Stressed, not Frozen:

The Federal Funds Market in the Financial Crisis[*]

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Abstract

This paper examines the impact of the financial crisis of 2008 on the federal funds market, specifically the bankruptcy of Lehman Brothers. Rather than a complete collapse of lending in the presence of a market wide shock, we see that banks become more restrictive in which counterparties they lend to. After Lehman Brothers, we find that amounts and spreads become more sensitive to borrower bank characteristics. While the market does not contract dramatically, lending rates increase. Further, the market does not seem to expand to meet the increased demand predicted by the drop in other bank funding markets. We examine discount window borrowing as a proxy for unmet fed funds demand and find that the fed funds market is not indiscriminate. As expected, borrowers who access the discount window have lower ROA. When looking at the lender side we do not find that the characteristics of the lending bank importantly affect the amount of interbank loans a bank makes. In particular, we do not find that worse performing banks start hoarding liquidity and indiscriminately reduce their lending.

I. Introduction

The interbank market is the most immediate source of bank liquidity and thus an important indicator of the functioning of the banking market overall. Problems in the efficiency of interbank markets can lead to insufficient bank liquidity and thus to inadequate allocation of capital and risk sharing between banks. At the extreme, a failure in interbank markets could even trigger bank runs. In addition, the overnight interbank market, known as the fed funds market in the US, is one of the main mechanisms by which monetary policy is implemented, and thus an important market, especially when the market rate can differ from the target. It is therefore of particular interest to understand whether the interbank market mitigates or amplifies shocks to individual banks or the banking sector overall.

In this paper we study how the Lehman Brothers' bankruptcy and the ensuing government interventions affected the functioning of the overnight fed funds market. Apart from contributing to a better understanding of the 2008 financial crisis, this period serves as a useful experiment to observe how the fed fund market reacts to market wide shocks to the stability of the banking industry. While the direct losses of large banks from the Lehman's bankruptcy were not big enough to trigger a bankruptcy, large banks' access to fed funds loans is the most affected. Unlike the Bear Stearns' failure, which did not result in meaningful disruptions in the interbank market, we see significant changes in spreads and access to credit after Lehman. Thus we interpret the Lehman's bankruptcy as an implicit shock to the market's belief that large banks would not be allowed to fail. There is an ongoing debate in the theoretical literature as well as in policy circles about the extent to which interbank markets are prone to contagion: Do shocks to one part of the banking sector lead to a freeze of the overall market? A number of recent theory papers model contagion risk from information asymmetry. In these models lenders in the

interbank market are unable to assess bank specific risks or the probability of liquidity shortages which then can lead to market unraveling when negative shocks hit banks. See for example, Freixas (1999) and Flannery (1996) or more recently Heider, Hoerova and Holthausen (2009) and Acharya, Gale and Yorulmazer (2009). On the other side of the debate are scholars such as Furfine (2001) or Flannery and Sorescu (1996) who assume that participants in the interbank market have sufficient knowledge to differentiate between banks with good and bad credit and are able to provide liquidity to good banks. However, to date, there has been no empirical analysis of the overnight fed funds market during the 2008 crisis.

We use transaction level data of participants in the fed funds market to investigate the provision of credit in this market after the Lehman Brothers' bankruptcy. We find a much more nuanced picture: Under "normal" or pre-crisis conditions the fed funds market functions via rationing of riskier borrowers rather than prices, e.g. adjustments of spreads.[1] After Lehman we see a different picture emerge: In the days immediately after the Lehman Brothers' bankruptcy the market seems to become sensitive to bank specific characteristics, not only in the amounts lent to borrowers but even in the cost of overnight funds. We see sharp differences between large and small banks in their access to credit: Large banks (especially those with high percentages of non-performing loans) show drastically reduced daily borrowing amounts after Lehman and borrow from fewer counterparties. In fact, the interest rate spread at which large banks borrow in the fed funds market after Lehman falls below pre-crisis levels after September 16th, 2008. We interpret this initial response as an effect of credit rationing. In contrast, smaller banks were able to increase the amount borrowed from the interbank markets and even managed to add lending

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[1] For example, in the aftermath of the Bear Stearns' near-bankruptcy we do not observe that interest rates spreads become more sensitive to the underlying bank characteristics, e.g. performance and size. However, generally, we do see that bank characteristics predict borrowing amounts and the number of banks willing to lend to a borrower. (Unreported analysis).

counterparties during the crisis; but to do so they faced higher interest rate spreads. Different from the predictions of many theoretical models of interbank lending, when faced with a market wide shock, we do not observe a complete cessation of lending but instead we see increased differentiation between borrowers of high versus low type.

When looking at the exact timing of changes in the interbank market, we see that in the two days after Lehman's bankruptcy large banks show a steep decline in the amount of funds they borrow while small banks do not see any significant decline and were even able to increase their borrowing. The sharp drop in loan volumes is mainly driven by the poorly performing banks (measured as banks with historically high levels of nonperforming loans (NPL) as a percentage of loans). This result is especially strong for the larger banks and suggests that directly after the crisis lenders in the fed funds market became more sensitive to credit risk, especially for larger borrowers. We find that this drop in loan volumes is associated with a sharp increase in interest rates and a loss in the number of counterparties large (and poorly performing) banks borrow from. However, beginning on Wednesday, September 16th, once the AIG bailout is announced (and later the CPP) the trend reverses especially for the large banks. After the AIG bailout is announced, spreads for the largest banks fall steeply, falling below the rate in the week before Lehman. We interpret the return to pre-crisis spreads as the effect of the government's support for systematically important banks, because the same is not true for small banks: these banks continue to face higher spreads till well after the announcement of the CPP.

In contrast, we do not find a relationship between lender characteristics and amounts lent immediately after Lehman's failure. Banks that might be expected to hoard liquidity (such as worse performing banks or banks that had been more dependent on repo financing) did not lend less in the interbank market after the crisis compared to their pre-crisis lending. This suggests

either that these banks did not need to hoard liquidity, or that they did not want to reveal weakness to this market by appearing to hoard liquidity. The fact that larger, worse performing banks disproportionately increased their number of counterparties could suggest that they feel more pressure to signal to the market that they are stable. Of course, this interpretation is only suggestive; and alternative interpretation could be that worse performing lenders differentially seek to diversify credit risk. However, independently of the interpretation of the banks' lending behavior, the results suggest that liquidity hoarding was a less important factor in the difficulty many banks had in accessing the fed fund market than the fear of counterparty risk.

It is difficult to definitively determine whether the fed funds market was able to efficiently provide banks with liquidity through the crisis, since we do not observe the full distribution of latent demand and supply. After the Lehman Brothers' bankruptcy, it is likely that decreases in banks' other funding sources increased demand for overnight funds. We attempt to measure the extent of unmet demand in two ways. First, we look at the use of the Federal Reserve's discount window during the crisis. Because of the high interest rate and potential for stigma, banks usually access the discount window only if they face severe unmet liquidity needs. Thus use of the discount window gives a lower bound for the unmet liquidity needs in the fed funds market. We find that even in the days after the Lehman Brothers' bankruptcy only very poorly performing banks, those with low ROA, access the discount window. It seems reasonable to assume that these are banks which were rationed by private banks lending in the fed funds market. While again it is difficult to assess whether this means that interbank markets operated efficiently after the crisis, it is, however, reassuring that we do not observe that well performing banks are forced to turn to the discount window. This would have been a very alarming indication of dysfunction in the fed funds market.

Second, we estimate the pre-crisis relationship between fed funds borrowing, bank characteristics and the price of other overnight funding such as overnight repo and deposit rates. We then use these relationships to predict post-crisis demand. While the amount borrowed in the fed funds market does not fall sharply, predicted demand for the fed funds market far exceeds actual borrowing. The gap is not related to banks' risk characteristics. Thus, while the overnight market did not collapse, it did not increase at a time when there was likely to have been increased demand for overnight funding.

II.   Related Literature

This research is related to a wider theory literature on interbank markets and bank liquidity. Theories of interbank markets generally postulate that these markets should fulfill two separate functions: liquidity insurance between banks and peer monitoring. However, the channels for financial contagion and the reasons why markets may freeze differ across studies.

Freixas (1999), Flannery (1996) and Heider, Hoerova and Holthausen (2009) present models of the interbank market with asymmetric information about counterparty risk which can lead to a collapse of the overall market if the fraction of risky borrowers in the market becomes too high and lenders do not have the ability to separate good from bad counterparties. In Bruche and Suarez (2010)'s general equilibrium model, counterparty risk in an economy with retail deposit insurance may lead to a freeze in interbank money markets. The authors show that the risk of bank failure creates an asymmetric allocation of capital between banks with access to abundant insured deposits (cheap funding) and those with no access that then need to pay higher spreads in

money markets. This asymmetry distorts the aggregate allocation of credit and can lead to a drying-up of interbank money markets.

Allen, Carletti and Gale (2009) propose a model of interbank market freeze where there is no asymmetric information or counterparty risk. If there is uncertainty about aggregate liquidity demand, banks hoard liquidity in anticipation of high aggregate demand for liquidity to deal with their idiosyncratic liquidity needs and to take advantage of high volatility in asset prices. Hoarding liquidity also plays a key role in Diamond and Rajan (2009). The authors argue that an overhang of illiquid securities might reduce their price sufficiently such that banks have no interest in selling them. Markets then freeze as investors hoard liquidity expecting high returns when banks in need of cash are forced to sell at fire sale prices.

Several other relevant papers predict market freezes, although do not explicitly model the interbank market. Bolton, Santos and Scheinkman (2009) presents a model of liquidity demand arising from the maturity mismatch between asset payoffs and desired redemptions, where adverse selection ultimately leads to a market freeze. Adverse selection is also the driving factor of a total break-down of trade in Morris and Shin (2009). The authors show that the market for toxic assets freezes when there is a failure of market confidence. Acharya, Gale and Yorulmazer (2009) focuses on freezes in the market for repurchase agreements (repo) or asset-backed commercial paper. They conclude that, when debt needs to be rolled over frequently, shifts in the information structure of the true value of the underlying assets can cause lending to dry up leading to a market freeze.

Our paper is closely related to other empirical studies of the impact of financial crises on interbank markets. The key advantage of our paper relative to the existing literature is that we

have transaction level data on all trades in the fed funds market. Therefore we are able to look carefully at the decisions at the lender and borrower levels. In the UK, Acharya and Merrouche (2009) examine the behavior of settlement banks and show that precautionary hoarding by some banks raised lending rates for all settlement banks. Wetherilt, Zimmerman and Soramäki (2009) find a reduction in the number of bilateral relationships in the sterling unsecured overnight market compared to pre-crisis levels. They also show that in the short term when core banks appear risky, correspondents prefer to diversify away from the core. Halsall, Jackson and Merrouche (2008) analyze the relationship between rate volatility and the level of participation in the unsecured overnight interbank market in the UK and document trading shifts later in the day during the sub-prime turmoil.

In continental Europe, the interbank market as a potential channel of contagion is examined in Memmel and Stein (2008), who finds that the risk of interbank contagion is very low using German data. Using data from e-MID, an electronic interbank market born as an initiative of the Bank of Italy, Brunetti, di Filippo and Harris (2009) examines the effects of central bank intervention in this market during the subprime crisis.

Before the 2008, crisis Furfine (2002) uses similar data to study the performance of the US interbank market during the autumn of 1998 and finds that risk premiums on overnight lending were largely unaffected and lending volumes in the federal funds market increased during a period that included Russia's default on its sovereign bonds and the collapse of Long-Term Capital Management. Cocco, Gomes and Martins (2009), highlights the role of bank relationships in the process of liquidity provision in interbank markets. Using data from the Portuguese interbank market between January 1997 and August 2001, they find that banks with a larger reserve imbalance, small banks and banks with more nonperforming loans rely more on

relationships and that relationships are established between banks with less correlated liquidity shocks.

III.   The Federal Funds Market

Federal Funds, or fed funds, are uncollateralized loans of reserve balances at Federal Reserve banks. Banks and other depository institutions keep reserves at the Federal Reserve banks to meet reserve requirements and to clear financial transactions. The fed funds market allows institutions with excess reserve balances to lend to those with reserve deficiencies. These loans are accounted for as deposit liabilities exempt from the reserve requirements under the Federal Reserve's Regulation D (Reserve Requirements of Depository Institutions[2]). On daily basis, financial institutions purchase and sell reserve balances, mostly overnight (although longer maturity loans are also traded), at a rate known as the federal funds rate.

The fed funds market is an over-the-counter market where institutions seeking to borrow or lend negotiate loan terms directly with each other or indirectly through a fed funds broker. To expedite the lending process and reduce transaction costs, most overnight loans are booked without a contract. These verbal agreements rely on lending relationships and on established credit lines between borrowing and lending institutions. Participants include commercial banks, thrift institutions, agencies and branches of foreign banks in the United States, federal agencies, and government securities dealers.

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[2] http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=b190e5829176d4ca80bef82dd7a11a1b&rgn=div5&view=text&node=12:2.0.1.1.5&idno=12

IV.   Other Funding Sources

Depository institutions have several alternatives to the fed funds market to meet their funding needs. First, they can borrow at the discount window from one of the three lending programs: primary credit, secondary credit and seasonal credit programs.[3] Unlike fed funds loans, borrowing from the discount window is collateralized. However, the Federal Reserve accepts a broad range of assets as discount window collateral, including home mortgages and related assets, and thus collateral is unlikely to be a limiting factor.[4] More importantly, banks have been reluctant to borrow from the discount window because of a perceived "stigma".[5] Federal Reserve banks extend primary credit on a short-term basis to banks that are adequately or well capitalized (CAMEL rating of 1-3), for up to 90 days at a rate currently 25 basis points above the target federal funds rate.[6] Discount window loans are typically overnight and allow for early repayment of the loan if issued for a longer term.

Second, banks can bid to borrow funds from the Term Auction Facility (TAF), created on December 12, 2007.[7] The TAF provides funding at interest rates and amounts set by biweekly auctions. Unlike the discount window and fed funds loans, TAF funding cannot be prepaid and is

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[3] Primary credit is extended to depository institutions with strong financial positions while secondary credit is offered to those institutions that do not qualify for primary credit. Small depository institutions in agricultural communities are the typical users of seasonal credit.

