

Thawing Frozen Capital Markets and Backdoor Bailouts: Evidence from the Fed's Liquidity Programs*

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Abstract

During the subprime crisis, the Federal Reserve introduced several emergency liquidity programs as supplements to the discount window: TAF, PDCF, and TSLF. Using microdata on loans to large commercial banks and investment banks, we find that the programs were used by relatively few institutions and had modest effects on the liquidity of short-term debt markets. Instead, our evidence suggests that the decisions to borrow and to prepay loans were more closely related to a firm's financial health. Our results suggest that healthy banks found the terms of the loans expensive relative to private market funds, while banks closer to insolvency often did not.

“...in September [2008], after 13 months of market stress, the financial system essentially seized up and we had a system-wide crisis. Our markets were frozen, banks had pulled back very substantially from interbank lending.”

(Testimony of Hank Paulson, Treasury Secretary, to the House Committee on Financial Services on November 18, 2008.)

The Federal Reserve (the Fed) aims to mitigate the effects of financial system shocks by acting as a lender of last resort (LOLR) to banks through its discount window (DW). Borrowing from the DW carries the potential for stigma, as the market might perceive banks that need to borrow from the Fed as financially weak.¹ To provide additional support to financial intermediaries in the subprime crisis, and in an attempt to reduce this stigma, the Fed introduced three new loan facilities: the Primary Dealer Credit Facility (PDCF), the Term Securities Lending Facility (TSLF) and the Term Auction Facility (TAF).²

Like the DW, which is available only to commercial banks, the PDCF provides short-term secured loans to I-banks at a penalty over the unsecured Fed Funds (FF) rate. Since both programs charge a penalty, they are potentially quite costly for banks and I-banks, especially since secured loans typically carry lower interest rates than unsecured loans (Benmelech and Bergman (2009), Fleming, Hruang and Keane (2009), and Hrung and Seligman (2011)).³ Figure A1 shows that the discount window rate typically exceeded the repo rate by 50 – 100 basis points during our sample period. Thus, most banks would shun these loans in normal times. However, in a crisis, when capital markets are frozen, the penalty rate may be a small price to pay when other funding has dried up. We investigate all four Fed facilities in the subprime crisis and their use by large commercial banks and I-banks to determine how well the programs alleviated stress in short-term capital markets.⁴

¹ See Peristiani (1998), Furfine (2001, 2003), and Armandier, Ghysels, Sarkar and Shrader (2011). In the remainder of the paper we use the term “weak” to refer to banks that are close to insolvency.

² See Tables A1-A4 in the appendix for details on the Fed emergency facilities.

³ Studies that compare yields on secured and unsecured debt typically find the opposite, but this owes to endogeneity (Benmelech and Bergman (2009)).

⁴ See also Wu (2011), Fleming, Hrung and Keane (2009), Hrung and Seligman (2011), McAndrews, Sarkar and Wang (2008) and Christensen, Lopez, and Rudebusch (2009) who analyze aggregate data showing that the Fed programs provided liquidity. However, Taylor and Williams (2008) and In, Cui and Maharaj (2012) contend otherwise.

By following Bagehot's (1873) dictum to lend freely to sound banks against good collateral at a penalty rate, the Fed intends to combat illiquidity in a crisis and at the same time avoid loans that are essentially substitutes for capital at weak banks (Schwartz (1992)). In contrast, Ashcraft, Bech and Frame (2010) show that Federal Home Loan Bank (FHLB) advances, which do not have a penalty, were mainly used in the recent crisis by distressed banks that viewed FHLB loans as a cheap source of funding. While the Fed intends to reduce this problem for DW and PDCF loans by charging a penalty rate, it sets the penalty rate the same for all institutions. This one-size-fits-all policy affords undercapitalized banks a relative advantage since these banks typically pay a premium in the FF markets anyway. In contrast, stronger banks pay a rate closer to the FF target rate used as the benchmark for DW and PDCF loans (Furfine (2003) and Armantier, Ghysels, Sarkar and Shrider (2011)).⁵

The penalty rates on DW and PDCF loans might make these two facilities less popular than the TAF and TSLF auctions, which do not have penalties. However, these auction programs were normally held just once a week and thus may not have been available to banks when needed. In addition, the Fed typically offered less than \$75 billion at each auction, and even when raised to \$150 billion the funds might not have been sufficient to satisfy the needs of all bidders. Thus, banks would have required alternative funding in the event that their bids did not win. Since weak banks had fewer alternative sources of funds, they should have bid more aggressively. Thus, these two facilities could serve a disproportionately high fraction of weak banks (Armantier, Ghysels, Sarkar and Shrider (2011)).

We analyze two frameworks to characterize the use of Fed credit facilities. The first views these emergency liquidity programs as potential lifelines to all banks when short-term debt markets are frozen ("liquidity provision" framework). This framework implies that more banks should use the loan programs and borrow more money as the crisis

⁵ Consider a healthy bank with Treasury bonds as collateral shortly after Bear Stearns failed. With a FF rate of 4% and a penalty of 1%, the bank would obtain a loan at 5%, well above the repo rates of 3% - 4% reported by Krishnamurthy, Nagel and Orlov (2013). In contrast, their figures suggest that a weak bank that had only the riskiest bonds as collateral might pay as much as 6% to borrow in the repo market in Q1 2008, and hence would prefer a 5% DW rate then. The rates on DW and PDCF loans are even more favorable to the weak bank in late 2008 when the Fed lowered the penalty (and the FF rate) and mortgage-backed securities (MBS) repo rates soared (Gorton and Metrick (2012) and Adrian, Burke and McAndrews (2009)).

deepens, and that the pressure should be most evident among banks that rely on short-term debt markets. The framework predicts that these patterns should reverse as capital markets ease up. The second framework to describe LOLR borrowing focuses on the financial strength of the institutions (the “bailout” framework). Under the bailout framework, we should observe (1) small and infrequent amounts borrowed from the Fed, especially relative to the banks’ typical funding from short-term debt markets and (2) concentrated borrowing by weaker banks rather than widespread use of the programs. In addition, the bailout framework predicts that repayment of loans, to the extent it exists, is not related to general market conditions but to the health of the bank.

Our sample includes large U.S. commercial banks, investment banks and foreign banks – essentially all large financial institutions permitted to borrow directly from the Fed during the crisis. Many of these large firms had both commercial and investment banking arms and, thus had access to all four programs. We focus on large firms since the new Fed programs should have had the most significant impact on these firms. In contrast, Berger, Black, Bouwman and Dlugosz (2013) analyze the same data Freedom of Information Act (FOIA) data, but limit the sample to banks that submit Call Reports, thus ignoring many large firms that would have been severely affected by disruptions in repo and public bond markets.⁶ Acharya, Fleming, Hrungrung and Sarkar (2014) also analyze large borrowers, but they restrict their analysis to the emergency facilities aimed at primary dealers (PDCF and TSLF).

We find that all Fed liquidity programs were used more heavily after the bankruptcy filing of Lehman Brothers on September 15, 2008, and that the largest loans were provided to I-banks under the PDCF facility. Post-Lehman, borrowing from the Fed liquidity programs became more widespread, and many large commercial banks borrowed from at least one facility. These results suggest that the new emergency

⁶ Prior to a Freedom of Information Act (FOIA) lawsuit in 2011, use of the DW was not disclosed to the public. The FOIA data, which are described in detail in the appendix, are matched by name to datasets on bank financial information, such as Compustat in our case, and to Call Reports by Berger, Bouwman, Black and Dugosz (2013). The entity matched to the FOIA name may be at a different level than the borrower. For example, Berger et al. report substantial TAF borrowing by Chase Bank USA relative to its \$79 billion in assets (as of year-end 2007), but we note that this borrowing is not substantial compared to the assets of JPMorgan Chase Bank (\$1.3 trillion). The former bank did not report any repo borrowing but JPMorgan Chase Bank lists \$99 billion in repo debt. Both entities have lower assets than the consolidated balance sheet of JPMorgan Chase & Co. (\$1.6 trillion; Compustat).

facilities were successful in providing liquidity to stressed markets (Afonso, Kovner and Schoar (2011)). However, borrowing remained quite concentrated through the crisis, and some safer banks were noticeably absent from the Fed programs even after Lehman's collapse. Loans were often small compared to banks' typical short-term debt levels – at the peak of borrowing, nearly 90% of short-term funding continued to be supplied by capital markets. Multivariate analysis shows that weaker banks were significantly more likely to borrow from the Fed. These results suggest that the programs had a tendency to prop up weaker banks. Finally, loan prepayments were not generally motivated by better market conditions, but rather by a desire among weaker banks to avoid investor scrutiny.

We also note that some large loans were granted by the Fed in situations that were unrelated to general market conditions. For example, JPMorgan Chase borrowed billions in early 2009 coinciding with its acquisition of Bear Stearns. Furthermore, Lehman borrowed from the Fed after it declared bankruptcy. And, some very weak foreign banks borrowed frequently and in large amounts throughout the crisis, even after receiving bailouts from their own governments. These large loans suggest that the emergency facility programs were sometimes used for purposes other than easing general market conditions.

Overall, our findings imply that while the Fed programs increased liquidity, the amount provided was small relative to the size of these banks' short-term borrowings in capital markets. Of course, it is possible that the situation would have been worse if the Fed did not offer the new LOLR programs, but our results suggest that these programs could have been more widely used. Our results suggest that subdued borrowing from these emergency programs owes at least in part to their high cost (the penalty rate on secured debt) for healthy institutions.

The remainder of the paper is as follows: Section 1 discusses the framework for analyzing the extent of liquidity provision by the Fed and the sample. Section 2 presents results. Section 3 concludes. The appendix provides detailed information on the Fed liquidity programs and the FOIA data.

1. Analytical Framework and Sample

A. Analytical framework

We test two frameworks describing the use of the Fed liquidity facilities: the “liquidity provision” and “bailout” frameworks. The former framework explicitly assumes that capital markets froze at some point during the crisis, as indicated in prior research (e.g., Afonso, Kovner and Schoar (2011) and Berger, Black, Bouwman and Dlugosz (2013)) and the above-cited statement made by Secretary Paulson. While debt markets were stressed prior to the Bear Stearns deal in March of 2008, regulators did not declare debt markets frozen until September of that year. Thus, some firms that avoided Fed borrowing early in the crisis may have only later taken advantage of the emergency facilities. To account for this possibility, we analyze borrowing from the Fed facilities during the pre- and post-Lehman periods separately.

An alternative framework (bailouts) is articulated by Ennis and Weinberg (2009) and Artuc and Demiralp (2010). Their perspectives implicitly assume that markets, while not functioning as normal, continue to provide some funds to the strongest financial institutions. As a result, the weakest banks are more likely to find DW loans cheaper than private market debt. Thus, if bailouts are the primary factor in Fed lending, the use of the programs will be limited and skewed towards undercapitalized banks.

Our first set of hypotheses describing the use of the Fed programs is related to the aggregate amount borrowed and the amount of capital market funding such borrowing replaced. Specifically, the two frameworks predict different uses of the facilities:

H1 (Market funding replacement hypotheses)

H1A (Liquidity provision): *If the Fed liquidity facilities were effective in thawing frozen capital markets, financial institutions should have replaced a substantial portion of their short-term borrowing with loans from the Fed programs.*

H1B (Bailout): *If the Fed liquidity facilities were used as bailouts of insolvent institutions, the capital markets should have continued to supply most short-term borrowing by solvent banks.*

H2 (Pervasiveness of use hypotheses)

H2A (Liquidity provision): *If the Fed liquidity facilities were effective in thawing frozen capital markets, the use of the facilities should have become more widespread when capital markets froze.*

H2B (Bailout): *If the Fed liquidity facilities were used to bail out insolvent institutions, the use of the facilities at time of market turmoil should have remained more concentrated.*

We test H1 by examining the time series patterns of aggregate borrowing in all four programs relative to the total amount of short-term debt on banks' and dealers' balance sheets. If the Fed facilities succeeded in providing liquidity to thaw frozen markets, we should observe that the emergency loans replaced a large fraction of short-term debt. If, by contrast, Fed loans replace a small fraction of short-term debt, then the results are more consistent with the bailout hypothesis. There is no theoretical cutoff that determines what constitutes a small or large fraction of short-term debt replacement. However, we note that prior research finds that the majority of banks suffering short-term debt shortfalls are able to offset at least half of the shortfall with deposits (Boyson et al. (2014)). Hence, we consider whether LOLR borrowing replaces at least half of short-term debt at some point during the crisis.

We test H2 by calculating Herfindahl indexes for each program on each day and examining the changes in the indexes around the time of the Lehman bankruptcy, since it is after the Lehman bankruptcy that regulators declared credit markets frozen. If the Herfindahl indexes decline sharply following the Lehman event, indicating that more institutions accessed the liquidity programs, we conclude that the Fed programs provided liquidity to thaw frozen markets (accept H2A and reject H2B). If the index increases, the bailout framework gains support (accept H2B). We also examine the absolute level of the Herfindahl indexes in the post-Lehman period. If the indexes are high, we infer that disruptions in capital markets were not severe enough to affect most firms and that the programs were not very widely used (reject H2A).

Next, we consider the cross-sectional variation in the types of firms that access the Fed liquidity programs. Under the liquidity provision framework, the institutions most exposed to debt markets should be more likely to borrow from the Fed. If the bailout framework is correct, weak institutions should be more likely to take advantage of the Fed programs because the penalty rate of the Fed loans is not institution-specific. That is, weak institutions do not face as high a penalty as healthy ones when borrowing from the Fed. Therefore, if these weak institutions face a high market cost of debt, they should find the Fed loans economical. Specifically,

H3 (Loan initiation hypotheses)

H3A (Liquidity provision): *If the Fed liquidity facilities were effective in thawing frozen capital markets, financial institutions with high (low) exposure to capital markets were more (less) likely to access the Fed programs.*

H3B (Bailout): *If the Fed liquidity facilities were used as bailouts of insolvent institutions, financially weak (strong) institutions were more (less) likely to access the Fed programs during times of market turmoil.*

We test the liquidity provision loan initiation hypothesis (H3A) by examining firms' prior reliance on short-term debt markets. H3A predicts that firms with high short-term debt and low deposits are more likely to access the Fed programs after Lehman fails. We also consider the type of collateral posted when borrowing from the Fed. According to Gorton and Metrick (2012), when the repo market froze in 2008, MBS repo lending was particularly distressed. Thus, the use of MBS collateral for Fed loans should have increased sharply when repo markets froze. With respect to the bailout loan initiation hypothesis (H3B), weaker firms are more likely to access the Fed facilities, especially after Lehman's collapse. We use measures of firm health, such as bank capital and ROA prior to borrowing from the facilities. We also consider information on TARP program usage from Call Reports regarding both the usage and early repayment. Firms that were closer to insolvency would have had fewer high quality assets to pledge to the Fed and thus were more likely to post equity collateral when the Fed started accepting it in late 2008 (see Table A4).

Finally, we analyze factors related to early repayment of DW and PDCF loans. Under the liquidity provision framework, when market funding is severely limited, institutions would be less likely to voluntarily prepay loans obtained from the DW or PDCF. However, as markets eased and the penalty rate rose well above market rates, prepaying LOLR loans might have become attractive, especially for institutions with high exposure to capital markets. Under the bailout framework, factors other than easing of capital markets should be related to loan prepayments. Specifically:

H4 (Loan prepayment hypotheses)

H4A (Liquidity provision): *If the Fed liquidity facilities were effective in thawing frozen capital markets, financial institutions with high (low) exposure to capital markets should have been more (less) likely to prepay their loans.*

H4B (Bailout): *If the Fed liquidity facilities were used as substitutes for capital by undercapitalized institutions, financially weak institutions should have been more*

likely to prepay their loans when either their situation improved or the end of fiscal quarter approached.

