30.1</i>	<i>28.8</i>	<i>32.5</i>	<i>36.4</i>	<i>21.3</i>	<i>10.4</i>	<i>-1.1</i>	<i>-19.0</i>	
Trading Assets	0.5	11.0	1.0	1.8	3.1	1.9	2.0	2.4	0.3	-0.5	0.5	0.0	9.3
	<i>5.2</i>		<i>8.8</i>	<i>15.0</i>	<i>25.2</i>	<i>16.2</i>	<i>17.0</i>	<i>20.0</i>	<i>2.8</i>	<i>-4.4</i>	<i>4.7</i>	<i>-0.1</i>	
Total Loans	1.5	49.1	2.2	5.1	5.6	5.2	8.0	6.8	5.6	5.7	4.1	3.8	45.1
	<i>3.0</i>		<i>4.4</i>	<i>9.8</i>	<i>10.8</i>	<i>10.1</i>	<i>15.0</i>	<i>12.9</i>	<i>10.9</i>	<i>10.9</i>	<i>8.0</i>	<i>7.5</i>	
Real estate	0.9	25.0	0.4	1.8	1.8	1.2	3.4	3.2	3.0	3.7	2.9	3.4	24.3
	<i>3.7</i>		<i>1.4</i>	<i>6.9</i>	<i>6.8</i>	<i>4.8</i>	<i>12.7</i>	<i>11.9</i>	<i>11.4</i>	<i>13.6</i>	<i>11.1</i>	<i>12.9</i>	
C&I	0.4	10.3	0.9	1.6	2.0	2.0	2.2	2.0	1.6	1.0	0.1	-0.8	8.1
	<i>4.3</i>		<i>8.6</i>	<i>14.5</i>	<i>18.1</i>	<i>17.9</i>	<i>19.4</i>	<i>18.1</i>	<i>14.9</i>	<i>8.9</i>	<i>0.8</i>	<i>-7.6</i>	
Other loans	0.1	13.8	0.9	1.7	1.8	2.0	2.4	1.6	1.0	1.1	1.1	1.2	12.7
	<i>0.9</i>		<i>6.6</i>	<i>11.5</i>	<i>12.3</i>	<i>13.4</i>	<i>15.9</i>	<i>10.8</i>	<i>6.8</i>	<i>7.5</i>	<i>7.6</i>	<i>8.1</i>	
Total Assets	3.2	100.0	4.8	10.8	14.7	13.5	19.6	20.8	17.0	16.1	16.6	16.0	
	<i>3.2</i>		<i>4.8</i>	<i>10.8</i>	<i>14.7</i>	<i>13.5</i>	<i>19.6</i>	<i>20.8</i>	<i>17.0</i>	<i>16.1</i>	<i>16.6</i>	<i>16.0</i>	
<b>Liabilities</b>													
Deposits	1.7	56.5	2.5	6.6	8.2	7.8	11.6	14.4	12.9	14.2	15.8	17.3	62.9
of which:	<i>3.0</i>		<i>4.3</i>	<i>11.0</i>	<i>13.6</i>	<i>12.9</i>	<i>18.7</i>	<i>22.7</i>	<i>20.6</i>	<i>22.4</i>	<i>24.6</i>	<i>26.7</i>	
Insured deposits <sup>(a)</sup>	0.4	17.2	0.1	0.8	1.7	1.7	3.9	4.6	5.6	5.4	11.2	12.0	24.9
	<i>2.1</i>		<i>0.7</i>	<i>4.7</i>	<i>9.5</i>	<i>9.3</i>	<i>20.4</i>	<i>23.8</i>	<i>28.2</i>	<i>27.4</i>	<i>50.0</i>	<i>52.9</i>	
Core deposits <sup>(b)</sup>	0.6	32.3	0.2	2.4	3.8	3.4	6.3	9.7	10.8	11.8	12.4	14.7	40.0
	<i>1.6</i>		<i>0.6</i>	<i>7.1</i>	<i>11.1</i>	<i>9.9</i>	<i>17.8</i>	<i>26.3</i>	<i>28.9</i>	<i>31.1</i>	<i>32.6</i>	<i>37.4</i>	
