A Crisis of Banks as Liquidity Providers

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ABSTRACT

Can banks maintain their advantage as liquidity providers when they are exposed to a financial crisis? While banks honored their promised credit lines drawn by firms during the 2007-09 crisis, this provision of liquidity by banks was only possible because of explicit, large support from the government and government-sponsored agencies. At the onset of the crisis, aggregate deposit inflows into banks weakened and their loan-to-deposit shortfalls widened. These patterns were more pronounced at banks exposed to greater undrawn commitments. Such banks sought to attract deposits by offering higher rates, but the resulting private funding was insufficient to cover loan-to-deposit shortfalls and they reduced new credit.

JEL Codes: E4, G01, G11, G21, G28.
Keywords: Liquidity risk; Solvency risk; Financial crisis; Flight to safety.

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Can banks maintain their advantage as liquidity providers when they are exposed to a financial crisis? While banks honored their promised credit lines drawn by firms during the 2007-09 crisis, this provision of liquidity by banks was only possible because of explicit, large support from the government and government-sponsored agencies. At the onset of the crisis, aggregate deposit inflows into banks weakened and their loan-to-deposit shortfalls widened. These patterns were more pronounced at banks exposed to greater undrawn commitments. Such banks sought to attract deposits by offering higher rates, but the resulting private funding was insufficient to cover loan-to-deposit shortfalls and they reduced new credit.

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This paper investigates whether the onset of 2007-09 crisis was, in effect, a crisis of banks as liquidity providers, which increased the fragility of the financial system. The starting point of our analysis is the widely accepted notion that banks have a natural advantage in providing liquidity to businesses through credit lines and other commitments established during normal times. Even though banks experience significant and synchronized drawdowns during episodes of market stress, it is argued that they have no difficulty meeting these increased credit demands (e.g., Gatev and Strahan, 2006). The reason is that banks are awash with funds from depositors seeking a safe haven due to deposit insurance as well as due to the regular occurrence of crises outside the banking system (e.g., the fall of 1998 following the Russian default and LTCM hedge fund failure, and the 2001 Enron accounting crisis).

In 2007-09, however, the banking system was itself at the center of the financial crisis. As noted by Acharya, Schnabl, and Suarez (2013), Brunnermeier (2009) and Diamond and Rajan (2009), among others, a significant portion of "toxic" financial instruments found their way on to commercial and investment bank balance sheets, raising questions about their solvency. As the solvency risk of a bank increases, it might seek to attract deposits by offering higher rates.[1] Figure 1 shows that this has indeed been the case for 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 (concentrated within the

[1] 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*, Oct. 9, 2008, "Deposit-Gathering Pitches Evolving Amid Upheaval" and Dec. 5, 2007, "Why Rate Cuts Aren't Helping on the Deposit Side".

crisis). For ease of comparison, the x-axis is the time to failure. As is evident, weak institutions offered substantially higher CD rates in the run-up to failure.[2]

This rise in deposit rates reflected possible stress on deposit funding of banks. In particular, not all deposit liabilities were insured, especially at the onset of the crisis when over 62% of deposits were uninsured. Did banks manage to retain their deposit base in wake of the funding stress? And did they manage to meet their credit demands in the form of undrawn credit lines and commitments to firms?

Our main result is that until the government interventions in the fall of 2008, the mechanism whereby the banking system as a whole provides backup liquidity to the market by experiencing deposit inflows broke down. This crisis was in fact a crisis of banks as liquidity providers in the aggregate; and not just of the weakest banks. In particular, deposit funding pressure 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, 2013), until just before the Lehman failure on September 15, 2008. Core deposits increased by only $90 billion up until end-2008:Q2 (an increase which did not exceed core deposit inflows in a comparable period just before the crisis).[3] Core deposits eventually increased in the banking system as a whole by close to $800 billion by early 2009, but only starting in 2008:Q3 when they grew by $272 billion in just one quarter (Table I and He, Khang and Krishnamurthy, 2010).

[2] This finding conforms to 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. Flannery (1998) provides a good review of the capacity of such market mechanisms to supervise and remedy excessive risk taking by financial firms. Therefore, we do not dwell in detail on these results.

[3] For example, the $90 billion increase in core deposits at all banks in the first half of 2008 fell short of an average $130 billion increase in the preceding five years. The gap was even greater for small banks ($7 billion compared with $40 billion in the preceding 5 years) than for large banks ($82 billion compared with $90 billion in the preceding 5 years). 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 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. Similar evidence of initially weak deposit growth and the contrast with 1998 is documented in Ashcraft et al. (2010).

Importantly, prior to Lehman's failure, lending growth outpaced core deposit funding growth, that is, at the aggregate level, the banking system recorded a loan-to-deposit shortfall throughout the first year of the crisis.[4]

We argue that the weakness in the aggregate deposit funding position of banks and its sharp reversal following Lehman's failure is explained by investor perception of greater risk in bank deposits relative to instruments offering similar liquidity and payments services. Because most deposits were over the deposit insurance limit at the outset, investors preferred to hold assets with an explicit government guarantee such as Federal Home Loan Bank discount notes (analyzed in Ashcraft, Bech, and Frame, 2010) and Treasury securities (directly and indirectly through money market mutual funds specializing in government securities). The funding inflow into government funds exceeded that into "prime" funds beginning in August 2007[5], and accelerated in the aftermath of Lehman's failure, Reserve Primary Fund's "breaking the buck", and the sharp outflow from prime funds. Concurrently, the government backed the depository system more explicitly through an increase in insurance limits from $100,000 to $250,000 and the full insurance of non-interest bearing accounts, among other measures. Therefore, explicit government backing appears to have been the key factor explaining the aggregate funding shifts.

To understand the microeconomics of these aggregate effects on the banking sector, we analyze the liquidity provision role of banks at the individual bank level. Our results show that the aggregate liquidity shock at the onset of the crisis particularly hit banks exposed to drawdowns of commitments and credit lines. These banks were vulnerable to liquidity risk because liquidity tensions coincided on both sides of their balance sheet in the crisis. Drawing on

[4] Note that the application of terms such as "pressure" or "squeeze" to aggregate deposits in this paper is best interpreted in the *relation* of deposit funding to loan demand and drawdowns. That is, characterizing deposit changes in isolation is incomplete in addressing the question of whether the banking sector functioned adequately in its natural liquidity hedge role. This is examined in more detail in Section I.B.

[5] Prime funds invest in privately-issued short-term, highly-rated, liquid securities.

evidence from quarterly Call Reports and CD rates from a weekly proprietary survey, we find that a bank exposed to high commitments increased deposit rates significantly more than one exposed to low commitments (whether exposure is measured by potential or effective drawdowns). But crucially, despite scrambling for deposits by raising rates, commitments-exposed banks experienced weaker deposit growth, including of core deposits that are commonly considered a stable source of funding, and were forced to cut back on new credit originations.[6]

The credit adjustment of banks exposed to liquidity risk in the form of undrawn commitments might seem at odds with the existing evidence from firm-level data (survey-based and SEC-filing-based) in Ivashina and Scharfstein (2010), Campello, Giambona, Graham, and Harvey (2011) and Berrospide, Meisenzahl, and Sullivan (2012), among others, which shows that firms drew heavily on credit lines with banks beginning in August 2007, and that banks honored their ex ante promises and met this demand. They conclude that corporate investment was cushioned because of credit line availability as cancellations by banks were rare. We show, however, that this provision of liquidity insurance by banks was possible *only* because of explicit, large support from the government and government-sponsored agencies (Federal Home Loan Bank advances and Fed liquidity facilities). For example, advances from the FHLBs covered 65% of non-deposit borrowing growth at commitments-exposed banks during the first year, and the widening shortfall between their on-balance sheet loans and deposits was closed halfway with government-sponsored borrowing.[7] Equally importantly, we document that unlike

[6] While they experienced a positive inflow of insured deposits, this was statistically insignificant and economically small during the first year of the crisis. These banks also were more likely to seek expensive brokered deposits and to pay a fee to participate in the FDIC's transaction account guarantee program, which was established in October 2008 to guarantee non-interest bearing transaction accounts. Moreover, re-intermediation through interbank markets to these liquidity-short banks was insufficient. It only bridged roughly one-quarter of their total non-deposit borrowing growth during the first year.

[7] Indicative of the extent to which the overall 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

previous crises, banks did not expand total loans and credit lines. In this sense, the role of banks as liquidity providers was itself in crisis during the crisis of 2007-08.

We conduct several tests to rule out the alternative hypothesis that commitments-exposed banks were simply those with greater solvency problems, and thus, expected to be disciplined by depositors, as discussed in footnote 2. The results indicate that solvency problems, such as real-estate related exposure, were relevant risk factors, whose effect persisted (as expected) even after the deposit funding squeeze eased in the latter part of the crisis. In contrast, the funding pressure on commitments-exposed banks coincided with the shifts in aggregate deposit funding. The sharp liquidity reversal following Lehman's failure due to explicit government guarantees benefited banks with promised outstanding lines of credit and other liquidity-exposed banks (such as banks dependent on wholesale funding). We also show that commitments-exposed banks with weaker fundamentals were more vulnerable to the onset of the crisis than equally-exposed banks but with stronger fundamentals. These findings are motivated by theoretical models (e.g., Rochet and Vives, 2004, and Diamond and Rajan, 2005) in which there is a range of fundamentals for which a solvent bank can be illiquid. Interestingly, however, even the healthier but commitments-exposed banks did not experience a funding inflow in the first year of the crisis and were therefore not well placed to re-intermediate funds within the banking system.

The rest of the paper is organized as follows: Section I 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. We also support this discussion with aggregate evidence from the recent crisis. Section II investigates how exposure to heightened liquidity demand risk at the individual bank level shaped deposit rates and was

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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).

reflected in funding flows and lending shortfalls. Section III addresses the robustness of the results and reconciles our findings with previous crises. Section IV concludes with some policy implications.

I. Banks as Liquidity Providers: The Traditional View and its Reconsideration

A. 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. In particular, banks have a natural advantage in providing liquidity, provided 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 just as borrowers resorted to drawing down their bank credit lines. These studies argue that investors withdrew funds from markets at large, not just the commercial paper market, and deposited their funds with the banking system because it was seen

as a safe haven given sufficient government guarantees on deposits.[8] The view that government guarantees are responsible for the deposit inflows during crises is supported by evidence that no such deposit inflows occurred prior to the FDIC's inception in 1934. Pennacchi (2006) showed that during times of tight market liquidity from 1920 to 1933, no increase in bank deposits was observed and liquidity shocks were accompanied by declines in bank loans and investments. Interestingly, U.S. banks did not extend formal loan commitments in the pre-FDIC era.

B. When the Liquidity Backup Mechanism of the Banking System as a Whole Breaks Down

While it may make sense *ex ante* for banks to combine deposit-taking with loan commitments when liquidity demand realizations of depositors and firms are idiosyncratic or not very positively correlated, banks may experience *ex post* a coincident liquidity demand from depositors and firms leading to a more fragile financial system. Banks might be forced to run down liquid assets and to borrow from outside the interbank system to make good on promised loans. They likely will be forced to adjust to the shock by cutting back on new lending. This section provides supporting evidence from the U.S. subprime crisis in 2007-08.

