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**Working Paper**

## The Federal Home Loan Bank System: The lender of next-to-last resort?

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Staff Reports

The Federal Home Loan Bank System:  
The Lender of Next-to-Last Resort?

Adam B. Ashcraft  
Morten L. Bech  
W. Scott Frame

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This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in the paper are those of the authors and are not necessarily reflective of views at the Federal Reserve Bank of New York or the Federal Reserve System. Any errors or omissions are the responsibility of the authors.

## **The Federal Home Loan Bank System: The Lender of Next-to-Last Resort?**

Adam B. Ashcraft, Morten L. Bech, and W. Scott Frame

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### **Abstract**

The Federal Home Loan Bank (FHLB) System is a large, complex, and understudied government-sponsored liquidity facility that currently has more than \$1 trillion in secured loans outstanding, mostly to commercial banks and thrifts. In this paper, we document the significant role played by the FHLB System at the onset of the ongoing financial crises and then provide evidence on the uses of these funds by the System's bank and thrift members. Next, we identify the trade-offs faced by member-borrowers when choosing between accessing the FHLB System or the Federal Reserve's Discount Window during the crisis period. We conclude by describing the fragmented U.S. lender-of-last-resort framework and finding that additional clarity about the respective roles of the various liquidity facilities would be helpful.

Key words: Federal Home Loan Bank, government-sponsored enterprise, lender of last resort, liquidity

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## **Introduction**

In July 2007, the credit rating agencies (Standard & Poors, Moody's, and Fitch) responded to the rapid deterioration in the performance of recently originated subprime mortgages by taking a historical downgrade action on the entire sector of associated mortgage-backed securities (MBS). This downgrade had global implications.

Many of the very largest U.S. and European financial institutions were directly exposed to the subprime mortgage market through loans to subprime originators, investments in the senior tranches of subprime MBS, and retained tranches of collateralized debt obligations (CDOs); the latter of which was largely secured by the subordinate tranches of subprime MBS. These same institutions were also indirectly exposed through their sponsorship of structured investment vehicles (SIVs) and asset-backed commercial paper conduits (ABCP conduits), which purchased subprime MBS, as well as through exposures to their trading counterparties who in turn had similar problems.

The ratings action also triggered a loss of confidence by investors in a broad array of structured finance products. Related selling and hedging activity put additional downward pressure on the prices of a broad range of structured finance securities. Mark-to-market accounting rules, in turn, resulted in the recognition of large accounting losses and a material deterioration in capital positions for the exposed institutions. Uncertainty about the ultimate level of exposure faced by individual institutions prompted money market investors to reduce their exposure to any entity which might have exposure; thereby leading to a sharp increase in the cost and a significant reduction in the availability of term funding. This stress in term funding markets was key because the inability of institutions to access term credit -- concurrent with the breakdown of the originate-to-distribute model of financial intermediation that left them

with unexpected assets on their balance sheets -- would impair the ability of these institutions to originate new credit and amplify the effect of the correction in the housing and mortgage markets.

Conventional wisdom holds that, when faced with such liquidity shocks, a government-sponsored liquidity provider (e.g., the central bank) should be available to act as a lender of last resort.<sup>1</sup> Over the last year, the Federal Reserve has indeed played the role of a lender of last resort and has provided substantial amounts of liquidity to the financial system. However, at the outset of the liquidity crisis, the Federal Reserve saw little demand for primary credit through its Discount Window -- even after lowering the discount rate from 100 basis points to 50 basis points above the Federal Funds target.<sup>2</sup> Some observers attributed the lack of Discount Window lending during this period to the notion of there being a ‘stigma’ to such borrowing insofar as it would send an adverse signal about the financial viability of the borrower. However, the lack of borrowing from the Discount Window can also be explained by the presence of an alternative, lower cost government-sponsored liquidity backstop: The Federal Home Loan Bank System (FHLB) System.

The FHLB System is a large, complex, and understudied U.S. government-sponsored enterprise (GSE) that was created in the midst of the Great Depression. This housing GSE consists of 12 cooperatively owned wholesale banks that act as a general source of liquidity to

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<sup>1</sup> Frexias, Giannini, Haggarth, and Soussa (1999) define the role of the lender of last resort to be the discretionary provision of liquidity to in reaction to an adverse shock that causes an abnormal increase in the demand for liquidity not available from an alternative source. While history provides some examples of the lenders of last resort being private entities (e.g. clearing houses in the United States prior to the establishment of the Federal Reserve) or even private individuals (J.P. Morgan in 1907), we consider the lender of last resort to be either part of the government or operating with explicit or implicit governmental backing.