Uninsured deposits <sup>(a)</sup>	1.3	39.3	2.4	5.7	6.5	6.1	7.7	9.7	7.3	8.8	4.6	5.3	38.0
	<i>3.4</i>		<i>5.8</i>	<i>13.6</i>	<i>15.3</i>	<i>14.5</i>	<i>18.0</i>	<i>22.1</i>	<i>17.0</i>	<i>20.2</i>	<i>11.1</i>	<i>12.6</i>	
Large time deposits	0.1	5.9	0.6	1.5	1.8	1.3	2.8	2.0	1.2	0.8	0.2	-0.2	4.9
	<i>1.1</i>		<i>9.7</i>	<i>23.2</i>	<i>26.9</i>	<i>20.5</i>	<i>39.2</i>	<i>29.6</i>	<i>18.7</i>	<i>12.1</i>	<i>4.1</i>	<i>-3.5</i>	
Fed Funds and Repos	0.3	7.3	-0.2	-0.1	0.6	0.8	1.4	0.6	0.5	0.3	-0.1	-2.1	4.5
	<i>3.4</i>		<i>-3.3</i>	<i>-1.0</i>	<i>8.4</i>	<i>10.0</i>	<i>17.4</i>	<i>8.0</i>	<i>6.4</i>	<i>4.5</i>	<i>-2.0</i>	<i>-33.2</i>	
Trading Liabilities	0.1	4.5	0.5	0.6	1.2	0.7	0.5	1.8	0.5	-0.6	-0.1	-0.6	3.3
	<i>1.7</i>		<i>10.3</i>	<i>11.8</i>	<i>24.0</i>	<i>15.1</i>	<i>11.3</i>	<i>34.5</i>	<i>9.9</i>	<i>-14.3</i>	<i>-3.3</i>	<i>-15.5</i>	
Other borrowing	0.4	9.0	1.4	1.5	1.8	1.8	3.8	3.1	2.2	0.6	-0.9	-0.4	7.4
	<i>4.7</i>		<i>14.3</i>	<i>15.3</i>	<i>17.9</i>	<i>18.0</i>	<i>34.7</i>	<i>29.6</i>	<i>21.5</i>	<i>5.9</i>	<i>-10.3</i>	<i>-4.1</i>	
of which: FHLB Advances	0.2	2.5	0.7	0.8	0.9	0.9	2.3	1.5	1.0	0.9	0.5	0.5	2.6
	<i>7.5</i>		<i>24.9</i>	<i>27.3</i>	<i>31.3</i>	<i>29.8</i>	<i>64.3</i>	<i>47.2</i>	<i>32.0</i>	<i>30.9</i>	<i>16.4</i>	<i>19.1</i>	
of which: Other (incl. Federal Reserve)	0.2	6.5	0.7	0.7	0.8	0.9	1.5	1.6	1.2	-0.4	-1.3	-0.9	4.8
	<i>3.7</i>		<i>9.9</i>	<i>10.1</i>	<i>12.1</i>	<i>13.0</i>	<i>20.3</i>	<i>21.8</i>	<i>17.1</i>	<i>-5.8</i>	<i>-23.0</i>	<i>-14.8</i>	
Subordinated Debt	0.1	1.8	0.1	0.2	0.2	0.2	0.2	0.3	0.1	0.1	0.0	-0.1	1.5
	<i>5.4</i>		<i>3.8</i>	<i>9.0</i>	<i>8.8</i>	<i>8.4</i>	<i>8.3</i>	<i>13.9</i>	<i>6.4</i>	<i>4.6</i>	<i>0.4</i>	<i>-3.4</i>	
Capital	0.3	10.6	0.6	1.3	1.5	1.5	1.7	1.6	2.5	3.0	3.5	3.9	12.4
	<i>3.0</i>		<i>5.5</i>	<i>11.3</i>	<i>13.0</i>	<i>13.3</i>	<i>14.5</i>	<i>14.4</i>	<i>21.2</i>	<i>24.8</i>	<i>28.1</i>	<i>31.2</i>	