At the outset of the U.S. subprime crisis, investors (households) seeking safety piled into securities issued or sponsored by the government, not deposits and debt issued by banks. Some argue that the initial subprime shock and lack of information about bank exposures to the shock led investors to lose confidence in their ability to identify low- from high-risk banks leading to a collective withdrawal from deposit accounts (e.g, Gorton, 2008; Covitz, Liang, and Suarez,

[8] 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 et al. 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.

2013).[9] Others argue that when aggregate risk rises, the ability of banks to diversify or smooth shocks across corporations and depositors is disrupted (Acharya, Almeida, and Campello, 2010). 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, depositors may leave banks, especially those that are heavily exposed to the rise in aggregate risk and the underlying economic shock. For this argument to hold, it is necessary that a significant share of deposits not be explicitly guaranteed by the government (which was true since most deposits in the banking system were over the deposit insurance limit at the onset of the crisis; more than 62% in 2007:Q2 when the limit was only $100,000). Lacking an explicit guarantee[10], investors preferred to hold assets with explicit guarantees, such as FHLB discount notes (analyzed in Ashcraft, Bech, and Frame, 2010) and Treasuries.

One main asset through which investors hold Treasuries is through money market mutual funds (MMMFs) specializing in government securities. Generally, MMMFs (both government and prime funds) are seen as competing deposit collectors because they offer similar liquidity and payments services (Pennacchi, 2006). Investors also 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. Importantly, however, while both government and so-called prime funds received large inflows beginning with the subprime crisis, the percentage

[9] 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."

[10] 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. For example, Iyer and Puri (2012) 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.

increase was significantly *greater* at funds devoted to government securities even prior to Lehman's failure (Figure 2a). For example, from August 2007 to pre-Lehman's failure, the change in government (prime) funds was $465bn ($411bn); the de-trended change in government (prime) funds was $422bn ($182bn), and the percentage change in government (prime) funds was 101% (25%). This occurred despite a jump in the yield on prime funds relative to government funds (Figure 2b).

The inflow into government funds gathered pace in the aftermath of Lehman's failure and Reserve Primary Fund's net asset value falling below one dollar when there was a sharp outflow from prime funds.[11] For example, in the two weeks following Lehman's failure, prime funds lost $410bn and government funds gained $238bn, partly reallocated from prime funds. Assets in prime funds stabilized end-September 2008 only after several government actions including new Federal Reserve liquidity facilities (such as the AMLF and the CPFF) and the Treasury's introduction of temporary insurance for all MMMF investments made prior to Lehman's failure (see Adrian, Kimbrough, and Marchioni, 2010; Kacperczyk and Schnabl, 2010).

At the same time, deposits in the banking system shot up by $189bn. This followed a period of anemic inflow of deposits in the banking system from the ABCP freeze in the summer of 2007 to just before the Lehman failure (Figure 3 and Table II) (the surge was visible across both core and large-time deposits and at both large and small banks). The absence of a sharp deposit inflow at the onset of the crisis is surprising when compared with the behavior in previous crises when commercial paper spreads also exceeded 100 bps. For example, Table II illustrates the robust deposit inflow in the fall of 1998 (more than quadrupling to $8.7 billion per

[11] The Reserve Primary Fund had close to an $800 million exposure to Lehman commercial paper. While only the Reserve Primary Fund halted redemptions on Sept. 16, 2008, other funds were close to halting redemptions. 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 (Kacperczyk and Schnabl, 2013).

week equivalent to $100 billion by year-end) and its absence in 2007-08. A similar outward shift in the supply of funding to banks (by $200 billion) followed the 9/11 attacks as market liquidity dried up and commercial paper spreads rose. Therefore, the flight-to-safety to the banking system that systematically occurred previously broke down early on in this crisis and was not observed until September 2008.

This aggregate funding shift following Lehman's failure is explained by both the acute flight-to-safety out of prime funds because these were suddenly perceived to be even riskier than bank deposit accounts, and the concurrent backing of the banking system made by the government. For example, in addition to recapitalization measures, the Emergency Economic Stabilization Act (TARP) increased the deposit insurance limit from $100,000 to $250,000 per depositor. This change was followed by the FDIC's announcement of its temporary liquidity guarantee program, in which it 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 (known as the transaction account guarantee (TAG) program). 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.[12]

The inflow of deposits finally allowed the banking system as a whole to close its loan-to-deposit shortfall that had opened up during the first year of the crisis (Table II and Figure 4). The shortfall refers to the difference between lending growth and deposit growth, where growth in

[12] Absent increased government support of the banking system, we would not expect that much of the outflows from prime funds found their way into a wide range of banks and deposit accounts, not just the safest of them. Moreover, Afonso, Kovner, and Schoar (2011) observe that once government support of AIG was announced two days after Lehman's failure, interbank spreads returned to their pre-crisis levels. This effectively signaled a backstop even before TARP was finally passed by Congress on Oct. 3, 2008. There were other factors contributing to weak deposit inflows all through the crisis but these do not explain the shift following Lehman's failure: Reasons include i) the hit to household wealth (stock and property markets continued to decline), ii) the withdrawal of deposits by liquidity-constrained households to cover consumption needs (also continued), and iii) the FDIC's negative reserve balance that may have led depositors to worry that the FDIC would not provide enough resources to make them whole in the event of failure (also persisted; the Treasury later increased its line of credit to the FDIC in March 2009).

Figure 4 is measured by cumulative growth from the beginning of the crisis in July 2007. For example, the shortfall widened to $198.1 billion by the end of 2007:Q3, reached a cumulative $239.2 billion by 2008:Q2, and over $300 billion in the weeks prior to Lehman's failure, based on snapshots of the weekly data. On-balance-sheet lending increased, reflecting loan commitment takedowns and mortgage loans that were warehoused because they could no longer be securitized. Other non-deposit non-interbank borrowing helped to support lending growth (Figure A1).[13] Banks, especially small banks, ran down their most liquid assets to support lending and the buildup of assets (reflected in cash assets and Treasury and Agency securities; Figure A2).

The next section tests whether this shortfall seen in the aggregate banking system was indeed a problem for banks exposed to liquidity demand risk. That is, was the role of banks as liquidity providers itself in crisis during the first year of the crisis?

II. Liquidity Demand Risk and Individual Bank Behavior in the 2007-09 Crisis

A. Hypotheses

As shown by the narrative in the previous section, at the outset of the crisis the banking system as a whole was short of deposits relative to lending and other asset funding needs. This section begins by developing testable hypotheses for individual bank behavior when banks need funds to support increased loan demand but face deposit funding pressure. Next, we test whether commitments-exposed banks were liquidity-short, and if so, whether they promised higher rates in an effort to stem deposit outflows, and what, if any, additional actions they took to adjust their balance sheets to the shock. There is considerable variation in a bank's vulnerability to the risk

[13] Appendix Figures and Tables are in the online appendix, available on the authors' website. Figure A1 shows that borrowing from "other" (i.e., non-U.S. banks) dwarfed borrowing from U.S. banks, and that large banks also pulled in funds from related foreign offices (consistent with Cetorelli and Goldberg, 2012).

of liquidity demand, controlling for its wholesale funding, solvency measures and size. We expect therefore that a bank at greater risk of credit line drawdowns likely offers higher rates during the crisis if it does not gain (or anticipate to gain) proportionate deposits to match its funding needs. We estimate the model:

$$Deposit\ Rate_{i,t} = \beta_1 liquidity\ demand\ risk_{i,t-1} + \beta_2 liquidity\ demand\ risk_{i,t-1} \times crisis_{\,t} + bank\ fixed\ effect_i + time\ fixed\ effect_t + other\ controls_{i,t} + e_{i,t}. \quad (1)$$

Other controls capture time-varying changes in a bank's local geographic market conditions such as deposit market concentration and district time trends.

Because our thesis is predicated on the reversal in the aggregate liquidity shock in the latter half of the financial crisis, the dummy variable *crisis* 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. This allows us to test whether bank behavior differed in the early and late stages of the crisis, as represented by the interaction terms between bank fundamentals and *crisis1* or *crisis2*. We test whether a commitments-exposed bank actively responded to the deteriorating liquidity position at the onset of the crisis by offering higher rates. And later, with the reversal of the banking system's position to a liquidity-rich one, we test whether this bank lowered its rate. For example, Gatev and Strahan (2006) show that a funding advantage for commitments-exposed banks during periods of heavy inflows to the banking system takes the form of consistently higher flows into deposit accounts at these banks and lower yields on their deposits.[14] We also conduct several tests on the timing of the liquidity reversal, including exploiting a weekly proprietary survey of CD rates.

[14] The possibility that these banks anticipate getting inflows during periods of market stress, and therefore, offer lines of credit ex ante is a likely explanation. For example, banks made little, if any, term loan commitments and

In addition to tests of deposit rate actions, we test whether banks took additional actions to meet increased loan commitment demand. Absent sufficient deposit insurance to ensure adequate core deposit funding and absent sufficient re-intermediation through inter-bank markets to liquidity-constrained banks (we test for both claims), a bank will likely be forced to adjust to the liquidity shock by cutting back on new credit. Other backup actions include running down liquid assets and seeking out government and government-sponsored borrowing. We test whether commitments-exposed banks took these possible actions by specifying models similar to equation (1), in which the dependent variable is replaced with a bank's growth in borrowing from government-sponsored agencies, for example.

B. Data and Variable Description

Summary statistics of the main variables are in Table III, and a detailed description of the variables follows in Table AI (available online). 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, and standard errors are clustered at the panel variable of banking organizations. The panel of roughly 7,000 banking organizations 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 1st and 99th percentiles to

lines of credit in the pre-FDIC era. An interesting question is whether the current significantly lower commitment lending than the pre-crisis ratio marks a permanent downward shift in the backup liquidity mechanism provided by the banking system to the nonfinancial sector (Figure A3).

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.

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.

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.[15] 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). 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 their drawdown when funding conditions are stressed. 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 aggregate evidence presented so far casts doubt on this liquidity insurance notion extending to the subprime crisis.

[15] Results are similar if unused loan commitments are scaled instead by the sum of assets and unused commitments. The main measure applied in this paper follows that in Kashyap, Rajan, and Stein (2002) and Gatev and Strahan (2006), and therefore excludes credit card commitments because they reason that a large share of credit card lines is unlikely to be drawn. In robustness checks, we also employ a narrower measure of unused commitments to proxy for C&I loan commitments and also check that the analysis is robust to excluding the conduit banks.

We control for a bank's other liquidity and solvency measures including net wholesale funding, nonperforming loans, capital, real-estate exposure, 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. Real-estate exposure is mainly measured by the share of loans secured by real estate in a bank's loan portfolio (robustness checks with a range of other real-estate related securities and trading exposure are also conducted). 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.[16]

The main sample period is quarterly from 1994 through 2009 (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.