We test the liquidity provision prepayment hypothesis (H4A) by analyzing whether the amount of short-term debt and deposits affect the likelihood of prepayment. The rationale is that when credit conditions ease, banks with the highest exposure to the credit markets stand to benefit the most in prepaying above-market rate loans and, instead rely on short-term debt markets. The most important factor for the bailout loan prepayment hypothesis (H4B) is the creditworthiness of the firm, especially if it improves over time. We also consider the effect of disclosure in audited financial statements. The Fed loan data was secret prior to the Bloomberg FOIA lawsuit in 2011. However, if the amounts borrowed were large enough, banks would be required to disclose them in financial statements, which might lead to a run on a bank, difficulty rolling over short-term debt, or a decline in the firm's stock price. Therefore, to avoid disclosure, banks would prefer to prepay loans immediately prior to the end of the fiscal reporting period.

B. Sample

Because we are interested in the effects of overall capital market disruptions on financial firms and the role of the LOLR in dealing with them, we restrict our sample to large firms. We screen for a set of potential borrowers that are publicly traded, have at least one quarter of Compustat and CRSP data available, and have assets of at least \$1 billion (Berger et al. (2014)). Several foreign banks borrowed heavily from the Fed during the crisis but not all of them have data on Compustat or CRSP. In those cases, we search for their data on Global Compustat or collect data from their annual reports and SEC filings.⁷ Our total sample consists of 382 large commercial banks and 17 primary dealers with full Compustat and CRSP data. By construction, our sample uses data for the consolidated entity (including bank holding companies and bank subsidiaries).

Next, we identify firms that borrowed at least once during the crisis from at least one of the four facilities. We identify institutions accessing the DW, TAF, PDCF, and

⁷ We include all US banks and investment banks that might have borrowed through one of the four programs. However, data limitations prevent us from creating a comparable sample for foreign banks. We include foreign banks that actually did borrow from one of the programs or which have available data on Compustat. We confirm that most large foreign banks are included in the sample: When we compare our sample to the American Bankers Association list of the 150 largest banks in the world by assets (December 2007 and June 2009 lists) only eight foreign banks are missing from our sample.

TSLF from the 3/31/2011 FOIA production by the Federal Reserve as discussed in the Appendix. Since the FOIA files only report the name of the institution and no other identifying information, we match the names manually. If the name of a borrower is not in CRSP or Compustat, we search for other identifying data in SEC filings and company websites to improve the matching process. We identify 213 banks that borrowed from at least one Fed facility and 169 non-users. Finally, we identify 17 primary dealers with available Compustat and CRSP data.

While data stop before June 2009 for 40 banks, we do not consider survivorship bias to be a problem among our sample of large commercial banks.⁸ We obtain information regarding bank failures from the FDIC failed bank list and from a review of the financial press. We use their data for as long as it is available. We note that several European banks would not have survived as stand-alone entities absent a bailout from their local governments, but they were not shut down by their regulators, and are included in the sample throughout. In addition to acquisitions that cause a firm to exit the sample, acquisitions cause some sample firms to expand in size. This information comes from Securities Data Corporation (SDC).

Likewise, survivorship bias is negligible among the primary dealers. In early 2008, there were 20 primary dealers, including Bear Stearns, whose takeover by JPMorgan Chase was announced the day before the PDCF began. One of the few US dealers with high deposits, Countrywide, ceased to be a primary dealer in July 2008. Lehman is deleted from the New York Fed's list of primary dealers on September 22, 2008 and Bear Stearns, which merged with JPMorgan Chase, is not deleted from the list until October 2008. Merrill continued to be a primary dealer until February 11, 2009. Only one new primary dealer, Jefferies, was added after the sample period started (in May 2009). Most of the primary dealers were investment banks or had large investment banking arms. Ten of the dealers were foreign and, in contrast to US dealers, often had large deposit-taking divisions that allowed them access to DW loans.

C. Sample characteristics

⁸ For example, Washington Mutual is missing data after it goes bankrupt, and National City, Provident and Wachovia are acquired in 2008. ABN-Amro is acquired in mid-2007 and is the only acquisition that is not clearly related to losses in the crisis. We note that data for about 5% of users, 9% of light users, and 13% of non-users stop before the end of the sample period.

We begin by reporting the characteristics of loans and borrowers. Table 1, Panel A reports the size of each loan in the FOIA data regardless of whether or not the borrower is in our sample. The table also reports maturity and interest rate for the 3,614 loans together and by program. Panels B-E show that the DW and the TAF are the most popular programs, as each accounts for nearly one-third of all lending. Most of the DW and PDCF loans are overnight, whereas the TAF and TSLF loans typically have a maturity of about one month. The range of interest rates is wide, reflecting the decline in interest rates at the start of the crisis to the end of the sample period.

The median TSLF loans and PDCF loans were larger than those made through the DW and TAF, partly reflecting the large relative size of the primary dealers that borrowed from the PDCF and TSLF. However, the distribution of DW loans is heavily skewed, as some large borrowers used the DW as well. For example, JPMorgan Chase borrowed \$8.6 billion from the DW in late May 2008.

While the loan amounts are large in absolute terms, the median loan of \$1.9 billion is about 12% of the (untabulated) median book value of short-term debt of the users in our sample. Some firms take out more than one loan at a time, but even considering the size of all new loans for a firm, the median amounts are comparable. Panel F of Table 1 shows that the average and median amounts increase by this method of calculation, but only by a few hundred million dollars. Thus, as a percentage of short-term debt, average borrowing is not large. A few banks borrowed from more than one facility at a time or took out additional loans from the same program before the first one matured. Panel G of Table 1 shows the average and median quantities borrowed by each bank on days when there is a loan outstanding. The averages and medians are larger still, but remain small for most banks. The largest amount outstanding at any one point was nearly \$100 billion, which was owed by Morgan Stanley.⁹ Part of this sum reflects a \$40.1 billion PDCF loan on September 29, 2008, the same day that Morgan Stanley received a \$9 billion dollar equity injection from Mitsubishi UFJ Financial Group. With a balance sheet of slightly under a trillion dollars and \$323 billion in short-term debt, the total Fed borrowing on that day amounted to about 10% and 30% of Morgan Stanley's assets and short-term

⁹ Bloomberg reported that Morgan Stanley borrowed \$107 billion from the Fed. The Bloomberg figure includes borrowing using a single tranche repo. The Fed does not consider these repos to be emergency loans.

debt, respectively. The largest single loan in the sample is a 4-day loan to Barclays on September 18, 2008 for \$47.942 billion.¹⁰

The first two columns of Panel A of Table 2 compare the characteristics of commercial banks that used at least one of the Fed programs to non-users. The last column presents the characteristics of primary dealers.¹¹ The results indicate that users are larger firms, whether measured by the average or median assets, and they rely more heavily on capital markets funding (they have fewer deposits and more ST debt). These results are consistent with a description of the programs as providing liquidity during a crisis.

Only one measure suggests that the users are weaker banks: Their capital ratios are significantly lower in Panel A when compared to non-users. In contrast, the return on assets and (median) non-performing loans are not significantly different between users and non-users. The average of non-performing loans indicates that users have stronger balance sheets and their market-to-book ratios imply that they enjoy higher valuations. To capture the effects of weak balance sheets in this crisis period while avoiding multicollinearity, we create an insolvency index. The index is the sum of the following indicator variables: whether equity capital divided by total assets is below the sample median, whether ROA is negative, whether non-performing loans scaled by total assets are above the sample median, and whether the market-to-book ratio is below the sample median. The insolvency index of users is not significantly different from the insolvency index of non-users.

Foreign firms account for 21% and 16% of users and non-users, respectively. While this difference is not significant, the availability of loans from their home governments suggests that 21% is a high fraction of foreign users.

We also report whether banks received capital from the TARP program. The results indicate that users have significantly higher propensity to access TARP funding

¹⁰ As can be seen from Figure 4, other firms borrowed more than \$47.942 billion through the PDCF. The data in Figures 1-6 represent total loan amount outstanding at a given point in time. In the case of Morgan Stanley, for example, it borrowed slightly over \$61 billion from the PDCF through two loans on September 29, 2008.

¹¹ We do not report data on non-users for the PDCF or TSLF because that sample of primary dealers is small. We report data as of year-end 2007 except when missing data are replaced with figures from the next quarter.

compared to non-users. Conditional on accessing TARP, users are about as likely as non-users to repay TARP quickly (i.e., before June 2009).

Finally, primary dealers are large firms that rely heavily on short-term debt markets. On average, short-term debt accounts for 24% of assets, while deposits are only 42% of assets. Equity capital, ROA, and market-to-book are all low compared to the commercial banks in our sample. The insolvency index is lower, but this is not surprising given that it uses only three measures of strength instead of the four used in the commercial bank index (non-performing loans are not included). Two (12%) of the primary dealers accessed TARP and both of the firms repaid TARP before June 2009.

2. Results

A. Tests of the market funding replacement hypotheses (H1)

Our first test of the market funding replacement hypothesis (H1) is conducted in Table 2 Panels B-F, which report quarterly data. The most striking aspect of these panels is the small number of users. Over 380 large commercial banks could have used the DW and TAF during this period, but at most 64 banks accessed either of them during any of the eight quarters in the sample period (Panels B and C). We note that a much higher fraction of primary dealers used the facilities, although the PDCF is not widely used in the two quarters after Bear Stearns. TSLF attracted wide participation throughout the crisis, with over 80% (14) of the primary dealers accessing the facility in Q3 2008. The number of users increased among all four programs after Lehman declared bankruptcy, with the sharpest increase in the PDCF. Nonetheless, the liquidity framework predicts that borrowing would be widespread at some point in the crisis, but as Panel F shows, the largest number of borrowers is only 91 (23%) in 2008Q3. The size of the borrowers increases around the Lehman event in most programs, but the median DW borrower asset size drops after Lehman. The average amounts borrowed in the post-Lehman period relative to the pre-Lehman period are higher for the DW and TAF. However, the median loan sizes for DW are still relatively small and not meaningfully different from median DW loan sizes in the earlier periods. We note larger PDCF loans in the post-Lehman period, especially in Q3 and Q4, but TSLF loan sizes do not show dramatic changes then. Thus, Panel F shows that the median amount borrowed in all four programs only jumps a

small amount after Lehman fails. Finally, we note that the use of all four programs dropped off dramatically by the end of the sample period.

We present further univariate analyses of the market funding replacement hypotheses (H1) in Figures 1-6. Figure 1 shows the amount outstanding owed by all firms, including small banks and thrifts that are not in our sample. In all Fed programs the aggregate outstanding never exceeds \$800 billion, and indeed, the debt rarely exceeds \$750 billion at any point in time in the crisis. To put the amount of borrowing in perspective, we consider the total amount of borrowing from all four Fed facilities by firms in our sample relative to the total amount of their short-term debt (Figure 2). We hypothesize in H1A that Fed borrowing should replace a substantial portion (at least 50%) of short-term borrowing if the programs mainly worked to provide liquidity to frozen markets. Instead, Figure 2 shows that even when the markets were most stressed, they continued to supply about 90% of these large firms' short-term debt funding. This evidence contradicts the market funding replacement hypothesis H1A.

Figure 3 shows that DW borrowing was very light until late March 2008. As a comparison, Furfine (2001) shows that borrowing from a Fed facility set up for Y2K problems reached \$1.187 billion on December 29, 1999. Only about a third of the days between August 20, 2007 and April 1, 2008 had DW loans outstanding of more than \$1.187 billion and several of those days were related to the Fed's request of several large banks that they "test borrow" in August 2007. Thus, DW borrowing in the first nine months of the crisis suggested a situation that was only marginally worse than the Y2K scare. Figure 3 also indicates that the majority of the Fed loans usually went to financial institutions less likely to be affected by frozen debt markets in the U.S. In particular, large money center banks (LMCBs) scarcely approached the DW before October 2008 and quickly repaid the loans when they did. Furthermore, foreign institutions accounted for most of the borrowing from DW despite their ability to access LOLR loans in foreign countries.¹²

¹² A possible explanation for this heavy borrowing by foreign banks is a shortage of dollar funding in foreign markets. In untabulated results, we assess this conjecture by analyzing the amount of swap lines made available by the Fed to foreign LOLRs. Table A4 indicates that following Lehman bankruptcy, the swap lines increased from about \$62 billion to \$635 billion. Hence, at the time that the Fed entered in swap line agreements with foreign LOLRs, foreign institutions substantially increased their DW borrowing.

Figure 4 shows that TAF borrowing was much larger for LMCBs, but they still accounted for less than half of all borrowing in the program. The fraction of LMCB debt in Figure 4 is particularly small before October 2008, and while it increased after Lehman, these banks' total TAF borrowing never exceeded \$200 billion.

One explanation for the low LMCB borrowing is that banks obtained a large portion of their funding from deposits, which is a stable, even increasing, source of funds in a crisis (Gatev and Strahan (2006), Gatev, Schuermann, and Strahan (2009) and Cornett, McNutt, Strahan and Tehranian (2011), and Boyson, Helwege, and Jindra (2014)). In untabulated results, we note that deposits for users increased by almost \$1 trillion between 2Q 2007 and 4Q 2008.

In contrast, some primary dealers may not have been able to increase deposits to offset the loss of short-term debt funding, especially the U.S. dealers, which typically do not own retail banks. Consistent with this argument, the two facilities available to primary dealers (PDCF and TSLF) have the highest participation rates of the Fed programs, suggesting that the use of Fed programs increases with illiquidity in capital markets. Figure 5 shows that 18 dealers used the PDCF at some point in the crisis and only HSBC and Greenwich/RBS never used the facility.¹³ Figure 6 also shows borrowing by 18 dealers, but the two firms that did not use the TSLF were Daiwa and Mizuho.

Overall, based on the univariate analyses of the market funding replacement hypotheses in Table 2 and Figures 1-6, we find evidence that generally favors H1B over H1A (bailouts over frozen markets).

B. Tests of pervasiveness of use hypotheses (H2)

We next analyze the pervasiveness of use hypotheses (H2) by testing whether participation in the Fed programs was widespread. Table 3 reports the average and median Herfindahl index (HHI) of loan amounts for each program (Panel A) and the index scaled by HHI of the size of the firms in the sample eligible to borrow from a particular sample (Panel B). Thus, a firm that borrows 10% of the loans would be borrowing its "fair share" of Fed debt if it also accounted for 10% of the overall bank assets in our sample. In that case the normalized value would equal 1. A number larger

¹³ Note that Figures 5 and 6 show borrowing for all 20 primary dealers, whereas Table 2 includes firms with data in Compustat and CRSP.

than one indicates the firm is borrowing more than would be expected given its size. We test for differences in the HHIs from the pre- to post-Lehman bankruptcy periods to test H2. For DW and PDCF, we calculate the HHI based on the share of the loans initiated on the same day. For TAF and TSLF, the share is based on the size of the auction offering, so that if a particular auction was undersubscribed, the HHI would be low.¹⁴ The HHI values are, by design, capped for the TAF and TSLF, as their rules limit funding to any one firm.¹⁵

Prior to Lehman's bankruptcy, participation in the Fed programs was often concentrated among a handful of firms. Panel A shows that DW and PDCF borrowing was often done by only one or two firms since the average HHI is close to one. Panel B shows that the scaled HHI is substantially higher than one.

If borrowing increased sharply in late 2008 because debt markets froze after Lehman, we would expect the HHI values to decline after September 15. Table 3 shows that the HHI as well as the scaled HHI do indeed decline for DW, PDCF, and TAF after September 15. Therefore, the Lehman event leads to a statistically significant increase in pervasiveness of the use of the three facilities, which is consistent with H2A. For TAF, we further note that the post-Lehman concentrations are consistent with pervasive use and supportive of H2A. However, while the declines in the loan concentrations are significant for DW and PDCF, the absolute levels of the HHI indicate that the use of the programs remained concentrated even in the post-Lehman period. For example, for DW (PDCF), the HHI value of 0.497 (0.292) indicates that as few as two (three) institutions borrowed comparable amounts on the same day.

The use of TSLF is characterized by increasing HHI values, implying that TSLF borrowing becomes more concentrated after the Lehman bankruptcy. This owes only a bit to Lehman's lack of participation in the auctions after its bankruptcy (an increase of

¹⁴ Note the gray areas in Figures 3 and 5, which show the size of the available funds in the auctions. We note that TAF auctions in October to December 2008 were undersubscribed after the Fed increased the auction size to \$150 billion. The TSLF was undersubscribed in November 2008 even though the Fed did not change its size.