Note:

(a) There is a break in the insured deposit series in 2009Q3 when banks were asked to report accounts under \$250,000 (the previous account limit reported was under \$100,000).

(b) Core deposits are defined as the sum of transaction deposits, savings deposits (including MMDAs), and time deposits of less than \$100,000.

Both core and large time deposits are components of domestic deposits. The remaining component of total deposits are foreign deposits.

Panel B. Small Banks

	Average quarterly change	Share of Assets, 2007Q2	Cumulative Change										Share of Assets, 2009Q4
			2007Q3	2007Q4	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2	2009Q3	2009Q4	
<b>Assets</b>													
Cash	-0.1	3.4	0.0	0.0	0.1	0.3	1.2	6.6	5.5	4.3	6.7	7.9	11.1
	-2.1		1.4	0.2	3.4	8.4	29.9	108.3	96.1	82.1	109.2	120.6	
Securities	-0.1	16.1	0.0	-0.2	-1.1	-1.2	-1.5	-0.9	-0.6	-0.9	-0.4	-0.4	15.4
	-0.4		-0.1	-1.4	-6.9	-8.0	-9.9	-5.9	-4.0	-5.4	-2.2	-2.8	
MBS and ABS	-0.1	6.1	-0.3	-0.4	-0.5	-0.4	-0.4	-0.2	-0.1	0.0	0.2	0.3	6.3
	-1.3		-5.8	-6.9	-8.4	-7.1	-6.2	-3.2	-1.0	0.5	3.8	4.8	
Fed Funds and Repos	0.3	6.6	0.0	0.0	-0.4	-1.3	-4.0	-5.3	-5.3	-5.5	-5.7	-5.7	0.8
	5.3		0.3	0.2	-6.7	-22.4	-93.5	-167.9	-164.3	-182.7	-203.7	-206.4	
Trading Assets	0.3	5.5	-0.1	0.0	0.9	0.2	-0.1	0.3	-0.2	-1.2	-1.4	-2.2	3.2
	5.7		-1.3	-0.8	15.4	4.1	-2.4	5.9	-4.6	-24.9	-30.0	-50.6	
Total Loans	0.8	51.7	1.6	2.4	2.6	3.3	4.7	5.1	4.0	3.1	1.5	0.8	51.3
	1.5		3.0	4.5	4.9	6.3	8.7	9.4	7.5	5.8	2.8	1.4	
Real estate	0.4	30.2	0.4	0.6	0.7	1.3	1.8	1.8	2.2	2.0	1.3	1.0	30.6
	1.2		1.3	1.9	2.3	4.3	5.8	5.8	7.1	6.5	4.1	3.3	
C&I	0.3	11.9	0.8	1.3	1.4	1.7	2.3	2.7	1.9	1.3	0.7	0.6	12.2
	2.2		6.7	10.4	10.9	13.5	17.8	20.7	14.8	10.3	5.5	4.8	
Other loans	0.2	9.6	0.4	0.5	0.5	0.3	0.6	0.6	-0.1	-0.2	-0.4	-0.8	8.6