One caveat on deposit rates is that U.S. bank regulations exist to restrict the rates that less than well-capitalized banks can offer to no more than 75 bps above the market rate (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 (as

[16] 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.

would a bank not wanting to signal the true extent of its adverse condition). 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.

C. The Relation between Deposit Rates and Liquidity Demand Risk

Table IV focuses on variation in a bank's vulnerability to liquidity demand shocks and its effect on deposit rates. The first two columns report the results for large time deposits followed by core deposits in columns (3) and (4). The results indicate that banks vulnerable to liquidity risk raised rates in the first year of the crisis. The key coefficient of interest is that on 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 preexisting 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 or the difference between a 75th percentile bank and a 25th percentile bank) raised the large time deposit rate by 5.9-7.1 bps. 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). As funding pressures eased in the second year of the crisis, these banks offered significantly lower rates in line with Gatev and Strahan (2006).

Note that the results do not support the alternative hypothesis that commitments-exposed banks were simply those with greater solvency problems. The results indicate that solvency problems, such as nonperforming loans and real-estate loans (the latter measure closely related to the proximate causes of the crisis), were independent risk factors. Indeed, their effects did not subside in the second year of the crisis, in contrast to the liquidity risk measures, further supporting the notion that unused commitments are properly picking up liquidity risk only. For

example, a one standard deviation in a bank's real estate lending increased its core rate by 5.7 bps in the latter part of the crisis (column (3)). The difference in timing issues are parsed in greater detail in Section III.B.[17] More generally, however, there can be an interesting interplay between liquidity risk and solvency risk, which we take up in Section III.

The remaining controls enter with the expected effects overall. For example, banks reliant on net wholesale funding increased deposit rates, also in the first year of the crisis when the liquidity shock was acute. Banks enjoying implicit support such as the TBTF institutions generally pay lower rates, and were also associated with lower deposit rates on average during the crisis. For example, large banks lowered rates by 14-66 bps and the effect is statistically significant for core deposits (columns (3) and (4)).[18]

D. The Relation between Deposit Flows and Liquidity Demand Risk

We next turn to evaluating the responsiveness of deposit flows to a bank's liquidity risk, 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 enough 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).

[17] Tables AII-AIV also show results with a broad set of additional real-estate and trading-related variables, to whose inclusion, the effect of unused commitments is robust. While a number of these measures are positively related to unused commitments, they are not strongly correlated. Moreover, none of these additional variables are associated with lending shortfalls so that their incentive to raise deposit rates was subdued or absent during the crisis.

[18] Note also that the relation between commitments-exposure and deposit rates was a positive one for the set of larger banks, though weaker than for smaller banks (Table AXI). This result conforms to the generally muted sensitivity to liquidity risk by more "solvent" banks (see Section III). Note also that there is the possibility that a bank with a profitable business opportunity will seek to raise deposit funding by offering a higher rate. This possibility is, however, unlikely to explain the results in this section – in particular the shift in relative rates for riskier banks in the first year of the crisis. But this may be a plausible explanation for the positive estimated effect on the capital ratio (where the next section shows that well-capitalized banks increased lending growth initially more than deposit growth).

The regression results confirm this to be the case in the first phase of the recent crisis, coinciding with the aggregate deposit funding squeeze relative to the increase in demand on banks for liquidity. Results of deposit growth regressions are shown in Table V for several deposit types, including total deposits and measures of "stable" deposits (core deposits and insured deposits). 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 0.16-0.17 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 (Table III). Therefore, banks with unused commitments lost their systematic advantage at gaining deposits, unlike during previous episodes of stress (as explored further in Section III). Even the inflow of insured deposits was small and statistically insignificant at the onset of the crisis (column (3)).[19]

Consistent with these findings, banks seeking brokered deposits and choosing to participate in the FDIC's transaction account guarantee (TAG) program at the end of 2008 were those that had a high unused commitment ratio (columns (4) and (5)). Breaking down the results by the type of deposit account indicates an active search for deposit funds by commitments-exposed banks, over and above that of a passive response to deposit withdrawals. For example, brokered deposits are funds obtained through a broker, whereby the broker often relies on a

[19] Note that the focus is on the interaction term of unused commitments with the crisis because this isolates a differences-in-differences effect. That is, whether there is significant deposit growth differences for banks before and after the crisis shock as a function of their treatment intensity (commitments exposure). The main conclusion in this paper is unaffected by instead examining the overall effect. Even if the reduced deposit growth was still overall positive (column (1)), the real issue is whether these commitments-exposed banks obtained sufficient deposit funding. The next section shows that this was not the case.

deposit listing service to identify high offer rates on deposits. The broker also often facilitates the placement of third party deposits by selling participations in shares up to the deposit insurance limit in a given bank instrument to one or more investors. Similarly, the FDIC facilitated access to funds through its TAG program in which banks choosing to participate paid an extra premium for the additional insurance. For example, the estimated difference in the TAG share between the 75th and 25th percentile unused commitments-exposed bank (0.017) was close to half the actual difference between the 75th percentile and 25th percentile TAG share bank (0.04) (the results control for the share of transaction deposits).

Other results in Table V are mostly in line with priors; banks less reliant on wholesale funding gained deposits as did better capitalized and large banks. Collectively, these findings imply that banks were not indiscriminately seen as safe havens during this crisis. As expected, insured deposit growth was less sensitive to measures of riskiness. For example, inflows into insured deposit accounts represented the bulk of inflows at banks with high nonperforming loans (column (3)).[20]

E. The Relation between Lending, Shortfalls, and Liquidity Demand Risk

The final step is to test how liquidity-exposed banks adjusted lending and other available margins on their balance sheet in reaction to the liquidity shock. The results in columns (1) and (2) of Table VI show that banks with preexisting commitments increased on-balance sheet loan growth in the first year. This result reflects involuntary lending that occurs when off-balance sheet commitments are converted to loans. The lending increase was not confined to increasing buybacks of conduit assets or to warehousing real estate loans but also reflected higher C&I lending growth through loan commitment drawdowns by corporations (column (2)). For

[20] In unreported results, we also find that an insolvent bank is able to attract insured deposit inflows despite an overall deposit drain in the run-up to its failure. This finding attests to the role of deposit guarantees in weakening depositor discipline.

example, a high commitments-exposed bank saw a 0.14 percentage point greater increase in its quarterly loan growth than a low commitments-exposed bank (where high unused commitments are taken at the 75th percentile (0.17) and low commitments are taken at the 25th percentile (0.07)). The high commitments-exposed bank also saw a 0.04 percentage point increase in C&I loan growth (equivalent to 40 percent of the average quarterly increase in C&I loan growth).[21]

As discussed earlier, compelling evidence of nonfinancial corporations' access to liquidity through extensive drawdowns of credit lines is documented by Campello, Giambona, Graham, and Harvey (2011). Conducting a unique corporate survey during the crisis, they show that corporations drew heavily on credit lines and cancellations by banks were rare (even though banks increased commitment fees and shortened the maturity of the lines).[22] Similarly, Berrospide, Meisenzahl, and Sullivan (2012), use SEC filings to show that non-financial firms were more likely to draw down lines beginning in 2007 and sharply increasing in March 2008 following Bear Stearns's problems. By contrast, they too find that credit line cancelations and covenant-induced reductions were small during the crisis. Santos (2012) uses confidential data on large corporations' syndicated credit lines also to show that higher drawdowns occurred during the 2007-08 crisis, especially on riskier banks.

However, liquidity-exposed 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 (column (3) of Table VI). For example, a 0.1 increase in a bank's unused commitment ratio led to a 0.23 percentage point fall in new credit growth compared with a typically positive credit

[21] Additional evidence on C&I lending is available in Table AX, employing narrower measures of exposure to C&I commitments. The results also are robust to estimating over the set of non-conduit banks.

[22] In an interesting parallel on the other side of the balance sheet, we find that the deposit maturity structure shortened for banks with higher liquidity demand risk. Also, banks that were tilted toward a short maturity profile before the crisis had a greater rollover risk. They offered significantly higher rates in the first year of the crisis, and also sought to lengthen the maturity of their time deposits during the crisis (Table AV).

growth of 1.1 percentage point (Table III). Similar evidence of drawdowns displacing new credit originations is documented by Cornett, McNutt, Strahan, and Tehranian (2011), Ivashina and Scharfstein (2010) and Mora (2010).

Importantly, while commitments-exposed banks managed to fund drawn credit lines, the shortfall between on-balance sheet lending and deposits *widened* in the first year as shown in columns (4) and (5) of Table VI. The shortfall is expressed here, respectively, as the difference between loans and deposits scaled by lagged assets in column (4) and as the growth rate of this term in column (5). For example, a 0.1 increase in undrawn commitments led to a 0.28 percentage point increase in the quarterly difference between lending and deposit growth (column (5)), compared to a typical zero value. 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 were forced to turn to other margins of adjustment. Note also that this shortfall subsided with the aggregate liquidity reversal in the banking system as a whole during the second year of the crisis. In contrast, the shortfall persisted at real-estate exposed banks through the two periods of the crisis.

In order to analyze how banks met the demands on their liquidity providing services, we show in Table VII the possible margins of adjustment available to liquidity-short banks. These include running down liquid asset buffers, borrowing from the interbank and repo market, and borrowing from "other" sources known as "other borrowed money" in the Call Reports – primarily government and government-sponsored agencies. First, the result in column (1) shows that commitments-exposed banks drew on their liquid asset buffers as reflected by the negative coefficient on the interaction term, *unused commitment ratio x crisis1*. Second, the key result in column (3) is that a high commitments-exposed bank significantly increased its growth of other-

borrowed-money by 0.13 percentage point more than a low commitments-exposed bank in the first year, primarily from the FHLBs (a 0.11 percentage point increase as seen in column (4)). To make sense of the relative importance of this government-related borrowing, one can compare it to interbank borrowing. The results in columns (2) and (3) show that re-intermediation within the banking system from liquidity-rich to liquidity-poor banks through the interbank and repo market comprised only one-quarter of their total non-deposit borrowing growth (i.e., 0.04 of a 0.17 percentage-point total).[23] Or more simply put, almost the entire increase in on-balance sheet lending growth for liquidity-exposed banks (0.14 percentage point from column (1) of Table VI) was funded with explicit government borrowing.