¹⁵ For the TAF the limit is 10% and for the TSLF it is 20%. If each TAF auction had exactly 10 recipients, the HHI would be $10 \cdot 0.1^2 = 0.1$. If each TSLF auction had exactly 5 winners its HHI would be $5 \cdot 0.2^2 = 0.2$. Furthermore, the PDCF and TSLF programs are limited to no more than 20 participants (the number of primary dealers), so if all primary dealers participate in the auction, the HHI cannot fall below 0.05.

about 0.005 in the HHI, or less than 10% of the increase in the average HHI of TSLF loans).¹⁶

Overall, for DW, TAF, and PDCF, the evidence shows significant declines in concentration in the post-Lehman period, which is supportive of the liquidity provision of the pervasiveness of use hypothesis (H2A), while for TSLF, the evidence is supportive of the bailout hypothesis (H2B). We also note that for all but the TAF, the usage of the programs remains concentrated in the post-Lehman period, as indicated by the high levels of HHI.

C. Tests of the loan initiation hypotheses (H3)

The liquidity provision hypothesis H3A predicts that repo market borrowing will be replaced to a large extent by Fed emergency loans. In Table 4, we examine the use of collateral pledged for PDCF loans over the course of the crisis. Copeland, Martin and Walker (2010) show that the majority of collateral posted in the repo market is either Treasury or MBS bonds, with only about 6% of repo borrowing backed by corporate bonds and even less by equity. At the onset of the crisis, PDCF collateral was fairly similar to tri-party repo collateral, although Treasury bond collateral was rarely posted. After Lehman, the mix of assets changes significantly. Rather than the majority of the collateral being MBS, as in the first half of 2008, post-Lehman the most common types of collateral are corporate bonds followed by equity. The fact that MBS collateral drops off sharply is inconsistent with Fed programs substituting for frozen repo markets, as primary dealers rarely used MBS collateral at the Fed window. Further, the high fraction of equity collateral in late 2008 suggests these banks were short on unencumbered, high quality collateral, as predicted by the backdoor bailout hypothesis H3B.

Next, we use a multivariate analysis of the factors related to Fed borrowing and how they changed around the time of Lehman bankruptcy. Specifically, we estimate a hazard function of the conditional probability of borrowing that allows for multiple events (see Andersen and Gill (1982)), where each event is defined as a new loan from the Fed. In Tables 5-8, we present estimates of such hazard functions with multiple events, where each table presents separate estimates for DW, TAF PDCF, and TSLF borrowing. The dependent variable in these models is set to one each time a user borrows

¹⁶ Assuming that 15 primary dealers, i.e. one extra dealer, would participate in the Q3 2008 auctions.

from the program and zero otherwise. We estimate the coefficients over the pre- and post-Lehman periods for each program, and then test whether differences in the coefficients support the liquidity provision or bailout loan initiation hypotheses. For DW and TAF, we also perform the analysis using the sample of domestic banks to assess whether foreign banks' borrowing is meaningfully different from US banks' borrowing.

Table 5 shows the hazard function estimates for DW loan initiations. The first four models use data for the base period prior to the Lehman bankruptcy (models 1 and 2 are for the whole sample and models 3 and 4 only include data on US banks). The coefficient on ST debt is positive and significant, which indicates that, early in the crisis, banks that rely more on wholesale funding were more likely to borrow from the Fed. The coefficient on deposits is significantly negative for US banks, indicating that banks that rely more on wholesale funding (have fewer deposits) are more likely to borrow from the DW. However, the deposit variable is not significant in the sample as a whole. These results support the liquidity framework, while the bailout framework draws almost no support from models (1) and (2). Indeed, during the pre-Lehman bankruptcy period, most solvency measures indicate that users are healthier (banks with higher capital, ROA, and market-to-book borrow more). Only non-performing loans suggests otherwise. Consistent with these results, aggregating the four individual measures into an insolvency index yields a significant negative coefficient for the whole sample and an insignificant coefficient for US banks. With respect to other variables, banks that completed an acquisition in the prior 30 days, domestic, and large banks are more likely to access the DW. The models also indicate that foreign banks were less frequent borrowers early in the crisis and that the DW loans were significantly more likely to fund an acquisition, as in the case of Bear Stearns and JP Morgan.

The test of the loan initiation hypothesis (H3A) focuses on the change in the coefficients as the crisis deepens. In Table 5 models (5) through (8), we analyze the post-Lehman period and test whether the coefficients are significant and consider whether they change. We would accept H3A if the coefficients on ST debt are significantly positive and significantly larger than in the pre-Lehman period. The figures in brackets below the coefficients' p-values in parentheses are p-values for the test of significant differences between the two periods. We find that the coefficients on ST debt remain significantly

positive in all four models, but they do not increase as expected when debt markets freeze. The coefficients either decline (model (6)) or remain about the same size (models (5), (7), and (8)). The coefficients on ST debt in model (6) is significantly smaller than its counterpart in model (1), indicating that banks with high exposure to capital markets were *less* likely to access the DW in the post-Lehman period, contradicting the liquidity provision loan initiation hypothesis (H3A). The coefficient on deposits remains insignificant in the later period when estimated with the whole sample and it changes to the incorrect sign in the sample of US banks. The evidence from deposits provides further evidence against H3A.

With respect to the bailout loan initiation hypothesis (H3B), model (5) indicates that after Lehman, DW users are more likely to be weaker firms, as the coefficients on capital, ROA, and market-to-book change from significantly positive in the pre-Lehman period (model (1)) to significantly negative. The coefficient on non-performing loans remains positive but is no longer significant. Furthermore, the tests on changes indicate that all coefficients are significantly different from their counterparts in model (1). The positive and significant coefficient on the insolvency index (model (6)) lends further supports to the bailout hypothesis.

However, the results for US banks in models (7) and (8) do not paint as clear a picture of weakness. Only the negative coefficient on ROA and the positive sign on non-performing loans are significant with the signs consistent with H3B. Market-to-book is insignificant, but its decline from the pre-Lehman period does suggest a greater likelihood of weaker firms borrowing as the crisis evolves. The coefficient on equity capital for US banks contradicts the bailout hypothesis, as it is significantly positive and as large as in the pre-Lehman period. We also consider whether borrowing is affected by the penalty rate in Table 5 by including a variable that measures the difference between the interest rates on DW and repo loans. While this is not an apples-to-apples comparison once the Fed accepts a wider range of collateral in late 2008, the signs and sometimes the significance of the penalty variable suggest the higher cost of Fed loans played a role in banks' borrowing decisions. After Lehman, foreign banks step up their borrowing while acquirers borrow less. Consistent with the size of the banks reported in Table 2, Table 5 shows that smaller banks are significantly *more* likely to access the DW in the post-

Lehman period, even though they are not the expected victims of stress in short-term debt markets. Finally, the evidence on DW usage by TARP banks is mixed, indicating that institutions forced to access TARP were significantly more likely to borrow from the DW.¹⁷ Overall, based on the multivariate analysis of DW loan initiations, the Fed may have followed the Bagehot rule when markets first showed signs of weakness, however, the estimates from the post-Lehman period suggest that DW loans often propped up weak foreign banks.¹⁸

Table 6 shows the same specifications of the hazard function for TAF borrowing, except for the pre-Lehman time period since TAF starts in late 2007. The sample used in these analyses includes only auction dates. Consistent with the DW results, during the pre-Lehman period reliance on ST debt (and deposits for US banks) is a significant factor behind the decision to borrow from the Fed. For the post-Lehman period, the coefficients on ST debt are similar in models (5) and (6) when compared to their pre-Lehman counterparts. However, for US banks, the coefficients on ST debt increase significantly, providing support for H3A. The coefficients on deposits in the post-Lehman period are generally insignificant and show less support for H3A.

Table 6 shows much more evidence in favor of the bailout framework during the early crisis period than the DW estimates, as equity, ROA, market to book and the insolvency index all suggest weaker banks were more likely to borrow (although equity is only significant in model (1) and M/B only in model (3)). The insolvency index enters with a significant positive coefficient in both models (1) and (3). These solvency measures, however, are generally less significant in the post-Lehman period and sometimes change sign (e.g., equity for the US bank sample). In that sense, the results are

¹⁷ These institutions include Bank of America, Bank of New York, Citibank, Goldman Sachs, J.P. Morgan, Merrill Lynch, Morgan Stanley, State Street, and Wells Fargo. U.S. Treasury Secretary Paulson's talking points for a meeting with CEOs of these banks contained the following language "...We don't believe it is tenable to opt out because doing so would leave you vulnerable and exposed. If a capital infusion is not appealing, you should be aware your regulator will require it in any circumstance." For details see, <http://www.businessinsider.com/uncovered-tarp-docs-reveal-how-paulson-forced-banks-to-take-the-cash-2009-5>

¹⁸ Table 1 indicates that the distribution of loan sizes is skewed. Thus, the multivariate analyses reported in Tables 5-8 use hazard models of whether borrowing occurred instead of regressions using the amount borrowed. In an untabulated robustness check we consider loan size by estimating a Tobit regression where the dependent variables in Tables 5-8 are replaced by the total amount of debt borrowed on a particular day scaled by assets. Our conclusions are not affected when we use Tobit regressions analyzing amount borrowed.

in conflict with the DW estimates, which showed that weaker banks were more likely to use the window after Lehman. The contrasting results may owe to the fact that DW loans are made at a penalty rate whereas the TAF minimum is set by auction. Although weak banks have an incentive to bid more aggressively in TAF auctions than strong ones, it is still the case that the cost of replacing frozen debt market funds is cheaper using the TAF instead of DW loans. Foreign banks are more likely to borrow from the TAF in both periods, as are larger banks (which likely have more expertise with bidding in auctions).

Overall, the evidence on TAF usage shows some evidence favoring the liquidity provision hypothesis for US banks, but not for foreign banks. The results also show that weak banks were more likely to access TAF in both pre- and post-Lehman periods. However, the results do not support the bailout loan initiation hypothesis in that weak banks were no more likely to access TAF during the period of market turmoil.

We further investigate whether TAF loans helped thaw frozen capital markets by analyzing the level of participation in the auctions. Figure 4 indicates that TAF auctions were not always fully subscribed during the sample period – the gray background indicates that the amount borrowed by bidders is less than the amount available. In untabulated results, we regress the subscription ratio (calculated as the total of dollar bids submitted divided by the size of the auction) less one on measures of market conditions as well as features of the loans being auctioned. The dependent variable is larger (smaller) than zero whenever there is oversubscription (undersubscription) and banks desire more (fewer) funds than is available via TAF loans. Under H3A, we expect TAF auctions post-Lehman to be significantly oversubscribed (i.e., the coefficient on the time period indicator to be significantly positive), but we find that of the 44 TAF auctions in our sample period only those in the pre-Lehman period are significantly oversubscribed. The post-Lehman and pre-TARP period (8/15-10/28/2008) is characterized by insignificant oversubscription; during the post-TARP period they are significantly undersubscribed. Loan-specific maturity characteristics and market return on the day before the auction are both insignificant predictors of the level of TAF participation.

While the results on oversubscription contradict H3A, it is possible that the size of TAF auctions was increased by the Fed in response to market disruptions so that they provided sufficient liquidity. The total TAF amount was raised from \$600 billion in

December 2008 to \$900 billion for a short time. We note, however, that the auction size is always below 20% of total short-term debt, which, as Figure 2 shows, is around \$5 trillion in aggregate. Moreover, much of the borrowing in the TAF was done by smaller banks that are not in our sample (Figure 4), indicating that TAF provided well under 10% of the short-term funding required by our sample firms even in Fall 2008. We conclude that while TAF attracted more participation as short-term debt markets seized up, it did not succeed in attracting a higher fraction of healthier banks than DW, despite the fact that its loans did not carry a penalty. We conjecture that since the auctions are infrequent and do not guarantee timely loans in a pinch, healthy banks are forced to obtain alternative funds in the event that more aggressive bids shut them out of the TAF auction.

We next consider borrowing from the PDCF with a multiple event hazard function. H3A predicts that the ST debt variable will be more important in these models and H2A predicts that the impact will be greatest after Lehman fails since primary dealers tend to rely heavily on ST debt to fund their balance sheets (Table 2, Panel A). Counter to the liquidity framework, Table 7 reveals that PDCF usage is *negatively* related to a dealer's ST debt during the pre-Lehman period. While the ST debt coefficients increase significantly for the post-Lehman period, the coefficients themselves are insignificant. Prior to Lehman, deposits do not affect the likelihood of borrowing from PDCF, while after Lehman, deposits have a significant negative effect. The decline in the coefficient is significant in model 4. These results might reflect a switch from ST debt to deposits by some primary dealers, especially as the largest primary dealers converted to bank holding companies, which likely helped them attract more deposits. Overall, PDCF use provides very little evidence in support of H3A.

Turning to the measures of solvency, the PDCF is more likely to be used when a dealer is closer to default in both periods, but the insolvency measures are stronger in the pre-Lehman period. During the post-Lehman period, the usage of PDCF is still related to solvency characteristics, however, the relationships are either statistically indistinguishable from pre-Lehman period (equity capital and ROA) or the absolute levels of the coefficients decline (market-to-book and insolvency index). Overall, the results show that institutions closer to default continued to be more likely to use PDCF loans, although, the likelihood of accessing PDCF by weak firms does not increase

during times of market turmoil. Unlike the DW and TAF facilities, the PDCF is less likely to be used by foreign firms. The coefficient on the indicator for primary dealers that converted to bank holding companies is significantly positive in model 3, indicating a preference for PDCF even when other Fed facilities are available. Finally, institutions using TARP are also more likely to access PDCF.¹⁹ Overall, the findings for PDCF show little support for the liquidity provision loan initiation hypothesis. The results indicate that during the whole sample period, weak institutions were more likely to access PDCF. However, this relationship did not increase during the post-Lehman period, suggesting that the facility drew in somewhat healthier banks as the penalty rate declined.

Table 8 shows the same specifications of the hazard function for TSLF borrowing, except for the time periods (reflecting the later start of the TSLF) and that the analysis includes only auction dates. Contrary to the PDCF, TSLF borrowing is related to a dealer's funding model. Both ST debt and deposits are significant in the pre-Lehman period in at least one model and have signs that support the liquidity framework in both models. While the coefficients are larger in absolute value in the post-Lehman period than in the pre-Lehman period, the increases are not statistically significant, which contradicts H3A. Contrary to the results for the PDCF, all measures of solvency are insignificant in the pre-Lehman period. In the post-Lehman period, the coefficients on market-to-book and the insolvency index suggest that weaker banks accessed the TSLF. Both of the increases in the coefficients are statistically significant. With respect to other variables, we find that larger firms are more likely to use TSLF. Models 3 and 4 capture the possibility of arbitrage, since they include an indicator variable for the period in late 2008 when the rate on TSLF loans is below the interest rate on excess reserves, but the variable is not significant. Perhaps not surprisingly, firms that converted to a bank charter are less likely to participate in TSLF auctions. TARP users are no more likely to access TSLF than TARP non-users. Overall, these results are consistent with the bailout framework and contrary to the liquidity provision hypothesis.

The PDCF and TSLF hazard function estimates provide mixed evidence on the role of the liquidity provision framework for primary dealers. Thus, we further investigate the

¹⁹ We note that the forced TARP indicator cannot be included in the model because it is collinear with the indicator for banks with TARP balances (correlation of 0.94).

level of participation in the TSLF auctions. Similar to the TAF analysis, we calculate the subscription ratio as total dollar bids submitted divided by the size of the auction and analyze whether oversubscription (a subscription ratio larger than one) occurs more often after Lehman. In untabulated results we note that in the 85 TSLF auctions in our sample period, auctions taking place before Lehman and post-TARP (after 10/28/2008) periods are undersubscribed, and significantly so in the post-TARP period. Only the auctions taking place between September 15, 2008 and October 28, 2008 are significantly oversubscribed. The TSLF arbitrage opportunity indicator enters with a significantly positive coefficient, implying that some participation in the TSLF auctions is related to the existence of arbitrage. This evidence is consistent with the loan initiation hypothesis for TSLF and suggests that the penalty rate limits the appeal of the PDCF.