[4] Acceptable collateral include U.S. government and agency securities, certain types of foreign sovereign debt obligations, municipal or corporate obligations of investment quality, commercial paper of investment quality, bank issued assets by an institution in "sound financial condition" and customer obligations that meet credit-quality standards. See http://www.frbdiscountwindow.org/20090819margins_announcement.cfm?hdrID=14 for a list of acceptable collateral for discount window loans as well as their corresponding collateral margins.

[5] Armantier et al. (2009b) and Furfine (2003) find empirical evidence for discount window stigma.

[6] In March 17, 2008, the spread between the primary rate at the discount window and the federal funds target was narrowed from 50 to 25 basis points and the maximum maturity of discount window loans extended from 30 to 90 days.

[7] Armantier et al. (2008) presents a detailed analysis of the liquidity conditions in the term funding markets leading up to the introduction of the Term Auction Facility as well as the structure and results of the first ten TAF auctions. See also http://atthebank.ny.frb.org/BankBusiness/facilities.shtml#taf for more information on the facility.

available only on pre-specified dates and on a term basis. Borrowing is collateralized and assets eligible for collateral are the same as those eligible to be pledged at the discount window. In contrast to the discount window, TAF funding is not perceived to be associated with stigma. The first TAF auction was held on December 17, 2007, auctioning $20 billion, and the size of the auctions were increased over time to a peak of $150 billion on October 6th, 2008. Auctions of 84-day credit were established in July 2008 to supplement the existing 28-day auctions.

Borrowing in the repo market is a third alternative. A repurchase agreement, or repo, is a financial contract that allows the use of a financial security as collateral for a cash loan, mostly on an overnight basis, at a rate known as the repo rate. The overnight repo rate is generally lower than the fed funds rate.

The repo market is a large and opaque over-the-counter market which exceeded $10 trillion in the US by mid-2008 (Hördahl and King (2008)). Gorton and Metrick (2009a) finds evidence for a "run on repo" in the two weeks following the Lehman's bankruptcy. They estimate that average haircuts for non-US Treasury collateral increased from approximately 25 percent to 43 percent in these two weeks, and argue that this pricing change was the result of concerns about the illiquidity of the assets being used as collateral.[8]

V.   Data

Fed funds data for this analysis come from a proprietary transaction-level dataset which contains all transfers sent and received by institutions through Fedwire. An institution that maintains an account at a Reserve bank can generally become a Fedwire participant and use this account to

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[8] See also Gorton and Metrick (2009b) for a more detailed analysis of the impact of financial turmoil on repo haircuts.

make large-value payments as well as to settle interbank loans. Fed fund loans are thus a subset of all Fedwire transactions. We identify transfers as fed funds transactions using an algorithm similar to the one proposed by Furfine (1999). Similar data is used in Bartolini et al. (2009), Bech and Atalay (2008) and Ashcraft and Duffie (2007), among others.[9] The data include the date, amount, interest rate, time of delivery and time of return as well as the identity of the lender and the borrower of every transaction sent over Fedwire. The borrower and lender are identified at the lead American Banking Association (ABA) level, which corresponds with a bank-level RSSD. We aggregate the fed funds data to the bank holding company level and aggregate loans between each borrower-lender pair on a daily basis, calculating the federal funds rate for each borrower-lender pair as a weighted average.

We augment this data with quarterly information on bank characteristics as filed in the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C).[10] It provides information on credit risk variables, total assets and financial ratios. In addition, we merge information from proprietary Federal Reserve databases on reserve requirements and discount window borrowing. Discount window data include information on the borrower, amount borrowed, available collateral and interest rate. This data is described in greater detail by Armantier et al. (2009a) in their analysis of the interaction between TAF bidding and discount window borrowing.

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[9] As previously noted, this methodology presents some weaknesses. First, only fed fund loans settled through Fedwire are identified. Second, term fed funds loans are not included. Third, sending and receiving institutions may act as correspondent or brokers of the actual parties. Forth, rates outside the specified window are missed. Fifth, other overnight loans settled through Fedwire, such as Eurodollars or tri-party repos, could be misidentified as fed funds.

[10] Consolidated Reports of Income and Condition (FR Y-9C) are available from the Federal Reserve online at http://chicagofed.org/economic_research_and_data/bhc_data.cfm. Data become available about two to three months after the end of each quarter (e.g., data for the third quarter of 2008 became available at the beginning of December 2008).

VI.   The Federal Funds Market 2007-2008

Despite theoretical predictions and public perception of a collapse in interbank lending around financial crises, the *overnight* federal funds market was remarkably stable through the recent period of turmoil in the financial markets. Figures 1-6 show the amount, participation and interest rates in the fed funds market beginning in 2007. We highlight four key dates in each figure:[11] i) August 9th, 2007 – BNP Paribas tells investors that they cannot value assets in two funds, ii) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for $2 a share, iii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner, and iv) October 9th, 2008 – First day of the first maintenance period after the Federal Reserve's announcement that it will pay interest on required reserve balances and on excess balances held by or on behalf of depository institutions.[12]

As shown in FIGURE 1 and FIGURE 2, the daily amount of transactions is surprisingly stable through the period, rising from an average daily amount of $177 billion in January of 2007 to a peak of more than $250 billion immediately post-Bear Stearns on March 17th, 2008, and stabilizing at approximately $190 billion post-Lehman. Fed funds market volume begins to fall only after the interest on reserves (IOR) period begins. Similarly, as shown in FIGURE 3 and FIGURE 4, the number of borrowers is relatively stable through the Lehman Brothers episode

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[11] See Hellerstein, Ryan and Shrader (2009) and also http://www.newyorkfed.org/research/global_economy/Crisis_Timeline.pdf for a detailed description of the key events surrounding the financial turmoil after June 2007.

[12] The Financial Services Regulatory Relief Act of 2006 authorizes the Federal Reserve to pay interest on reserve balances and on excess balances held by or on behalf of depository institutions beginning October 1, 2011. The effective date of this authority was advanced to October 1, 2008 by the Emergency Economic Stabilization Act of 2008. Initially, the interest rate paid on required reserve balances was 10 basis points below the average target federal funds rate over a reserve maintenance period while the rate for excess balances was set at 75 basis points below the lowest target federal funds rate for a reserve maintenance period. The Federal Reserve began to pay interest for the maintenance periods beginning on October 9, 2008. The interest rate paid on required reserve balances was modified to 35 basis points below the lowest target federal funds rate on October 23, 2008. On November 6, 2008, the rate paid on required reserve balances was set equal to the average target federal funds rate over the reserve maintenance period while the interest rate on excess balances was equal to the lowest target federal funds rate in effect during the reserve maintenance period. Since December 18, 2008 the interest rate on required reserve balances and excess balances has been 25 basis points.

ranging between 130 and 200 banks. In contrast, the number of lenders fell from 250-300 in the summer of 2008 to hover around 265 after Lehman Brothers, and fell even more dramatically after the payment of interest on reserves to the 2009 level of around 100-115. As shown in FIGURE 5 and

FIGURE 6, the daily fed funds rate was relatively stable after the Bear Stearns' episode until Lehman Brothers' bankruptcy. The weighted average rate jumped more than 60 basis points on September 15, 2008, with substantially more widening of the distribution.

[FIGURE 1 - FIGURE 6]

VII. Definition of variables

In order to understand the impact of the financial crisis on the fed funds market, we study the period surrounding the bankruptcy of Lehman Brothers. We begin the pre-Lehman period on April 1, 2008 so as to avoid the period surrounding the collapse of Bear Stearns and sample through February 28, 2009 so that there are an equal number of days preceding and following the event. We aggregate the data into two samples for the analysis in TABLE III – TABLE VIII so that we can examine the importance of both borrower and lender characteristics. The first sample, aggregating all fed funds loans to each borrower in a day, consists of 21,003 observations from 360 borrowers. The second sample, aggregating all fed funds loans from each lender in a day, consists of 20,354 observations from 274 lenders. Each analysis is conducted with one observation per borrower – day (lender – day).

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We allow market conditions to vary in different windows around the bankruptcy, selecting breakpoints around the following events:

- September 15th, 2008 – Lehman Brothers files for bankruptcy (pre-market open)

- September 16th, 2008 – Federal Reserve loans $85 billion to AIG (after market close)

- October 9th, 2008 – Federal Reserve begins to pay interest on required and excess reserve balances (IOR)

- October 14th, 2008 – 9 large banks agree to capital injection from Treasury (CPP)

We indicate with binary variables the following time periods: 2 weeks pre Lehman (August 29th, 2008 to September 4th, 2008), 1 week pre-Lehman (September 5th, 2008 to September 11th, 2008), Friday September 12th, 2008, Monday September 15th, 2008, Tuesday September 16th, 2008, Post-AIG and pre-IOR (September 17th, 2008 to October 8th, 2008), post-IOR and pre-CPP (October 9th, 2008 to October 13th, 2008), and monthly after CPP (October 14th, 2008 to November 10th, 2008 and thereafter). In the tables, we present coefficients only through the 1 month post-CPP period. Dummy variables for each month are included but not shown due to table size limitations. Estimated coefficients are available upon request.

We analyze three variables to assess conditions in the fed funds market: price, amount and number of counterparties. We measure the price of fed funds with the weighted average spread between the rate for that bank and the target federal funds rate on that day.[13] The amount of fed funds loans is calculated as the log of the total amount borrowed in $ millions plus one. We include in this analysis only banks that were observed borrowing in the market at any time from

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[13] In unreported specifications, we estimated TABLE V using spread to the effective fed funds rate rather than the target. Results for the interaction of bank characteristics were similar, although the positive coefficient on Monday 9/15 was naturally reduced, since the effective rate was dramatically higher than the target rate on that day.

2007 through the Lehman Brothers' bankruptcy.[14] Finally we calculate the number of counterparties as the log of the number of different lenders (borrowers) in a given day. We also tabulate the daily percentage of banks borrowing, by dividing the number of unique borrowers by the total 360 banks that borrowed in the sample time period (April 2007 to February 2008).

Summary statistics for the fed funds market in this time period are presented in TABLE I. While the mean and median amount of daily loans do not fall, the mean spread between banks' fed funds loan rates and the target fed funds rate almost doubles in the period immediately surrounding the Lehman's bankruptcy, and the volatility of spreads increases as well. It is worth noting that even in the pre-Lehman time period, approximately 30% of borrowers actually borrow on any given day. This number falls to 27.5% surrounding Lehman's bankruptcy, and the decline in mean daily borrowers is significantly different from the pre-Lehman period only after IOR (October 2008).

[TABLE I]

Table II shows bank characteristics from the call reports for the sample borrowing and lending banks. The borrower sample includes only borrowers with call report data so that we can measure banks' characteristics consistently. It includes loans from all lenders, including government-sponsored enterprises (GSEs) and US subsidiaries of foreign banking organizations. As summarized in TABLE II, the median borrower in this market has more than $1 billion in assets (the mean is $27 billion) and non-performing loans of 0.8% of total loans as of December 31, 2007 (the mean level of non-performing loans is 1.1%).

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[14] In unreported specifications, we estimated similar results expanding the analysis to include banks which did not borrow, filling in the amount to be the log of one, effectively creating observations for banks who did not borrow on a given day with amounts of 0.

The analysis also considers the relationship between lender characteristics and the price, amount and number of counterparties of fed funds loans after the Lehman Brothers' bankruptcy. The lender sample is different from the borrower sample, because it includes only lenders with call report data. Excluded are loans from GSEs and US subsidiaries of foreign banking organizations, but we included loans to those entities. The median lender in this market has characteristics that are similar to those of the median borrower, with close to $1billion in assets and non-performing loans of 0.8% of total loans as of December 31, 2007, again the mean values are $26 billion and 1.3%, respectively.

[TABLE II]

VIII.   The Effects of Shocks to the Interbank Market

In the following analyses we want to shed light on the functioning of the fed funds market in the aftermath of a major shock to the banking industry, the bankruptcy of Lehman Brothers. Our objective is to document which banks were able to access the market after the onset of the Lehman crisis and at what terms. The alternative view is that this shock led to a market wide collapse of the fed funds market and prevented even banks that are good credit risks from accessing to the market. For that purpose we look at different dimensions of access to credit such as the interest rate at which banks borrow, the amount of loans, and the number of counterparties. The last two are particularly important since many participants suggest that credit risk in the interbank market is managed via credit rationing rather than interest rates.

In TABLE III we first look at the effect of the Lehman's bankruptcy on the fed funds market with and without controlling for fixed bank borrower characteristics. This allows us to separate the effect of the crisis on a given bank from the composition effects of who (was able to) access the interbank market after the Lehman crisis. The first column is a probit estimation with a dependent variable equal to one if a bank borrows on a given day. We do not estimate a probit model with borrower fixed effects because fixed effects for the 20 banks that borrow every day (including the period around Lehman's bankruptcy) would perfectly predict access and thus be excluded from the analysis, distorting the results. The dependent variable in the next two columns is the spread to target (the difference between the weighted average interest rate for a given bank and the target interest rate), columns (4) and (5) report the effect on the log of the amount borrowed and finally columns (6) and (7) show the log number of counterparties for a given borrower.

In contrast to theoretical predictions of a cessation in trading, without controlling for bank fixed effects, there does not seem to be much happening in the two days following Lehman's bankruptcy. While the probit estimation suggests access to the interbank market decreased around the Lehman's bankruptcy, the change to the market is not the abrupt cessation of activity predicted by some theories. Rather than a sudden large negative coefficient immediately after Lehman's bankruptcy, we estimate small negative coefficients beginning in August 2008. These negative coefficients become significantly more negative only after IOR.

There is no statistically significant change in the amount borrowed (column (4)) or the number of counterparties (column (6)). Spreads increase on Monday, September 15th, but begin falling thereafter (column (2)). Results are similar when the data are grouped by lender and controlling

for fixed lender characteristics and when data is included for all borrowers and all lenders (see TABLE XIII and TABLE XIV in Appendix).