III. Additional Results and Robustness Tests

A. Do Liquidity and Solvency Problems Interact?

We have shown empirically that a bank's exposure to liquidity demand risk was an important determinant of its deposit funding position, its rates on deposits and the extent to which the bank took offsetting draws on its liquid assets and borrowing actions, controlling for a range of solvency risk measures. Therefore, at a basic level, the hypothesis that a bank's liquidity risk can be collapsed into solvency risk is rejected. However, theory predicts a relation between liquidity risk and solvency risk, even when these two risks can be easily separated conceptually. For example, in the model by Rochet and Vives (2004) an otherwise solvent bank may be illiquid when investors receive a negative signal on the future realization of the return on the bank's assets and withdraw early. In their model, there is an intermediate range of fundamentals

[23] That is, the 0.28 percentage-point increase in the lending growth shortfall (from Table VI) was covered by a 0.13 percentage-point increase in other borrowing, a 0.11 percentage-point decrease in liquid assets, and a 0.04 percentage-point increase in interbank borrowing. At the same time, there is evidence that commitments-banks significantly withdrew from lending on the interbank market until 2008:Q3. Afonso, Kovner, and Schoar (2011) also show that the interbank market rationed riskier banks and did not expand to meet latent demand. Note that banks with much real-estate lending covered most of their shortfall by running down liquid assets (including into the second year when there was no inflow of deposit funds at real-estate banks).

(solvency) in which a coordination failure can occur. But this range diminishes as the strength of fundamentals increases or as the adverse selection premium on a bank's asset sales diminishes. Similarly, in the model by Diamond and Rajan (2005), a higher risk of insolvency leads to a socially detrimental outcome because the bank is forced to sell not only the late project loans but also other loans that would soon deliver real liquidity and for which the banker has an advantage in collection skills, exacerbating an aggregate liquidity shortage.

Therefore, a testable hypothesis that flows directly from the theory is that a bank's vulnerability to liquidity risk is expected to be greater within the class of banks with greater solvency problems. That is, the estimated coefficient on the term *unused commitment ratio x crisis1* should be greater in magnitude in the class of banks characterized by weak fundamentals. An alternative hypothesis is that liquidity risk has a uniform effect irrespective of the bank's solvency position. This latter hypothesis is consistent with the view that the *crisis1* funding shock reflected a concern about the asset quality, and therefore insolvency, of the banking system as a whole.

Table VIII presents the results of these tests in which the sample is partitioned into high- and low-solvency problems according to three proxies for fundamentals: high nonperforming loans, high real estate loans, and low capital. The top panel shows the rates on large-time deposits and the lower panel shows deposit funding flows. The results generally support the hypothesis that weaker banks react to the aggregate funding shock by raising deposit rates more than fundamentally stronger banks with a similar ex ante liquidity demand exposure. For example, a 0.1 increase in unused commitments raised the rate of banks with high nonperforming loans (real estate loans) by 6.9 (6.5) bps compared with 4.6 (3.1) bps for banks with low nonperforming loans (real estate loans). In the case of real estate loans, these effects are found to

be significantly statistically different as well, so that a uniform effect of liquidity demand risk is rejected. To summarize, bank liquidity risk can interact with solvency risk in practice.

A related question is whether we observe that banks' advantage as liquidity providers is restored in this crisis when focusing on the set of fundamentally stronger banks. It is plausible that this set of banks were still seen as a safe haven and able to re-intermediate excess funds (Gatev and Strahan, 2006). Interestingly, however, the deposit growth regressions in Panel B of Table VIII show no evidence of a compensating effect within the class of fundamentally stronger banks. In other regressions (Table AVI), we also confirm that these stronger but liquidity-exposed banks did not significantly increase interbank and repo lending to other banks in the crisis.[24]

B. Robustness Checks

This section offers additional support for our thesis that the liquidity-insurance mechanism broke down at commitments-exposed banks precisely when there was a shortage of funding in the banking system. Moreover, the liquidity shock constrained banks that experienced higher *actual* drawdowns during the crisis.

B.1. Timing Issues

The empirical model in Table IX exploits the aggregate deposit funding shift after Lehman's failure by deconstructing the *crisis2* dummy into the 2008:Q3 quarter and the remainder of the *crisis2* period. One alternative is that the observed easing in *crisis2* could be spuriously picking up something that occurred later in the crisis, not attributable to the turnaround in liquidity following Lehman's failure. The results show that, indeed, the very sharp

[24] There is some evidence, however, that stronger but liquidity-exposed banks were better able to *borrow* on the interbank market to cover their loan-to-deposit shortfalls than their fundamentally weaker peers (although they still obtained the majority of their non-deposit funding from "other borrowed money"). The fundamentally weaker banks resorted more to running down liquid assets and borrowing from "other" sources.

increase in deposits (and liquid assets) at liquidity-exposed banks occurred in 2008:Q3, not later in the period (when comparing the coefficients on the interactions terms, *unused commitment ratio x crisis2,08Q3* and *unused commitment ratio x crisis2,08Q4-09Q2* in columns (3) and (5)). For example, a 0.1 increase in a bank's exposure to unused commitments was associated with a 0.49 percentage point increase in deposit growth for the period ending September 2008 but only a 0.08 percentage point increase in the subsequent three quarters, on average).

The crisis indicators also can be further partitioned into their respective four quarters (results are shown in Table AVIII in the interest of space). The results confirm that the largest deposit inflow at liquidity-exposed banks occurred in 2008:Q3, and was sustained by a smaller, significant increase in 2008:Q4. At the same time, the lending shortfall significantly reversed in 2008Q3 after having peaked in 2008Q1. What helped close the loan-to-deposit gap was sustained growth in "other" borrowed money throughout the 2007Q4-2008Q2 period. In addition to the re-intermediation of funds by the FHLBs, the Federal Reserve had explicitly put in place the Term Auction Facility (TAF) and other extensive term funding programs such as the Term Securities Lending Facility (TSLF) by mid-2008.[25] For example, the TAF provided credit to institutions with access to the discount window but at an auction-determined rate to mitigate stigma.

To summarize, these results back the case that explicit government intervention propped up liquidity-exposed banks. In this light, the funding outflows from prime money funds following Lehman's failure can be seen as really a supporting factor that enforced the funding availability at commitments-exposed banks and helped lower their deposit rates further. The results also are robust to the use of pre-crisis values for commitments and other controls,

[25] As noted by Ashcraft, Bech, and Frame (2010), by end-2007, it became evident that the FHLB system was not enough to ease liquidity stress, so that by May 2008, the Federal Reserve became the largest government-sponsored liquidity facility. It is worth noting, therefore, that these programs helped support commitments-exposed banks, thus easing their pursuit of customer deposits by mid-2008. For example, commitments-exposed banks raised deposit rates (even core rates) at the onset of the crisis, but this pressure appears to have subsided by 2008Q2.

mitigating the concern that these measures are contaminated by regulatory changes and bank-specific actions taken after the onset of the crisis to change risk profiles (Table AXII).

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® (BRM), also can be used to study rate changes in a window surrounding the Lehman event. This survey has a number of advantages and disadvantages: Its main advantage is that reported rates reflect *marginal* funding costs rather than *average* funding costs as measured using the Call Reports data. However, the survey is on a selection of banks and is largely participation based. The interesting result in Table AXIII is that – unlike solvency measures (such as nonperforming and real-estate loans) – liquidity risk was highest in the period just before Lehman failed. Rates eased for commitments-exposed banks in the aftermath, and then more so after TARP was introduced.[26]

B.2. Effective Drawdowns

Second, we hypothesize that, if unused commitments capture liquidity risk, then the liquidity shock should have constrained especially banks that experienced significant drawdowns on credit lines during the crisis, not just any bank with a lot of credit lines outstanding (i.e., the relevant measure is effective, not potential, drawdowns). It is this constrained set that should have relied most on "other" borrowing and running down liquid buffers as well as raising deposit rates more in an environment of tight funding. This is precisely what we find in Table X (full results for the controls are in Table AIX), by comparing the coefficients on the interaction term *unused commitment ratio x crisis1* for banks with above- and below- median declines in their unused commitments during the crisis. For instance, columns (11)-(12) show that the set of

[26] This is not to say that nonperforming loans did not push up bank CD rates throughout the crisis, just that the relation did not die out suddenly in the aftermath of Lehman's failure. See Table AXIV for results over a wider period, comparable to the relation between deposit rates and bank fundamentals in Table IV from Call Report data.

banks with larger effective drawdowns cut their liquid asset growth by 0.27 percentage points for a 0.1 increase in ex ante exposure to commitments, while the set with smaller drawdowns did not significantly adjust their liquidity margins. At the same time, because banks honored their commitments, the on-balance sheet lending of the constrained set of banks significantly increased as expected despite all indications otherwise that they were more stressed; meaning this result is hard to reconcile with a voluntary expansion in lending by this group (columns (5) and (6)).

The results also show that that while commitments-exposed banks lowered rates in the latter part of the crisis when funding was aplenty (a roughly equal decline for both banks with above- and below-median effective drawdowns) , the above-median set saw the sharpest increase in rates at the onset (coefficient 0.75 versus 0.39 in columns (1) and (2)).

C. Previous Crises: Revisiting Gatev and Strahan (2006)

We also extend the Gatev and Strahan (2006) results, confirming the hedge against market dislocations that banks provided in previous crises such as when LTCM failed, but showing how deposits growth and real-sector credit were disrupted when commercial paper spreads rose in this crisis. In order to ensure that differences in model specification are not driving the results, the specifications in Tables XI and XII 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 (Table XI column (1)) and loan growth equations (Table XII columns (1) and (4)) for a sample period over 1991-2000 as in Gatev and Strahan.

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 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) of Tables XI and XII show that the coefficients on *unused commitments x stress x crisis* are mostly negative and statistically significant.[27] Together, the deposit and credit 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. And while non-deposit funding played no regular role in supporting the banking system in previous crises (see also Gatev and Strahan), this occurred *throughout* the recent crisis (columns (4)-(6) of Table XI).

IV. Concluding Remarks and Policy Implications

Though we focused on banks in 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.[28] Given that many large European banks were also exposed to the ABCP freeze starting August of 2007 (Acharya, Schnabl, and Suarez, 2013), the funding

[27] These specifications 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). 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. 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.

[28] Two recent papers by Liu (2011) and Gozzi and Goetz (2010) also highlight the importance of funding shocks in crises. For example, Liu 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). Gozzi and Goetz find that, controlling for solvency position, a bank's reliance on wholesale funding was associated with reduced lending during the 2007-09 crisis, and that employment fell in metropolitan areas with a greater bank dependence on wholesale 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). 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 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.

Further, during the crisis of 2007-09, banks seem to have *only* partly helped avoid financial disruptions and business liquidations that would have occurred in the absence of a liquidity backstop by the central bank and the government. Our results suggest that the existing safety net was insufficient at sustaining a synergy between deposit-taking and commitment lending. 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 backstop banks so as to avoid critical disruptions in credit and liquidity may be justified, provided they are suitably priced and made contingent on bank quality.

A part of this improvement could feature better charging for deposit insurance to align premiums with still-existing implicit guarantees which encourage banks to take excessive risks.[29] 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. The FDIC, following the Dodd-Frank Act of 2010, proposed some new reforms in this direction to make deposit insurance premiums more sensitive to the systemic risk of an institution and not just to its idiosyncratic risk. Our results show, however, that liquidity risk of institutions, for instance, the risk of drawdowns on promised credit lines may also be a relevant factor, and that liquidity risk interacts with the fundamental or solvency risk of institutions.