Next, we consider individual loans in the dataset to determine if the largest loans are motivated by solvency or liquidity. We first identify loans exceeding \$5 billion and consider the circumstances under which these loans were obtained. Table 9 shows the results of this analysis, including information on the largest and smallest loans for each borrower in the time periods of interest. Panel A reveals that billions of dollars of loans were made to troubled institutions *after* they announced a merger or bankruptcy. Bear Stearns borrowed \$28 billion the day after the announcement of its merger with JPMorgan Chase and rolled over the debt until the merger was completed. Lehman borrowed about \$28 billion the day it filed for bankruptcy and then again in the next two days, albeit in slightly smaller amounts. Wachovia was taken over by Wells Fargo after the FDIC's involvement in finding a buyer, essentially declaring it a failed bank. It too borrowed from the Fed after it was clear it would no longer exist as an independent firm. Finally, Merrill Lynch rolled over a series of large loans while in the process of being acquired by Bank of America. These data indicate that the Fed did not always follow Bagehot's advice to lend to sound banks.²⁰ Because of the redactions in the documents

²⁰ See Thornton (2008). Bernanke alludes to the Fed's intention of following the Bagehot rule: "In the context of the crisis of 2008, ... the financial system ... looked very different in its details, if not in its conceptual structure, from what Walter Bagehot saw in the 19th century. And so the challenge for us at the Fed was to adapt Bagehot's advice to the context of a modern financial system. So for example, instead of having retail depositors ... standing in line out the doors ... in the 1907 panic, ... we had instead runs by ... repo lenders or commercial-paper lenders, and we had to find ways to essentially provide liquidity to stop those runs." ("Central Banking after the Great Recession: Lessons Learned and Challenges Ahead; A

produced by the Fed, we are unable to determine whether the loans to weak (and sometimes insolvent) banks were classified as “primary credit” or “secondary credit” loans.²¹

Panel B of Table 9 shows unusually large loans to foreign institutions. Dexia, which had the largest DW loan (\$37 billion) and Depfa, which borrowed \$28.5 billion in November 2008, accounted for *all* of the 70 largest DW loans in the sample. Panel B shows that, besides the loan at the time of the Lehman bankruptcy, Barclays borrowed billions earlier in the year. While these loans and the loans to Bank of Scotland and Royal Bank of Scotland could have been in response to capital markets disruptions, the Bank of Scotland loan could as likely have been related to the takeover of its parent company by Lloyds on September 18, 2008 and its subsequent bailout. The other large loans to Dexia, Depfa and Fortis occur around the time when each of the institutions received bailouts from European governments. Hence, in these instances of borrowing by foreign banks, Bagehot’s advice to lend to sound institutions was not followed.

We also review borrowing patterns by two banks that might have taken out loans of \$5 billion or more and did not: Goldman Sachs and JPMorgan Chase, two institutions generally considered to have remained strong during the crisis. We find that borrowing by these two firms was relatively limited even in the worst part of the crisis. For example, Goldman Sachs only borrowed from the Fed in two periods, one of which includes the date it became a bank holding company (September 21, 2008). The first loan was for \$100 million immediately after Bear Stearns failed and the other time was a series of loans that were rolled over continuously from September 15 through November 27, 2008. While the latter set of loans seems to support the idea of a liquidity shock in late 2008, the quantities involved do not. Goldman had over a trillion dollars of liabilities at the end of Q3 2008, including more than \$250 billion of ST debt. Yet, most of the time after Lehman’s bankruptcy, the bank only rolled over a billion dollars or less. The largest loan was for \$8 billion, but even that was repaid by November 28, the last day of its fiscal

Discussion with Federal Reserve Chairman Ben Bernanke on the Fed’s 100th Anniversary.” The Brookings Institution, Washington, D.C., January 16, 2014.

²¹ The Fed describes secondary credit loans as those made through the discount window when the bank is not eligible for primary credit (i.e., when the bank is not sound). It further notes that the purpose of such loans is on a very short term basis to facilitate an orderly resolution of serious financial difficulties. See <http://www.frbdiscountwindow.org/programs.cfm?hdrID=14>.

fourth quarter. Likewise, JPMorgan Chase's borrowing is very small at a time when most firms were thought to be struggling with frozen debt markets. While this bank borrowed far more often than Goldman, the vast majority of its loans were in the first half of 2008 and coinciding with its takeover of Bear Stearns. It had seven loans from the DW and PDCF in the second half of 2008, including four before Lehman's bankruptcy, but the median amount borrowed was only \$250 million. Its largest loan, for \$3 billion on September 15, 2008, was a tiny fraction of its \$2.25 trillion in assets and only 0.7% of its short-term debt. And, like Goldman Sachs, JPMorgan Chase repaid the debt prior to the end of its third quarter (September 30, 2008). The bank only borrowed twice from the DW and PDCF in the last three months of 2008, each time for \$10 million. JPMorgan Chase borrowed more often from the TSLF, reaching a peak of \$13 billion in April 2008. Its TSLF borrowing dropped sharply from the first nine months of 2008 and ended completely by early 2009.

Overall, our analysis shows that reliance on short-term debt funding was an important factor in whether a bank or dealer borrowed from the Fed. This suggests that the programs were important substitutes for frozen capital markets. However, several results also indicate that the programs were disproportionately helpful to banks closer to insolvency: frequent instances of posting equity and corporate bond collateral, rather than the Treasury and MBS bonds typically seen in the repo market; measures of bank health are often significant in the multivariate analysis, suggesting that insolvency was an important reason for Fed borrowing; and a number of unusual loans, particularly to already failed foreign banks, is inconsistent with widespread dislocations in short-term debt markets. Overall, we conclude that our evidence favors the bailout loan initiation hypothesis as much if not more than the liquidity provision hypothesis.

D. Tests of the loan prepayment hypotheses (H4)

Disruptions in debt markets around the time of the Lehman bankruptcy were extreme, so we expect that borrowing from Fed programs would have continued at a high level for some time. While Figure 1 suggests this is the case, Figures 3 and 5 show a sharp drop-off in DW and PDCF borrowing before the end of the last quarter of 2008. By late December only three primary dealers had PDCF debt outstanding: Morgan Stanley,

Merrill Lynch, and Citigroup.²² We note that the identity of the borrowers from these programs was not made public until after the Fed lost the Bloomberg FOIA lawsuit and that the publicly traded firms did not list these loans in detail in their SEC filings. We therefore examine the propensity to repay DW and PDCF debt in hazard function estimations in Tables 10 and 11.

Table 10 shows the results for the probability of repaying a DW loan using a multiple event hazard function estimation. Hypotheses H1A, H2A and H3A imply that firms with more ST debt would struggle to repay the Fed debt, especially after Lehman, and would continue to roll over the loans until the crisis pressure subsided. In contrast, if the bailout framework describes borrowing more accurately, firms with a greater fraction of bad loans and a lower capital base would continue to use the programs as the market penalizes them for being closer to insolvency (making the Fed's penalty rate less onerous for them). Table 10 shows that all of the variables are insignificant. Interestingly, during the post-Lehman period, institutions were significantly more likely to prepay DW loans as the quarter end approached, lending support to the bailout loan repayment hypothesis. This result may also suggest that frozen debt markets thawed before December 31, 2008 as banks sought to repay DW loans before the quarter end. The desire to prepay DW loans may further reflect the increased availability of deposits for banks.

Table 11 reports the same estimations for primary dealers borrowing from PDCF. Among these firms, the end of quarter variable is significantly positive in the pre-Lehman but not in the post-Lehman period. The insolvency index coefficient is significantly negative in the pre-Lehman period, indicating that more insolvent firms are less likely to prepay loans.

In untabulated results, we find that only a few firms borrowed amounts exceeding 30% of their equity from the Fed.²³ In total, only 14 banks and 5 dealers ever borrowed

²² Since Bank of America announced the takeover of Merrill Lynch in September, its PDCF debt could easily have been associated with the merger, as has often been the case with DW and PDCF borrowing in the crisis. If so, the decline in LOLR lending through the PDCF was even sharper.

²³ Our reference to the cutoff of 30% of equity reflects SEC guidance on reporting short-term debt (U.S. SEC Industry Guide at <https://www.sec.gov/about/forms/industryguides.pdf>). Specifically, p. 12 states:

“VII. *Short-Term Borrowings*

For each reported period, present the following information for each category of short-term borrowings reported in the financial statements pursuant to §210.0-04.11:

(1) The amounts outstanding at the end of the reported period, the weighted average interest rate thereon, and the general terms thereof;

such a high fraction from the Fed, and all but a handful of these firms had either already failed or were about to be merged into a stronger bank.

Overall, the prepayment patterns show that firms avoided reporting Fed loans at the end of a quarter as part of a strategy to avoid the effects of revealing poor financial health. For primary dealers, solvency concerns during pre-Lehman period played a significant role in loan prepayments. These results are consistent with the bailout loan prepayment hypothesis.

3. Conclusion

The Federal Reserve introduced a number of emergency loan programs in the most recent financial crisis in its role as lender of last resort in order to improve market liquidity. In this paper we analyze the loan micro data to assess whether the programs were effective in thawing the frozen capital markets or whether the programs amounted to backdoor bailouts of weak institutions.

We find that the amount lent through the programs increased dramatically during the crisis, but the total amount outstanding was always small relative to the amount of short-term debt it was meant to replace. We document that throughout the crisis, private debt markets supplied over 90% of the short-term debt used by the institutions in our sample. Furthermore, while the usage of the programs became more widespread after the Lehman bankruptcy, the results reveal a high concentration of borrowers even in the post-Lehman period. We also find that only a small fraction of banks and a handful of primary dealers ever borrowed as much as 30% of their equity at one time. Given their very high leverage, this means that the majority of their assets were funded by private capital markets and deposits.

We attribute the low level of borrowing from Fed facilities at least in part to the high cost of borrowing. Previous research and our analysis indicate that most large commercial banks and many of the primary dealers had ample access to deposits during

(2) The maximum amount of borrowings in each category outstanding at any month-end during each reported period;

(3) The approximate average amounts outstanding during each reported period and the approximate weighted average interest rate thereon.

Instruction. This information is not required to be given for any category of short-term borrowings for which the average balance outstanding during the period was less than 30 percent of stockholders' equity at the end of the period."

the crisis. Since these funds were less expensive than secured debt with a penalty rate, commercial banks would naturally rely on them more in a crisis. And as long as banks had access to secured funding in the crisis from private markets, they had little incentive to borrow from the DW or PDCF at the Fed's high rates. We note that Fed borrowing was not often backed with typical repo market collateral after Lehman, and instead involved a large fraction of corporate bonds and equity.

Furthermore, while the Fed program borrowing is at a penalty rate, this penalty rate does not take into account firm-specific (solvency) characteristics. Even the auction programs, which do not set rates and have no penalty, encourage weaker banks to bid more aggressively for funds, again making the relative cost of the Fed loans lower for banks that were closer to insolvency. Furthermore, we find that weaker banks were more likely to borrow from the Fed after Lehman declares bankruptcy while stronger firms like Goldman and JPMorgan Chase avoided the loans. Our analysis of factors affecting DW and PDCF loan prepayments also suggests that weaker banks took advantage of the programs and repaid the loans in order to keep them out of the SEC filings.

In addition to the fact that the programs replaced only a small portion of the firms' short-term debt, much of that low fraction owed to loans that were unrelated to market conditions. Some of the largest individual loans were made to foreign firms that had already failed, such as Dexia and Depfa. The timing of several large loans coincides with a merger, such as JPMorgan's acquisition of Bear Stearns, and not the result of market freezes.

Overall, we conclude that the programs added liquidity to debt markets at a time when they were stressed. However, the added liquidity was quite limited and it often went to institutions in danger of a bailout or firms that already received one.

Appendix

A. 1. Fed Lending Pre- and Post-2007

Prior to the start of the crisis, the Fed's emergency lending facilities consisted solely of overnight lending to commercial banks via the discount window. The penalty at that point was set at 100 basis points (bp) above the FF rate. Starting with the "quant shock" in August 2007 (Khandani and Lo (2007)), the Fed modified the DW to expand its LOLR role and subsequently introduced several new programs. It also reduced the penalty to 50 bp. Appendix Table A1 summarizes the main borrowing facilities analyzed in this paper available to large financial institutions during the crisis and Figure A1 shows a timeline that relates them to events in the markets. An important change to its approach occurred in March 2008 after the Bear Stearns bailout, when the Fed opened the discount window to large investment banks (the primary dealers) via the PDCF and reduced the penalty further to only 25 bp above the target FF rate. The rules for PDCF loans were identical to those for commercial banks using the discount window – the loans were short-term (ST), mostly overnight (although by that point up to a maturity of 90 days), secured, and offered immediately to any firm that requested the money, no questions asked as to why the cash was necessary.²⁴ Both facilities made a distinction between primary and secondary credit, with the former meant for sound institutions. In our data we see no such distinction and thus we refer to the two types of loans as if they were the same.

In contrast to the DW and PDCF, the TAF and TSLF were longer maturity programs that lent money at regularly scheduled intervals to the winners of an auction. The TAF began in December 2007 as a means of supplying additional liquidity to commercial banks.²⁵ The TAF was a biweekly auction of 28-day loans, where no bidder could obtain more than ten percent of the auction total and the rate charged was determined by the bidding. Initially, the program lent up to \$20 billion but it was expanded to \$900 billion later when the crisis worsened. Unlike the DW and PDCF loans,

²⁴ Madigan and Nelson (2002) discuss changes to the DW that were designed to reduce the stigma, including the elimination of the requirement that the borrower show evidence that other sources of funding were unavailable and therefore that the Fed was truly its last resort.

²⁵ Goldman and Morgan Stanley converted to bank holding companies on September 22, 2008, making them eligible for both the DW and TAF on that date. Lehman was able to borrow from the DW through its bank subsidiary but not the TAF.

a TAF loan could not be paid back prior to maturity. Likewise, the TSLF was also a biweekly auction of secured loans with 28-day maturities, but the TSLF auctions offered up to \$245 billion of loans to primary dealers.

Of the four programs, only the DW facility lasted beyond 2010. These emergency facilities were considered temporary, for use in a crisis, and thus were considered unnecessary by early 2010. For similar reasons, the penalty on DW loans was reset to 100 bp in 2010.

The Fed also introduced four other programs. However, these programs would not be considered methods for a LOLR to provide funding to financial institutions in a crisis and thus we do not match up their use to data on a specific commercial bank or primary dealer. The CPFF was instituted in October 27 2008 to purchase commercial paper (CP) directly from issuers. The AMLF, which began on September 19, 2008, purchased asset-backed CP from money market mutual funds (see Duygan-Bump, Parkinson, Rosengren, Suarez and Willen (2013)). A complementary program, the MMIF, was also intended as a way to buy CP. The TALF was a debt guarantee program. We ignore these programs because they were either not restricted to financial institutions (CPFF and TALF) or were restricted to a set of financial institutions that did not borrow from potentially frozen credit markets (AMLF and MMIF).

A. 2. Loan data

In response to an FOIA lawsuit by Bloomberg News, the Fed produced data on its lending activities during the crisis. With respect to DW, two types of electronic documents were produced for each day during the crisis: The first document shows loan initiations on that day; the second shows all loans outstanding.²⁶ We collect information on the date the loan starts, how long it remains outstanding, its maturity date, the borrower's name, the type of institution, and its Federal Reserve district from the second set of documents and cross-check these data with the documents on loan initiations. The Fed classified institutions into seven categories, with the majority of institutions fitting into the categories of Large Money Center Bank (LMCB), Other Large Commercial Bank (OLCB), Small Commercial Bank, Thrift or Credit Union, and Foreign.

²⁶ The Fed produced more than 29,000 pages of documents related to the Bloomberg's FOIA lawsuit (all documents pertaining to DW borrowing were released as Acrobat files). The original electronic files produced by the Fed were obtained at: cdn.gotraffic.net/downloads/30110331_fed_release_documents.zip.