But that hides a dramatic shift in the flow of funds and the distribution of rates across different borrowers revealed by controlling for borrower fixed effects. When we include borrower fixed effects in column (5) the coefficient on the post Lehman dummy is negative and significant with a coefficient estimate of -0.19 on September 15th. The economic effect is economically large since a point estimate of -0.19 translates into a reduction of lending of 17.3%. The results suggest that while after the Lehman's bankruptcy the average loan size of banks in the fed funds market did not drop (TABLE III, column (4)), for any given bank the amount borrowed decreased (TABLE III, column (5)). These two seemingly contrary effects can only be reconciled if there is a change in the composition of banks that are borrowing in the market: larger banks or those banks that were able to borrow larger amounts must have accessed the interbank market less often after the Lehman's bankruptcy. Therefore, the average loan in the sample is unchanged, while at the same time the average bank in the sample sees a decline in the amount borrowed. It seems that those banks that usually borrow a lot and often from the market were the ones facing very different borrowing terms or even losing access, while banks that use the market less seem to have increased their borrowing.

Similarly, Column (7) shows that there is a reduction in the number of counterparties a bank borrows from post-Lehman only after including borrower fixed effects. The coefficient on the post-Lehman dummy is negative in the cross section but not significant. This suggests that a given borrower in the sample borrows from fewer counterparties post-Lehman. Even those banks which are able to access the fed funds market after the Lehman's bankruptcy borrow from a smaller number of counterparties.

It is important to note that when including borrower fixed effects in TABLE III the adjusted R-squared jumps dramatically. So clearly bank characteristics are an important determinant of banks' borrowing in the fed funds market. In fact, including only borrower characteristics such as assets, ROA, NPL levels and risk ratios instead of bank fixed effects, we can explain about 70% of the cross sectional variation of bank borrowing and interest rates (unreported results).

[TABLE III]

In TABLE V - TABLE VII we begin to disentangle the impact of the Lehman Brothers' bankruptcy on banks of different size and performance metrics. We first estimate a probit specification where the dependent variable is a binary variable $Access_{t,b}$ equal to one when banks borrow (lend)

$$Access_{b,t} = \beta(Date) + \delta\big(Date \times X_{b,2007}\big) + \gamma\big(Date \times Assets_{b,2007}\big) + \theta\left(Date \times \frac{Amount_{b,t}}{Assets_{b,2007}}\right) + \varepsilon_{b,t}$$

and then for each of the fed funds terms $F_{t,b}$ (spread to target, log amount and log number of counterparties):

$$F_{b,t} = \beta(Date) + \delta\big(Date \times X_{b,2007}\big) + \gamma\big(Date \times Assets_{b,2007}\big) + \theta\left(Date \times \frac{Amount_{b,t}}{Assets_{b,2007}}\right) + \alpha_b + \varepsilon_{b,t}$$

where b indexes bank borrowers or lenders, t indexes time, *Date* is a vector of dummy variables equal to 1 in the time period of interest and 0 otherwise, $X_{b,2007}$ is the bank characteristic of interest such as % NPLs measured as of December 31, 2007, $Assets_{b,2007}$, are bank borrower or lender assets as of December 31, 2007, $Amount_{b,t}$ *is* the amount borrowed or lent in the fed funds market (not included when the dependent variable is amount), and $\varepsilon_{b,t}$ is an error term. The Fed Funds terms specifications include α_b fixed effects for bank borrowers (lenders).

We consider characteristics of borrowing (lending) banks in two ways. First, we split the sample into three equally sized bins by asset size. The smallest banks are those with less than $937 million in assets, and the largest have more than $3.5 billion. In the fed funds terms specifications (TABLE IV to TABLE VII), there are fewer observations in the smaller bank group, because smaller banks are less frequent borrowers (both in the pre- and post-crisis periods). We estimate the same specifications separately for each size group, allowing all of the coefficients to vary with bank size. We present the coefficients for the largest and smallest banks to show how pricing changes differently for large and small banks. When the difference in coefficients between columns is statistically significant, the coefficients are shown in bold type. It is worth emphasizing that the fed funds terms regressions include borrower (lender) fixed effects. Our identification therefore is only driven by changes in the sensitivity of fed funds terms to banks' pre-crisis characteristics. That means we estimate a change in the slope of the relationship between bank characteristics and fed funds' loan amounts and pricing.

Since the fed funds terms specifications already include controls for bank fixed effects, splitting the sample by asset size also allows us to see if the time period effect is different for banks of different sizes. We also control for the interaction of asset size and the date dummies in each specification shown in TABLE V - TABLE VII, although these coefficients are not presented in the tables. In the specifications with spread or counterparties as a dependent variable, we control for interaction of amount borrowed divided by asset size and the date dummies in each specification, although these coefficients are not presented in the tables. We next add the interaction of bank characteristics such as the percentage of non-performing loans with time period dummies to the specifications sorted by bank size. The end result is effectively a triple difference-in-difference estimation, testing to see if the market becomes more sensitive to these underlying characteristics

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in the post-Lehman period, and if fed funds borrowing of small and large banks is differentially sensitive to these characteristics.

We first test to see if borrowing (lending) is associated with borrower (lender) characteristics (TABLE V). We find that borrowers and lenders that are large access the fed funds market less after Lehman's bankruptcy. Furthermore, it is the worst performing large banks that access the market least – the coefficient on % NPL is negative and statistically significant for large borrowers. Surprisingly, this pattern is reversed for lenders – the worst performing large lenders are actually more likely to lend on the Monday and Tuesday following Lehman's bankruptcy.

TABLE V examines how interbank lending rates for large and small banks changed after the Lehman Brothers' bankruptcy. While smaller borrowers see an increase in spreads of over 94 basis points on Monday, the larger borrowers have no significant increase in their spreads. Post-Lehman spread changes are similar for small and large lenders. In columns (3) and (4) and (7) and (8) we add interactions of the post-Lehman dummies with non-performing loans as a proxy of borrower and lender quality.[15] Immediately after the Lehman's bankruptcy, the relationship between spreads and quality is no different from that of the pre-crisis period.

These results underscore again that interest rates in the fed fund markets did not become increasingly sensitive to bank performance metrics in a consistent manner. Yet this does not necessarily mean that lenders are not concerned about the counterparty risk of banks. But rather the results suggest that lenders seem to be more likely to manage their risk exposure to individual banks by the amount they lend to a given bank or even whether they lend at all to the bank. The fact that interest rates go up for the smaller banks but not for the larger banks does not

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[15] Surprisingly, we do not consistently see a flight to quality as measured by ROA or risk ratio. These results are available upon request.

necessarily constitute a flight to size. In contrast these trends could be driven by rationing in the market. If only smaller banks are able to access the fed funds market after the Lehman Brothers shock but at higher rates, we could find higher rates for smaller banks. But in this case the higher rate is an indication that only smaller banks are able to access the market, while large banks are not. The results of the next two tables will provide additional evidence to corroborate this interpretation.

[TABLE V]

We next describe in TABLE VI the daily amount borrowed by banks in the fed funds market. Interestingly we see a difference in the effect on larger versus smaller banks which comes through differences in bank quality. The decline in borrowing on September 15th is largest for large banks with high amounts of non-performing loans (-49.1). This means that the reduction in loan amounts post Lehman for large banks is concentrated in banks with more non-performing loans.

Borrowers that have higher quality metrics are able to access larger loans in the fed funds market on September 15th. The interaction between NPLs and Monday shows banks with higher NPLs are associated with lower borrowing post Lehman.[16] The relationship is also economically large. These results underscore that banks manage their risk exposure in the interbank market via rationing of loan amounts rather than interest rates. Large banks with high percentages of NPLs continue to borrow less even after the Federal Reserve's investment in AIG was announced after the close of the market on September 16th. In unreported analysis, we found similar results when we estimated similar specifications looking only at a binary measure of whether a bank accessed the market or not.

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[16] Similarly, lower ROAs and lower risk ratios are associated with lower borrowing post Lehman.

In contrast, lender characteristics such as NPLs are not associated with changes in the amount lent immediately after Lehman Brothers. This means that even riskier banks did not hoard funds on the Monday and Tuesday after Lehman's failure. While we do not observe meaningful differences in the lending amounts of riskier banks, it is impossible to know from amounts if these lenders were trying to send a positive signal to the interbank market or simply did not want to hoard cash.

[TABLE VI]

Finally in TABLE VII we look at the composition of counterparties. We again begin by splitting the specification between the smallest and largest banks. Controlling for amount borrowed, we see a sharp difference in the number of counterparties for smaller versus large borrowers. The direct effect of the Monday (9/15) post-Lehman dummy now turns positive for smaller borrowers while the coefficient for large borrowers is negative and highly significant; the point estimate is -0.129. Large banks see a statistically significant reduction in counterparties they borrow from while smaller banks have more counterparties immediately post Lehman. Smaller banks do not seem to be as strongly affected by the Lehman shock. In fact, the market was functioning well enough that small banks were able to add more counterparties in order to maintain their level of borrowing from the market. The reduction in counterparties for larger banks appears to be driven by larger banks with worse performance (as measured by NPLs). In contrast, smaller banks' number of counterparties does not appear to be associated with performance.

We find an interesting relationship between lender characteristics and counterparties. For every additional 1% in NPLs, larger lenders increase their counterparties by 8% on September 15th.

Effectively, worse performing larger banks are distributing the same amount of money to more counterparties – spreading the signal that they are lending to even more banks. We do not see a similar increase in counterparties for small banks, perhaps because it is more difficult for them to quickly increase counterparties.

Overall we show that large banks that are borrowing in the fed funds market see a sharp increase in spreads and a drop in loan amounts immediately following the Lehman's bankruptcy. These effects are particularly strong for large banks with high NPL levels. In contrast, small banks do not experience the same fall in loan amounts. However, immediately before the Federal Reserve's $85 billion loan to AIG is announced (and again after the initial CPP announcement) we see that spreads for large banks return to pre-crisis levels or below. These results suggest that the Lehman's bankruptcy led to a change in beliefs in the interbank market about whether the authorities would let big banks fail. In response we see that lenders in the fed funds market started both pricing the credit risk of and reducing exposure to poorly performing large banks (rather than a complete freeze of the market). However, as soon as the AIG loan is announced the fear of counterparty risk for large banks is alleviated and loan amounts and spreads go back to pre-crisis levels. In contrast, we do not see any significant changes in banks' average lending amounts in response to the crisis. There is some evidence that especially larger banks lend to more counterparties. These results do not seem consistent with liquidity hoarding by banks in the interbank market.

[TABLE VII]

IX.   Discount Window Analysis

One concern with the preceding analysis is that observed transactions are the result of the intersection of supply and demand. To cleanly differentiate between the supply and demand effects we would need to observe the levels and changes of (unmet) demand and supply of liquidity that banks have. This is very difficult to obtain since it entails knowing the amount and the interest rate schedule at which each bank would have liked to borrow.

The overnight interbank market provides a rare opportunity to observe latent demand, since we can observe other sources of funding that banks access. In particular we obtained data on the amount of loans that banks draw down from the discount window. Borrowing from the discount window is a near perfect proxy for latent or unmet demand: on the one hand it is provided by the Federal Reserve at the same periodicity as fed funds, i.e. as daily overnight loans. But the rate is higher than the target fed funds rate (the rate has been 25 basis point higher than the target rate since March 17, 2008 and was 50 basis points higher prior to that). Second, while discount window loans are collateralized, collateral is unlikely to be a limiting factor for discount window access. Finally, the discount window can be accessed at the end of the day, allowing banks to first transact in the fed funds market. However, in addition to the interest rate premium, accessing the discount window is associated with a stigma. So banks will only resort to this form of liquidity if they are shut out from other forms of funding.

Therefore, we first analyze whether the level of borrowing from the discount window increased dramatically after the Lehman's bankruptcy. Similar to the analysis in TABLE IV, we include in the possible sample all banks that borrow from the fed funds market from April 2008 to February

2009, and indicate with a binary variable equal to one if they access the discount window.[17] In a second step we examine which types of banks accessed the discount window after Lehman. If the main predictor of accessing the discount window is poor past performance, we infer that the fed funds market is allocating funds to better banks, which would be consistent with the predicted demand shortfalls of weaker banks. However, in contrast, if we see that even banks with good past performance have to go to the discount window to meet their liquidity needs in the post-Lehman period, it would be a sign of dysfunction in the fed funds markets.

In column (1) of TABLE VIII we use a probit estimator of the likelihood that a bank goes to the discount window pre-and post-Lehman controlling for the interest rate and lending amount this bank had in its last transaction on the fed funds market. There is a clear increase in the likelihood of accessing the discount window, especially on Monday, September 15th. In specifications (2)–(5) we then explore the likelihood that a bank accesses the discount window as a function of bank characteristics and its past borrowing behavior in the fed funds market. We find a very strong and economically large correlation between bank ROA and the likelihood of accessing the discount window. Only banks that have very poor performance as measured by ROA turn to the discount window. We find similar results with NPL on Tuesday September 16th, but the NPL results are not statistically significant in every time period, perhaps because the number of banks accessing the window is quite small.

So overall, while we cannot rule out that some banks were screened out of the market it appears that the turmoil in the interbank market cannot have been that big that completely normal and

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[17] We include as controls the amount borrowed on the most recent previous day. As a result, we exclude observations where banks have not yet borrowed, resulting in a lower number of observations compared to the fed funds access analysis (TABLE IV).

solvent banks had to turn to the discount window for liquidity. This provides evidence that the interbank market was not completely frozen through the crisis.

[TABLE VIII]

X.   Historical Repo Financing as a Demand Measure

Our next measure of bank demand for fed funds exploits disruptions in other overnight funding markets to identify banks that might have increased demand for overnight funds. According to market participants, in normal times, banks will seek liquidity in the fed funds and repo markets and will substitute between the markets depending on pricing (subject to collateral availability). As shown by Gorton and Metrick (2009a) this market was severely disrupted after Lehman's failure, with dramatically increased haircuts and pricing. Therefore, to the extent that these two markets are substitutes, post-Lehman fed funds borrowing demand should increase for banks that fund a larger percentage of their assets with repo borrowing. We examine the relationship between bank borrowing (lending) and changes in the access to overnight repo markets in TABLE IX and TABLE X.