On the liquidity risk front, better liquidity regulation is being proposed under Basel III in the form of a Liquidity Coverage Ratio (LCR) and a Net Stable Funding Ratio (NSFR). More progress to date has been made on the LCR, which requires banks to hold a sufficient amount of unencumbered high-quality liquid assets to cover funding outflows over 30 days in a liquidity stress event. The rationale for an *ex ante* LCR is that *ex post* intervention in the form of the lender-of-last-resort by the central bank can be socially costly (e.g., Rochet and Vives, 2004; Diamond and Rajan, 2005; Stein, 2013). First, in reality, even central banks cannot perfectly distinguish between illiquid and insolvent banks so that liquidity guarantees come with credit risk incurred by taxpayers. Second, the use of government backstops in a crisis induces a moral hazard problem. Therefore, as Stein (2013) argues, if access to the central bank's liquidity facilities is to count toward an LCR requirement, it makes sense to price this access (e.g, an up-front fee on a loan commitment from the central bank, as done in Australia).

[29] 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).

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Figure 1. Deposit Rates: Failed minus Non-Failed Banks

This figure plots 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. Specifically, the series 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. The x-axis is the time to failure in weeks. The failure date is the last available weekly (Friday) survey date prior to failure.

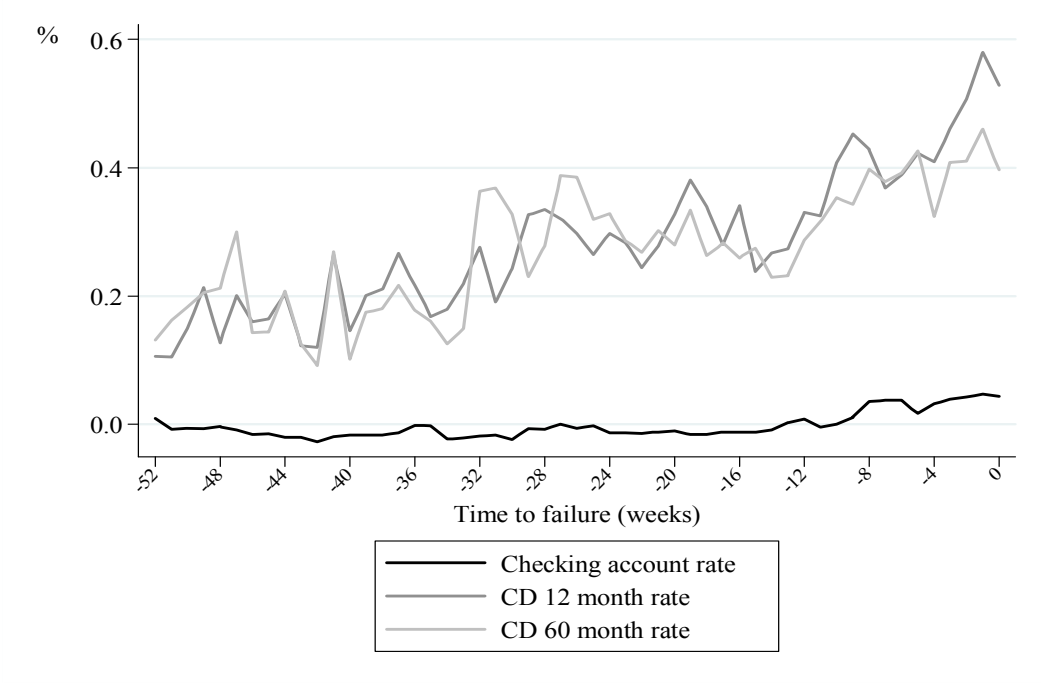
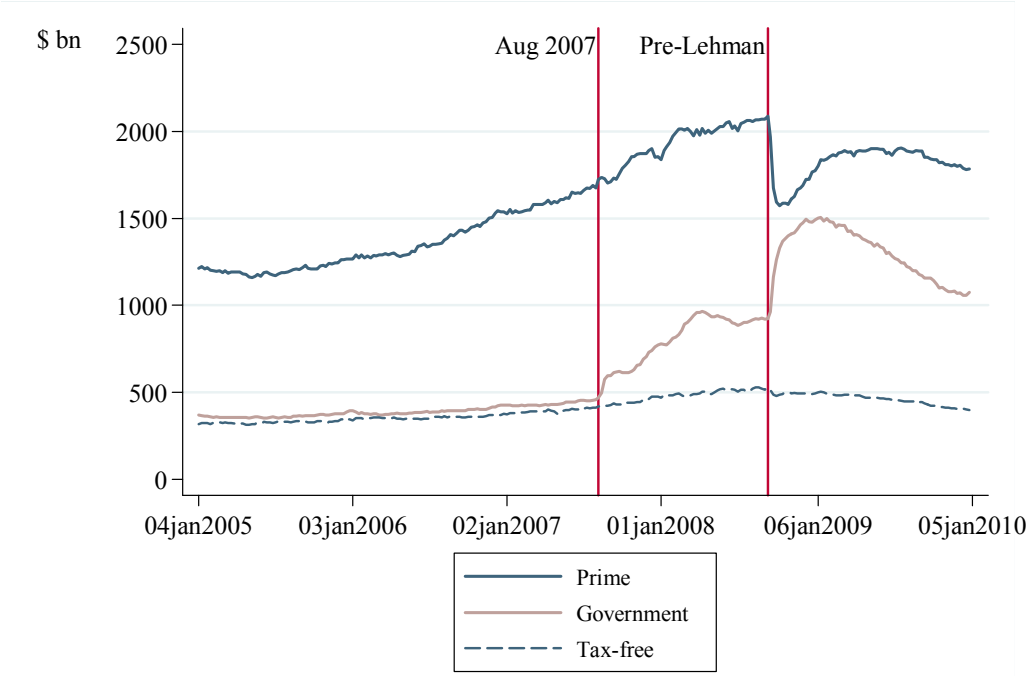


Figure 2. Money Market Mutual Funds

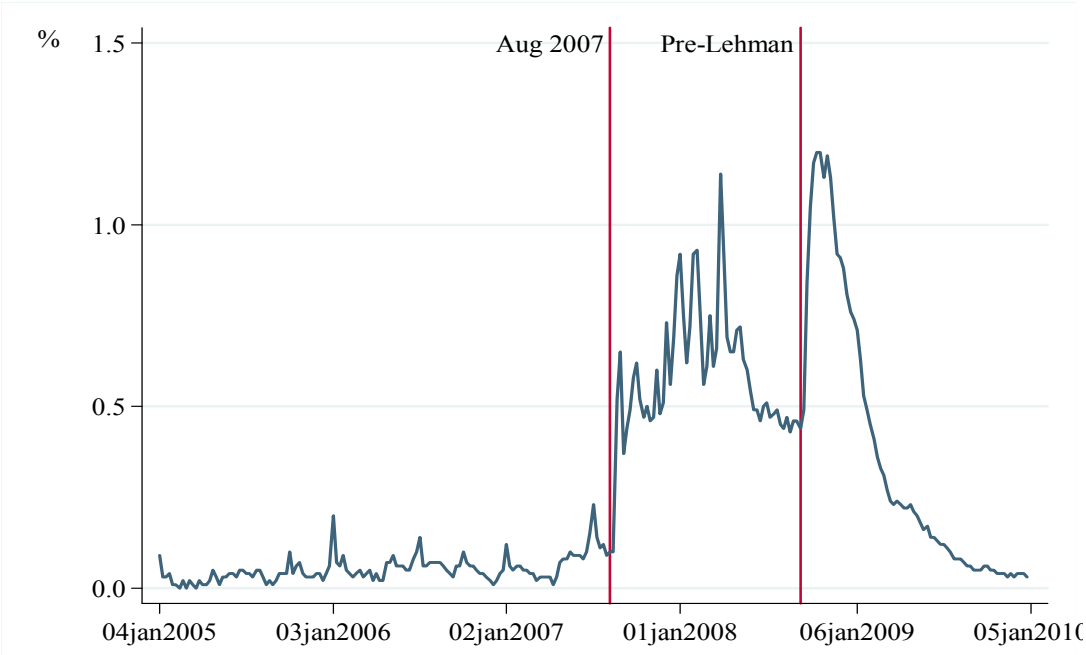
The top figure plots assets under management in money market mutual funds (MMMFs) by investment type. The bottom figure plots the net yields for prime funds minus that for government funds.

Figure 2a. Assets under management in money market mutual funds



Source: iMoneyNet for money market mutual funds (MMMFs), weekly data.

Figure 2b. MMMF yields: Prime minus government



Source: iMoneyNet for money market mutual funds (MMMFs), weekly data.

Figure 3. Market Stress and Net Flows into Deposits at Commercial Banks

This figure 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.