<sup>2</sup> The Discount Window is historically the principal mechanism through which the Federal Reserve performs its lender of last resort function. The Discount Window is considered to be a “Lombard Facility” – meaning that eligible depository institutions can freely access central bank credit at a penalty rate with appropriate collateral. The Discount Window began operating this way in 2003.

over 8,000 member financial institutions, which are commercial banks, thrifts, credit unions, and insurance companies. This liquidity is primarily provided through “advances” or (over) collateralized lending to members. During the second half of 2007, the FHLB System increased its advance lending by \$235 billion to \$875 billion by the end of that year (a 36.7% increase). And ten FHLB members alone accounted for almost \$150 billion of this new advance lending. Advances have continued to grow into 2008, albeit at a slower rate, and stood at \$914 billion as of June 30, 2008.

Interestingly, the re-intermediation of credit through the FHLBs during the fall of 2007 was quite different from what occurred during the last major global liquidity event: the Asian financial crisis. During the fall of 1998, money market investors ran from short-term paper issued by the corporate sector and deposited their funds with the banking system. Banks, in turn, re-lent those funds to corporations through backup lines of credit (e.g., Gatev, Schuermann and Strahan 2005). By contrast, during the recent liquidity stress, money market investors ran away from debt issued or sponsored by depository institutions and into instruments guaranteed explicitly or implicitly by the U.S. Treasury. By issuing implicitly guaranteed debt, the FHLB System was able to re-intermediate term funding to member depository institutions through advances.

However, it became clear in December 2007 (and again in March 2008) that the response of the FHLB System was not enough to ease all of the stress in term funding markets. Institutions ineligible for FHLB membership, such as foreign banks and primary dealers, continued to have significant demands for term dollar funding and were not borrowing from the Federal Reserve. While operating using only the Discount Window and open market operations



for most of its existence, necessity became the mother of invention, and the Federal Reserve had introduced no fewer than seven new liquidity facilities (as of August 31, 2008).<sup>3</sup>

During the recent financial crisis, the liquidity facilities of the Federal Reserve and the FHLB System have at the same time complemented and competed with each other. The FHLB System took the early lead, and it was not until March 2008 that the Federal Reserve became the largest government-sponsored liquidity facility in terms of crisis-related lending to the financial system. Hence, we view the FHLB system as the lender of next to last resort.

The objective of our paper is three-fold. First, we seek to document and understand the role played by the FHLB System in the ongoing financial crisis. To this end, we provide a brief overview of this larger sibling to the more well-known housing GSEs: Freddie Mac and Fannie Mae. We then document FHLB advance activity during the second half of 2007 and analyze how these funds were used by commercial banks and thrifts.

Second, we want to understand the interplay between the liquidity facilities provided by the FHLB System and the Federal Reserve, respectively. We do so by comparing quantities and prices. As a general reluctance to lend among private agents emerged at the outset of the crisis, the FHLB System became an attractive source of funding as investors placed a premium on the implicit government backing of their debt. Despite substantial cuts in the Federal Reserve's discount rate relative to the federal funds target, the FHLB System continued to see strong demand for advances through the end of 2007. However, following heightened concerns about the financial health of Fannie Mae and Freddie Mac in the second quarter of 2008, the FHLB System found itself "guilty by association" and saw its borrowing costs and advance rates rise.

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<sup>3</sup> These new facilities are the: Term Discount Window (TDW), Term Auction Facility (TAF), swaps with the European Central Bank and the Swiss National Bank, single-tranche open market operations (Single-Tranche OMOs), Term Security Lending Facility (TSLF), Primary Dealer Credit Facility (PDCF), and Term Securities Lending Facility Options Program (TOP).

Hence, the Discount Window became a more attractive option in terms of pricing and saw some increase in borrowings.