In TABLE IX and TABLE X, we divide the sample into terciles based on the level of repos sold under agreement to repurchase divided by assets as of December 31st, 2007 (*%Repo*). Banks in the bottom tercile have *%Repo* of less than .00176 and banks in the top tercile have *%Repo* greater than or equal to .03721. Comparing the estimated coefficients from the bottom and top terciles allows us to see if results from our previous estimations are different for banks with high and low values of repo financing. As before, the dependent variable in the first two columns is

spread to target, in the next two columns the log amount and in the final two columns the log number of counterparties.

TABLE IX examines the impact of increased liquidity demand for borrowers and TABLE X summarizes the identical analysis for lenders. Immediately following Lehman's bankruptcy, there is no relationship between borrowers' repo financing and their fed funds amount borrowed. In fact, controlling for % NPL, the coefficients in column (4) are higher than those in column (3) of TABLE IX in the three days immediately surrounding the Lehman's bankruptcy (rows 2-4), indicating that banks that should have higher demand for fed funds loans are not increasing their borrowing more than banks which do not have reduced access to an important source of overnight funding. If pre-crisis reliance on repo funding is an indicator for increased liquidity demand post Lehman, our results suggest that lending in the fed fund market did not expand in response to increased demand; not even for the best of these borrowers (those with low NPL levels).

Just as borrowers which relied on the repo market for overnight financing should have higher demand for fed funds, lenders which relied on the repo market for overnight financing might reduce their supply of fed funds when the repo market dried up. In this market we do see that in many cases the coefficients in column (4) of TABLE X are lower than the coefficients in column (3) (rows 2-4) after Monday, September 15th although the difference is not statistically significant. Again, this effect is reversed for lenders with higher NPLs. Lenders with high NPLs and high repos actually lend more than did lenders with high NPLS and low repos, although the difference is statistically significant in some time periods only.

[TABLE IX and TABLE X]

XI.   Predicted Demand

Finally, we attempt to estimate fed funds market demand by estimating the pre-crisis relationship between fed funds borrowing, borrower characteristics and macroeconomic variables. We use the estimates from the pre-crisis specification to predict post-crisis demand. We then calculate the difference between predicted demand and actual borrowing. Of course, this methodology assumes that the estimated pre-crisis relationships are similar to post-crisis relationships. While this may not be the case, predicted demand based on pre-crisis correlations remains an interesting counterfactual.

TABLE XI presents the results from the pre-crisis estimation (January 1, 2007 to August 29, 2008). We estimate an OLS model of the relationship between the log of amount borrowed and the following bank characteristics: Daily: log of average amount borrowed in the previous month, log of customer funds sent, log of customer funds received, difference between reserve balance without fed funds transactions and required reserves (all from Federal Reserve databases); Quarterly: assets, ROA, risk ratio, % NPL, % MBS, % Repos (from the Y-9C). We also include the following daily macroeconomic variables: target fed funds rate, one month term rates on: AA asset-backed commercial paper, certificates of deposit, financial commercial paper, LIBOR and OIS, overnight rates on treasury repos and MBS repos. In addition, we allow fixed effects for end of maintenance period days, calendar months and quarter end dates, and estimate the model separately for small and large banks. We explain more than 60% of the variation in amount borrowed with these variables.

We create a variable "forecast error" which is the difference between actual borrowing and predicted borrowing and then see if bank characteristics are associated with actual borrowing being significantly below predicted borrowing. In TABLE XII we replicate the analysis in the first four columns of TABLE VI replacing as the dependent variable "forecast error." When forecast error is high, predicted borrowing is higher than actual borrowing, suggesting the possibility of unmet demand. As expected, predicted borrowing is much higher than actual borrowing immediately following the Lehman's bankruptcy, especially for smaller banks. After September 17th, predicted values are much higher than actual values for the largest banks, while smaller banks continue to borrow more than the pre-crisis relationships would predict. Most of that difference is driven by bank characteristics, since the difference between smaller and larger banks is no longer statistically significant once measures of quality are added. Post-crisis borrowing shortfalls are associated with low quality banks (high NPLs) experiencing higher shortfalls (see specifications (3) and (4) of TABLE XII).

[TABLE XI AND TABLE XII]

XII.   Conclusions

This research presents a first detailed look at the events in the fed funds market in the 2008 financial crisis. In the immediate aftermath of the Lehman's bankruptcy we see that the market seems to become sensitive to bank specific characteristics, not only in the amounts lent to borrowers but even in the cost of funds. We see sharp differences between large and small banks in their access to credit: Large banks show reduced amounts of daily borrowing after Lehman and borrow from fewer counterparties. In fact, the interest rate spread at which large banks are

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borrowing in the fed funds market after Lehman goes down. Assuming that in the very short-run banks do not change their demand for liquidity, this is likely to be an effect of credit rationing. In contrast, smaller banks were able to increase the amount borrowed from the interbank market and even managed to add lending counterparties during the crisis. We do not find evidence of a complete cessation of lending predicted by some theoretical models, nor do we find evidence that riskier lenders are more likely to hoard liquidity at the height of the crisis.

We also see that only the worst performing banks in terms of ROA started accessing the Federal Reserve's discount window after the Lehman's bankruptcy. It seems reasonable to assume that these are banks which were rationed by the fed funds market since private banks were not willing to lend to them. While again it is difficult to assess whether this means that interbank markets operated efficiently after the crisis, it is, however, reassuring that we do not observe well performing banks having to turn to the discount window. This would have been a very alarming indication of dysfunction in the fed funds market.

This research is only a first step in understanding how the fed funds market has been affected by the financial crisis and how robust this market is against financial contagion. It will be important in future research to investigate more directly how lenders in the market reacted to the change in the perception of bank risk. We need to understand much better how fed fund loans are priced and how they are affected by expectations about government and central bank interventions. The same is true for the decision on the extensive margin, e.g. the decision to add or drop counterparties. Finally we believe that it is important to investigate the role that banking relationships and repeat interactions in the fed funds market can play in improved monitoring of counterparty risks or as a vehicle to provide coinsurance of liquidity needs.

FIGURE 1: DAILY AMOUNT OF FEDERAL FUNDS TRANSACTIONS ($ MILLIONS)
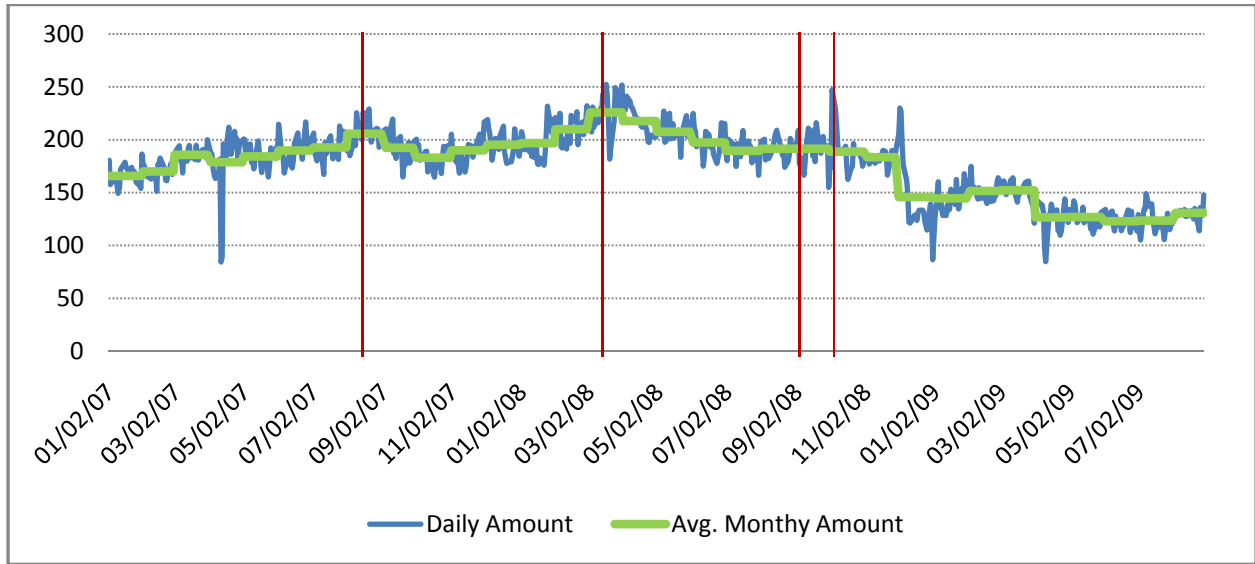
FIGURE 1 shows average daily amount borrowed in the fed funds market in US $ millions and the monthly average of this amount from January 2nd, 2007 to August 28th, 2009. The red lines indicate the following dates: i) August 9th, 2007 – BNP Paribas tells investors that they cannot value assets in two funds ii) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for $2 a share, iii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner, and iv) October 9th, 2008 – First day of the first maintenance period after the Federal Reserve's announcement that it will pay interest on required reserve balances and on excess balances held by or on behalf of depository institutions.

FIGURE 2: DAILY AMOUNT OF FEDERAL FUNDS TRANSACTIONS ($ MILLIONS)
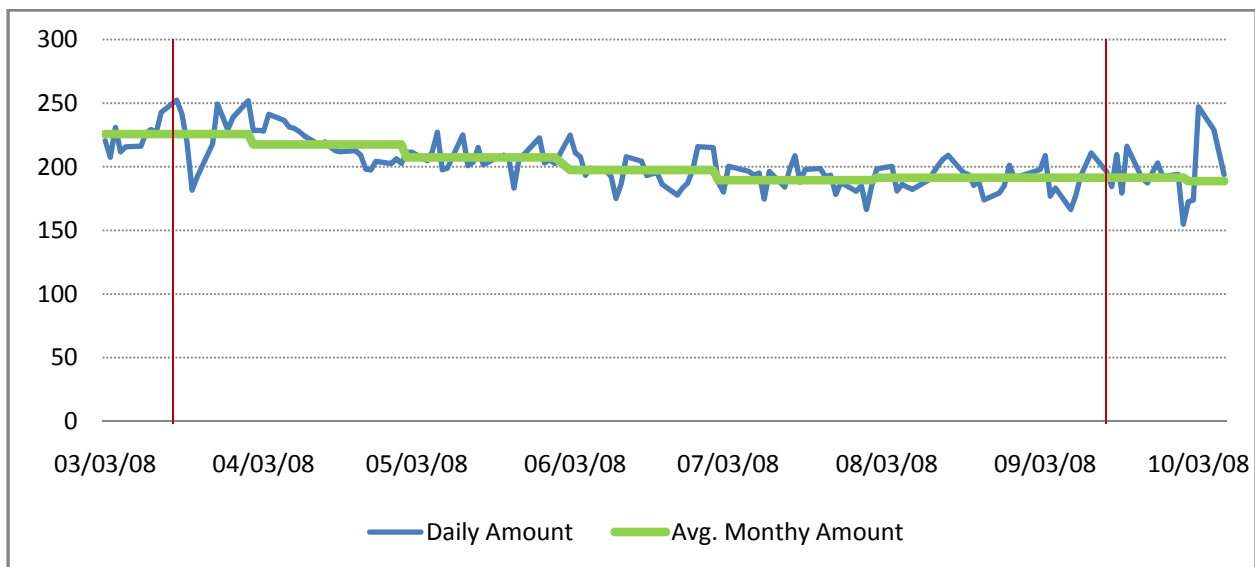
FIGURE 2 shows average daily amount borrowed in the fed funds market in US $ millions and the monthly average of this amount from March 3rd, 2008 to October 8th, 2008. The red lines indicate the following dates: i) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for $2 a share, and ii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner.

FIGURE 3: DAILY NUMBER OF BORROWERS AND LENDERS
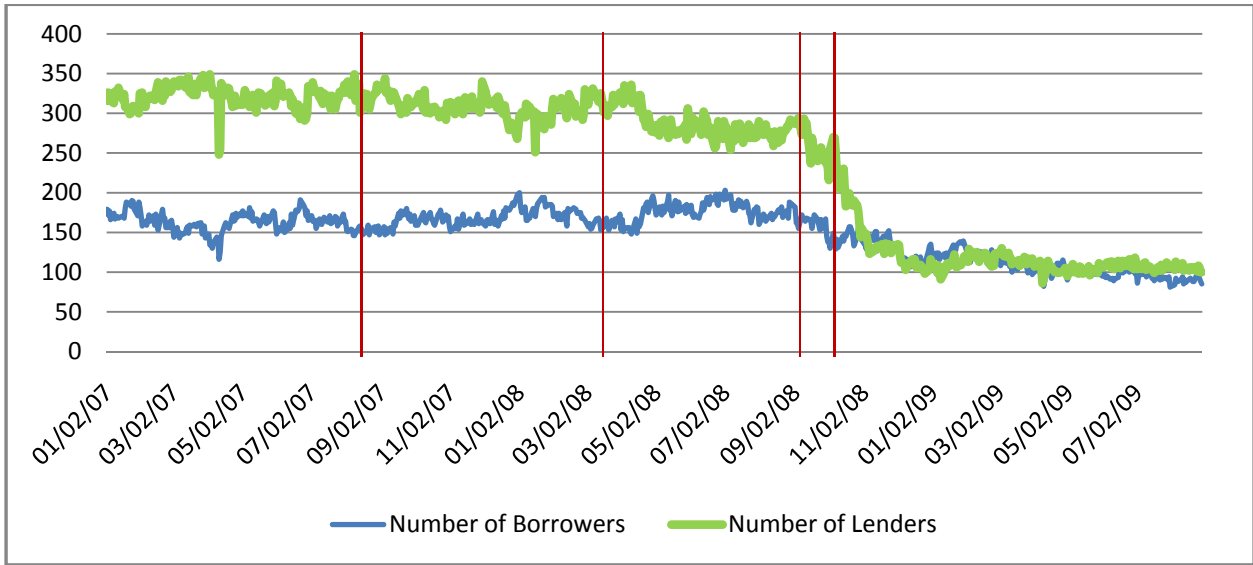
FIGURE 3 shows average daily number of borrowers and lenders in the fed funds market from January 2nd, 2007 to August 28th, 2009. The red lines indicate the following dates: i) August 9th, 2007 – BNP Paribas tells investors that they cannot value assets in two funds ii) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for $2 a share, iii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner, and iv) October 9th, 2008 – First day of the first maintenance period after the Federal Reserve's announcement that it will pay interest on required reserve balances and on excess balances held by or on behalf of depository institutions.