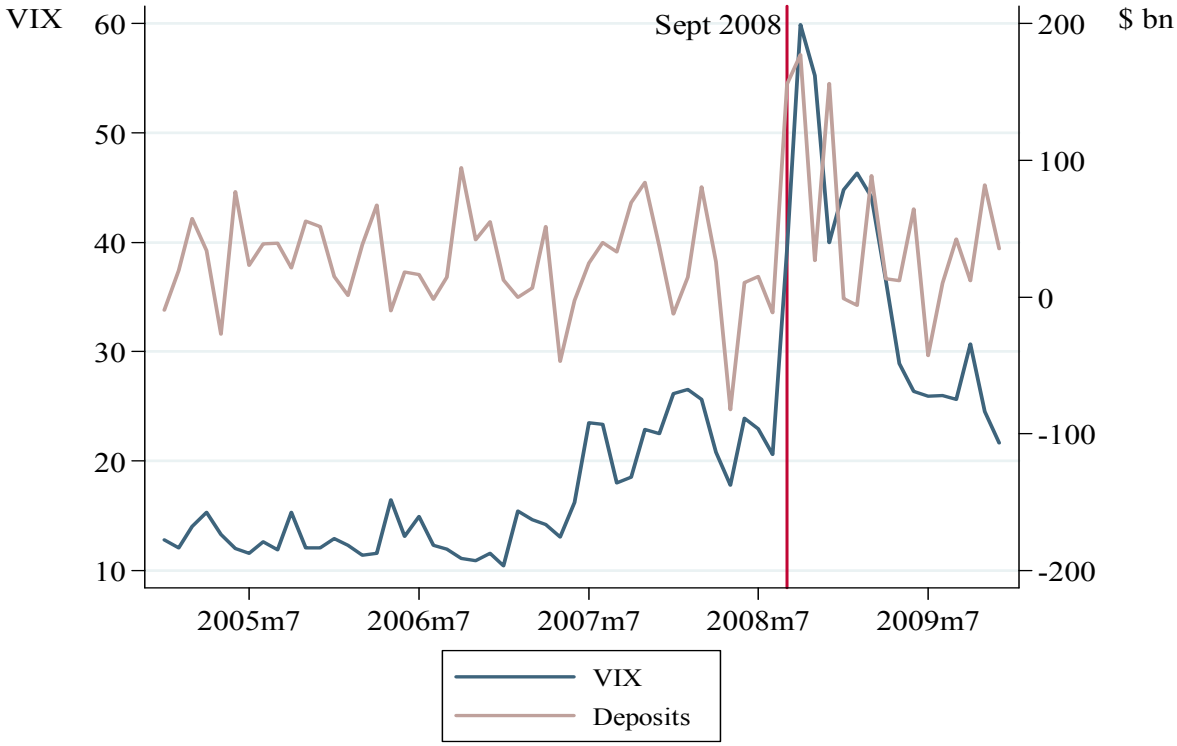


Figure 4. Cumulative Growth of Balance Sheet Components

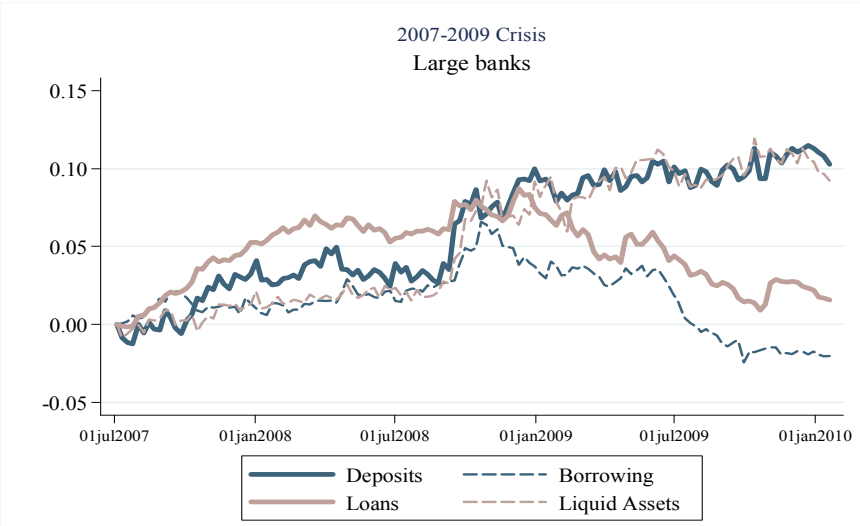
The two figures plot the cumulative growth of key balance sheet assets and liabilities at the weekly frequency from July 2007 through the end of 2009 (growth figures are relative to the first week of July 2007).The four key series are total deposits, non-deposit borrowing, loans and leases, and liquid assets (the sum of cash assets, securities, and interbank loans extended). Panel B is for large domestically chartered banks and Panel C 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. Note that the top panel A shows quarterly snapshots of the loan-to-deposit shortfall (for all domestically chartered banks based on the underlying weekly data).

Panel A. Memorandum

Quarter-on-Quarter Change in the Aggregate Loan-to-Deposit Shortfall (in $ billions)

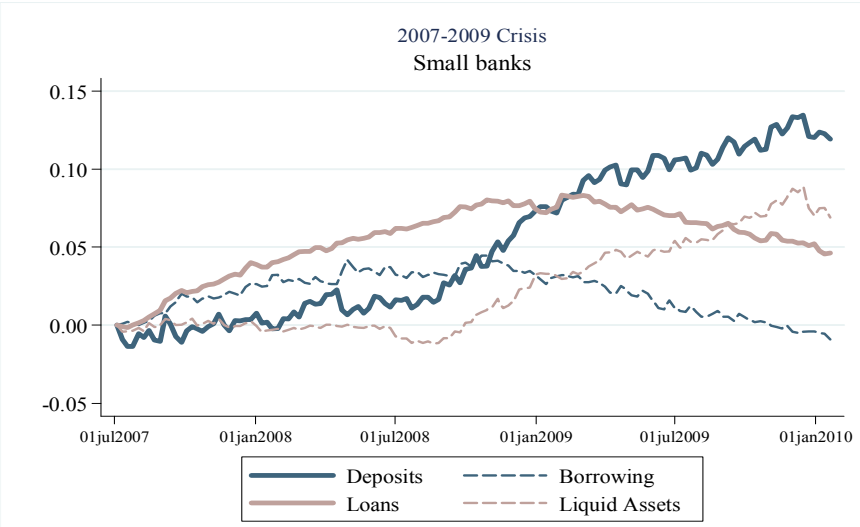
2007:Q3	2007:Q4	2008:Q1	2008:Q2	2008:Q3	2008:Q4	2009:Q1	2009:Q2
198.1	-32.1	11.3	61.9	-169.4	-253.8	-243.8	-59.4

Panel B



Source: Federal Reserve H8 release

Panel C



Source: Federal Reserve H8 release

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

	2007:Q3	2007:Q4	2008:Q1	2008:Q2	2008:Q3	2008:Q4	2009:Q1
Panel A. Large Banks (Largest 25 banks, H8 criteria)							
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
Panel B. Small Banks							
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

All Banks, Core: $767 billion = $90 billion + $272 billion

All Banks, Large-Time: - $172 billion = $53 billion + $66 billion

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 Tables AXV and AXVI 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 II. Average Weekly Deposit Funding and Lending Changes
(All Domestically Chartered Banks, in $ billions)

	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	Oct 8 2008 - July 1 2009
Deposits	2.1	8.7	6.6	6.5	94.7	9.0
of which, Core deposits	1.4	7.7	5.2	4.7	59.2	12.2
Loans	3.5	8.1	8.1	9.5	38.2	-5.3
of which, C&I loans	1.0	2.1	0.9	3.1	15.8	-2.5
Loan-to-Deposit Shortfall	1.4	-0.5	1.6	3.0	-56.5	-14.3
of which, for small banks	0.4	-0.4	0.2	1.6	-4.0	-6.1

The sample is weekly from the Federal Reserve H8 Release for all reporting domestically chartered banks.

Table III. Summary statistics for regression bank panel 1990Q1-2009Q4

	Mean	Standard Deviation	25th Percentile	Median	75th Percentile	Observations
Dependent variables (Call Reports)						
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 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 C&I loans	0.001	0.013	-0.003	0.001	0.006	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
Quarterly growth in federal funds purchased and repo borrowing	0.000	0.013	0.000	0.000	0.001	253492
Quarterly growth in other borrowed money (total)	0.001	0.016	0.000	0.000	0.001	210745
Dependent variables (Bank Rate Monitor 1997-2009)						
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
Covariates						
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

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

	1	2	3	4	5	6
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	
6 Real Estate Loan Share	0.045	0.007	0.074	0.272	-0.086	1.000

Source: Call Reports, National Information Center, FDIC, Bank Rate Monitor,

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 Table AI for variable definitions.

Table IV. 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$_{t-1}$	0.139	-0.810***	-0.329***	-1.804***
	(0.095)	(0.106)	(0.093)	(0.117)
Unused commitment ratio$_{t-1}$ × Crisis1	0.592***	0.710***	0.033	0.725***
	(0.119)	(0.139)	(0.095)	(0.217)
Unused commitment ratio$_{t-1}$ × Crisis2	-0.577***	-0.810***	-0.590***	-0.617***
	(0.131)	(0.156)	(0.102)	(0.176)
Controls				
Net wholesale funding$_{t-1}$	0.310***	0.529***	0.012	0.890***
	(0.043)	(0.036)	(0.037)	(0.044)
Net wholesale funding$_{t-1}$ × Crisis1	0.119***	0.162***	0.467***	0.575***
	(0.046)	(0.053)	(0.042)	(0.064)
Net wholesale funding$_{t-1}$ × Crisis2	0.019	0.066	0.248***	0.312***
	(0.051)	(0.058)	(0.038)	(0.059)
NPL to Loans$_{t-1}$	1.073***	0.687**	0.218	1.122***
	(0.236)	(0.316)	(0.170)	(0.346)
NPL to Loans$_{t-1}$ × Crisis1	-0.549	0.302	0.784***	2.302**
	(0.465)	(0.521)	(0.269)	(0.952)
NPL to Loans$_{t-1}$ × Crisis2	1.083***	1.872***	1.050***	2.373***
	(0.316)	(0.395)	(0.209)	(0.457)
Capital ratio$_{t-1}$	-0.834**	-0.098	-1.834***	0.381
	(0.328)	(0.223)	(0.260)	(0.259)
Capital ratio$_{t-1}$ × Crisis1	0.775***	0.660***	0.389	0.176
	(0.220)	(0.233)	(0.306)	(0.417)
Capital ratio$_{t-1}$ × Crisis2	-0.418	-0.804**	0.394*	-0.542*
	(0.317)	(0.354)	(0.218)	(0.333)
Large Bank Indicator	-0.244*	-0.204	-0.038	-0.393***
	(0.146)	(0.131)	(0.122)	(0.087)
Large Bank Indicator × Crisis1	-0.167	-0.215	-0.307***	-0.664***
	(0.138)	(0.163)	(0.073)	(0.093)
Large Bank Indicator × Crisis2	-0.142	-0.133	-0.002	-0.143
	(0.103)	(0.143)	(0.070)	(0.094)
Real Estate Loan Share$_{t-1}$	0.025	0.117***	-0.044	-0.021
	(0.060)	(0.042)	(0.054)	(0.050)
Real Estate Loan Share$_{t-1}$ × Crisis1	-0.066	-0.069	0.058	0.003
	(0.053)	(0.055)	(0.046)	(0.070)
Real Estate Loan Share$_{t-1}$ × Crisis2	0.109*	0.084	0.242***	0.067
	(0.062)	(0.077)	(0.046)	(0.072)
Bank Fixed Effects	Yes	No	Yes	No
Observations	196124	196124	196151	196151
R^2	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^2 is the within R^2. 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 V. 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) Δ Deposits$_t$/ Assets$_{t-1}$	(2) Δ Core Deposits$_t$/ Assets$_{t-1}$	(3) Δ Insured Deposits$_t$/ Assets$_{t-1}$	(4) Δ Brokered Deposits$_t$/ Assets$_{t-1}$	(5) TAG Deposits (2008Q4)/ Assets$_{t-1}$
Unused commitment ratio$_{t-1}$	0.034***	0.025***	0.014***	0.008***	0.174***
	(0.004)	(0.003)	(0.002)	(0.001)	(0.016)
Unused commitment ratio$_{t-1}$ × Crisis1	-0.016***	-0.017***	0.007	0.007***	
	(0.006)	(0.005)	(0.004)	(0.002)	
Unused commitment ratio$_{t-1}$ × Crisis2	0.018***	0.005	0.030***	0.018***	
	(0.006)	(0.005)	(0.004)	(0.002)	
Controls					
Net wholesale funding$_{t-1}$	0.068***	0.066***	0.028***	0.008***	-0.023***
	(0.002)	(0.002)	(0.001)	(0.000)	(0.007)
Net wholesale funding$_{t-1}$ × Crisis1	-0.008***	0.004**	0.005***	0.002***	
	(0.002)	(0.002)	(0.002)	(0.001)	
Net wholesale funding$_{t-1}$ × Crisis2	0.005**	0.010***	0.007***	0.006***	
	(0.002)	(0.002)	(0.002)	(0.001)	
NPL to Loans$_{t-1}$	-0.192***	-0.139***	-0.100***	-0.040***	0.073*
	(0.014)	(0.010)	(0.008)	(0.004)	(0.040)
NPL to Loans$_{t-1}$ × Crisis1	0.009	0.023	0.041***	0.014	
	(0.015)	(0.015)	(0.013)	(0.009)	
NPL to Loans$_{t-1}$ × Crisis2	0.058***	0.042***	0.056***	0.002	
	(0.019)	(0.015)	(0.013)	(0.006)	
Capital ratio$_{t-1}$	0.189***	0.158***	0.058***	0.018***	-0.031
	(0.012)	(0.009)	(0.007)	(0.003)	(0.029)
Capital ratio$_{t-1}$ × Crisis1	0.024*	0.023**	0.040***	0.007**	
	(0.013)	(0.011)	(0.008)	(0.003)	
Capital ratio$_{t-1}$ × Crisis2	0.073***	0.053***	0.052***	0.022***	
	(0.014)	(0.012)	(0.010)	(0.004)	
Large Bank Indicator	-0.006**	-0.005**	-0.002	-0.002**	0.013
	(0.003)	(0.002)	(0.002)	(0.001)	(0.009)
Large Bank Indicator × Crisis1	0.005	0.000	0.000	0.000	
	(0.003)	(0.003)	(0.002)	(0.001)	
Large Bank Indicator × Crisis2	-0.005	0.009***	0.003	-0.005***	
	(0.005)	(0.003)	(0.002)	(0.001)	
Real Estate Loan Share$_{t-1}$	-0.012***	-0.012***	-0.006***	-0.001	-0.032***
	(0.002)	(0.002)	(0.001)	(0.000)	(0.005)
Real Estate Loan Share$_{t-1}$ × Crisis1	-0.026***	-0.026***	-0.011***	0.002**	
	(0.002)	(0.002)	(0.002)	(0.001)	
Real Estate Loan Share$_{t-1}$ × Crisis2	0.000	-0.004*	0.003*	0.002**	
	(0.003)	(0.002)	(0.002)	(0.001)	
Bank Fixed Effects	Yes	Yes	Yes	Yes	No
Observations	197198	197198	197198	196655	3522
R^2	0.07	0.08	0.32	0.04	0.14