We obtain information on TAF, PDCF, and TSLF borrowing from the Fed's website.²⁷ Files for each facility include the date the loan is initiated, its maturity date, the institution's name, the amount of the loan, its interest rate, and various items about pledged collateral.

While all four of the programs were intended to provide liquidity to financial institutions in an emergency, the features of the liquidity facilities differed in a number of ways. Thus, we investigate the separate use of the facilities as well as the aggregate use. The DW and the TAF are aimed at commercial banks. However, the TAF has limited funding, in terms of both the frequency of the auctions and the size of the program, while the DW offers the borrower immediate access to funds at any point in time. The PDCF and the DW are identical in the terms of their loans, but the PDCF is for primary dealers only and it does not start until after the announcement of the Bear Stearns acquisition. However, by the fourth quarter of 2008 most of the large primary dealers are bank holding companies and eligible for DW loans. Lastly, the TSLF lowered its requirements on collateral after Lehman's bankruptcy, likely affecting the choice of which program to borrow from in late 2008.

²⁷ http://www.federalreserve.gov/newsevents/reform_transaction.htm

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Table 1 - Descriptive Statistics of Loans from the Federal Reserve During 8/2007 - 6/2009

This table reports distribution of loan characteristics. Included are all loans by institutions with data in Compustat (bank or industrial). DW stands for Primary and Secondary credit (Discount Window).

Panel A: All (N = 3,614); Loan-Specific	Ave	Min	Med	Max
Loan Amount (million)	\$4,472	\$0.001	\$1,900	\$47,942
Interest Rate	1.46%	0.10%	1.25%	5.75%
Maturity (days)	20	1	4	91
Panel B: DW (N = 1,147); Loan-Specific	Ave	Min	Med	Max
Loan Amount (million)	\$6,569	\$0.001	\$272	\$35,000
Interest Rate	1.78%	0.50%	1.75%	5.75%
Maturity (days)	6	1	1	91
Panel C: TAF (N = 1,128); Loan-Specific	Ave	Min	Med	Max
Loan Amount (million)	\$2,041	\$5.000	\$1,000	\$15,000
Interest Rate	1.56%	0.20%	1.39%	4.67%
Maturity (days)	45	28	28	84
Panel D: PDCF (N = 844); Loan-Specific	Ave	Min	Med	Max
Loan Amount (million)	\$5,316	\$10.000	\$3,521	\$47,942
Interest Rate	1.47%	0.50%	1.25%	3.25%
Maturity (days)	2	28	28	28
Panel E: TSLF (N = 495); Loan-Specific	Ave	Min	Med	Max
Loan Amount (million)	\$3,714	\$10.000	\$4,000	\$15,000
Interest Rate	0.44%	0.10%	0.25%	3.22%
Maturity (days)	28	8	29	32
Panel F: Total Loan Amount Initiated on the Same Day; Bank-Initiation Day-Specific (million)				
All Loans (N = 3,379)	\$4,783	\$0.001	\$1,825	\$49,118
DW (N = 1,141)	\$6,603	\$0.001	\$275	\$35,000
TAF (N = 1,119)	\$2,057	\$5.000	\$1,000	\$15,000
PDCF (N = 844)	\$5,316	\$10.000	\$3,521	\$47,942
TSLF (N = 485)	\$3,791	\$10.000	\$3,900	\$15,000
Panel G: Total Loan Amount on Calendar Day; Bank-Calendar Day-Specific				
All Loans (N = 19,417)	\$6,941	\$0.001	\$2,500	\$97,292
DW (N = 2,414)	\$5,023	\$0.001	\$1,950	\$37,000
TAF (N = 16,748)	\$4,679	\$5.000	\$2,000	\$60,000
PDCF (N = 844)	\$9,862	\$10.000	\$7,400	\$61,292
TSLF (N = 3360)	\$10,697	\$200.000	\$8,977	\$38,510

Table 2 - Univariate Analysis

In Panel A, number of observations (N) reflects number of institutions in the sample on 12/31/2007. *Users/Non-Users* are institutions with available data on Bank Compustat and CRSP that have total assets larger than \$1 billion as of 4Q 2006 and accessed/did not access Fed facilities during the crisis. Insolvency Index is a sum of the following indicator variables: Equity/TA is below median, ROA is negative, Non-Perf. Loans/TA are above median, and MB is below median of the in-sample distribution. For primary dealers, Non-Perf. Loans are not used in the calculation of the Insolvency Index. TARP related variables are reported based on a sample of U.S. institutions only. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively, of test of means and medians against the *Users* group. Panels B-F shows characteristics of unique users and the average of the loans obtained from each of the facility in a particular calendar quarter.

Panel A: Q4 2007	Commercial Banks:			
		Users (N = 213)	Non-Users (N = 169)	Primary Dealers (N = 17)
Total Assets (billion)	<i>Ave</i>	\$226.3	\$26.5 ***	\$1,692.2
	<i>Med</i>	\$7.8	\$2.9 ***	\$1,562.1
S-T Debt / TA	<i>Ave</i>	8.39%	5.02% ***	23.75%
	<i>Med</i>	7.06%	3.11% ***	21.68%
Deposits / TA	<i>Ave</i>	66.21%	68.65% *	41.54%
	<i>Med</i>	68.62%	71.47% **	47.17%
Equity / TA	<i>Ave</i>	8.32%	9.52% ***	4.03%
	<i>Med</i>	8.52%	8.78% **	3.17%
ROA	<i>Ave</i>	0.10%	0.07%	-0.06%
	<i>Med</i>	0.16%	0.17%	0.06%
Non-Perf. Loans / Loans	<i>Ave</i>	1.24%	1.70% **	
	<i>Med</i>	0.88%	0.88%	
MB	<i>Ave</i>	1.04	1.02 **	0.99
	<i>Med</i>	1.03	1.01 **	1.00
Insolvency Index	<i>Ave</i>	1.63	1.67	1.27
	<i>Med</i>	2.00	2.00	1.00
Foreign Indicator	<i>Ave</i>	0.21	0.16	0.47
Used TARP Indicator	<i>Ave</i>	0.42	0.31 **	0.12
Repaid TARP before 6/2009 Used TARP	<i>Ave</i>	0.40	0.30	1.00

Table 2, continued

		Pre-Bear		Post-Bear & Pre-Lehman		Post-Lehman			
		2007Q3	2007Q4	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2
Panel B: Discount Window	<i>N</i>	26	34	41	38	64	54	28	12
Total Assets (million, q-1)	<i>Ave</i>	\$713,093	\$233,942	\$505,473	\$248,238	\$373,797	\$145,416	\$350,768	\$215,190
	<i>Med</i>	\$181,583	\$34,986	\$59,849	\$61,069	\$33,673	\$6,905	\$16,320	\$89,845
Loan Amount (million)	<i>Ave</i>	\$269	\$134	\$410	\$552	\$390	\$1,311	\$1,870	\$2,561
	<i>Med</i>	\$84	\$3	\$36	\$105	\$57	\$19	\$26	\$8
Panel C: TAF	<i>N</i>		18	52	39	46	50	57	35
Total Assets (million, q-1)	<i>Ave</i>		\$548,494	\$585,558	\$496,848	\$735,777	\$457,343	\$689,995	\$438,455
	<i>Med</i>		\$273,763	\$224,330	\$111,396	\$300,671	\$144,627	\$253,525	\$150,737
Loan Amount (million)	<i>Ave</i>		\$544	\$1,252	\$1,347	\$1,525	\$1,986	\$2,215	\$2,133
	<i>Med</i>		\$199	\$783	\$500	\$984	\$1,000	\$1,126	\$1,075
Panel D: PDCF	<i>N</i>			6	5	9	9	4	2
Total Assets (million, q-1)	<i>Ave</i>			\$1,879,932	\$1,132,956	\$1,871,473	\$1,434,092	\$1,536,673	\$2,072,271
	<i>Med</i>			\$2,311,542	\$1,090,896	\$1,775,670	\$1,446,309	\$1,774,704	\$2,072,271
Loan Amount (million)	<i>Ave</i>			\$1,475	\$4,241	\$4,416	\$6,934	\$3,208	\$2,648
	<i>Med</i>			\$1,286	\$1,704	\$4,393	\$5,911	\$2,973	\$2,648
Panel E: TSLF	<i>N</i>			11	11	14	10	11	2
Total Assets (million, q-1)	<i>Ave</i>			\$1,959,424	\$1,562,790	\$1,978,952	\$1,560,768	\$2,116,232	\$1,373,934
	<i>Med</i>			\$2,017,263	\$1,217,613	\$1,908,265	\$1,514,146	\$1,938,470	\$1,373,934
Loan Amount (million)	<i>Ave</i>			\$4,881	\$3,760	\$3,342	\$4,032	\$2,802	\$3,700
	<i>Med</i>			\$3,000	\$3,500	\$3,820	\$4,212	\$2,633	\$3,700
Panel F: All	<i>N</i>			79	66	91	86	76	43
Total Assets (million, q-1)	<i>Ave</i>			\$505,906	\$436,916	\$496,436	\$325,750	\$567,135	\$397,977
	<i>Med</i>			\$142,543	\$106,444	\$126,649	\$33,572	\$205,656	\$142,144
Loan Amount (million)	<i>Ave</i>			\$1,128	\$1,398	\$1,158	\$2,035	\$2,243	\$1,950
	<i>Med</i>			\$354	\$410	\$420	\$299	\$902	\$1,000

Table 3 - Statistical Tests of Changes in Loan Concentration

This table reports the average and median concentration of loans in DW, TAF, PDCF, and TSLF for periods preceding and following the Lehman bankruptcy. The concentration is measured as the Herfindahl index (HHI) of loans taken out on the same day (Panel A) and as the HHI of loans taken out on the same day scaled by the HHI of total assets of total assets of firms in the sample eligible to borrow from a particular program. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively, of test of means and medians.

		Pre-Lehman	Post-Lehman (9/16/08 - 12/31/08)
Panel A: HHI Loans			
Discount Window	<i>Ave</i>	0.776	0.497 ***
	<i>Med</i>	0.867	0.491 ***
TAF	<i>Ave</i>	0.058	0.027 ***
	<i>Med</i>	0.053	0.032 ***
PDCF	<i>Ave</i>	0.635	0.292 ***
	<i>Med</i>	0.608	0.290 ***
TSLF	<i>Ave</i>	0.094	0.152 ***
	<i>Med</i>	0.082	0.148 ***
Panel B: HHI Loans Normalized by Size HHI			
Discount Window	<i>Ave</i>	25.155	16.117 ***
	<i>Med</i>	28.411	15.985 ***
TAF	<i>Ave</i>	2.724	1.310 ***
	<i>Med</i>	2.511	1.639 ***
PDCF	<i>Ave</i>	8.505	4.193 ***
	<i>Med</i>	7.956	4.197 ***
TSLF	<i>Ave</i>	1.656	2.604 ***
	<i>Med</i>	1.586	2.626 ***

Table 5 - Hazard Model: Discount Window Loan Initiation

This table reports hazard model estimates modeling the probability of an institution accessing the discount window between 8/21/2007 and 6/30/2009. Accessing the discount window means that firm takes out a loan on a particular day. The model allows for time-varying covariates and for multiple events per institutions (Andersen and Gill (1982)). If a loan has longer maturity than one business day, only the loan initiation date is included in the analysis (i.e. 30-day loan taken out on 1/1/2008 is used in the hazard model only on 1/1/2008 and the observations for the institution for the period 1/2/2008 through 1/31/2008 are deleted). Time is relative to the beginning of availability of the discount window data, except for the Post-Lehman period for which the beginning is 9/15/2008. The sample includes institutions accessing as well as not accessing (users and non-users) the Fed facilities during the crisis. All variables are allowed to change daily. All regressions include Federal Reserve district indicators and indicators denoting the frequency of accounting data. (q) and (d) denotes the quarterly and daily measurement frequency relative to the loan initiation. Insolvency Index is a sum of the following indicator variables: Equity/TA is below median, ROA is negative, Non-Perf. Loans/TA are above median, and MB is below median of the in-sample distribution. Penalty rate over DW rate is calculated daily as the difference between the target Federal Funds rate and the primary credit discount window rate. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively. p-values in parentheses. Numbers in brackets report the p-values of the test of equality of the coefficients in the two sub-periods.

	8/21/2007-9/15/2008 (Pre-Lehman)				9/16/2008-6/30/2009 (Post-Lehman)			
	1	2	3	4	5	6	7	8
	All	US Only			All	US Only		
S-T Debt / TA (q-1)	6.95*** (0.00)	6.35*** (0.00)	7.79*** (0.00)	6.47*** (0.00)	5.64*** (0.00) [0.22]	5.40*** (0.00) [0.00]	10.47*** (0.00) [0.10]	8.22*** (0.00) [0.12]
Deposits / TA (q-1)	-0.60 (0.27)	-0.59 (0.26)	-1.62*** (0.00)	-1.67*** (0.00)	-0.37 (0.43) [0.43]	-0.12 (0.78) [0.00]	2.36** (0.01) [0.00]	2.18** (0.01) [0.00]
Equity / TA (q-1)	8.28*** (0.00)		11.06*** (0.00)		-17.55*** (0.00) [0.00]		11.58*** (0.00) [0.86]	
ROA (q-1)	43.46*** (0.00)		60.91*** (0.00)		-35.48*** (0.00) [0.00]		-29.82*** (0.00) [0.00]	
Non-Perf. Loans / TA (q-1)	13.15*** (0.00)		14.81*** (0.00)		2.12 (0.22) [0.00]		6.31*** (0.00) [0.01]	
MB (d-1)	3.11*** (0.00)		1.93** (0.03)		-2.53** (0.01) [0.01]		-2.20 (0.11) [0.02]	
Insolvency Index (d)		-0.09** (0.04)		-0.07 (0.16)		0.21*** (0.00) [0.00]		0.08 (0.15) [0.01]
Penalty Rate Over DW Rate (d)	3.57 (0.66)	5.27 (0.58)	-0.66 (0.95)	1.69 (0.90)	-2.17* (0.09)	-2.16 (0.11)	-2.54 (0.21)	-3.06* (0.10)
Made Acquisition in Prior 30 Days	0.89*** (0.01)	0.85*** (0.01)	0.89*** (0.01)	0.82** (0.01)	-10.81 (0.96)	-11.45 (0.97)	-12.46 (0.98)	-12.02 (0.98)
Foreign Institution Indicator	-0.61*** (0.00)	-0.84*** (0.00)			1.52*** (0.00)	1.74*** (0.00)		
Total Assets (q-1) [trillions]	0.84*** (0.00)	0.62*** (0.00)	0.92*** (0.00)	0.69*** (0.00)	-0.90*** (0.00)	-0.54*** (0.00)	-1.18* (0.08)	-0.95 (0.16)
TARP Balance Indicator (q)					-0.08 (0.62)	-0.37** (0.01)	-0.35** (0.03)	-0.46*** (0.00)
Forced TARP Indicator					0.37 (0.50)	0.07 (0.90)	1.96** (0.02)	1.77** (0.04)
S&P 500 Return (d)	-11.03 (0.52)	-10.48 (0.52)	-0.25 (0.99)	-0.95 (0.96)	3.03 (0.35)	1.76 (0.61)	0.27 (0.97)	1.40 (0.81)
Pr(Likelihood Ratio)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations Total	79,622	79,622	71,768	71,768	53,986	53,986	48,323	48,323
Observations With Event	419	419	366	366	443	443	214	214

Table 6 - Hazard Model: TAF Loan Initiations

This table reports hazard model estimates modeling the probability of an institution accessing the TAF between 12/12/2007 and 6/30/2009. The model allows for time-varying covariates and for multiple events per institutions (Andersen and Gill (1982)). Accessing the TAF means that a firm takes out a loan on a particular auction day. Only the loan initiation date is included in the analysis (i.e. 30-day loan taken out on 1/1/2008 is used in the hazard model only on 1/1/2008 and the observations for the institution for the period 1/2/2008 through 1/31/2008 are deleted). Time is relative to the beginning of availability of the data, except for the Post-Lehman period for which the beginning is 9/15/2008. The sample includes institutions accessing as well as not accessing (users and non-users) the Fed facilities during the crisis. All variables are allowed to change daily. All regressions include Federal Reserve district indicators and indicators denoting the frequency of accounting data. (q) and (d) denotes the quarterly and daily measurement frequency relative to the loan initiation. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively. p-values in parentheses. Numbers in brackets report the p-values of the test of equality of the coefficients in the two sub-periods.