Finally, we wish to draw insights and lessons from this episode in order to frame a discussion for how to think about the lender of last resort role in a modernized financial regulatory structure. While the Federal Reserve has eclipsed the FHLB System in terms of total lending during the crisis, the FHLB System has been the largest lender to U.S. depository institutions. Indeed, much of the Federal Reserve's liquidity operations have been for the benefit of non-depository or foreign financial institutions. Moreover, had U.S. depository institutions turned to the Federal Reserve's Discount Window instead of the FHLB System, the amount of unencumbered outright holdings of U.S. Treasury securities on the Federal Reserve's balance sheet would have been below \$100 billion (as of August 31, 2008) assuming that all credit would have been forthcoming and sterilized. Ultimately, it was concerns about the Federal Reserve's ability to further address financial market strains without affecting its monetary policy stance that led to the Supplementary Financing Program (SPF) and the statutory authority to pay interest on reserves three years ahead of the original schedule.

The organization of the paper closely follows these objectives. We begin with an overview of the FHLB System, continue with an analysis of the uses of FHLB advances during the recent stress, and then provide a detailed comparison of the liquidity facilities of the FHLB System and the Federal Reserve.

## The Federal Home Loan Bank System

The FHLB System is composed of 12 regional Federal Home Loan Banks (FHLBs) and an Office of Finance that acts as the FHLBs' gateway to the capital markets. Each FHLB is a separate legal entity and has its own management, employees, board of directors, and financial statements. FHLBs are cooperatively owned by its member commercial banks, thrifts, credit unions, and insurance companies headquartered within the distinct geographic area that the FHLB has been assigned to serve. Members must either maintain at least 10 percent of their asset portfolios in mortgage-related assets or be designated as "community financial institutions."<sup>4</sup> The FHLB System was originally created in 1932 to primarily serve the thrift (or savings and loan) industry, which at that time did not have access to the Federal Reserve's Discount Window.<sup>5,6</sup> In 1989, following the savings and loan crisis, FHLB membership was expanded to include commercial banks and credit unions. As of year-end 2007, the FHLB System had 8,075 financial institution members – 87% of which were commercial banks or thrifts.

Table 1 presents the relative sizes (in terms of total assets) and numbers of members for each of the 12 FHLBs as of December 31, 2007. The FHLB of San Francisco is by far the largest institution (\$323.0 billion), accounting for almost a quarter of the FHLB System's assets. The FHLBs of Des Moines and Atlanta each have 15% of the total FHLB System membership. By contrast, the table also shows the extent to which each bank's business is dominated by its

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<sup>4</sup> "Community financial institutions" are defined at 12 U.S.C. § 1422(13).

<sup>5</sup> In the Presidential statement about the signing of the Federal Home Loan Bank Act in 1932, Herbert Hoover noted that: "Its purpose is to establish a series of discount banks for home mortgages, performing a function for homeowners somewhat similar to that performed in the commercial field by the Federal Reserve banks through their discount facilities." See: < <http://www.presidency.ucsb.edu/ws/?pid=23176>>.

<sup>6</sup> The Depository Institutions Deregulation and Monetary Control Act of 1980 opened the Discount Window to all banks, savings and loan associations, savings banks, and credit unions holding transactions accounts and non-personal time deposits.

largest members. The percentage of each bank's advances (loans to members) that is accounted for by its five largest users range from 42.1% (the FHLB of Chicago) to 79.0% (the FHLB of San Francisco).<sup>7</sup>

The FHLB System is often viewed as a whole because virtually all FHLB financing takes the form of consolidated obligations for which the 12 institutions are jointly and severally liable. Hence, Table 2 shows the consolidated balance sheet of the 12 FHLBs, as of December 31, 2007. Advances constitute 68.7% of the FHLB System's \$1,274.5 billion in total assets; cash and investments another 23.4%; and holdings of residential mortgages are 7.2% of total assets. On the liability side of the balance sheet, consolidated obligations constitute 92.5% of total assets. The FHLB System's capital is only 4.2% of assets, and almost all of that is the members' contributed capital; retained earnings are only 0.3% of assets. The FHLB System is thus a very large and highly leveraged financial institution.