	1.7		3.9	5.2	5.0	3.1	5.7	6.0	-0.6	-2.2	-4.8	-9.2	
Total Assets	2.1	100.0	1.5	3.0	4.4	4.2	4.7	5.2	3.5	2.3	2.8	2.0	
<b>Liabilities</b>													
Deposits	0.3	48.7	-0.6	-1.0	-1.0	-0.9	-0.3	0.7	1.0	1.1	1.2	2.0	49.7
	0.6		-1.2	-2.1	-2.0	-1.9	-0.6	1.5	2.0	2.2	2.4	4.0	
Insured deposits <sup>(a)</sup>	0.3	24.6	0.0	0.0	0.7	1.0	2.3	3.0	2.0	1.9	10.1	10.0	33.9
	1.0		0.1	0.0	3.0	4.0	9.0	11.3	7.8	7.4	34.3	34.3	
Core deposits <sup>(b)</sup>	0.2	39.2	-0.4	-0.7	-0.7	-0.5	0.0	0.9	0.5	0.7	1.0	1.9	40.2
	0.5		-1.0	-1.7	-1.9	-1.4	0.1	2.1	1.3	1.8	2.5	4.8	
Uninsured deposits <sup>(a)</sup>	0.0	24.1	-0.6	-1.0	-2.0	-1.9	-2.6	-2.2	-1.0	-0.8	-8.8	-8.0	15.7
	0.1		-2.6	-4.3	-8.5	-8.3	-11.4	-9.7	-4.4	-3.4	-45.7	-40.6	
Large time deposits	1.0	24.4	1.7	2.4	3.4	3.8	2.7	-0.2	-0.1	1.3	2.4	3.6	27.4
	4.1		6.8	9.6	13.0	14.4	10.7	-0.7	-0.3	5.2	9.4	13.7	
Fed Funds and Repos	0.3	8.8	-0.5	-0.7	-0.4	-1.0	-2.0	-3.8	-3.4	-2.8	-2.8	-3.2	5.5
	3.1		-6.0	-7.8	-4.2	-12.4	-25.6	-56.4	-48.8	-38.7	-38.5	-45.5	
Trading Liabilities	0.1	2.3	-0.1	0.0	0.3	0.0	-0.2	0.9	0.5	-0.2	0.1	-0.4	1.9
	4.5		-5.0	0.2	13.2	-1.8	-7.4	34.1	18.2	-8.8	2.2	-19.3	
Other borrowing	0.2	9.2	0.3	1.6	2.5	3.5	3.9	6.1	5.6	4.1	2.7	0.9	9.9
	2.2		2.9	15.7	23.7	32.3	35.7	50.9	47.6	36.7	25.3	8.9	
of which: FHLB Advances	0.0	3.3	0.4	0.8	1.0	1.3	1.6	1.2	0.7	0.5	0.3	0.2	3.4
	0.4		11.6	21.2	26.1	32.7	39.0	31.6	20.1	15.2	9.4	5.8	
of which: Other (incl. Federal Reserve)	0.0	1.1	0.1	0.1	0.1	0.3	0.2	0.3	0.4	0.3	0.1	0.1	1.1
	1.2		4.8	12.8	9.6	22.6	16.0	26.0	28.8	21.0	12.5	8.6	
Subordinated Debt	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.2
	-2.5		1.4	-1.1	-0.6	-0.4	2.2	-2.6	-17.3	-18.4	-25.0	-13.0	
Capital	0.1	6.9	0.1	0.0	0.0	-0.1	0.0	-0.1	-0.1	-0.1	0.1	0.0	6.8
	1.1		1.0	-0.4	0.2	-0.9	-0.5	-1.5	-2.0	-1.1	1.0	0.1	