	12/12/2007-9/15/2008 (Pre-Lehman)				9/16/2008-6/30/2009 (Post-Lehman)			
	1	2	3	4	5	6	7	8
	All		US Only		All		US Only	
S-T Debt / TA (q-1)	6.18*** (0.00)	6.33*** (0.00)	5.87*** (0.00)	4.58*** (0.00)	7.44*** (0.00)	7.26*** (0.00)	11.19*** (0.00)	10.08*** (0.00)
Deposits / TA (q-1)	-0.44 (0.45)	-0.24 (0.68)	-2.42*** (0.00)	-3.63*** (0.00)	0.52 (0.35)	0.42 (0.44)	-0.54 (0.52)	-1.93*** (0.00)
Equity / TA (q-1)	-6.22** (0.02)		-1.83 (0.57)		-3.69 (0.11)		5.36* (0.08)	
ROA (q-1)	-30.83*** (0.00)		-25.58** (0.01)		-18.44*** (0.00)		-11.60** (0.04)	
Non-Perf. Loans / TA (q-1)	-14.10** (0.02)		-20.04** (0.04)		-11.75*** (0.01)		-8.51 (0.17)	
MB (d-1)	0.52 (0.15)		-10.10*** (0.00)		0.99 (0.21)		-5.36** (0.01)	
Insolvency Index (d)		0.27*** (0.00)		0.47*** (0.00)		0.02 (0.65)		0.13* (0.05)
Made Acquisition in Prior 30 Days	0.47 (0.32)	0.36 (0.45)	0.16 (0.74)	0.18 (0.72)	-0.07 (0.89)	-0.08 (0.88)	-0.41 (0.45)	-0.28 (0.61)
Foreign Institution Indicator	1.63*** (0.00)	2.07*** (0.00)			1.71*** (0.00)	1.99*** (0.00)		
Total Assets (q-1) [trillions]	0.29*** (0.00)	0.31*** (0.00)	0.44 (0.44)	0.81 (0.12)	0.47*** (0.00)	0.50*** (0.00)	0.21 (0.51)	0.25 (0.43)
TARP Balance Indicator (q)	1.29*** (0.00)	1.39*** (0.00)	1.49*** (0.00)	1.60*** (0.00)	0.62*** (0.00)	0.65*** (0.00)	0.61*** (0.00)	0.66*** (0.00)
Forced TARP Indicator	0.76** (0.01)	0.92*** (0.00)	0.29 (0.75)	-0.28 (0.71)	1.39*** (0.00)	1.49*** (0.00)	1.31** (0.02)	1.08* (0.06)
S&P 500 Return (d)	6.29 (0.75)	9.70 (0.64)	-7.99 (0.85)	3.41 (0.93)	-1.58 (0.74)	-1.77 (0.71)	3.78 (0.73)	4.11 (0.69)
Pr(Likelihood Ratio)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations Total	6,391	6,391	5,633	5,633	6,417	6,417	5,664	5,664
Observations With Event	334	334	170	170	400	400	191	191

Table 7 - Hazard Model: PDCF Loan Initiations

This table reports hazard model estimates modeling the probability of an institution accessing the PDCF between 3/17/2007 and 6/30/2009. The model allows for time-varying covariates and for multiple events per institutions (Andersen and Gill (1982)). Accessing the PDCF means that a firm takes out a loan on a particular day. If a loan has longer maturity than one business day, only the loan initiation date is included in the analysis (i.e. 30-day loan taken out on 1/1/2008 is used in the hazard model only on 1/1/2008 and the observations for the institution for the period 1/2/2008 through 1/31/2008 are deleted). Time is relative to the beginning of availability of the data, except for the Post-Lehman period for which the beginning is 9/15/2008. The sample includes only primary dealers. All regressions include indicators denoting the frequency of accounting data. (q) and (d) denotes the quarterly and daily measurement frequency relative to the loan initiation. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively. p-values in parentheses. Numbers in brackets report the p-values of the test of equality of the coefficients in the two sub-periods.

	3/17/2008-9/15/2008 (Pre-Lehman)		9/16/2008-6/30/2009 (Post-Lehman)	
	1	2	3	4
S-T Debt / TA (q-1)	-2.66* (0.10)	-1.29 (0.16)	1.25 (0.53) [0.00]	2.07 (0.21) [0.00]
Deposits / TA (q-1)	-1.39 (0.23)	0.91 (0.22)	-2.92*** (0.00) [0.23]	-1.81** (0.03) [0.02]
Equity / TA (q-1)	-65.27*** (0.00)		3.57 (0.47) [0.91]	
ROA (q-1)	-71.26 (0.16)		-122.82*** (0.00) [0.34]	
MB (d-1)	-51.68*** (0.00)		-48.93*** (0.00) [0.00]	
Insolvency Index (d)		0.93*** (0.00)		0.77*** (0.00) [0.00]
Foreign Institution Indicator	-2.97*** (0.00)	-1.12*** (0.00)	-2.51*** (0.00)	-3.24*** (0.00)
Total Assets (q-1) [trillions]	0.31 (0.21)	-0.40*** (0.00)	0.21 (0.43)	0.30 (0.21)
TARP Balance Indicator (q)			0.63* (0.09)	0.65* (0.10)
Conv. To Bank Chrt. Indicator (d)			0.35** (0.02)	0.15 (0.29)
S&P 500 Return (d)	-440.15 (0.99)	-449.99 (0.98)	44.18 (0.22)	61.78* (0.10)
Pr(Likelihood Ratio)	0.00	0.00	0.00	0.00
Observations Total	1,673	1,673	2,194	2,194
Observations With Event	152	152	540	540

Table 8 - Hazard Model: TSLF Loan Initiations

This table reports hazard model estimates modeling the probability of an institution accessing the TSLF program between 3/27/2007 and 6/30/2009. The model allows for time-varying covariates and for multiple events per institutions (Andersen and Gill (1982)). Accessing the TSLF means that a firm's loan taken out on a particular day falls in the top 90% of all loans by users. Not accessing the TSLF includes non-users, light users, and users whose loans on particular day fall in the bottom 10% of all loans by users. Only the loan initiation date is included in the analysis (i.e. 30-day loan taken out on 1/1/2008 is used in the hazard model only on 1/1/2008). Time is relative to the beginning of availability of the data, except for the Post-Lehman period for which the beginning is 9/15/2008. The sample includes only primary dealers during the crisis. All regressions include indicators denoting the frequency of accounting data. (q) and (d) denotes the quarterly and daily measurement frequency relative to the loan initiation. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively. p-values in parentheses. Numbers in brackets report the p-values of the test of equality of the coefficients in the two sub-periods.

	3/27/2008-9/15/2008 (Pre-Lehman)		9/16/2008-6/30/2009 (Post-Lehman)	
	1	2	3	4
S-T Debt / TA (q-1)	1.93 (0.14)	1.91* (0.08)	2.29 (0.20) [0.55]	2.88* (0.08) [1.00]
Deposits / TA (q-1)	-1.03 (0.12)	-1.04** (0.04)	-1.69** (0.01) [0.32]	-1.39** (0.03) [0.21]
Equity / TA (q-1)	-1.26 (0.86)		-10.47 (0.18) [0.02]	
ROA (q-1)	4.14 (0.91)		-10.97 (0.71) [0.70]	
MB (d-1)	1.05 (0.84)		-13.07* (0.06) [0.04]	
Insolvency Index (d)		0.05 (0.61)		0.20** (0.02) [0.05]
Foreign Institution Indicator	-0.36 (0.41)	-0.40 (0.13)	-0.30 (0.50)	0.02 (0.94)
Total Assets (q-1) [trillions]	0.61*** (0.00)	0.60*** (0.00)	0.55*** (0.01)	0.55*** (0.00)
Arbitrage Possible in TSLF			-0.35 (0.56)	-0.26 (0.67)
TARP Balance Indicator (q)			-0.16 (0.67)	-0.31 (0.38)
Conv. To Bank Chrt. Indicator (d)			-0.77** (0.02)	-0.76** (0.01)
S&P 500 Return (d)	24.49** (0.02)	24.61** (0.02)	-1.85 (0.58)	-1.87 (0.59)
Pr(Likelihood Ratio)	0.00	0.00	0.00	0.00
Observations Total	288	288	441	441
Observations With Event	213	213	278	278

Table 9 - Detailed Information on Selected Loans Made Through Discount Window and PDCF

For loans rolled over, the minimum and maximum amount are shown - note that those amounts do not necessarily correspond to the dates shown.

Institution	Loan Initiation	Loan Maturity/ Repayment	Amount/ Range (billion)	Facility	Notes
Panel A: Discount Window and PDCF Borrowing of Selected Merged/Failed Institutions					
Bear Stearns & Co.	3/17/2008 through	Rolled over 5/30/2008	\$28.0 \$7.2	PDCF	3/16/2008: Merger announcement (JPM-Chase) 5/29/2008: Merger approval by shareholders
Lehman Brothers Inc.	9/15/2008 9/16/2008 9/17/2008	9/16/2008 9/17/2008 9/18/2008	\$28.0 \$19.7 \$20.4	PDCF PDCF PDCF	9/15/2008: Bankruptcy
Wachovia	10/6/2008 10/6/2008 10/8/2008	11/4/2008 11/5/2008 10/22/2008	\$6.0 \$23.0 \$7.0	DW DW DW	10/3/2008: Merger announcement (Wells Fargo) 12/31/2008: Merger completed 10/22/2008: Loan partially repaid (\$3 billion)
Merrill Lynch	9/17/2008 through 12/9/2008	Rolled over 12/30/2008 12/10/2008	\$4.7 \$33.2 \$2.0	PDCF PDCF DW	9/14/2008: Merger announcement (BofA) 12/5/2008: Merger approval by shareholders
Panel B: Discount Window and/or PDCF Borrowing of at Least \$5 billion by Selected Foreign Institutions:					
Bank of Scotland	9/17/2008	10/17/2008	\$5.0	DW	9/18/2008: Merger announcement (Lloyds TSB) 10/13/2008: Bailout by UK
Barclays PLC	9/18/2008 through	Rolled over 10/7/2008	\$47.9 \$8.0	PDCF PDCF	9/16/2008: Agreement to acquire Lehman
Depfa	10/7/2008 through	Rolled over 6/30/2009	\$5.0 \$28.5	DW DW	9/29/2008: Bailout proposal announcement 10/6/2008: Holding company bailout by Germany
Dexia	4/18/2008 through	Rolled over 6/30/2009	\$6.0 \$37.0	DW DW	9/30/2008: Moody's downgrade from Aa1 to Aa3 9/30/2008: Bailout by Belgium and France 1/19/2009: Moody's downgrade from Aa3 to A1
Fortis	9/29/2008	9/30/2008	\$7.0	DW	9/28/2008: Partial nationalization by Benelux
Royal Bank of Scotland	10/6/2008	10/7/2008	\$8.4	DW	10/13/2008: Recapitalization by UK

Table 10 - Hazard Model: DW Loan Repayment

Institutions repaying/not rolling over a discount window loan are classified as experiencing an "event/hazard". Time is relative to the first time a particular loan was taken out and resets when this loan is considered repaid. Loan is considered repaid when more than 80% of the current loan is not rolled over or when the bank does not take out loan within five calendar days of the last repayment. The sample includes institutions accessing the discount window facilities during the crisis. All variables are allowed to change daily and multiple events are allowed for single institution. All regressions include Federal Reserve district indicators and indicators denoting the frequency of accounting data. (q) and (d) denotes the quarterly and daily measurement frequency relative to the loan initiation. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively.

	8/21/2007-9/15/2008 (Pre-Lehman)		9/16/2008-6/30/2009 (Post-Lehman)	
	1	2	3	4
S-T Debt / TA (q-1)	-0.22 (0.83)	-0.24 (0.82)	0.93 (0.42)	1.03 (0.34)
Deposits / TA (q-1)	0.46 (0.52)	0.45 (0.51)	-0.61 (0.51)	-0.29 (0.75)
Equity / TA (q-1)	1.27 (0.65)		-0.06 (0.98)	
ROA (q-1)	9.57 (0.58)		2.50 (0.70)	
Non-Perf. Loans / TA (q-1)	-0.54 (0.93)		1.09 (0.42)	
MB (d-1)	0.26 (0.78)		2.00 (0.13)	
Insolvency Index (d)		0.04 (0.53)		-0.09 (0.15)
End-of-Quarter Indicator (d)	-0.27 (0.48)	-0.24 (0.54)	0.71*** (0.00)	0.70*** (0.00)
Foreign Institution Indicator	-0.03 (0.91)	-0.09 (0.68)	-0.83* (0.10)	-0.64 (0.17)
Total Assets (q-1) [trillions]	0.16 (0.32)	0.15 (0.32)	-0.19 (0.61)	-0.21 (0.58)
TARP Balance Indicator (q)			0.15 (0.27)	0.10 (0.43)
Forced TARP Indicator			0.55 (0.37)	0.44 (0.48)
S&P 500 Return (d)	-0.20 (0.96)	-0.06 (0.99)	-3.35* (0.07)	-3.51* (0.06)
Pr(Likelihood Ratio)	0.97	0.95	0.02	0.01
Observations Total	1,667	1,667	2,711	2,711
Observations With Event	342	342	297	297

Table 11 - Hazard Model: PDCF Loan Repayment

Institutions repaying/not rolling over a PDCF loan are classified as experiencing an "event/hazard". Time is relative to the first time a particular loan was taken out and resets when this loan is considered repaid. Loan is considered repaid when more than 80% of the current loan is not rolled over or when the institution does not take out loan within five calendar days of the last repayment. The sample includes institutions accessing the PDCF facilities during the crisis. Corporate Instruments Collateral Indicator equals one if the collateral pledged contains unsecured securities issued by private corporations. All variables are allowed to change daily. (q) and (d) denotes the quarterly and daily measurement frequency relative to the loan initiation. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively.