The FHLB System is considered a government-sponsored enterprise (GSE) since it has been expressly created by an Act of Congress (The Federal Home Loan Bank Act of 1932) that includes several institutional benefits designed to reduce their operating costs. In this way, the FHLB System is similar to the other two housing GSEs – Fannie Mae and Freddie Mac. Certain charter provisions combined with past government actions, have created a perception in financial markets that GSE obligations are implicitly guaranteed by the federal government.<sup>8</sup> This, in turn, allows these institutions to finance their activities by issuing debt on more favorable terms

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<sup>7</sup> Similarly, the percentage of each bank's capital that is accounted for by its five largest members ranges from 30.0% (the FHLB of Chicago) to 74.9% (the FHLB of San Francisco).

<sup>8</sup> Special privileges accruing to the FHLB System include: a provision authorizing the Treasury Secretary to purchase up to \$4 billion of FHLB securities; the treatment of FHLB securities as “government securities” under the Securities and Exchange Act of 1934; the statutory ability to use the Federal Reserve as its fiscal agent (like the Treasury); and an exemption from the bankruptcy code by way of being considered “federal instrumentalities”.

than any AAA-rated private corporation.<sup>9</sup> Housing GSEs also accrue cost savings through an exemption from federal corporate income taxes and an exemption from Securities and Exchange Commission registration requirements for their debt securities. Key differences between the FHLB System and Fannie Mae/Freddie Mac relate to their primary functions (collateralized lending via advances versus issuing credit guarantees on mortgage-backed securities) and ownership structure (cooperative versus publicly held corporations). The \$1.3 trillion in total assets controlled by the FHLB System as of June 30, 2008 exceeded those for Fannie Mae and Freddie Mac at that time (\$886 billion and \$879 billion respectively).<sup>10</sup>

It is understood that explicit or implicit government guarantees of financial institution liabilities will distort the risk-taking incentives of the insured institutions in a way that increases the probability of financial distress.<sup>11</sup> Recognizing this potential moral hazard, the federal government regulates the FHLB System for “safety and soundness” through the Federal Housing Finance Agency (FHFA), which also has responsibility for Fannie Mae and Freddie Mac. The FHFA is an independent agency within the executive branch that was created in July 2008 with the passage of the Housing and Economic Recovery Act of 2008. Previously, the Federal Housing Finance Board had sole responsibility for supervising the FHLB System. Like other financial regulators, the FHFA is authorized to set capital standards, conduct examinations, and take certain enforcement actions if unsafe or unsound practices are identified.<sup>12</sup>

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<sup>9</sup> See Ambrose and Warga (1996, 2002), Nothaft, Pearce, and Stevanovic (2002), and Passmore, Sherlund, and Burgess (2005).

<sup>10</sup> Fannie Mae and Freddie Mac also maintain large volumes of credit guarantees on mortgage-backed securities. These guarantees (net of securities held on their own balance sheets) totaled \$2.3 trillion (Fannie Mae) and \$1.4 trillion (Freddie Mac) as of June 30, 2008.

<sup>11</sup> Flannery and Frame (2006) identify and analyze FHLB System risk-taking incentives and compare them to those faced by Fannie Mae and Freddie Mac.

<sup>12</sup> The regulations currently applying to the FHLB System are those previously promulgated by the Federal Housing Finance Board. These regulations are codified at 12 C.F.R. § 900-999.

The stated public purpose of the FHLB System is to provide their members with financial products and services, most notably advances, to assist and enhance the members' financing of housing and community lending.<sup>13</sup> One important empirical question relates to what types of assets FHLB advances ultimately fund on member balance sheets. While members must post collateral to secure their advances and that collateral is typically residential mortgage-related (whole loans or mortgage-backed securities), money is fungible; there is no reason why the members would necessarily use the borrowed funds for further housing loans or other designated uses. Indeed, empirical evidence provided by Frame, Hancock, and Passmore (2007) suggests that FHLB advances are just as likely to fund other types of bank credit as to fund residential mortgages.

Another important question relates to whether the benefits of FHLB membership flow to members and, if so, whether it flows further still to consumers – especially mortgage borrowers. In one study, the U.S. Congressional Budget Office (2004) estimated that the FHLB System accrued \$3.4 billion in implicit federal support in 2003 and that \$0.2 billion of that accrued to conforming mortgage borrowers while the remainder was captured by various FHLB stakeholders. Presumably, most of these benefits accrue to the FHLBs member-owners who, in turn, pass them on to their customers. However, some benefits may be captured by FHLB management and shareholders. A more comprehensive analysis of the distribution of FHLB benefits would be a welcome addition to the literature.