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^2 is the within R^2. The specification in column (5) is cross-sectional for 2008Q4 when the Transaction Account Guarantee (TAG) was introduced. Also controlled for in column (5) 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 VI. 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) Δ $Loans_t$/ $Assets_{t-1}$	(2) Δ C&I $Loans_t$/ $Assets_{t-1}$	(3) Δ (Loan + Commitments)$_t$/ (Assets + Commitments)$_{t-1}$	(4) (Loans - Deposits)$_t$/ $Assets_{t-1}$	(5) Δ (Loans - Deposits)$_t$/ $Assets_{t-1}$
Unused commitment ratio$_{t-1}$	0.134***	0.018***	-0.016***	-0.042**	0.099***
	(0.006)	(0.001)	(0.004)	(0.017)	(0.006)
Unused commitment ratio$_{t-1}$ × Crisis1	0.014***	0.004**	-0.023***	0.118***	0.028***
	(0.005)	(0.002)	(0.005)	(0.019)	(0.007)
Unused commitment ratio$_{t-1}$ × Crisis2	-0.002	-0.003	-0.053***	0.095***	-0.021***
	(0.006)	(0.002)	(0.006)	(0.017)	(0.007)
Controls					
Net wholesale funding$_{t-1}$	-0.012***	-0.003***	-0.020***	0.513***	-0.084***
	(0.001)	(0.000)	(0.001)	(0.008)	(0.002)
Net wholesale funding$_{t-1}$ × Crisis1	-0.005***	-0.001**	-0.010***	0.027***	0.003
	(0.002)	(0.001)	(0.002)	(0.006)	(0.002)
Net wholesale funding$_{t-1}$ × Crisis2	-0.016***	-0.004***	-0.027***	0.014*	-0.022***
	(0.002)	(0.001)	(0.002)	(0.008)	(0.003)
NPL to Loans$_{t-1}$	-0.303***	-0.054***	-0.381***	-0.254***	-0.108***
	(0.017)	(0.005)	(0.020)	(0.035)	(0.012)
NPL to Loans$_{t-1}$ × Crisis1	-0.069***	0.005	-0.087**	-0.076	-0.077***
	(0.017)	(0.007)	(0.036)	(0.051)	(0.018)
NPL to Loans$_{t-1}$ × Crisis2	0.018	0.018***	-0.014	-0.070*	-0.046***
	(0.019)	(0.005)	(0.020)	(0.039)	(0.016)
Capital ratio$_{t-1}$	0.015	0.004	0.022**	0.725***	-0.176***
	(0.010)	(0.004)	(0.011)	(0.053)	(0.014)
Capital ratio$_{t-1}$ × Crisis1	0.042***	0.005	0.039***	0.045	0.027
	(0.010)	(0.004)	(0.012)	(0.038)	(0.017)
Capital ratio$_{t-1}$ × Crisis2	0.054***	0.010**	0.047***	0.010	-0.021
	(0.011)	(0.004)	(0.012)	(0.050)	(0.017)
Large Bank Indicator	0.001	-0.001	-0.002	-0.006	0.007*
	(0.003)	(0.001)	(0.003)	(0.026)	(0.004)
Large Bank Indicator × Crisis1	0.008***	0.005***	0.010***	-0.054***	0.003
	(0.003)	(0.001)	(0.003)	(0.015)	(0.004)
Large Bank Indicator × Crisis2	0.011***	0.005***	0.011***	-0.040***	0.018***
	(0.003)	(0.001)	(0.003)	(0.014)	(0.005)
Real Estate Loan Share$_{t-1}$	0.004*	0.011***	-0.003	0.039***	0.016***
	(0.002)	(0.001)	(0.002)	(0.010)	(0.002)
Real Estate Loan Share$_{t-1}$ × Crisis1	0.001	0.003***	-0.007***	0.051***	0.028***
	(0.002)	(0.001)	(0.002)	(0.007)	(0.003)
Real Estate Loan Share$_{t-1}$ × Crisis2	0.007***	0.009***	-0.004	0.037***	0.008***
	(0.002)	(0.001)	(0.003)	(0.008)	(0.003)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	197198	197198	197198	197198	197198
R^2	0.15	0.03	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^2 is the within R^2.
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 VII. The Relationship between Liquid Assets, Borrowed Money and Liquidity Demand Risk in the Crisis (Allowing for Two Phases of the Crisis: 2007Q3-2008Q2 and 2008Q3-2009Q2)

	(1) Δ (Liquid Assets)$_t$/ Assets$_{t-1}$	(2) Δ (Federal Funds and Repo Borrowing)$_t$/ Assets$_{t-1}$	(3) Δ (Other Borrowed Money Total)$_t$/ Assets$_{t-1}$	(4) Δ (Other Borrowed Money FHLB)$_t$/ Assets$_{t-1}$	(5) Δ (Other Borrowed Money Other)$_t$/ Assets$_{t-1}$
Unused commitment ratio$_{t-1}$	-0.073***	0.007***	0.012***	0.016***	0.001
	(0.005)	(0.001)	(0.002)	(0.002)	(0.000)
Unused commitment ratio$_{t-1}$ × Crisis1	-0.011*	0.004***	0.013***	0.011***	0.001*
	(0.006)	(0.002)	(0.002)	(0.002)	(0.001)
Unused commitment ratio$_{t-1}$ × Crisis2	0.009	-0.009***	-0.003	-0.004*	0.002**
	(0.006)	(0.002)	(0.003)	(0.002)	(0.001)
Controls					
Net wholesale funding$_{t-1}$	0.067***	-0.010***	-0.010***	-0.013***	-0.001***
	(0.002)	(0.000)	(0.001)	(0.001)	(0.000)
Net wholesale funding$_{t-1}$ × Crisis1	0.002	0.000	0.005***	0.004***	0.001**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Net wholesale funding$_{t-1}$ × Crisis2	0.008***	-0.003***	-0.011***	-0.010***	0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
NPL to Loans$_{t-1}$	0.009	-0.004**	-0.019***	-0.013***	-0.001
	(0.010)	(0.002)	(0.003)	(0.004)	(0.001)
NPL to Loans$_{t-1}$ × Crisis1	0.034*	-0.012***	-0.020**	-0.024***	-0.001
	(0.018)	(0.004)	(0.008)	(0.009)	(0.001)
NPL to Loans$_{t-1}$ × Crisis2	0.007	0.000	0.009*	0.007	0.000
	(0.016)	(0.003)	(0.005)	(0.005)	(0.001)
Capital ratio$_{t-1}$	0.177***	0.006***	0.020***	0.024***	0.001
	(0.013)	(0.002)	(0.004)	(0.004)	(0.001)
Capital ratio$_{t-1}$ × Crisis1	-0.021	-0.001	0.007	0.001	0.003
	(0.014)	(0.002)	(0.007)	(0.004)	(0.002)
Capital ratio$_{t-1}$ × Crisis2	0.028*	0.005*	0.007	0.005	0.003*
	(0.015)	(0.003)	(0.005)	(0.004)	(0.002)
Large Bank Indicator	-0.007***	-0.001	0.000	0.002	-0.001
	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)
Large Bank Indicator × Crisis1	0.001	0.000	0.003	0.001	0.003**
	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)
Large Bank Indicator × Crisis2	-0.016***	0.000	0.000	0.005***	-0.002
	(0.005)	(0.002)	(0.001)	(0.001)	(0.001)
Real Estate Loan Share$_{t-1}$	-0.012***	0.001***	0.002**	0.001	0.0003
	(0.002)	(0.000)	(0.001)	(0.001)	0.0002
Real Estate Loan Share$_{t-1}$ × Crisis1	-0.022***	0.001*	0.005***	0.006***	0.0003
	(0.002)	(0.001)	(0.001)	(0.001)	0.0002
Real Estate Loan Share$_{t-1}$ × Crisis2	-0.007***	0.002***	0.001	0.001	0.0003
	(0.002)	(0.001)	(0.001)	(0.001)	0.0003
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	197198	197198	197198	122324	122324
R^2	0.07	0.02	0.03	0.03	0.01

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^2 is the within R^2.
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. Note that "other borrowed money" is RCFD3190, of which borrowing from the FHLBs and "other" (includes borrowing from the Federal Reserve) are available from 2001 (see schedule RC-M).