FIGURE 4: DAILY NUMBER OF BORROWERS AND LENDERS
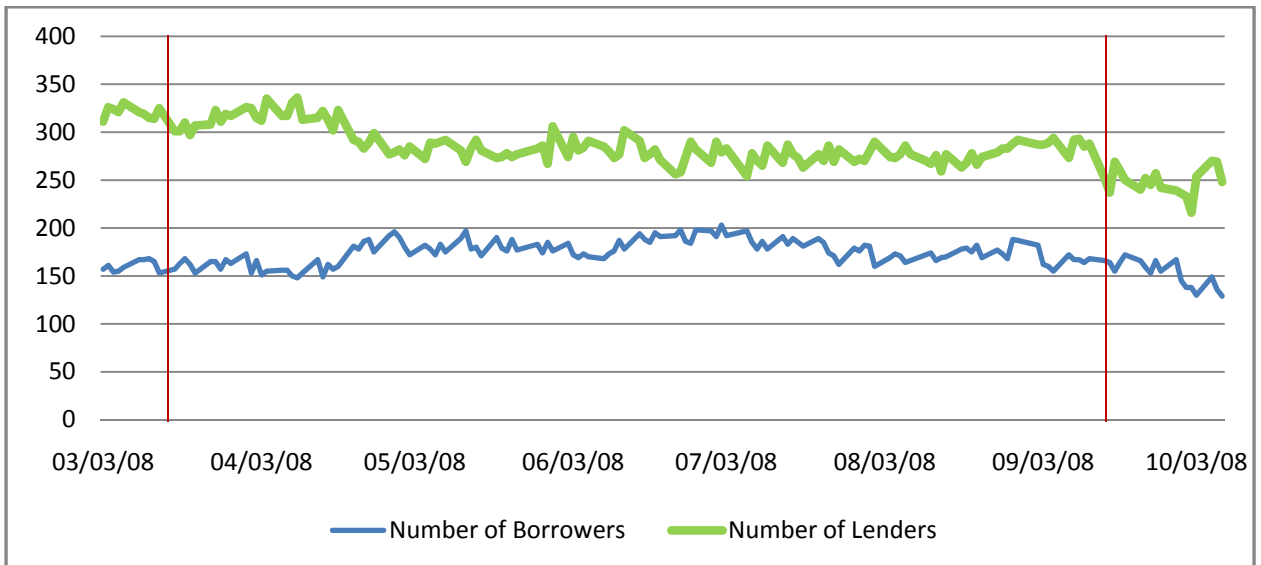
FIGURE 4 shows average daily number of borrowers and lenders in the fed funds market from March 3rd, 2008 to October 8th, 2008. The red lines indicate the following dates: i) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for $2 a share, and ii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner.

FIGURE 5: DAILY FED FUNDS
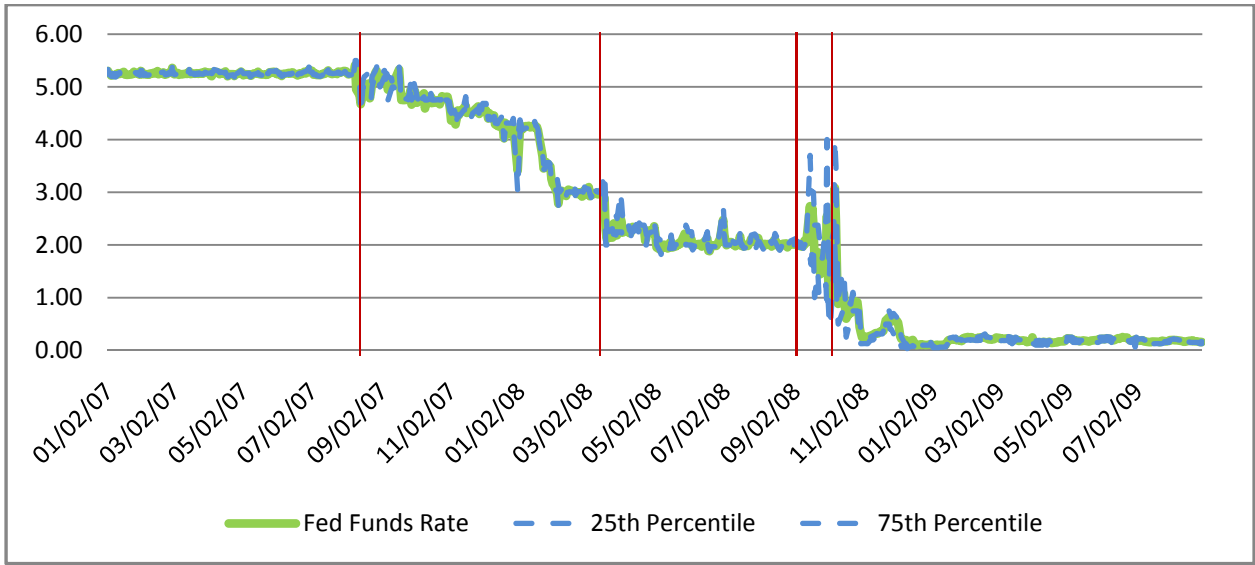
FIGURE 5 shows the weighted average daily fed funds rate as well as the daily fed funds rate in the 25th and 75th percentile of borrowers from January 2nd, 2007 to August 28th, 2009. The red lines indicate the following dates: i) August 9th, 2007 – BNP Paribas tells investors that they cannot value assets in two funds ii) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for \$2 a share, iii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner, and iv) October 9th, 2008 – First day of the first maintenance period after the Federal Reserve's announcement that it will pay interest on required reserve balances and on excess balances held by or on behalf of depository institutions.

FIGURE 6: DAILY FED FUNDS RATES
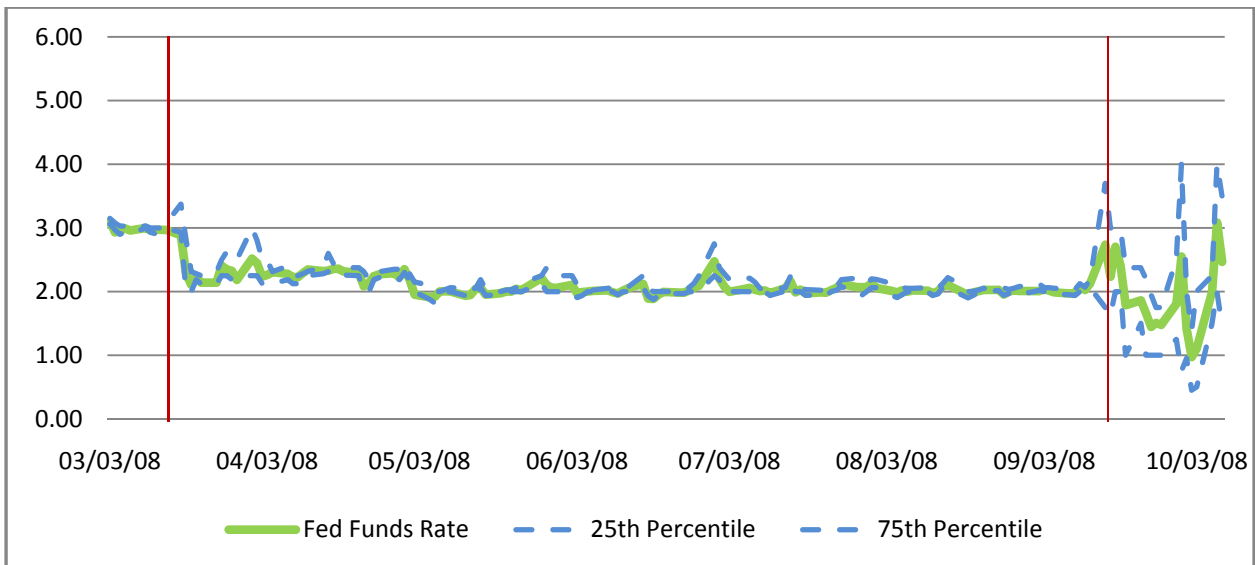
FIGURE 6 shows the weighted average daily fed funds rate as well as the daily fed funds rate for the 25th and 75th percentile of borrowers from March 3rd, 2008 to October 8th, 2008. The red lines indicate the following dates: i) March 16th, 2008 – JP Morgan announces that it will acquire Bear Stearns for \$2 a share, and ii) September 15th, 2008 – Lehman Brothers files for bankruptcy after failing to find a merger partner.

TABLE I : FED FUNDS MARKET SUMMARY STATISTICS

	Obs.	25%	Median	Mean	75%	StdDev.
Pre-Lehman (4/1 - 9/11):						
Spread to Target	12,391	0.0112	0.1006	0.1260	0.2250	0.1941
Amount ($M)	12,391	20.0	70.0	1,234.3	395.0	4,069.4
Counterparties	12,391	1.0	2.0	7.6	8.0	13.9
Borrowers / Day	115	.278	.303	.299	.317	.028
Surrounding Lehman (9/12 - 9/16)						
Spread to Target	297	0.0000	0.1875	0.2234	0.5000	0.6173
Amount ($M)	297	20.0	85.0	1,264.1	423.2	4,327.7
Counterparties	297	1.0	2.0	7.4	8.0	13.1
Borrowers / Day	3	.269	.275	.275	.281	.006
Post-Lehman (9/17 - 2/28)						
Spread to Target	8,315	-0.4905	0.1000	-0.0399	0.2835	0.5281
Amount ($M)	8,315	20.0	85.0	1,331.9	465.0	4,204.0
Counterparties	8,315	1.0	2.0	5.9	7.0	8.9
Borrowers / Day	111	.183	.203	.208	.228	.032

Note: The sample consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. *Spread to Target* is the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day. *Amount* is amount borrowed by a bank in the fed funds market on that day (in millions of US $). *Counterparties* is the number of counterparties each bank has on that day. *Borrowers / Day* is the number of active borrowers per day as a percent of all 360 borrowers that borrowed from April 1, 2008 to February 28, 2009.

TABLE II: FED FUNDS MARKET SUMMARY STATISTICS

	Obs.	25%	Median	Mean	75%	StdDev.
Borrower Characteristics:						
Non-Performing Loans (%)	360	0.4148	0.8252	1.1424	1.3581	1.4801
Assets ($M)	360	487	1,403	27,832	4,684	176,337
Repurchase Agreements (%)	360	0.0000	1.7068	3.1951	5.2044	3.8930
Lender Characteristics:						
Non-Performing Loans (%)	376	0.2442	0.7781	1.2894	1.4328	1.9332
Assets ($M)	376	325	831	26,184	3,312	172,577
Repurchase Agreements (%)	376	0.0000	0.6372	2.6752	3.8593	4.1637
Fed Funds Variables:						
Spread to Target	21,003	-0.0076	0.1001	0.0617	0.2500	0.3807
Amount ($M)	21,003	20.0	75.0	1,273.4	425.0	4,127.0
Counterparties	21,003	1.0	2.0	6.9	8.0	12.2
Total Amount ($M)	229	109,313.5	125,032.2	122,392.8	139,279.3	23,467.1
Target Rate (%)	229	1.0	2.0	1.4	2.0	0.8
Fed Funds Rate (%)	229	0.2492	1.9509	1.3390	2.0435	0.8890

Note: The sample for borrowers consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. The sample for lenders consists of 26,700 observations from 376 lenders from April 1, 2008 to February 28, 2009. *Non-Performing Loans (%)* is total non-performing loans divided by total loans. *Assets* is total bank assets (in millions of US $). *Repurchase Agreements (%)* is the amount of securities sold under agreements to repurchase divided by the amount of total assets. Note that *Non-Performing Loans (%)* and *Repurchase Agreements (%)* are in percentage format here, but are in decimal format for all specifications. Bank characteristics are measured as of the Call Report as of December 2007. *Spread to Target* is the weighted average spread between the borrowers' fed funds loans and the target federal funds rate on that day. *Amount* is amount borrowed by each bank in the fed funds market on that day (in millions of US $). *Counterparties* is the number of counterparties each bank has on that day. *Total Amount* is the daily sum of *Amount* across banks. *Target Rate (%)* is the overnight target rate set by the Federal Open Market Committee (FOMC). *Fed Funds Rate (%)* is the weighted average daily fed funds rate.

TABLE III: DEPENDENT VARIABLES, BORROWERS

	Access		Spread to Target				Amount				Counterparties			
	Probit		OLS		OLS		OLS		OLS		OLS		OLS	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
2 weeks Pre-Leh (8/29-9/4)	-0.059	*	0.008		0.008		-0.051		-0.077		0.029		-0.004	
	(0.034)		(0.008)		(0.006)		(0.101)		(0.056)		(0.053)		(0.035)	
1 week Pre-Lehman (9/5-9/11)	-0.095	***	-0.022	***	-0.017	**	0.016		-0.033		0.059		0.008	
	(0.037)		(0.008)		(0.007)		(0.104)		(0.055)		(0.056)		(0.037)	
Friday (9/12)	-0.063		0.067	***	0.076	***	-0.059		-0.076		0.030		0.002	
	(0.047)		(0.011)		(0.008)		(0.152)		(0.082)		(0.073)		(0.049)	
Monday (9/15)	-0.080	*	0.242	***	0.253	***	0.010		-0.190	**	-0.029		-0.122	**
	(0.046)		(0.087)		(0.087)		(0.150)		(0.093)		(0.075)		(0.053)	
Tuesday (9/16)	-0.097	**	-0.021		-0.013		0.070		-0.096		0.035		-0.062	
	(0.047)		(0.053)		(0.049)		(0.141)		(0.076)		(0.073)		(0.050)	
Post-AIG, pre-IOR (9/17-10/8)	-0.148	***	-0.224	***	-0.229	***	-0.050		-0.249	***	0.035		-0.096	**
	(0.032)		(0.037)		(0.036)		(0.094)		(0.063)		(0.050)		(0.038)	
Post-IOR, pre-CPP (10/9-10/13)	-0.300	***	-0.440	***	-0.388	***	0.297	*	-0.319	***	0.145	*	-0.182	***
	(0.048)		(0.047)		(0.043)		(0.168)		(0.093)		(0.085)		(0.054)	
1 month post-CPP (10/14-11/10)	-0.228	***	-0.515	***	-0.494	***	0.152		-0.259	***	-0.018		-0.252	***
	(0.040)		(0.028)		(0.026)		(0.115)		(0.082)		(0.064)		(0.055)	
Borrower Fixed Effects	No		No		Yes		No		Yes		No		Yes	
N	81,576		21,003		21,003		21,003		21,003		21,003		21,003	
Adjusted R-squared			0.27		0.51		0.00		0.86		0.00		0.83	

Note: The sample used in column (1) consists of 81,576 observations from 360 borrowers from April 1, 2008 to February 28, 2009, where observations have been filled in with 0's on days which banks do not borrow. The sample used in columns (2) – (7) consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009, where only banks that borrow are present. *Access* is an indicator equal to 1 if the bank borrowed on that day. *Spread to Target* is the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day. *Amount* is the logarithm of the amount borrowed in the fed funds market on that day (in millions of US $). *Counterparties* is the logarithm of the number of counterparties each bank has on that day.