	3/17/2008-9/15/2008 (Pre-Lehman)		9/16/2008-6/30/2009 (Post-Lehman)	
	1	2	3	4
S-T Debt / TA (q-1)	5.64 (0.23)	2.86 (0.46)	-34.34 (0.16)	-25.45 (0.12)
Deposits / TA (q-1)	-16.59 (0.45)	-23.76 (0.26)	-13.43 (0.45)	0.70 (0.93)
Equity / TA (q-1)	101.91 (0.18)		-486.16 (0.12)	
ROA (q-1)	140.64 (0.29)		872.84 (0.47)	
MB (d-1)	115.27** (0.03)		-185.23 (0.21)	
Insolvency Index (d)		-1.63** (0.02)		-0.48 (0.53)
End-of-Quarter Indicator (d)	3.59** (0.03)	4.08** (0.01)	8.01 (0.36)	1.54 (0.40)
Foreign Institution Indicator	12.42 (0.10)	8.15 (0.18)	-6.02 (0.49)	1.30 (0.55)
Total Assets (q-1) [trillions]	-1.93 (0.16)	-0.02 (0.98)	-6.76* (0.10)	-4.62 (0.10)
Arbitrage Possible in TSLF			18.17 (1.00)	16.38 (1.00)
TARP Balance Indicator (q)			30.13 (0.11)	1.78 (0.59)
Pr(Likelihood Ratio)	0.04	0.02	0.03	0.19
Observations Total	152	152	383	383
Observations With Event	16	16	10	10

Figure 1: Total Primary and Secondary Credit, PDCF, TAF, and TSLF Borrowing for Financial Institutions: 8/20/2007 - 6/30/2009

Source: Federal Reserve (FOIA 3/31/2011)

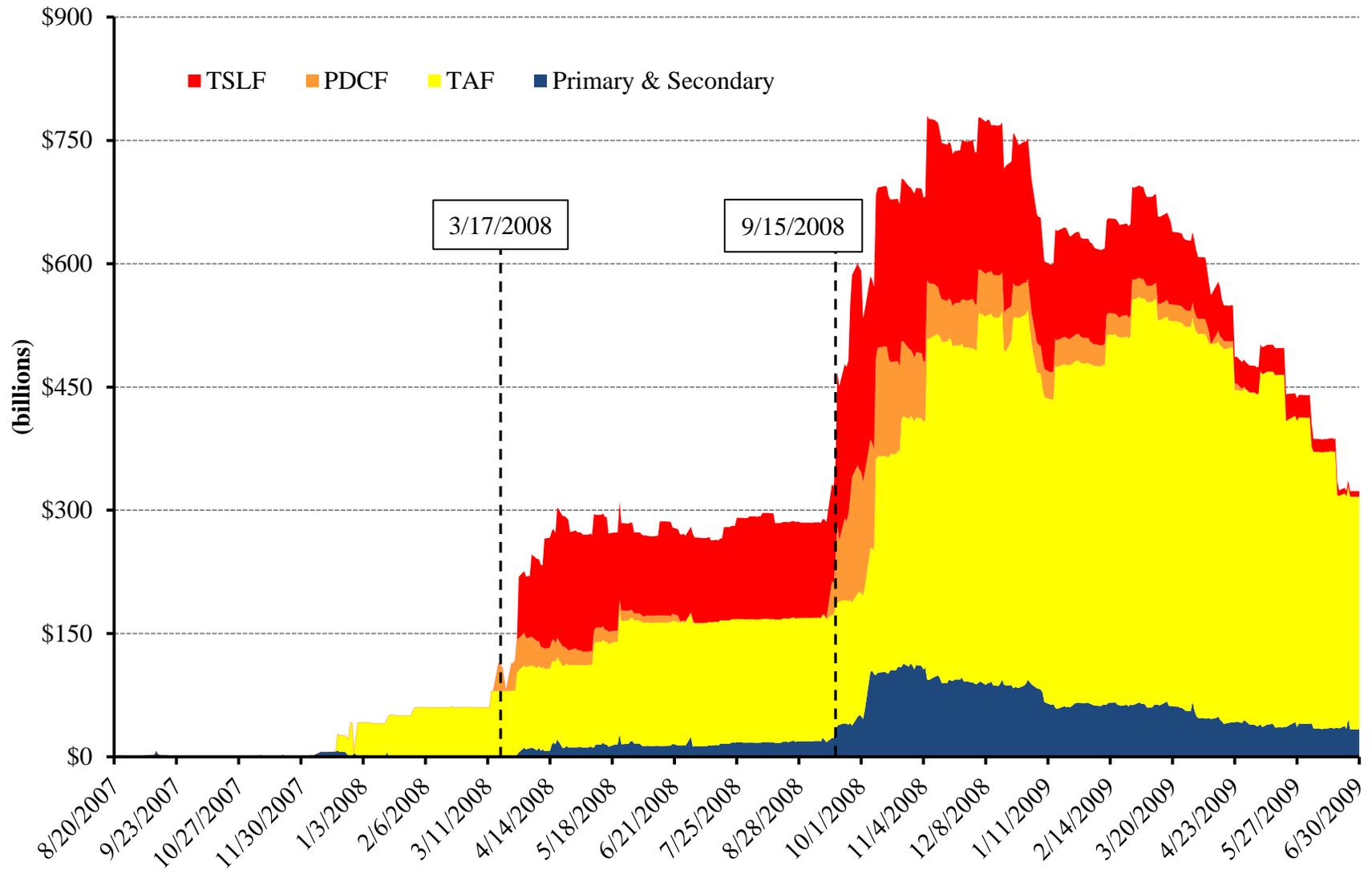


Figure 2: Total Fed Borrowing and S-T Debt for Sample Financial Institutions: 1/2/2008 - 6/30/2009

Source: Federal Reserve (FOIA 3/31/2011)

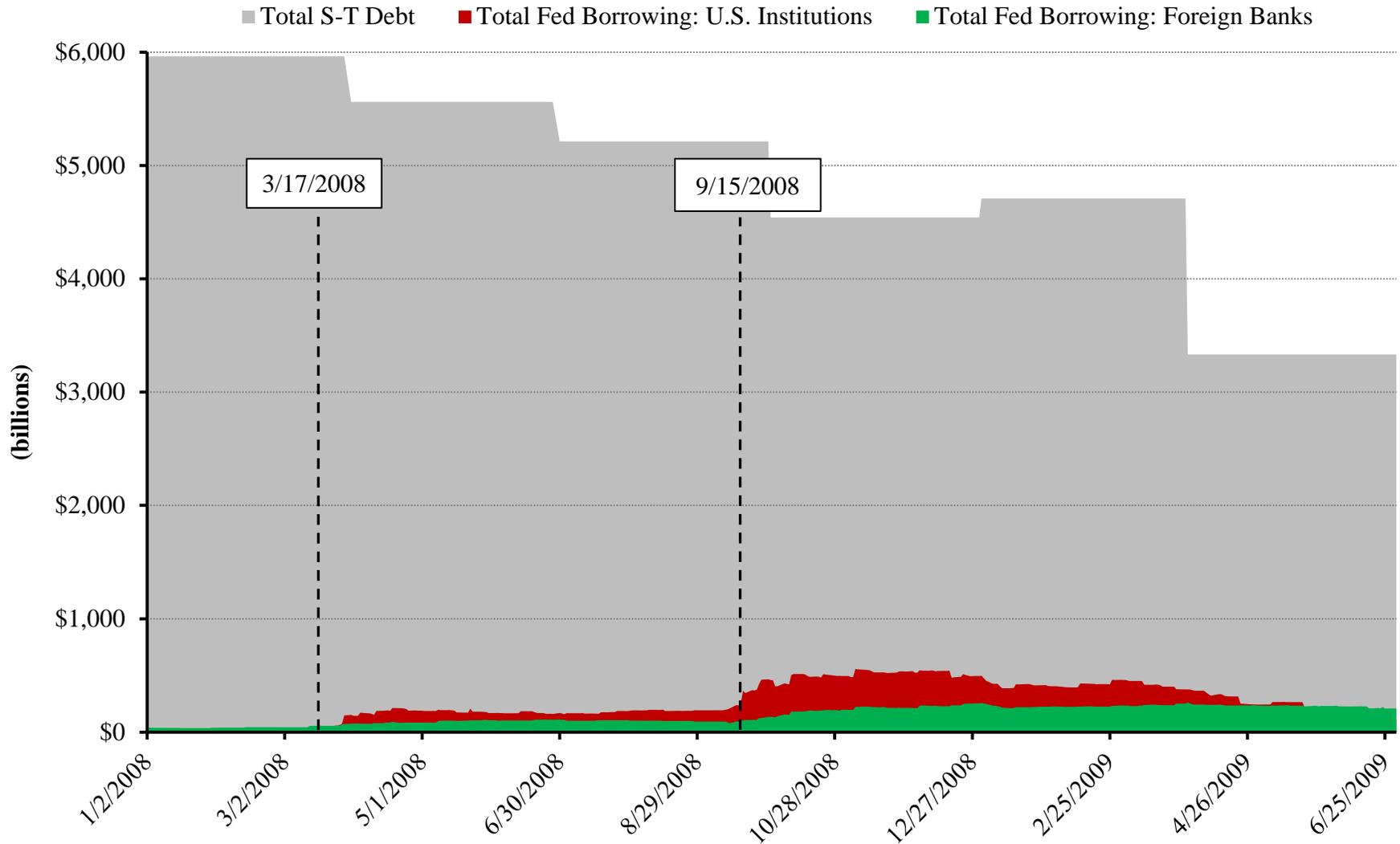


Figure 3: Total Primary and Secondary Credit Borrowing for Financial Institutions: 8/20/2007 - 6/30/2009

Source: Federal Reserve (FOIA 3/31/2011)

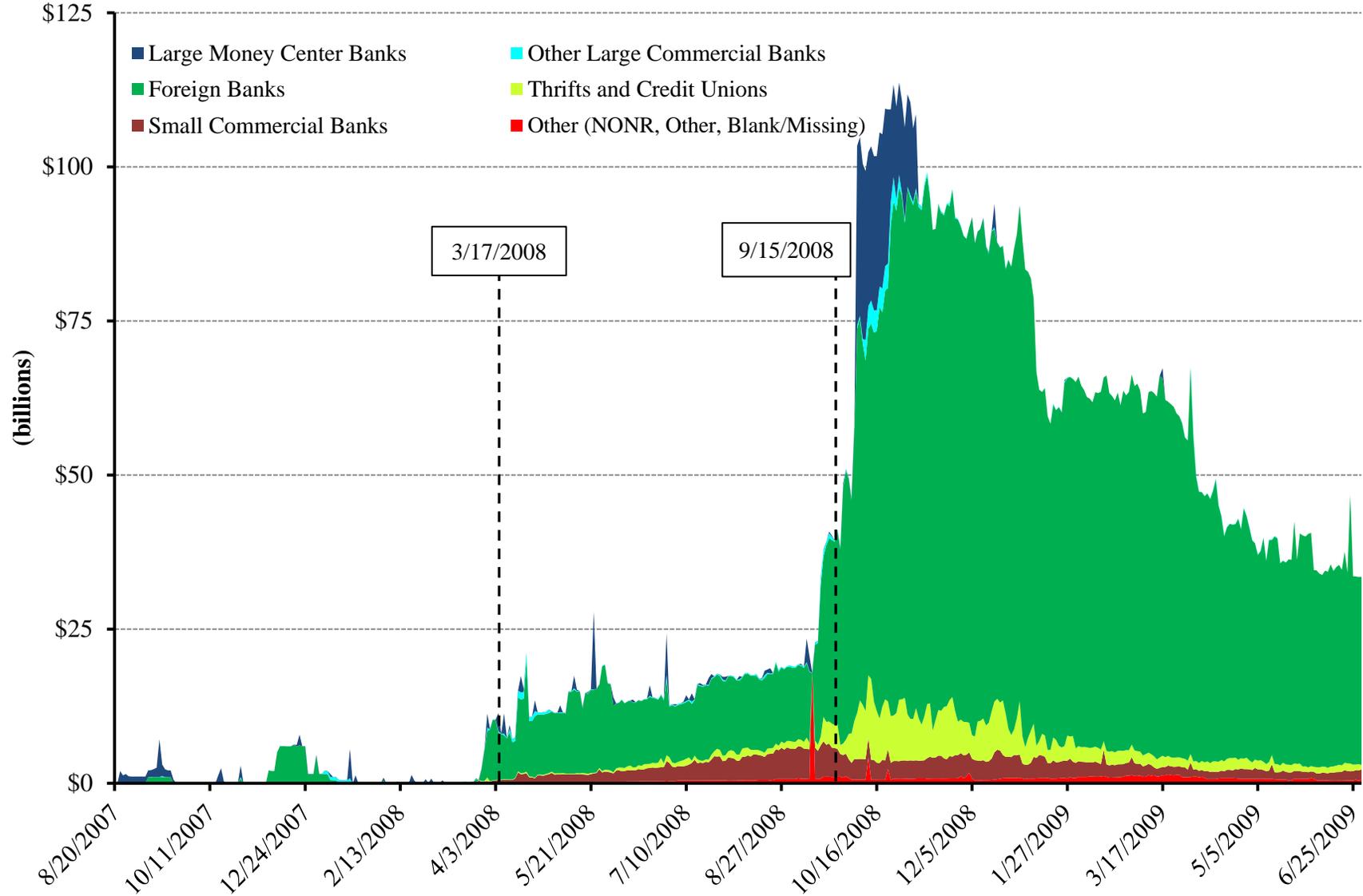


Figure 4: Total TAF Borrowing and Total Amount Made Available for Financial Institutions: 8/20/2007 - 6/30/2009

Source: Federal Reserve (FOIA 3/31/2011)

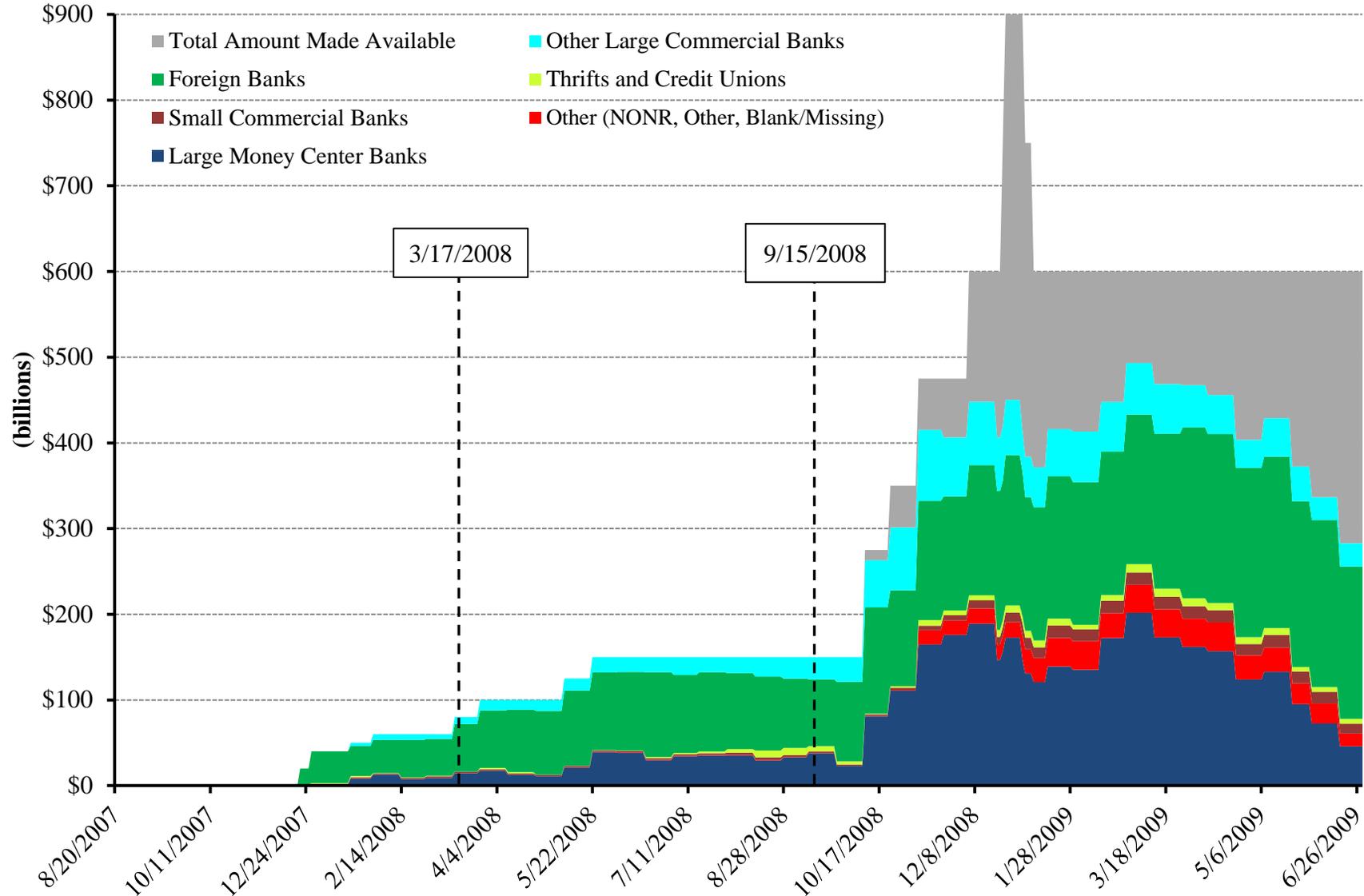
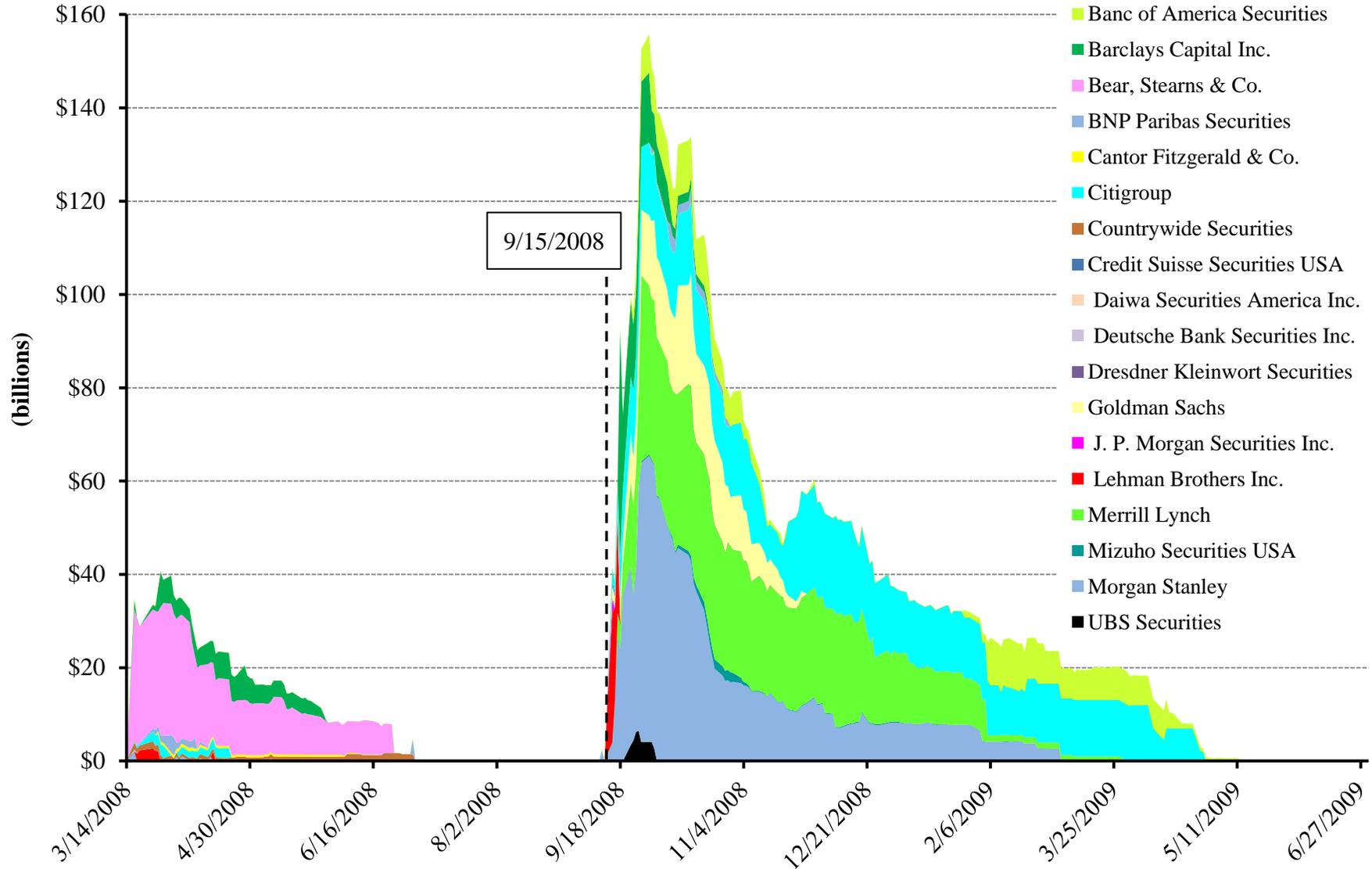