Note:

(a) There is a break in the insured deposit series in 2009Q3 when banks were asked to report accounts under \$250,000 (the previous account limit reported was under \$100,000).

(b) Core deposits are defined as the sum of transaction deposits, savings deposits (including MMDAs), and time deposits of less than \$100,000.

Both core and large time deposits are components of domestic deposits. The remaining component of total deposits are foreign deposits.

**Table A3. The Relationship between Offered Deposit Rates and Liquidity Demand Risk: An Alternative Data Set**  
**(Weekly, Bank Rate Monitor (BRM): September 1997 - December 2009)**  
**Banks covered by the BRM survey are a small subset of all banks filing Call Reports**

	Stress Proxy = Dummy from Bear Stearns failure to Emergency Economic Stabilization Act (March 14, 2008 - October 3, 2008)				Stress Proxy = Commercial Paper Spread (weekly)			
	High NPL		Low NPL		High NPL		Low NPL	
	(1) 24 month CD	(2) 60 month CD	(3) 24 month CD	(4) 60 month CD	(5) 24 month CD	(6) 60 month CD	(7) 24 month CD	(8) 60 month CD
Unused commitment ratio <sub>t-1</sub>	-0.037 (0.336)	0.173 (0.428)	0.140 (0.392)	-0.224 (0.403)	-0.207 (0.359)	0.012 (0.455)	0.021 (0.384)	-0.189 (0.382)
Unused commitment ratio <sub>t-1</sub> × Stress Proxy	0.766* (0.426)	1.428** (0.618)	-0.484 (0.548)	0.810 (0.677)	0.615** (0.271)	0.497* (0.287)	0.335 (0.290)	0.009 (0.383)
<b>Controls</b>								
Net wholesale funding <sub>t-1</sub>	-0.187 (0.171)	-0.111 (0.212)	-0.007 (0.176)	-0.065 (0.183)	-0.148 (0.179)	-0.082 (0.212)	0.044 (0.188)	-0.020 (0.194)
Net wholesale funding <sub>t-1</sub> × Stress Proxy	0.076 (0.196)	0.226 (0.255)	0.430 (0.279)	0.265 (0.311)	-0.104 (0.150)	-0.024 (0.167)	-0.076 (0.141)	-0.062 (0.205)
NPL to Loans <sub>t-1</sub>	-5.987* (3.358)	-8.413** (3.644)	6.063 (50.879)	65.660 (54.219)	-7.396** (3.512)	-11.969*** (3.793)	32.518 (67.654)	79.639 (69.586)
NPL to Loans <sub>t-1</sub> × Stress Proxy	19.986*** (4.340)	18.893* (10.442)	30.719 (97.510)	6.175 (122.398)	7.989** (3.587)	16.747*** (6.181)	-67.077 (92.957)	-31.744 (91.602)
Capital ratio <sub>t-1</sub>	1.548 (1.194)	0.810 (1.485)	-0.527 (1.138)	-3.103** (1.496)	1.202 (1.154)	-0.055 (1.646)	-0.721 (1.219)	-3.160* (1.673)
Capital ratio <sub>t-1</sub> × Stress Proxy	1.752 (1.356)	2.977 (1.810)	2.169 (1.445)	2.272 (2.061)	1.379 (1.065)	3.024* (1.619)	0.540 (0.726)	0.111 (1.124)
Large Bank Indicator	0.005 (0.094)	0.039 (0.212)	0.106 (0.223)	0.245* (0.136)	0.062 (0.088)	0.088 (0.216)	0.236 (0.267)	0.328** (0.160)
Large Bank Indicator × Stress Proxy	-0.261** (0.113)	-0.134 (0.186)	0.479* (0.255)	0.594*** (0.227)	-0.188*** (0.070)	-0.158** (0.080)	-0.257 (0.213)	-0.053 (0.161)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51804	48393	51405	47326	51804	48393	51405	47326
R <sup>2</sup>	0.92	0.85	0.87	0.77	0.92	0.85	0.86	0.76

The sample period of the regressions is from 1997 to 2009, using weekly Bank Rate Monitor data for the dependent variables.

All specifications are panel regressions with fixed effects for bank organizations and weekly time dummies. The reported R<sup>2</sup> is the within R<sup>2</sup>.

All regressions control for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits).

Note that bank liquidity and solvency characteristics are from the quarterly Call Reports, and therefore t-1 indicates the one quarter lag.