TABLE IV: IMPACT OF LEHMAN EVENT ON ACCESS

| | Borrowers | | Lenders | |
| | Large | Small | Large | Small |
Access	(1)	(2)	(3)	(4)
2 weeks Pre-Leh (8/29-9/4)	**-3.586** ***	**-0.995**	**-2.025** ***	**0.174**
	(0.937)	(1.104)	(0.642)	(0.840)
1 week Pre-Lehman (9/5-9/11)	**-4.102** ***	**-1.070**	-1.800 ***	-0.195
	(0.976)	(1.165)	(0.614)	(0.829)
Friday (9/12)	-3.888 ***	-2.352	**-1.764** **	**0.566**
	(1.101)	(2.245)	(0.739)	(0.890)
Monday (9/15)	**-6.038** ***	**-1.071**	**-2.349** ***	**0.347**
	(1.705)	(1.782)	(0.724)	(0.900)
Tuesday (9/16)	**-5.120** ***	**0.328**	**-2.938** ***	**0.386**
	(1.324)	(1.687)	(0.739)	(0.888)
Post-AIG, pre-IOR (9/17-10/8)	-4.712 ***	-3.002 ***	**-2.067** ***	**0.321**
	(0.919)	(0.969)	(0.559)	(0.791)
Post-IOR, pre-CPP (10/9-10/13)	-5.378 ***	-4.703 ***	**-2.162** ***	**0.022**
	(1.141)	(1.364)	(0.662)	(0.900)
1 month post-CPP (10/14-11/10)	**-5.116** ***	**-2.413** **	**-3.247** ***	**-0.715**
	(0.900)	(0.995)	(0.558)	(0.909)
2 weeks Pre-Leh x %NPL	**-43.195** **	**2.249**	15.485	3.750
	(17.005)	(4.450)	(9.740)	(5.306)
1 week Pre-Leh x %NPL	**-49.976** ***	**0.360**	17.683 *	4.942
	(17.394)	(4.397)	(9.821)	(5.282)
Friday x %NPL	-42.300 **	-17.150	15.009	6.436
	(17.800)	(18.111)	(10.194)	(5.892)
Monday x %NPL	**-71.045** ***	**0.494**	**29.302** ***	**-0.194**
	(23.368)	(5.869)	(11.338)	(5.949)
Tuesday x %NPL	**-51.931** ***	**0.589**	**22.341** **	**2.237**
	(19.379)	(4.784)	(10.622)	(5.776)
Post-AIG, pre-IOR x %NPL	**-56.501** ***	**1.954**	10.747	1.148
	(17.723)	(3.852)	(9.047)	(4.677)
Post IOR, pre-CPP x %NPL	**-57.972** ***	**3.032**	-1.624	3.443
	(21.747)	(4.626)	(10.786)	(5.787)
1 month post-CPP x %NPL	**-54.558** ***	**4.329**	5.193	1.208
	(17.184)	(4.578)	(8.838)	(5.023)
Borrower Fixed Effects	No	No	No	No
N	23,378	31,948	27,696	28,357

Note: The sample for borrowers consists of 81,576 observations from 360 borrowers from April 1, 2008 to February 28, 2009. The sample for lenders consists of 84,853 observations from 379 lenders from April 1, 2008 to February 28, 2009. We divide the samples into terciles, where *Large* is the top tercile of assets and *Small* is the bottom tercile of assets. The dependent variable is *Access*, an indicator variable equal to 1 if the bank borrowed / lent federal funds on that day. *%NPL* is the amount of non-performing loans divided by the amount of total loans. *Assets* is the logarithm of bank assets (in millions of US $). Bank characteristics are measured as of the Call Report as of December 2007. All specifications control for the interaction of *Assets* and the time period dummies. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses below coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively. Coefficients are bolded where their difference is statistically significant.

TABLE V: IMPACT OF THE LEHMAN EVENT ON SPREADS

	Borrowers				Lenders			
	Large	Small	Large	Small	Large	Small	Large	Small
Spread to Target	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 week Pre-Lehman (9/5-9/11)	-0.017 **	-0.021	0.029	0.093	-0.026 ***	-0.014 *	-0.005	-0.052
	(0.007)	(0.024)	(0.041)	(0.500)	(0.010)	(0.008)	(0.047)	(0.050)
Friday (9/12)	0.079 ***	0.104 ***	**-0.008**	**0.360** *	0.072 ***	0.062 ***	0.080	0.022
	(0.010)	(0.035)	(0.067)	(0.195)	(0.013)	(0.012)	(0.069)	(0.080)
Monday (9/15)	**0.154**	**0.943** ***	0.699	0.049	0.144	0.322 ***	-0.478	0.431
	(0.114)	(0.243)	(0.747)	(2.340)	(0.122)	(0.119)	(0.574)	(0.833)
Tuesday (9/16)	**-0.098** *	**0.355** *	0.175	0.545	-0.242 ***	-0.297 ***	**-1.357** ***	**0.400**
	(0.058)	(0.203)	(0.516)	(1.244)	(0.086)	(0.066)	(0.420)	(0.381)
Post-AIG, pre-IOR (9/17-10/8)	**-0.322** ***	**0.146**	0.254	1.537	-0.427 ***	-0.501 ***	**-1.358** ***	**0.043**
	(0.043)	(0.091)	(0.336)	(0.954)	(0.045)	(0.068)	(0.174)	(0.392)
Post-IOR, pre-CPP (10/9-10/13)	-0.483 ***	-0.198	-0.065	3.727	-0.420 ***	-0.526 ***	-0.961 ***	-0.158
	(0.043)	(0.186)	(0.283)	(7.433)	(0.056)	(0.057)	(0.306)	(0.454)
1 month post-CPP (10/14-11/10)	**-0.584** ***	**-0.166** ***	0.079	-0.280	**-0.486** ***	**-0.552** ***	**-0.442** ***	-0.150
	(0.027)	(0.041)	(0.154)	(0.396)	(0.035)	(0.042)	(0.158)	(0.290)
1 week Pre-Leh x %NPL			0.953	-0.298			-0.950	-0.017
			(1.646)	(0.825)			(0.720)	(0.230)
Friday x %NPL			**3.569**	**-3.732**			-0.538	-0.050
			(3.032)	(2.323)			(0.592)	(0.410)
Monday x %NPL			31.407 *	3.193			-1.447	2.554
			(18.405)	(7.393)			(6.022)	(5.379)
Tuesday x %NPL			-17.575 *	-19.354 **			**7.994** **	**0.371**
			(9.397)	(8.324)			(3.839)	(2.538)
Post-AIG, pre-IOR x %NPL			**10.114**	**-10.845** ***			-0.027	-3.714
			(6.911)	(3.327)			(1.770)	(2.910)
Post IOR, pre-CPP x %NPL			8.201	-6.036			-0.500	-4.888 *
			(9.622)	(4.601)			(3.354)	(2.765)
1 month post-CPP x %NPL			4.560	2.733 **			-2.293	-2.296
			(4.671)	(1.173)			(2.148)	(1.800)
Fixed Effects	Borrower	Borrower	Borrower	Borrower	Lender	Lender	Lender	Lender
N	13,887	1,951	13,887	1,951	10,469	9,233	10,469	9,233
Adjusted R-squared	0.50	0.49	0.52	0.51	0.40	0.51	0.41	0.52

Note: The sample for borrowers consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. The sample for lenders consists of 26,700 observations from 376 lenders from April 1, 2008 to February 28, 2009. We divide the samples into terciles, where *Large* is the top tercile of assets and *Small* is the bottom tercile of assets. The dependent variable is *Spread to Target* – the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day. *Assets* is the logarithm of bank assets (in millions of US $). *%NPL* is total non-performing loans divided by total loans. All specifications control for amount borrowed as a percentage of bank assets. Specifications (3), (4), (7) and (8) include controls for the interaction of *Assets* and the time periods. Bank characteristics are measured as of the Call Report as of December 2007. Standard errors are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively. Coefficients are bolded where their difference is statistically significant.

TABLE VI: IMPACT OF THE LEHMAN EVENT ON AMOUNT BORROWED / LENT

	Borrowers				Lenders			
	Large	Small	Large	Small	Large	Small	Large	Small
Amount	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 week Pre-Lehman (9/5-9/11)	-0.047	0.057	0.368	-0.317	0.079	-0.028	**0.573** *	**-0.666** *
	(0.074)	(0.065)	(0.305)	(0.549)	(0.074)	(0.055)	(0.344)	(0.382)
Friday (9/12)	-0.084	0.119	**-0.166**	**-1.283** ***	0.134	-0.006	0.359	-0.364
	(0.099)	(0.085)	(0.501)	(0.425)	(0.118)	(0.073)	(0.511)	(0.589)
Monday (9/15)	-0.289 **	-0.060	-0.491	-1.081 **	-0.002	-0.194 **	0.280	-0.339
	(0.117)	(0.119)	(0.585)	(0.436)	(0.103)	(0.080)	(0.529)	(0.519)
Tuesday (9/16)	-0.079	-0.196	0.117	0.421	-0.070	-0.199 **	0.411	-0.507
	(0.096)	(0.130)	(0.424)	(0.575)	(0.102)	(0.082)	(0.523)	(0.550)
Post-AIG, pre-IOR (9/17-10/8)	-0.267 ***	-0.082	-0.300	0.635	-0.084	-0.177 ***	0.020	-0.468
	(0.084)	(0.092)	(0.410)	(1.275)	(0.073)	(0.062)	(0.373)	(0.395)
Post-IOR, pre-CPP (10/9-10/13)	-0.289 ***	-0.536 **	**-0.030**	**17.315** ***	-0.157	-0.064	-0.712	-0.712
	(0.108)	(0.224)	(0.575)	(5.604)	(0.143)	(0.084)	(0.665)	(0.530)
1 month post-CPP (10/14-11/10)	**-0.273** ***	**-0.171**	0.351	0.660	**-0.543** ***	**-0.185** *	0.011	-1.456 *
	(0.103)	(0.168)	(0.497)	(1.676)	(0.122)	(0.097)	(0.638)	(0.761)
1 week Pre-Leh x %NPL			**-49.652** ***	**-7.077**			**7.881** *	**-2.307**
			(13.668)	(4.812)			(4.100)	(1.647)
Friday x %NPL			-31.274	-7.946 *			6.189	-4.328
			(22.139)	(4.127)			(6.602)	(2.683)
Monday x %NPL			**-49.159** ***	**-12.037** ***			0.397	-5.779 *
			(19.010)	(2.695)			(5.463)	(3.172)
Tuesday x %NPL			-35.325	-6.169			4.378	-4.511
			(25.199)	(11.294)			(5.699)	(2.946)
Post-AIG, pre-IOR x %NPL			**-46.921** ***	**-1.719**			0.407	-4.041
			(14.919)	(6.967)			(4.188)	(2.777)
Post IOR, pre-CPP x %NPL			2.210	8.930 ***			-0.775	0.506
			(34.169)	(2.721)			(6.460)	(3.569)
1 month post-CPP x %NPL			-13.318	0.273			-5.864	-2.440
			(16.879)	(6.538)			(8.891)	(3.930)
Fixed Effects	Borrower	Borrower	Borrower	Borrower	Lender	Lender	Lender	Lender
N	13,887	1,951	13,887	1,951	10,469	9,233	10,469	9,233
Adjusted R-squared	0.81	0.78	0.82	0.78	0.83	0.94	0.84	0.94

Note: The sample for borrowers consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. The sample for lenders consists of 26,700 observations from 376 lenders from April 1, 2008 to February 28, 2009. We divide the samples into terciles, where *Large* is the top tercile of assets and *Small* is the bottom tercile of assets. The dependent variable is *Log Amount* – the logarithm of the amount of a bank's loans in the fed funds market on that day (in millions of US $). *Assets* is the logarithm of bank assets (in millions of US $). *%NPL* is total non-performing loans divided by total loans. Specifications (3), (4), (7) and (8) include controls for the interaction of *Assets* and the time periods. Bank characteristics are measured as of the Call Report as of December 2007. Standard errors are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively. Coefficients are bolded where their difference is statistically significant.