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<sup>13</sup> See 12 U.S.C. § 1430(a)(2).

## **The Role of FHLB Advances during the 2007 Liquidity Crisis**

Advances are historically the primary activity conducted by the FHLBs. These loans are generally collateralized by residential mortgage-related assets (whole loans and mortgage-backed securities) and U.S. Treasury and Federal Agency securities.<sup>14</sup> Beyond the explicit collateral and a member's capital subscription, the FHLBs also have priority over the claims of depositors and almost all other creditors (including the Federal Deposit Insurance Corporation, or FDIC) in the event of a member's default; this is often described as a "super-lien."<sup>15</sup> Taken together, these features help to explain why none of the FHLBs has ever suffered a loss on an advance.

Unfortunately from a public policy perspective, the combination of over-collateralization and the super-lien can create an incentive for the FHLBs to provide their members with more credit than is socially optimal. This is due to the fact that these provisions reduce the FHLBs' incentives to screen and monitor their members and the pledged collateral. This arrangement also serves to weaken the claims of existing private creditors and expose the FDIC to increased losses in the event of failure (Stojanovic, Vaughan and Yeager 2008). Consistent with the potential for excessive lending, the FHFA (as previously established by the Federal Housing Finance Board) does not impose loan to one borrower limits on the FHLBs; and that individual FHLB internal limits (when imposed) are generally set in the range of 30 - 50 percent of member total assets. By contrast, national banks limit loans to one borrower at 25 percent of bank total equity (with not more than 15 percent of bank equity being unsecured).<sup>16</sup>

FHLB advances are generally viewed as an attractive source of wholesale funds. Advance interest rates are set by the individual FHLBs and reflect a mark-up to the cost of

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<sup>14</sup> See 12 U.S.C. § 1430(a)(3) for a complete list of eligible collateral. Federal Agency securities are generally synonymous with debt and mortgage-backed securities issued by government sponsored enterprises.

<sup>15</sup> See 12 U.S.C. § 1430(e).

<sup>16</sup> See 12 U.S.C. § 84(a) as this applies to national banks.

Federal Agency debt funding secured by the Office of Finance. However, in order to receive an advance, a member must also purchase FHLB stock in an amount ranging from 2-6 percent of the advance (as dictated by the individual FHLB's capital plan). While FHLB stock typically pays a dividend, to the extent this pay-out falls below the members' marginal investment opportunity the stock purchase requirement can create an opportunity cost. Generally speaking, there is an inverse relationship between advance rates and dividend rates across FHLBs; with differences presumably reflecting efficiencies and the collective preferences of the membership.

Advances grew rapidly during the 1990s and early 2000s following the introduction of commercial banks as FHLB System members. However, from the end of 2005 through the first half of 2007, the level of outstanding FHLB advances oscillated within a narrow range of \$620 to \$640 billion (see Figure 1). The amount of outstanding advances ticked up slightly in July 2007, but then exploded during August and September -- moving from \$659 to \$824 billion (a 25% increase). FHLB advances stood at \$875 billion at the end of 2007 – an amount equivalent to 6.2% of U.S. gross domestic product.

During the second half of 2007, the ten most active members accounted for almost \$150 billion of the \$235 billion increase (63%). Table 3 shows that Washington Mutual, Bank of America, and Countrywide borrowed the largest amounts from the FHLB System during this period; and for Washington Mutual and Countrywide their ratios of advances-to-total assets rose to 20 and 40 percent, respectively.

As liquidity pressures developed during the fall of 2007, FHLB advances became an attractive source of funding in terms of pricing. During this time, investors sought the protection of (explicitly or implicitly) federally guaranteed obligations and FHLB funding costs declined relative to other benchmarks like LIBOR and AA-rated asset-backed commercial paper. For example, the average spread between one month LIBOR and four week FHLB discount notes



increased from about 16 basis points prior to the turmoil to 44 basis points during the following 12 months. By contrast, the average spread between a 30-day advance from the FHLB New York and four week FHLB System discount notes has remained unchanged at about 25 basis points (see Figure 2).