Table VIII. The Relationship between Solvency Risk and Liquidity Demand Risk in the Crisis: Are Banks with Solvency Problems More Vulnerable to Liquidity Demand Risk? Sample is Partitioned into High- and Low-Solvency Problems based on Nonperforming Loans, Real Estate Loans, or Capital

Panel A. Rate on Large-Time Deposits

	(1) Nonperforming Loans	(2) Nonperforming Loans	(3) Real Estate Loan Share	(4) Real Estate Loan Share	(5) Capital Rratio	(6) Capital Ratio
	High	Low	High	Low	High	Low
Unused commitment ratio$_{t-1}$	0.049	0.368***	0.210*	0.087	0.173	0.043
	(0.129)	(0.127)	(0.114)	(0.150)	(0.148)	(0.124)
Unused commitment ratio$_{t-1}$ × Crisis1	0.688***	0.456***	0.651***	0.306*	0.577***	0.530***
	(0.159)	(0.170)	(0.140)	(0.184)	(0.191)	(0.147)
Unused commitment ratio$_{t-1}$ × Crisis2	-0.351**	-0.615***	-0.586***	-0.631***	-0.153	-0.826***
	(0.152)	(0.222)	(0.158)	(0.212)	(0.209)	(0.159)
Other bank controls included	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99731	96393	111204	84920	84466	111658
R^2	0.72	0.74	0.72	0.72	0.71	0.73

Panel B. Total Deposit Growth

	(7) Nonperforming Loans	(8) Nonperforming Loans	(9) Real Estate Loan Share	(10) Real Estate Loan Share	(11) Capital Rratio	(12) Capital Ratio
	High	Low	High	Low	High	Low
Unused commitment ratio$_{t-1}$	0.029***	0.037***	0.063***	0.009*	0.036***	0.028***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Unused commitment ratio$_{t-1}$ × Crisis1	-0.016**	-0.013	-0.029***	-0.001	-0.015	-0.015**
	(0.007)	(0.009)	(0.006)	(0.010)	(0.009)	(0.008)
Unused commitment ratio$_{t-1}$ × Crisis2	0.019**	0.011	0.020***	0.017*	0.021*	0.022***
	(0.008)	(0.010)	(0.007)	(0.009)	(0.011)	(0.007)
Other bank controls included	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	100013	97185	111329	85869	85178	112020
R^2	0.08	0.07	0.08	0.08	0.09	0.07

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^2 is the within R^2. 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.
Note that "High" solvency risk is proxied by the set of banks, respectively, with an above median nonperforming loan ratio, above median real estate loan share, or below median capital ratio (Table III).

Table IX. The Aggregate Shift in Funding: Separating Crisis2 into 2008:Q3 (post-Lehman) and 2008:Q4-2009:Q2

	(1) Rate on Large-Time Deposits	(2) Rate on Core Deposits	(3) Δ Deposits$_t$/ Assets$_{t-1}$	(4) Δ (Loans - Deposits)$_t$/ Assets$_{t-1}$	(5) Δ (Liquid Assets)$_t$/ Assets$_{t-1}$	(6) Δ (Federal Funds and Repo Borrowing)$_t$/ Assets$_{t-1}$	(7) Δ (Other Borrowed Money Total)$_t$/ Assets$_{t-1}$
Unused commitment ratio$_{t-1}$	0.140	-0.329***	0.034***	0.099***	-0.073***	0.008***	0.012***
	(0.095)	(0.093)	(0.004)	(0.006)	(0.005)	(0.001)	(0.002)
Unused commitment ratio$_{t-1}$ × Crisis1	0.594***	0.033	-0.016***	0.028***	-0.011*	0.004***	0.013***
	(0.120)	(0.095)	(0.006)	(0.007)	(0.006)	(0.002)	(0.002)
Unused commitment ratio$_{t-1}$ × Crisis2 08Q3	-0.315*	-0.541***	0.049***	-0.058***	0.030***	-0.015***	-0.007
	(0.174)	(0.109)	(0.010)	(0.012)	(0.010)	(0.004)	(0.005)
Unused commitment ratio$_{t-1}$ × Crisis2 08Q4-09Q2	-0.656***	-0.605***	0.008	-0.007	0.002	-0.007***	-0.002
	(0.145)	(0.112)	(0.007)	(0.008)	(0.007)	(0.002)	(0.003)
Other bank controls included (see appendix)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	196124	196151	197198	197198	197198	197198	197198
R^2	0.74	0.89	0.08	0.10	0.07	0.02	0.03

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^2 is the within R^2. 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, Crisis2 08Q3 is a dummy variable equal to 1 in 2008Q3, and Crisis 2 08Q4-09Q2 is a dummy variable equal to 1 from 2008Q4 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, and Table AVII for full controls. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Table X. Partitioning Banks by their Unused Commitments Constraint: Effective Drawdowns
(Allowing for Two Phases of the Crisis: 2007Q3-2008Q2 and 2008Q3-2009Q2)

	(1) Rate on Large-Time Deposits	(2) Rate on Large-Time Deposits	(3) Δ Deposits$_t$/ Assets$_{t-1}$	(4) Δ Deposits$_t$/ Assets$_{t-1}$	(5) Δ Loans$_t$/ Assets$_{t-1}$	(6) Δ Loans$_t$/ Assets$_{t-1}$
	High	Low	High	Low	High	Low
Unused commitment ratio$_{t-1}$	0.133	0.090	0.048***	0.022***	0.146***	0.113***
	(0.141)	(0.148)	(0.006)	(0.005)	(0.011)	(0.009)
Unused commitment ratio$_{t-1}$ × Crisis1	0.748***	0.390**	-0.021***	-0.009	0.030***	0.008
	(0.160)	(0.175)	(0.007)	(0.009)	(0.007)	(0.006)
Unused commitment ratio$_{t-1}$ × Crisis2	-0.555***	-0.619***	0.015	0.019***	0.007	-0.007
	(0.212)	(0.164)	(0.010)	(0.007)	(0.008)	(0.008)
Other bank controls included (see appendix)	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68511	83442	68645	84105	68645	84105
R^2	0.78	0.75	0.09	0.07	0.22	0.12

	(7) Δ Brokered Deposits$_t$/ Assets$_{t-1}$	(8) Δ Brokered Deposits$_t$/ Assets$_{t-1}$	(9) Δ (Other Borrowed Money Total)$_t$/ Assets$_{t-1}$	(10) Δ (Other Borrowed Money Total)$_t$/ Assets$_{t-1}$	(11) Δ (Liquid Assets)$_t$/ Assets$_{t-1}$	(12) Δ (Liquid Assets)$_t$/ Assets$_{t-1}$
	High	Low	High	Low	High	Low
Unused commitment ratio$_{t-1}$	0.011***	0.006***	0.011***	0.011***	-0.073***	-0.068***
	(0.002)	(0.001)	(0.002)	(0.003)	(0.008)	(0.007)
Unused commitment ratio$_{t-1}$ × Crisis1	0.010***	0.004	0.017***	0.010***	-0.027***	-0.001
	(0.003)	(0.004)	(0.004)	(0.003)	(0.006)	(0.009)
Unused commitment ratio$_{t-1}$ × Crisis2	0.026***	0.011***	-0.001	-0.003	-0.001	0.016**
	(0.003)	(0.003)	(0.004)	(0.003)	(0.009)	(0.008)
Other bank controls included (see appendix)	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68567	83787	68645	84105	68645	84105
R^2	0.06	0.03	0.04	0.03	0.07	0.08

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^2 is the within R^2. 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.
Also reported in the appendix are the full details for the control variables (see Table AIX).
Note that "High" is proxied by the set of banks with more than 4 quarters during the 8-quarter crisis of negative growth in their available commitments. These banks also roughly correspond to banks with above median declines in unused commitments.

Table XI. The Relationship between Market Stress and Growth in Deposits and Nondeposit Liabilities: 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)
	Δ Deposits$_t$/Assets$_{t-1}$			Δ Nondeposit Liabilities$_t$/Assets$_{t-1}$		
	Gatev and Strahan sample 1991-2000	1990-2009	1990-2009	Gatev and Strahan sample 1991-2000	1990-2009	1990-2009
Unused commitment ratio$_{t-1}$	-0.021***	0.025***	0.025***	0.021***	0.013***	0.016***
	(0.007)	(0.003)	(0.003)	(0.005)	(0.002)	(0.002)
Unused commitment ratio$_{t-1}$ × Stress	**0.041*** **	**0.007**	**0.022*** **	**-0.004**	**0.006***	**-0.007**
	(0.011)	**(0.005)**	**(0.008)**	**(0.008)**	**(0.003)**	**(0.006)**
Unused commitment ratio$_{t-1}$ × Stress × Crisis1			**-0.039** **			**0.029** **
			(0.017)			**(0.013)**
Unused commitment ratio$_{t-1}$ × Stress × Crisis2			**0.018**			**0.014**
			(0.013)			**(0.009)**
Unused commitment ratio$_{t-1}$ × Crisis1			0.004			-0.003
			(0.014)			(0.009)
Unused commitment ratio$_{t-1}$ × Crisis2			-0.011			-0.016***
			(0.007)			(0.004)
Controls						
Capital ratio and interactions with stress and crisis	Yes	Yes	Yes	Yes	Yes	Yes
Size and interactions with stress and crisis	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114323	252526	252526	114323	252526	252526
R^2	0.05	0.04	0.04	0.02	0.03	0.03

The sample period of the regressions is from 1990 to 2009, except for the Gatev and Strahan sample (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 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, th 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 XII. The Relationship between Market Stress and Growth in Loans and Total Credit
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)
		Δ Loans$_t$/Assets$_{t-1}$		Δ (Loan + Commitments)$_t$/(Assets + Commitments)$_{t-1}$		
	Gatev and Strahan sample 1991-2000	1990-2009	1990-2009	Gatev and Strahan sample 1991-2000	1990-2009	1990-2009
Unused commitment ratio$_{t-1}$	0.087***	0.110***	0.113***	-0.009	0.014***	0.023***
	(0.010)	(0.007)	(0.007)	(0.010)	(0.004)	(0.004)
Unused commitment ratio$_{t-1}$ × Stress	**0.047*** **	**0.004**	**0.032*** **	**0.031*** **	**-0.035*** **	**0.018***
	(0.012)	**(0.005)**	**(0.009)**	**(0.011)**	**(0.006)**	**(0.009)**
Unused commitment ratio$_{t-1}$ × Stress × Crisis1			**-0.020**			**0.026**
			(0.018)			**(0.018)**
Unused commitment ratio$_{t-1}$ × Stress × Crisis2			**-0.023***			**-0.026***
			0.013			**(0.015)**
Unused commitment ratio$_{t-1}$ × Crisis1			-0.004			-0.067***
			(0.013)			(0.014)
Unused commitment ratio$_{t-1}$ × Crisis2			-0.021***			-0.053***
			(0.006)			(0.008)
Controls						
Capital ratio and interactions with stress and crisis	Yes	Yes	Yes	Yes	Yes	Yes
Size and interactions with stress and crisis	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114323	252526	252526	114323	252526	252526
R^2	0.05	0.08	0.08	0.02	0.05	0.05

The sample period of the regressions is from 1990 to 2009, except for the Gatev and Strahan sample (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 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.