TABLE VII: IMPACT OF THE LEHMAN EVENT ON NUMBER OF COUNTERPARTIES

	Borrowers				Lenders			
	Large	Small	Large	Small	Large	Small	Large	Small
Counterparties	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 week Pre-Lehman (9/5-9/11)	0.005	0.030	0.060	-0.111	0.016	0.005	0.052	-0.229
	(0.036)	(0.024)	(0.186)	(0.258)	(0.039)	(0.032)	(0.194)	(0.321)
Friday (9/12)	-0.005	0.041	0.004	-0.220	0.069	0.032	-0.101	-0.130
	(0.051)	(0.043)	(0.211)	(0.208)	(0.057)	(0.028)	(0.297)	(0.211)
Monday (9/15)	**-0.129** **	**0.038**	0.332	-0.244	-0.024	-0.042	0.273	-0.159
	(0.052)	(0.037)	(0.260)	(0.274)	(0.057)	(0.041)	(0.252)	(0.230)
Tuesday (9/16)	**-0.078**	**0.151** **	**0.708** **	**-0.481** *	-0.034	-0.051	-0.131	-0.222
	(0.054)	(0.076)	(0.292)	(0.291)	(0.072)	(0.042)	(0.376)	(0.355)
Post-AIG, pre-IOR (9/17-10/8)	**-0.060**	**0.067**	**0.538** ***	**-0.502**	-0.122 ***	-0.035	-0.122	-0.295
	(0.040)	(0.056)	(0.188)	(0.523)	(0.040)	(0.041)	(0.203)	(0.372)
Post-IOR, pre-CPP (10/9-10/13)	-0.113 **	-0.030	0.522 *	0.067	**-0.245** ***	**0.034**	-0.366	-0.658 *
	(0.056)	(0.031)	(0.277)	(1.832)	(0.078)	(0.053)	(0.354)	(0.362)
1 month post-CPP (10/14-11/10)	**-0.267** ***	**-0.003**	**0.973** ***	**-0.054**	**-0.302** ***	**-0.083**	0.053	-0.778
	(0.054)	(0.032)	(0.266)	(0.299)	(0.051)	(0.069)	(0.237)	(0.713)
1 week Pre-Leh x %NPL			**-20.991** ***	**-1.130**			**5.224** **	**-0.007**
			(6.547)	(1.249)			(2.432)	(0.780)
Friday x %NPL			-12.604	-4.871			**5.255**	**-0.504**
			(10.730)	(3.517)			(3.353)	(0.724)
Monday x %NPL			**-16.927** **	**-0.964**			**7.800** ***	**-0.688**
			(7.678)	(1.729)			(2.938)	(1.586)
Tuesday x %NPL			-22.845 **	-3.876			3.213	-1.099
			(11.065)	(3.453)			(4.364)	(1.856)
Post-AIG, pre-IOR x %NPL			**-22.105** **	**0.809**			0.228	-0.088
			(9.567)	(1.874)			(2.592)	(0.974)
Post IOR, pre-CPP x %NPL			**-23.640** *	**-0.245**			6.898 *	1.300
			(12.500)	(0.993)			(3.950)	(2.113)
1 month post-CPP x %NPL			-6.547	0.761			0.638	-0.705
			(9.678)	(1.446)			(4.197)	(1.982)
Fixed Effects	Borrower	Borrower	Borrower	Borrower	Lender	Lender	Lender	Lender
N	13,887	1,951	13,887	1,951	10,469	9,233	10,469	9,233
Adjusted R-squared	0.87	0.62	0.89	0.62	0.85	0.92	0.85	0.92

Note: The sample for borrowers consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. The sample for lenders consists of 26,700 observations from 376 lenders from April 1, 2008 to February 28, 2009. We divide the samples into terciles, where *Large* is the top tercile of assets and *Small* is the bottom tercile of assets. The dependent variable is *Counterparties* – the logarithm of the number of counterparties each bank has on that day. *Assets* is the logarithm of bank assets (in millions of US $). *%NPL* is total non-performing loans divided by total loans. All specifications control for amount borrowed as a percentage of bank assets. Specifications (3), (4), (7) and (8) include controls for the interaction of *Assets* and the time periods. Bank characteristics are measured as of the Call Report as of December 2007. Standard errors are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively. Coefficients are bolded where their difference is statistically significant.

TABLE VIII: DISCOUNT WINDOW BORROWING

Access	Percent Borrowers	(1)	%NPL (2)	%NPL (3)	RoA (4)	RoA (5)
2 weeks Pre-Leh (8/29-9/4)	1.0	0.057	-0.879 ***	-0.786	-0.909 ***	-0.823
		(0.176)	(0.308)	(0.536)	(0.315)	(0.512)
1 week Pre-Lehman (9/5-9/11)	1.6	0.253 **	-1.006 ***	-0.922 *	-0.970 ***	-0.885 *
		(0.116)	(0.290)	(0.479)	(0.285)	(0.461)
Friday (9/12)	1.7	0.266	-1.212 ***	-1.156 **	-1.085 ***	-1.035 **
		(0.163)	(0.384)	(0.556)	(0.330)	(0.507)
Monday (9/15)	3.9	0.640 ***	-0.175	-0.051	-0.155	-0.037
		(0.139)	(0.337)	(0.546)	(0.333)	(0.526)
Tuesday (9/16)	1.7	0.264	-0.724 **	-0.665	-0.597 *	-0.543
		(0.180)	(0.287)	(0.490)	(0.335)	(0.511)
Post-AIG, pre-IOR (9/17-10/8)	2.3	0.387 ***	-0.115	-0.025	-0.082	-0.013
		(0.096)	(0.373)	(0.560)	(0.323)	(0.494)
Post-IOR, pre-CPP (10/9-10/13)	2.4	0.379 ***	1.188	1.300	1.207 *	1.288
		(0.142)	(0.743)	(0.878)	(0.670)	(0.791)
1 month post-CPP (10/14-11/10)	2.1	0.317 ***	0.574	0.689	0.621	0.710
		(0.122)	(0.548)	(0.712)	(0.498)	(0.645)
2 weeks Pre-Leh x Characteristic			-17.938	-17.322	-29.462	-30.274
			(18.984)	(18.761)	(22.153)	(21.743)
1 week Pre-Leh x Characteristic			-2.970	-2.666	-25.286	-26.473
			(7.859)	(7.768)	(16.795)	(16.175)
Friday x Characteristic			3.473	3.756	-34.010	-33.989
			(5.280)	(5.240)	(24.860)	(24.646)
Monday x Characteristic			-4.312	-4.294	-50.817 **	-52.650 **
			(9.773)	(9.803)	(24.612)	(24.136)
Tuesday x Characteristic			7.767 *	7.921 *	-75.161 ***	-75.552 ***
			(4.315)	(4.328)	(27.737)	(27.432)
Post-AIG, pre-IOR x Characteristic			1.546	1.562	-43.624 **	-45.363 ***
			(3.762)	(3.815)	(17.305)	(16.914)
Post IOR, pre-CPP x Characteristic			4.578	4.498	-41.523	-44.179 *
			(5.462)	(5.562)	(25.291)	(24.892)
1 month post-CPP x Characteristic			3.936	3.943	-27.866	-30.432
			(4.312)	(4.378)	(24.591)	(24.161)
Previous Fed Funds Amount				0.068		0.068
				(0.070)		(0.069)
Previous Fed Funds Spread				0.086		0.118
				(0.209)		(0.209)
Same Day Fed Funds Amount				-0.071		-0.072
				(0.051)		(0.052)
Same Day Fed Funds Access Dummy				0.238		0.250
				(0.186)		(0.186)
Borrower Fixed Effects	No	No	No	No	No	
N	64,583	64,583	64,583	64,583	64,583	

Note: The sample consists of 64,583 observations from 359 borrowers from April 1, 2008 to February 28, 2009. The dependent variable is *Access*, an indicator variable equal to 1 if the bank borrowed from the discount window on that day. *Percent Borrowers* is the daily percentage of active borrowers over the total number of borrowers in the sample, averaged across the days in the different time periods. *%NPL* is the amount of non-performing loans divided by the amount of total loans. *ROA* is net income divided by assets. *Assets* is the logarithm of bank assets (in millions of US $). Bank characteristics are measured as of the Call Report as of December 2007. *Previous Fed Funds Amount* is the logarithm of the total amount borrowed in the fed funds market on the most recent previous day. *Previous Fed Funds Spread* is the weighted average spread paid in the fed funds market on the most recent previous day. *Same Day Fed Funds Amount* is the logarithm of the total amount borrowed in the fed funds market on the same day. *Same Day Fed Funds Access Dummy* is an indicator variable equal to one if the bank borrowed in the fed funds market on that day. Specifications (2) through (5) control for the interaction of *Assets* and the time period dummies. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses below coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively.

TABLE IX: IMPACT OF LEHMAN EVENT ON SPREAD, AMOUNT AND COUNTERPARTIES FOR BORROWERS, SPLIT BY DEMAND PROXIES

% Repo ≥ / <	Spread to Target		Amount		Counterparties	
	< 0.0	≥ 0.04	< 0.0	≥ 0.04	< 0.0	≥ 0.04
	(1)	(2)	(3)	(4)	(5)	(6)
1 week Pre-Lehman (9/5-9/11)	0.015	-0.004	**-1.021** ***	**0.149**	**-0.322** ***	**0.241**
	(0.131)	(0.033)	(0.364)	(0.262)	(0.077)	(0.170)
Friday (9/12)	0.135	0.018	-0.554	-0.489	**-0.225** *	**0.189**
	(0.116)	(0.059)	(0.370)	(0.484)	(0.124)	(0.135)
Monday (9/15)	-0.498	0.229	-1.006 **	-0.319	**-0.569** **	**0.438** **
	(1.146)	(0.548)	(0.474)	(0.536)	(0.258)	(0.207)
Tuesday (9/16)	**1.225** *	**-0.081**	-0.413	0.240	0.245	0.700 ***
	(0.648)	(0.387)	(0.516)	(0.397)	(0.272)	(0.234)
Post-AIG, pre-IOR (9/17-10/8)	**1.324** ***	**0.098**	-0.900 *	-0.647 **	**-0.168**	**0.615** ***
	(0.165)	(0.277)	(0.503)	(0.280)	(0.170)	(0.159)
Post-IOR, pre-CPP (10/9-10/13)	**1.965** ***	**-0.011**	-1.910 **	-0.415	0.078	0.546 **
	(0.711)	(0.242)	(0.952)	(0.586)	(0.215)	(0.238)
1 month post-CPP (10/14-11/10)	**0.671** ***	**0.200**	-0.383	-0.107	0.769 ***	0.758 ***
	(0.187)	(0.170)	(0.372)	(0.376)	(0.274)	(0.183)
1 week Pre-Leh x %NPL	-0.078	1.489	**-4.030**	**-35.433** **	-0.901	-8.516
	(1.416)	(1.239)	(6.195)	(14.462)	(1.558)	(7.377)
Friday x %NPL	-4.313 *	3.065	-23.585 *	-55.830 *	-6.975 **	-11.256
	(2.382)	(3.848)	(12.304)	(31.591)	(3.447)	(8.868)
Monday x %NPL	1.230	56.991 **	-27.732 *	-19.842	0.699	5.921
	(9.540)	(25.808)	(14.304)	(25.536)	(2.526)	(9.915)
Tuesday x %NPL	-15.961 **	-2.873	-18.191	-34.729 **	-10.814 **	-6.150
	(7.541)	(6.291)	(17.008)	(14.169)	(5.106)	(11.703)
Post-AIG, pre-IOR x %NPL	-8.171 *	9.691	**2.944**	-23.874 *	-1.927	-8.148
	(4.730)	(7.600)	(5.530)	(12.373)	(1.630)	(10.662)
Post IOR, pre-CPP x %NPL	-10.226	2.973	16.987 *	-18.890	0.446	-19.795
	(9.763)	(11.334)	(10.098)	(39.931)	(2.216)	(13.864)
1 month post-CPP x %NPL	5.159	-0.311	-7.708	-0.818	-3.075 **	-7.488
	(4.121)	(4.494)	(9.504)	(19.083)	(1.447)	(9.674)
Borrower Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	2,799	9,927	2,799	9,927	2,799	9,927
Adjusted R-squared	0.58	0.50	0.85	0.87	0.89	0.93

Note: The sample consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. We divide the samples into terciles where banks in the bottom tercile have *%Repo* value of less than .00176 and banks in the top tercile have a *%Repo* value of greater than or equal to .03721. The dependent variables are: *Spread to Target* – the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day; *Amount* – the logarithm of the amount borrowed in the fed funds market on that day (in millions of US $); and *Counterparties* – the logarithm of the number of counterparties each bank has on that day. All specifications include controls for the interaction of *Assets* and the time period dummies. Specifications (1), (2), (5) and (6) control for amount borrowed as a percentage of bank assets. *%Repo* is the amount of securities sold under agreements to repurchase divided by the amount of total assets. *%NPL* is total non-performing loans divided by total loans. Bank characteristics are measured as of the Call Report as of December 2007. Standard errors are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively. Coefficients are bolded where their difference is statistically significant.