High nonperforming loan subset are those banks with a ratio of nonperforming loans (90 plus days) to loans above the median.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table A4. Impact of Lehman and TARP on Offered Deposit Rates**  
**Weekly, Bank Rate Monitor (BRM): March 28, 2008 to February 27, 2009 (5 month period surrounding Lehman failure)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	24 month CD NPL	24 month CD NPL	60 month CD NPL	60 month CD NPL	24 month CD Unused Commitments	24 month CD Unused Commitments	60 month CD Unused Commitments	60 month CD Unused Commitments
Risk Measure:								
Risk Measure <sub>t-1</sub> × Pre-Lehman (9/5, 9/12)	6.165 (5.692)	3.902 (4.382)	9.560 (7.249)	6.652 (4.925)	0.538 (0.373)	0.805** (0.320)	0.901** (0.438)	1.018*** (0.359)
Risk Measure <sub>t-1</sub> × Post-Lehman (9/19, 9/26)	10.610* (6.303)	2.912 (4.015)	13.04** (6.622)	5.637 (4.036)	0.295 (0.368)	0.428 (0.332)	0.663 (0.418)	0.662* (0.359)
Risk Measure <sub>t-1</sub> × Post-TARP (10/3, 10/10)	11.934 (7.645)	3.708 (4.674)	11.032 (9.220)	8.990 (7.642)	0.346 (0.413)	0.023 (0.324)	0.881 (0.563)	0.614 (0.477)
Pre-Lehman (9/5, 9/12)	0.243*** (0.028)	0.237*** (0.023)	0.275*** (0.034)	0.253*** (0.029)	0.159** (0.072)	0.089 (0.060)	0.123 (0.085)	0.070 (0.068)
Post-Lehman (9/19, 9/26)	0.235*** (0.029)	0.243*** (0.024)	0.268*** (0.032)	0.267*** (0.028)	0.210*** (0.073)	0.165** (0.064)	0.171** (0.085)	0.152** (0.071)
Post-TARP (10/3, 10/10)	0.258*** (0.034)	0.244*** (0.026)	0.318*** (0.040)	0.276*** (0.030)	0.208** (0.083)	0.257*** (0.068)	0.172* (0.103)	0.186** (0.088)
Bank Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	9092	9092	8333	8333	9092	9092	8333	8333
R <sup>2</sup>	0.02	0.06	0.02	0.06	0.08	0.07	0.04	0.06

The sample period of the regressions is from March 28, 2008 to February 27, 2009 using weekly Bank Rate Monitor data.

This period corresponds to a five-month window surrounding the Lehman failure, similar to Afonso, Kovner and Schoar (2010).

The reported R<sup>2</sup> is the within R<sup>2</sup> for the panel fixed effects regressions in columns (2), (4), (6) and (8).

All regressions control for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits).

Note that bank liquidity and solvency characteristics are from the quarterly Call Reports, and therefore t-1 indicates the one quarter lag.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table A5. Additional Measures: Controlling for Real Estate Loans and Securitization Exposure and for Market Equity Information**