Figure 5: Total PDCF Borrowing for Financial Institutions: 3/14/2008 - 6/30/2009

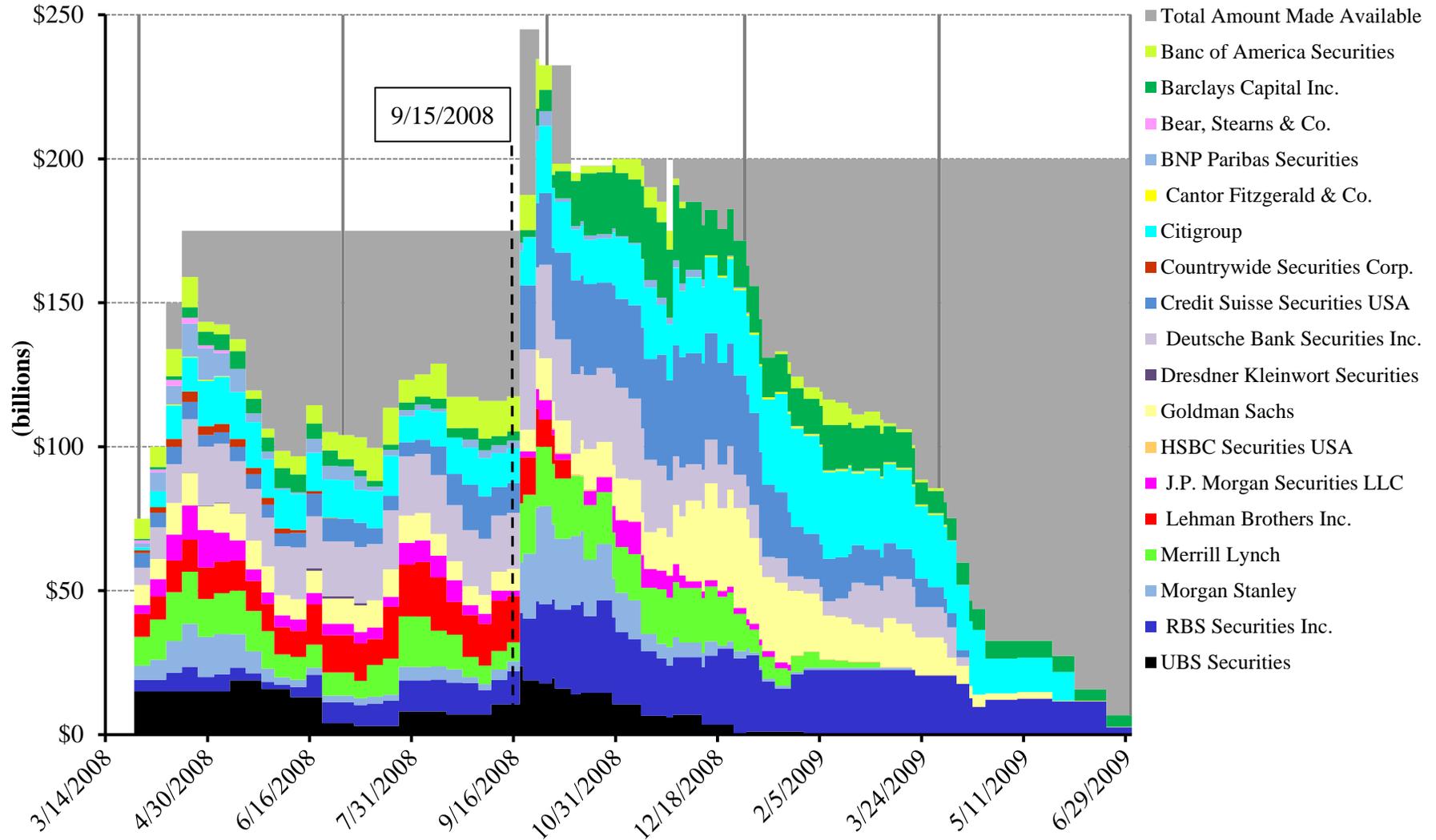
Source: Federal Reserve (FOIA 3/31/2011)



- Banc of America Securities
- Barclays Capital Inc.
- Bear, Stearns & Co.
- BNP Paribas Securities
- Cantor Fitzgerald & Co.
- Citigroup
- Countrywide Securities
- Credit Suisse Securities USA
- Daiwa Securities America Inc.
- Deutsche Bank Securities Inc.
- Dresdner Kleinwort Securities
- Goldman Sachs
- J. P. Morgan Securities Inc.
- Lehman Brothers Inc.
- Merrill Lynch
- Mizuho Securities USA
- Morgan Stanley
- UBS Securities

Figure 6: Total TSLF Borrowing for Financial Institutions: 3/14/2008 - 6/30/2009

Source: Federal Reserve (FOIA 3/31/2011)



Note: Calendar quarter ends are marked with vertical gridlines.

Table A1 - Overview of Federal Reserve Facilities During Subprime Crisis

	Start Date	End Date	Maturity	Notes
<i>Commercial Banks:</i>				
DW: Primary/Secondary Credit	8/17/2007		Maturity extended to 30 days	
	3/16/2008		Maturity extended to 91 days	
TAF	12/12/2007	4/8/2010	28 and 84 days	May not be prepaid. Primary credit institutions.
<i>Primary Dealers:</i>				
PDCF	3/17/2008	2/1/2010	Overnight	
TSLF - Schedule 1	3/27/2008	7/1/2009	28 days	May not be prepaid.
TSLF - Schedule 2	3/27/2008	2/1/2010	28 days	May not be prepaid.

Table A2 - Timeline of TAF Program: 12/12/2007 - 12/31/2008

Date	Event/Notes
12/12/2007	The Fed announces creation of Term Auction Facility (TAF).
12/20/2007	First TAF auction - total amount made available: \$20 billion.
12/27/2007	TAF total available amount increased to \$40 billion.
1/17/2008	TAF total available amount increased to \$50 billion.
1/24/2008	TAF total available amount decreased to \$30 billion.
1/31/2008	TAF total available amount increased to \$60 billion.
3/7/2008	TAF program extended for at least 6 months.
3/13/2008	TAF total available amount increased to \$80 billion.
3/27/2008	TAF total available amount increased to \$100 billion.
5/8/2008	TAF total available amount increased to \$125 billion.
5/22/2008	TAF total available amount increased to \$150 billion.
7/30/2008	Introduction of 84-day TAF loans.
10/9/2008	TAF total available amount increased to \$275 billion.
10/23/2008	TAF total available amount increased to \$350 billion.
11/6/2008	TAF total available amount increased to \$475 billion.
12/4/2008	TAF total available amount increased to \$600 billion.
12/22/2008	TAF total available amount increased to \$750 billion.
12/23/2008	TAF total available amount increased to \$900 billion.

Table A3 - Timeline of TSLF Program: 3/11/2008 - 12/31/2008

Date	Event
3/11/2008	The Fed announces creation of Term Securities Lending Facility (TSLF).
3/28/2008	First TSLF auction - total amount made available: \$75 billion.
4/4/2008	TSLF total available amount increased to \$100 billion.
4/11/2008	TSLF total available amount increased to \$150 billion.
4/18/2008	TSLF total available amount increased to \$175 billion.
5/2/2008	Eligible collateral for Schedule 2 expanded to include AAA/Aaa-rated ABS.
7/30/2008	TSLF extended through 1/30/2009.
9/14/2008	Eligible collateral for Schedule 2 expanded to include investment-grade debt securities. Schedule 2 auction frequency increased.
9/18/2008	TSLF total available amount increased to \$245 billion.
9/26/2008	TSLF total available amount decreased to \$232.5 billion.
10/10/2008	TSLF total available amount decreased to \$195 billion.
10/16/2008	TSLF total available amount increased to \$197.5 billion.
10/30/2008	TSLF total available amount increased to \$200 billion.
11/25/2008	TSLF total available amount decreased to \$175 billion.
11/28/2008	TSLF total available amount increased to \$200 billion.
12/2/2008	TSLF extended through 4/30/2009.

Table A4 - Timeline of Selected Key Events: 12/12/2007 - 12/31/2008

Date	Event
12/12/2007	The Fed announces Term Auction Facility (TAF). The Fed announces \$20 billion and \$4 billion swap lines for 6 months with European Central Bank and the Swiss National Bank, respectively.
12/20/2007	First TAF auction - total amount made available: \$20 billion.
2/17/2008	Northern Rock nationalized by UK Treasury.
3/11/2008	The Fed announces Term Securities Lending Facility (TSLF). The Fed increases swap lines with European Central Bank and the Swiss National Bank by \$10 billion and \$2 billion, respectively. Both swap lines extended through 9/30/2008.
3/16/2008	Merger announcement: JPM-Chase to acquire Bear Stearns. The Fed announces Primary Dealer Credit Facility (PDCF).
3/24/2008	The Fed provides financing to JPM-Chase for acquisition of Bear Stearns.
3/27/2008	TAF total available amount increased to \$100 billion.
3/28/2008	First TSLF auction - total amount made available: \$75 billion.
5/2/2008	The Fed increases swap lines with European Central Bank and the Swiss National Bank by \$20 billion and \$6 billion, respectively.
5/8/2008	TAF total available amount increased to \$125 billion.
5/29/2008	Bear Stearns acquisition approved by shareholders.
7/11/2008	IndyMac Federal Bank seized by regulators (largest thrift failure to-date).
7/15/2008	SEC issues order to temporarily suspend naked short-selling of Fannie Mae, Freddie Mac, and primary dealers.
7/30/2008	The Fed increases swap line with European Central Bank to \$55 billion.
9/7/2008	Fannie Mae and Freddie Mac taken over by the U.S. government.
9/14/2008	Merger announcement: Bank of America to acquire Merrill Lynch. The Fed expands the list of eligible collateral for PDCF and TSLF.
9/15/2008	Lehman Brothers Inc. Files for bankruptcy.
9/16/2008	Barclays to acquire Lehman Brothers Inc. \$85 billion AIG bailout by U.S. government.
9/17/2008	SEC issues order to temporarily suspend naked short-selling of of financial institutions.
9/18/2008	The Fed increases swap lines by \$180 billion and authorizes new swap lines with Bank of Japan, Bank of England, and Bank of Canada. Merger announcement: Lloyds TSB to acquire Bank of Scotland.
9/21/2008	Goldman Sachs and Morgan Stanley convert to bank holding companies.
9/24/2008	The Fed establishes swap with the Reserve Bank of Australia (\$10 billion), the Sveriges Riskbank (\$10 billion), Norges Bank (\$5 billion), and Danmarks Nationalbank (\$5 billion) through 1/30/2009.
9/25/2008	Washington Mutual closed by regulators (sold to JPM-Chase).
9/26/2008	The Fed increases swap lines with European Central Bank and the Swiss National Bank by \$10 billion and \$3 billion, respectively.
9/28/2008	Partial nationalization of Fortis by governments of Benelux countries.
9/29/2008	First bailout proposal of Depfa announced. The Fed expands swap lines by \$330 billion to a total of \$620 billion.
9/30/2008	Dexia bailed out by governments of Belgium and France.
10/3/2008	Merger announcement: Wells Fargo to acquire Wachovia. Congress passes TARP.
10/6/2008	Depfa's holding company bailed out by German government.
10/7/2008	FDIC announces increase in deposit insurance coverage to \$250,000.
10/8/2008	Additional \$37.8 billion AIG bailout by U.S. government.
10/9/2008	TAF total available amount increased to \$275 billion.
10/13/2008	Bank of Scotland bailed out by UK Treasury. Recapitalization of Royal Bank of Scotland by UK government. The Fed increases swap line with European Central Bank, Bank of England, and Swiss National Bank.
10/14/2008	The Fed increases swap line with Bank of Japan.
10/28/2008	First TARP transactions. The Fed establishes swap line with Reserve Bank of New Zealand (\$15 billion).
10/29/2008	The Fed establishes swap lines with Banco Central de Brasil, Banco de Mexico, Bank of Korea, and Monetary Authority of Singapore; \$30 billion each.
11/10/2008	AIG bailout restructured to include TARP and the creation of Maiden Lane facilities.
12/5/2008	Merrill Lynch acquisition approved by shareholders.
12/31/2008	Wells Fargo acquisition of Wachovia completed.

Figure A1: S&P 500 Index, Target Fed Funds, Fed's Liquidity Programs, TARP, QE, and Relevant Events: July 2007 - June 2011