TABLE X: IMPACT OF LEHMAN EVENT ON SPREAD, AMOUNT AND COUNTERPARTIES FOR LENDERS, SPLIT BY DEMAND PROXIES

% Repo ≥ / <	Spread to Target		Amount		Counterparties	
	≤ 0.0	≥ 0.03	≤ 0.0	≥ 0.03	≤ 0.0	≥ 0.03
	(1)	(2)	(3)	(4)	(5)	(6)
1 week Pre-Lehman (9/5-9/11)	0.002	0.040	**-0.292**	**0.279**	-0.090	-0.008
	(0.029)	(0.040)	(0.218)	(0.264)	(0.144)	(0.151)
Friday (9/12)	0.071 **	0.084 *	-0.120	0.081	-0.104	-0.070
	(0.036)	(0.050)	(0.307)	(0.325)	(0.143)	(0.175)
Monday (9/15)	**1.064** ***	**-0.673**	-0.008	-0.289	0.093	0.079
	(0.359)	(0.460)	(0.287)	(0.388)	(0.120)	(0.165)
Tuesday (9/16)	**0.224**	**-1.169** ***	-0.119	-0.073	0.049	-0.119
	(0.207)	(0.357)	(0.378)	(0.405)	(0.212)	(0.277)
Post-AIG, pre-IOR (9/17-10/8)	**-0.080**	**-1.399** ***	-0.163	-0.269	0.076	-0.026
	(0.209)	(0.145)	(0.262)	(0.340)	(0.203)	(0.169)
Post-IOR, pre-CPP (10/9-10/13)	**-0.480** *	**-1.073** ***	0.215	0.106	0.260	0.111
	(0.267)	(0.198)	(0.324)	(0.435)	(0.241)	(0.277)
1 month post-CPP (10/14-11/10)	-0.557 ***	-0.660 ***	0.218	0.166	0.235	0.117
	(0.177)	(0.149)	(0.501)	(0.523)	(0.380)	(0.224)
1 week Pre-Leh x %NPL	0.066	-1.441	**-3.616** **	**14.509** **	**-0.130**	**8.815** **
	(0.147)	(1.119)	(1.570)	(6.613)	(0.494)	(3.880)
Friday x %NPL	-0.256	-0.317	-3.825 *	9.755	-0.555	6.197
	(0.310)	(0.894)	(2.203)	(8.199)	(0.651)	(4.471)
Monday x %NPL	-1.815	-0.856	-2.912	11.378	**-0.103**	**11.029** **
	(2.971)	(9.420)	(2.905)	(9.846)	(0.824)	(4.549)
Tuesday x %NPL	-2.436	8.943	**-3.405** **	**13.890**	-0.501	3.841
	(1.858)	(5.553)	(1.511)	(8.679)	(0.745)	(6.485)
Post-AIG, pre-IOR x %NPL	-3.006 **	1.871	**-4.935** ***	**7.186**	-0.755	-1.596
	(1.235)	(2.786)	(1.491)	(7.061)	(0.690)	(3.943)
Post IOR, pre-CPP x %NPL	-2.380 **	3.848	-3.904 **	-1.336	0.822	-5.529
	(1.149)	(4.901)	(1.947)	(11.943)	(1.239)	(7.314)
1 month post-CPP x %NPL	-1.759	-0.675	-1.888	-18.170	-1.738	-0.666
	(1.300)	(3.791)	(3.967)	(12.038)	(2.155)	(5.553)
Lender Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	12,211	8,967	12,211	8,967	12,211	8,967
Adjusted R-squared	0.50	0.47	0.91	0.88	0.90	0.87

Note: The sample consists of 26,700 observations from 376 lenders from April 1, 2008 to February 28, 2009. We divide the sample into terciles, where banks in the bottom tercile have *%Repo* value equal to 0 and banks in the top tercile have a *%Repo* value of greater than or equal to .02502. The dependent variables are: *Spread to Target* – the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day; *Amount* – the logarithm of the amount lent in the fed funds market on that day (in millions of US $); and *Counterparties* – the logarithm of the number of counterparties each bank has on that day. All specifications include controls for the interaction of *Assets* and the time period dummies. Specifications (1), (2), (5) and (6) control for amount borrowed as a percentage of bank assets. *%Repo* is the amount of securities sold under agreements to repurchase divided by the amount of total assets. *%NPL* is total non-performing loans divided by total loans. Bank characteristics are measured as of the Call Report as of December 2007. Standard errors are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively. Coefficients are bolded where their difference is statistically significant.

TABLE XI: DEMAND PREDICTIONS

Amount	(1) Large		(2) Small	
Avg. Amount in Prev. Month	0.825	***	0.788	***
	(0.007)		(0.013)	
Customer Funds Sent	0.026	***	0.055	***
	(0.007)		(0.012)	
Customer Funds Received	-0.026	***	0.021	*
	(0.007)		(0.012)	
Distance from Req. Reserves	-0.000		-0.000	***
	(0.000)		(0.000)	
Assets	0.100	***	0.050	**
	(0.010)		(0.020)	
ROA	-2.561	*	2.269	
	(1.503)		(2.226)	
Risk Ratio	-0.390	***	-0.086	
	(0.137)		(0.222)	
%NPL	0.020		-0.187	
	(0.549)		(0.653)	
%MBS	0.583	***	0.409	***
	(0.093)		(0.122)	
%Repo	-0.966	***	-1.143	***
	(0.195)		(0.342)	
Target Rate	0.106		-0.149	
	(0.078)		(0.118)	
1M AA Asset-Backed CP	-0.099	*	-0.094	
	(0.058)		(0.085)	
1M Certificates of Deposit	0.289		-0.316	
	(0.181)		(0.267)	
1M Financial CP	0.069		-0.068	
	(0.085)		(0.123)	
1M LIBOR	-0.371	*	0.232	
	(0.201)		(0.295)	
Overnight Treasury Repo	-0.066	***	-0.056	**
	(0.016)		(0.023)	
Overnight MBS Repo	-0.057		0.225	***
	(0.055)		(0.082)	
1M OIS	0.101		0.199	**
	(0.066)		(0.098)	
Maintenance Day Fixed Effects	Yes		Yes	
Month Fixed Effects	Yes		Yes	
Quarter End Fixed Effects	Yes		Yes	
Observations	14,487		4,446	
Adjusted R-squared	0.64		0.69	

Note: The sample ranges from January 1, 2007 to August 29, 2008 with observations are included only if a bank borrowed on that day. The dependent variable is *Amount*, the logarithm of the amount borrowed in that day. *Avg. Amount in Prev. Month* is the logarithm of the average amount borrowed in the previous calendar month. *Customer Funds Sent* and *Customer Funds Received* are the logarithm of customer funds sent and received. *Distance from Req. Reserves* is difference between the bank's beginning of day balance (without any fed funds transactions) and the bank's required reserve amount divided by total assets. *Assets* is total bank assets (in millions of US $). *ROA* is net income divided by assets. *Risk Ratio* is Tier 1 plus Tier 2 Capital divided by assets. *%NPL* is total non-performing loans divided by total loans. *%MBS* is the amount of mortgage-backed securities divided by the amount of total assets. *%Repo* is the amount of securities sold under agreements to repurchase divided by the amount of total assets. *Target Rate* is the overnight target rate set by the Federal Open Market Committee (FOMC). *1M AA Asset-Backed CP, 1M Certificates of Deposit, 1M Financial CP, 1M LIBOR, 1M OIS* are one month term rates on AA asset-backed commercial paper, certificates of deposit, financial commercial paper, LIBOR and OIS. On British holidays, *1M LIBOR* is filled in with the previous business day's rate. *Overnight Treasury Repo* and *Overnight MBS Repo* are overnight rates on treasury repos and MBS repos. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively.

TABLE XII: DETERMINANTS OF FORECAST ERROR

Predicted less Actual	Large (1)		Small (2)		Large (3)		Small (4)	
1 week Pre-Lehman (9/5-9/11)	0.159	***	0.237	***	-0.163		0.162	
	(0.060)		(0.081)		(0.115)		(0.108)	
Friday (9/12)	0.196	**	0.059		0.031		0.015	
	(0.078)		(0.055)		(0.176)		(0.062)	
Monday (9/15)	0.157		0.509	***	-0.044		0.363	***
	(0.125)		(0.091)		(0.248)		(0.064)	
Tuesday (9/16)	0.216	**	0.458	***	0.039		0.350	*
	(0.104)		(0.144)		(0.229)		(0.202)	
Post-AIG, pre-IOR (9/17-10/8)	-0.461	***	0.371	***	-0.689	***	0.370	**
	(0.098)		(0.098)		(0.218)		(0.148)	
Post-IOR, pre-CPP (10/9-10/13)	-0.873	***	0.412	*	-0.467	**	0.886	***
	(0.128)		(0.232)		(0.219)		(0.124)	
1 month post-CPP (10/14-11/10)	-0.570	***	-0.040		-0.385	***	-0.079	
	(0.106)		(0.178)		(0.131)		(0.243)	
1 week Pre-Leh x %NPL					33.372	***	4.430	
					(9.531)		(5.298)	
Friday x %NPL					16.757		3.223	*
					(16.172)		(1.855)	
Monday x %NPL					21.263		8.675	***
					(20.019)		(1.624)	
Tuesday x %NPL					18.129		7.892	
					(21.402)		(10.239)	
Post-AIG, pre-IOR x %NPL					23.830		-0.162	
					(18.958)		(6.034)	
Post IOR, pre-CPP x %NPL					-42.552	*	-24.138	***
					(25.077)		(2.222)	
1 month post-CPP x %NPL					-19.055		2.191	
					(12.923)		(5.569)	
Borrower Fixed Effects	Yes		Yes		Yes		Yes	
N	13,864		1,698		13,864		1,698	
Adjusted R-squared	0.22		0.14		0.23		0.15	

Note: The sample consists of 21,003 observations from 360 borrowers from April 1, 2008 to February 28, 2009. We divide the sample into terciles, where *Large* is the top tercile of assets and *Small* is the bottom tercile of assets. The dependent variable is *Predicted less Actual* – the difference between the predicted estimate for borrowing calculated using the relationships estimated from January 1, 2007 to August 29, 2008 (presented in TABLE 10) and actual borrowing. *%NPL* is total non-performing loans divided by total loans. Bank characteristics are measured as of the Call Report as of December 2007. Standard errors are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level of significance, respectively.

TABLE XIII: DEPENDENT VARIABLES, LENDERS

	Access		Spread to Target			Amount			Counterparties		
	(1)		(2)		(3)		(4)		(5)		(6)	(7)
2 weeks Pre-Leh (8/29-9/4)	0.070	**	-0.005		0.006		-0.029		0.023		-0.030	-0.005
	(0.032)		(0.007)		(0.006)		(0.065)		(0.042)		(0.028)	(0.019)
1 week Pre-Lehman (9/5-9/11)	0.046		-0.024	***	-0.015	***	0.017		0.030		-0.019	-0.002
	(0.033)		(0.005)		(0.005)		(0.063)		(0.041)		(0.030)	(0.022)
Friday (9/12)	0.066		0.054	***	0.067	***	0.002		0.035		0.011	0.040
	(0.046)		(0.007)		(0.007)		(0.092)		(0.060)		(0.040)	(0.028)
Monday (9/15)	-0.086	*	0.178	**	0.168	**	-0.016		-0.099	*	-0.016	-0.064 **
	(0.044)		(0.072)		(0.071)		(0.091)		(0.058)		(0.043)	(0.030)
Tuesday (9/16)	-0.136	***	-0.303	***	-0.306	***	0.052		-0.131	**	0.042	-0.079 **
	(0.044)		(0.047)		(0.045)		(0.093)		(0.056)		(0.049)	(0.036)
Post-AIG, pre-IOR (9/17-10/8)	-0.160	***	-0.509	***	-0.507	***	0.143 *		-0.113	**	0.000	-0.113 ***
	(0.036)		(0.034)		(0.034)		(0.074)		(0.046)		(0.037)	(0.027)
Post-IOR, pre-CPP (10/9-10/13)	-0.296	***	-0.523	***	-0.530	***	0.261 *		-0.066		0.007	-0.153 ***
	(0.055)		(0.040)		(0.034)		(0.134)		(0.072)		(0.060)	(0.044)
1 month post-CPP (10/14-11/10)	-0.497	***	-0.513	***	-0.560	***	0.244 *		-0.334	***	0.041	-0.267 ***
	(0.047)		(0.027)		(0.023)		(0.127)		(0.070)		(0.060)	(0.042)
Lender Fixed Effects	No		No		Yes		No		Yes		No	Yes
N	84,853		26,700		26,700		26,700		26,700		26,700	26,700
Adjusted R-squared			0.29		0.48		0.01		0.88		0.01	0.86

Note: The sample used in column (1) consists of 84,853 observations from 376 lenders from April 1, 2008 to February 28, 2009, where observations have been filled in with 0's on days which banks do not lend. The sample used in columns (2) – (7) consists of 26,700 observations from 376 lenders from April 1, 2008 to February 28, 2009, where only banks that lend are present. *Spread to Target* is the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day. *Amount* is the logarithm of the amount lent in the fed funds market on that day (in millions of US $). *Counterparties* is the logarithm of the number of counterparties each bank has on that day.

TABLE XIV: DEPENDENT VARIABLES, LENDERS WITH FULL SAMPLE

	Spread to Target			Amount			Counterparties		
	(1)		(2)	(3)		(4)	(5)		(6)
2 weeks Pre-Leh (8/29-9/4)	-0.010 **		-0.002	-0.089 *		-0.051	-0.047 **		-0.034 *
	(0.005)		(0.005)	(0.052)		(0.036)	(0.022)		(0.018)
1 week Pre-Lehman (9/5-9/11)	-0.029 ***		-0.021 ***	-0.055		-0.045	-0.040 *		-0.029
	(0.004)		(0.004)	(0.052)		(0.038)	(0.024)		(0.019)
Friday (9/12)	0.057 ***		0.071 ***	-0.056		-0.049	-0.029		-0.013
	(0.007)		(0.007)	(0.079)		(0.057)	(0.033)		(0.026)
Monday (9/15)	0.231 ***		0.225 ***	0.039		-0.093 *	-0.023		-0.084 ***
	(0.063)		(0.063)	(0.080)		(0.048)	(0.037)		(0.028)
Tuesday (9/16)	-0.163 ***		-0.169 ***	0.112		-0.113 **	0.047		-0.083 ***
	(0.050)		(0.048)	(0.083)		(0.051)	(0.041)		(0.031)
Post-AIG, pre-IOR (9/17-10/8)	-0.408 ***		-0.411 ***	0.141 **		-0.083 **	-0.021		-0.110 ***
	(0.030)		(0.029)	(0.063)		(0.040)	(0.029)		(0.023)
Post-IOR, pre-CPP (10/9-10/13)	-0.459 ***		-0.465 ***	0.279 ***		-0.048	0.006		-0.143 ***
	(0.038)		(0.036)	(0.108)		(0.058)	(0.045)		(0.034)
1 month post-CPP (10/14-11/10)	-0.548 ***		-0.582 ***	0.285 ***		-0.310 ***	0.016		-0.250 ***
	(0.019)		(0.017)	(0.103)		(0.062)	(0.044)		(0.033)
Lender Fixed Effects	No		Yes	No		Yes	No		Yes
N	45,175		45,175	45,175		45,175	45,175		45,175
Adjusted R-squared	0.24		0.40	0.01		0.87	0.00		0.82

Note: The sample consists of 45,176 observations from 552 lenders from April 1, 2008 to February 28, 2009. *Spread to Target* is the weighted average spread between the banks' fed funds loans and the target federal funds rate on that day. *Amount* is the logarithm of the amount lent in the fed funds market on that day (in millions of US $). *Counterparties* is the logarithm of the number of counterparties each bank has on that day.

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