	(1)	(2)	(3)	(4)	(5)	(6)
	(Reduced Sample from 2006Q3 with Available Securitization Data)		(Reduced Sample of Banks with Available CRSP Equity Data)			
	Large Time	Core	Large Time	Large Time	Core	Core
<b>Real estate loan exposure and securitization</b>						
Real Estate Loan Share <sub>t-1</sub>	-0.137 (0.180)	-0.242* (0.133)				
Real Estate Loan Share <sub>t-1</sub> × Crisis1	-0.020 (0.044)	0.024 (0.038)				
Real Estate Loan Share <sub>t-1</sub> × Crisis2	0.143** (0.062)	0.263*** (0.039)				
Residential Mortgages Sold <sub>t-1</sub>	-0.153 (0.100)	-0.125 (0.116)				
Residential Mortgages Sold <sub>t-1</sub> × Crisis1	0.107 (0.171)	0.236** (0.103)				
Residential Mortgages Sold <sub>t-1</sub> × Crisis2	0.167 (0.147)	-0.064 (0.102)				
<b>Market equity measures</b>						
Volatility of Daily Equity Returns <sub>t-1</sub>			0.597 (0.696)	0.595 (0.668)	-0.065 (0.627)	0.071 (0.620)
Volatility of Daily Equity Returns <sub>t-1</sub> × Crisis1			2.876 (1.778)	1.830 (1.723)	5.721*** (1.535)	4.612*** (1.770)
Volatility of Daily Equity Returns <sub>t-1</sub> × Crisis2			2.610*** (1.015)	1.852* (1.092)	1.526* (0.833)	0.533 (0.781)
Equity Return <sub>t-1</sub>			-0.001 (0.015)		-0.011 (0.010)	
Equity Return <sub>t-1</sub> × Crisis1			-0.056 (0.132)		-0.268*** (0.085)	
Equity Return <sub>t-1</sub> × Crisis2			-0.106 (0.069)		-0.085* (0.047)	
Quasi market capital to asset ratio <sub>t-1</sub>				-1.427*** (0.365)		-1.154*** (0.247)
Quasi market capital to asset ratio <sub>t-1</sub> × Crisis1				0.341 (0.432)		-0.245 (0.357)
Quasi market capital to asset ratio <sub>t-1</sub> × Crisis2				-0.182 (0.760)		-0.958*** (0.281)
<b>Unused commitments</b>						
Unused commitment ratio <sub>t-1</sub>	0.546*** (0.176)	1.042*** (0.139)	0.513* (0.296)	0.576** (0.282)	-0.354 (0.328)	-0.312 (0.323)
Unused commitment ratio <sub>t-1</sub> × Crisis1	0.194** (0.093)	-0.679*** (0.084)	-0.079 (0.421)	-0.176 (0.416)	-0.144 (0.377)	-0.254 (0.372)
Unused commitment ratio <sub>t-1</sub> × Crisis2	-0.784*** (0.132)	-1.022*** (0.103)	-0.085 (0.494)	-0.181 (0.489)	-0.663 (0.421)	-0.788** (0.396)
<b>Controls</b>						
Net wholesale funding <sub>t-1</sub>	0.037 (0.083)	-0.321*** (0.071)	0.310** (0.148)	0.290** (0.143)	0.100 (0.126)	0.094 (0.127)
Net wholesale funding <sub>t-1</sub> × Crisis1	0.031 (0.041)	0.166*** (0.037)	0.330** (0.167)	0.230 (0.157)	0.513*** (0.182)	0.421** (0.178)
Net wholesale funding <sub>t-1</sub> × Crisis2	-0.086 (0.052)	-0.014 (0.037)	0.040 (0.232)	-0.123 (0.253)	0.419** (0.194)	0.157 (0.195)
NPL to Loans <sub>t-1</sub>	0.083 (0.308)	-0.752*** (0.251)	2.606*** (0.861)	1.986** (0.819)	1.338*** (0.484)	0.949* (0.515)
NPL to Loans <sub>t-1</sub> × Crisis1	-0.656 (0.403)	-0.039 (0.221)	-3.707 (3.126)	-3.393 (3.158)	1.805 (2.916)	1.889 (2.868)
NPL to Loans <sub>t-1</sub> × Crisis2	0.902*** (0.306)	0.568*** (0.178)	-0.544 (0.858)	-0.415 (0.934)	0.834 (0.650)	0.664 (0.583)
Capital ratio <sub>t-1</sub>	-2.157*** (0.444)	-1.119*** (0.417)	-1.839** (0.850)		-2.100*** (0.579)	
Capital ratio <sub>t-1</sub> × Crisis1	0.819*** (0.239)	0.246 (0.240)	3.027*** (1.063)		0.726 (0.459)	
Capital ratio <sub>t-1</sub> × Crisis2	-0.382 (0.309)	0.461** (0.235)	2.014 (1.376)		-0.123 (1.029)	
Large Bank Indicator	-0.812 (0.547)	-0.103 (0.174)	-0.343* (0.193)	-0.378** (0.184)	-0.034 (0.181)	-0.069 (0.183)
Large Bank Indicator × Crisis1	-0.217* (0.114)	-0.188*** (0.071)	-0.132 (0.178)	-0.126 (0.173)	-0.194** (0.089)	-0.183** (0.088)
Large Bank Indicator × Crisis2	-0.155* (0.091)	0.022 (0.085)	-0.153 (0.127)	-0.178 (0.125)	-0.112 (0.082)	-0.135* (0.080)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	48535	48628	22882	22882	22911	22911
R <sup>2</sup>	0.73	0.81	0.74	0.74	0.87	0.87

The sample period of the regressions is from 2006 to 2009 in column (1) and (2), and from 1994 to 2009 in columns (3) to (6), using quarterly Call Report data.