Much of the growth in FHLB advances in the second half of 2007 reflected longer-term lending, although the GSE financed this growth primarily by issuing short-term liabilities. Of the \$235 billion increase in FHLB advances during the second half of 2007, \$205 billion carried an original maturity of greater than one year (87.4%). By contrast, over the same period, discount notes with maturities of less than one year increased by \$213 billion comprising 94.2% of net new FHLB consolidated obligations.<sup>17</sup> We believe that this stark mismatch reflected the market stress during this period. For example, anecdotal evidence suggests that many depository institutions sought term funding for loans originally intended to be securitized but that were unable to be moved off-balance-sheet. On the other hand, investors shunned ABCP issuers and instead sought the safety of short-term U.S. Treasury and Federal Agency debt securities.

In order to better understand why financial institutions markedly increased their borrowing from the FHLBs during the second half of 2007, we take two approaches. First, we analyze aggregate growth within the balance sheets of banks and thrifts by comparing the trend in the six quarters preceding the crisis with the developments since. Second, we take a statistical approach, documenting how the correlation between the changes in FHLB advances and changes in other balance sheet items varied during the last two quarters of 2007.

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<sup>17</sup> Discount notes are generally sold in sizes ranging from \$500 million to over \$5 billion each; with typical maturities being overnight, 4-, 9-, 13-, and 26-weeks.

## ***Aggregate Balance Sheets***

We start by aggregating the Call Reports of both commercial banks and thrifts over three time periods: the six quarters before the recent financial crisis, 2006:Q1-2007:Q2 (our benchmark), and each of the two quarters following the onset of the crisis 2007:Q3 and 2007:Q4.<sup>18</sup> In order to capture differences across institutions of different sizes, these aggregates are broken out using a threshold of \$5 billion in total assets. “Large institutions,” or those with greater than \$5 billion in total assets, accounted for 80 percent of FHLB advances outstanding as of December 31, 2007.

Table 4 documents the aggregate behavior of large and small depository institutions over the three time periods (Panels A-C). For each line item, the table reports the aggregate percentage of the item relative to total assets in the last quarter, the percentage change over the quarter, and the change in the ratio of the item to total assets measured in percentage points.

We begin our discussion focusing on the behavior of large institutions during the third quarter of 2007 (Panel B). Most striking is the 31.7% increase in FHLB advances compared to the average quarterly growth rate in this balance sheet item of 0.4% over the previous six quarters reported in Panel A. The overall increase in “other borrowing,” of which FHLB advances are a part, more than offset a decline in federal funds and repo borrowing by large institutions. This suggests that FHLB advances were used, in part, to mitigate a funding shock. While deposit growth was slow (2.1%) relative to growth in total assets (4.0%), it was slightly higher than the average deposit growth over the previous six quarters (1.8%). This suggests that funding pressures faced by large institutions were largely isolated to federal funds and repo borrowing.

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<sup>18</sup> The bank and thrift Call Reports do have some minor differences and we have worked to keep categories comparable and thereby minimize distortions.

On the asset-side, large institutions also reduced their cash holdings (relative to total assets) during the third quarter of 2007 – consistent with an increased demand for liquidity. Asset growth during 2007:Q3 for these institutions largely came from federal funds and repo lending as well as trading assets. Large institutions also experienced a modest increase in total loans (3.4%), which was faster than the baseline average quarterly growth rate of 1.5% (Panel A). This acceleration largely came from non-mortgage loans. The increase in trading assets is consistent with large institutions using FHLB advances in order to fund mortgage loans in the securitization pipeline that were unexpectedly retained on the balance sheet due to the breakdown of the originate-to-distribute model.

One possible explanation for the increase in federal funds and repo lending during 2007:Q3 is that a number of institutions were granted exemptions from Section 23A of the Federal Reserve Act, which restricts lending to affiliates, in order to allow commercial banks to support their affiliated broker-dealers.<sup>19</sup> We investigated this explanation by comparing the increase in repo lending on the bank and thrift Call Reports with similar lending on the holding company's Y-9C, for the subset of U.S. institutions where such information is available. As lending from a bank to its affiliate would not appear on the consolidated balance sheet, this should provide indirect evidence on the importance of changes in inter-bank lending. The evidence suggests that this phenomenon only explained a small part of the increase in federal funds and repo lending. Hence it appears that large institutions were using FHLB advances to help fund assets more generally. In this way, the FHLBs appear to have been performing as a

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<sup>19</sup> Exemptions were granted on August 20, 2007 for Citigroup, Bank of America, and JP Morgan Chase. Later in the third quarter of 2007, similar exemptions were granted for the New York branches of Deutsche Bank AG, Royal Bank of Scotland PLC, and Barclays Bank PLC. These exemptions were announced on the public web site of the Board of Governors of the Federal Reserve <[www.federalreserve.gov](http://www.federalreserve.gov)>.

typical lender of last resort; providing liquidity to depository institutions that, in turn, provided liquidity more broadly to the rest of the economy.

The data in Panel B also documents a significant increase in FHLB advances during 2007:Q3 for small financial institutions, or those with less than \$5 billion in total assets. This appears to largely have been to offset slow deposit growth (relative to the baseline period). The growth in the assets of small institutions (1.7%) was slightly below average over the previous six quarters. One interpretation of this fact is that funding pressure was constraining balance sheets, but another is that small institutions reduced their demand for funding as they tightened underwriting standards. The outright decline in cash and the acceleration in the growth of federal funds and repo borrowing would appear to support the former explanation. Moreover, it is interesting to note the significant decline in federal funds and repo lending, suggesting that small institutions were part of the investor class exiting secured funding markets. As reducing the level of inter-bank lending is cheaper than increasing the level of inter-bank borrowing, this is also consistent with small institutions facing funding pressures.

Panel C documents the aggregate behavior of banks and thrifts during the fourth quarter of 2007, with a similar format to the first two panels. While the asset growth of large institutions slowed to 2.6%, it remained above the mean growth rate of the six pre-crisis quarters. And the growth in FHLB borrowing by large institutions was only modestly faster than that of total assets. This faster growth in assets is largely explained by the same sources from the third quarter: federal funds and repo borrowing, trading assets, and non-mortgage loans. Small institutions appeared to be under continued pressure in the fourth quarter, as deposit growth was slow relative to pre-crisis averages, federal funds and repo borrowing as well as FHLB borrowing expanded quickly, and federal funds and repo lending continued to contract.

Overall, the aggregate data suggest that both large and small institutions used FHLB advances during the second half of 2007 in order to smooth a liquidity shock. However, large institutions also used advances to fund increases in the trading book, federal funds and repo lending, and non-mortgage lending.

### ***Regression Analysis***

So far, our approach has been descriptive, but now we turn to some statistical analysis. In particular, we examine the correlation between changes in FHLB advances at the bank- and thrift-level and changes in their other balance sheet categories during 2007:H2. Specifically, we estimate an OLS regression of the quarterly change in FHLB advances on similar changes in: cash holdings, federal funds and repo lending, trading assets, funding (the sum of total deposits, federal funds borrowing, and repo borrowing), mortgage loans, non-mortgage loans, each scaled by the previous quarter's total assets. Given the heterogeneity documented above for large and small institutions, each of these variables is interacted with a dummy variable indicating a large institution. The specification is estimated over each of three samples: the six quarters before 2007:Q2, 2007:Q3, and 2007:Q4.

The first column in Table 5 documents the “normal” relationship between FHLB advances and the various balance sheet categories for the six quarters before the crisis. While advances are correlated with federal funds and repo lending for small institutions (Line 4) with an estimated coefficient of 0.385 (significant at the 1% level), the correlation for large institutions is close to zero with an estimated implicit coefficient of  $0.385 + (-0.317) = 0.068$ . There is a strong correlation between FHLB advances and both mortgage loans and non-mortgage loans for small institutions, but a much weaker one for large ones. Finally, small banks and thrifts appear to use FHLB advances to smooth changes in funding, while large institutions are less dependent on advances for this purpose.