All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies. The reported R<sup>2</sup> is the within R<sup>2</sup>.

All regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits).

Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.

**Table A6. Robustness Check: Pre-Crisis Values of Controls**

	(1) Large Time Rate	(2) Core Rate	(3) $\Delta$ Deposits <sub>t-1</sub> / Assets <sub>t-1</sub>	(4) (Loans - Deposits)/ Assets <sub>t-1</sub>
Unused commitment ratio <sub>t-1</sub>	0.125 (0.102)	-0.350*** (0.098)	0.028*** (0.004)	-0.033* (0.019)
Unused commitment ratio <sub>t-1</sub> × Crisis1	0.597*** (0.113)	-0.003 (0.094)	-0.005 (0.006)	0.107*** (0.025)
Unused commitment ratio <sub>t-1</sub> × Crisis2	-0.322** (0.137)	-0.367*** (0.097)	0.007 (0.006)	0.100*** (0.022)
<b>Controls</b>				
Net wholesale funding <sub>t-1</sub>	0.347*** (0.046)	0.075* (0.039)	0.060*** (0.002)	0.512*** (0.009)
Net wholesale funding <sub>t-1</sub> × Crisis1	0.129*** (0.047)	0.518*** (0.041)	-0.021*** (0.002)	0.040*** (0.007)
Net wholesale funding <sub>t-1</sub> × Crisis2	0.129*** (0.050)	0.425*** (0.039)	-0.018*** (0.002)	-0.039*** (0.010)
NPL to Loans <sub>t-1</sub>	1.029*** (0.329)	0.149 (0.232)	-0.202*** (0.020)	-0.278*** (0.056)
NPL to Loans <sub>t-1</sub> × Crisis1	-1.407** (0.704)	0.758** (0.317)	-0.023 (0.020)	-0.301** (0.118)
NPL to Loans <sub>t-1</sub> × Crisis2	1.155 (0.771)	0.879*** (0.310)	0.005 (0.028)	-0.433*** (0.145)
Capital ratio <sub>t-1</sub>	-0.654* (0.350)	-1.730*** (0.289)	0.178*** (0.012)	0.707*** (0.056)
Capital ratio <sub>t-1</sub> × Crisis1	0.748*** (0.204)	0.528* (0.295)	0.027** (0.011)	0.035 (0.045)
Capital ratio <sub>t-1</sub> × Crisis2	0.362 (0.244)	1.060*** (0.175)	0.024** (0.011)	-0.146** (0.062)
Large Bank Indicator	-0.246* (0.146)	-0.039 (0.122)	-0.006** (0.003)	-0.003 (0.026)
Large Bank Indicator × Crisis1	-0.149 (0.139)	-0.321*** (0.079)	0.011*** (0.004)	-0.074*** (0.018)
Large Bank Indicator × Crisis2	-0.279*** (0.105)	-0.174** (0.084)	-0.002 (0.005)	-0.073*** (0.017)
Bank Fixed Effects	Yes	Yes	Yes	Yes
Observations	195308	195330	196376	196376
R <sup>2</sup>	0.74	0.89	0.06	0.47

The sample period of the regressions is from 1994 to 2009, using quarterly Call Report data.

All specifications are panel regressions with fixed effects for bank organizations and quarterly time dummies.

The reported R<sup>2</sup> is the within R<sup>2</sup>. All regressions control for District time trends and for the deposit-weighted geographic market deposit concentration (annual from Summary of Deposits). Crisis 1 is a dummy variable equal to 1 from 2007Q3 to 2008Q2, and Crisis 2 is a dummy variable equal to 1 from 2008Q3 to 2009Q2.

Note that the liquidity and solvency measures in this table are taken at their pre-crisis values. That is, we include lagged values of these measures up to 2007:Q2 and from then on, the value of these variables as of 2007:Q2 are used.

The standard errors used in calculating significance levels are clustered at the bank organization level.

See Appendix for variable definitions and details about bank panel. \*\*\*, \*\*, \* indicate 1%, 5%, and 10% significance, respectively.