The second column of Table 5 documents how these correlations changed during the third quarter of 2007. While we established above that the federal funds and repo lending of large banks and thrifts were not related to FHLB advances pre-crisis, a strong positive relationship appeared during 2007:Q3 as the correlation becomes positive and statistically significant ( $0.433 + 0.150 = 0.583$ ). There was also an increase in the correlation between FHLB advances and trading assets for both large and small institutions, but not a differential increase. While there is a modest increase in the sensitivity of mortgage loans to advances for small banks and thrifts, there is a significant increase in the sensitivity for large institutions. On the other hand, while the positive relationship between FHLB advances and non-mortgage loans got stronger for small banks and thrifts, it actually got weaker for large institutions to the point of becoming negative ( $0.566 - 0.770 = -0.204$ ). Finally, while there was only a modest increase in the use of advances to smooth funding for small banks and thrifts (the coefficient became slightly more negative), a significant increase was apparent for large ones as the implied coefficient for these institutions became significantly more negative (from  $-0.451 + 0.231 = -0.220$  to  $-0.508 + 0.007 = -0.501$ ).

The last column of Table 5 documents how the balance sheet correlations changed during the fourth quarter of 2007 relative to the baseline. For each category, there appears to be a return towards pre-crisis patterns, as the correlations of small institutions which had increased in the third quarter fell back and correlations of large institutions reverted to pre-crisis signs and magnitudes. This convergence in correlations between the change in FHLB advances and changes in other balance sheet items may have interesting implications for the impact of the turmoil in the term funding markets played on loan originations. In particular, if limited access to term funding was constraining the ability of institutions to originate loans, one might expect these elevated correlations to persist. In other words, they would have simply continued to

access term funding from the FHLB System. This suggests that FHLB advances were used to smooth a large one-time shock; and that the willingness of banks to lend -- and not term funding pressure -- subsequently became the binding constraint on the origination of new loans.

## **Crisis-Related Lending by the Federal Reserve and the FHLB System**

During the 2007-08 financial crisis, the liquidity facilities of the Federal Reserve and the FHLB System seem to have both complemented and competed with each other. Below, we analyze prices and quantities in order to gauge the relative magnitude and importance of the crisis-related lending from the two institutions.<sup>20</sup> We focus on four distinct parts of the crisis: the initial shock in August 2007; the introduction of the Term Auction Facility (TAF) and swap lines with foreign central banks in December 2007; the introduction of Primary Dealer Credit Facility (PDCF) and Term Securities Lending Facility (TSLF) in March 2008; and the heightened concerns about the financial health of Fannie Mae and Freddie Mac in July 2008.

Figure 3 illustrates the crisis-related lending the Federal Reserve and the FHLB System over the 32 months ending June 30, 2008. For the Federal Reserve, we present both total Discount Window lending as well as total liquidity provided to the financial system, which is the sum of cash (Discount Window) and securities lending. (Figure 4 provides a lending breakdown by credit facility.) During the first four months of the liquidity crisis, the FHLB was clearly the dominate source of government-sponsored liquidity. It was not until December 2007 that the Federal Reserve began to lend significant amounts, as a result of the introduction of the TAF and swap lines with foreign central banks. The figure also documents that the Federal Reserve did not eclipse the FHLB System until April or May 2008 depending on whether the TSLF is included or not.

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<sup>20</sup> Usage alone might be a misleading measure of the impact of a liquidity backstop facility as the option of being able to use such a facility is valuable in its own right.



## ***August 2007: The initial shock***

The Federal Reserve initially responded to the turmoil in the inter-bank markets in August 2007 with the introduction of the Term Discount Window Program and a reduction in the price of primary credit through the Discount Window.<sup>21</sup> Specifically, on August 17, 2007, the term of primary credit was extended from overnight to as long as 30 days (later extended to 90 days). Moreover, the spread of the primary credit interest rate over the Federal Funds target rate was lowered from 100 to 50 basis points (and eventually to 25 basis points). The Federal Reserve also openly encouraged the use of the Discount Window by identifying such use as a sign of strength during a specially convened teleconference with a group of large banks and major investment banking firms (The Clearing House 2007).<sup>22</sup> Despite this initial activity, Discount Window borrowing was negligible during the second half of 2007. By contrast, the FHLB System saw brisk business: in August and September of that year alone, the FHLB System lent out an additional \$165 billion; and by the end of the year the level of outstanding advances was up \$235 billion.

One explanation for the lack of Discount Window borrowing is the perception by potential borrowers that markets will view such borrowing very unfavorably. In other words, that there is a “stigma” associated with borrowing from the Discount Window.<sup>23</sup> Figure 5 illustrates this point by documenting the fraction of days in each month where the intraday high in the Federal Funds market (as reported by the Federal Reserve Bank of New York) is above the

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<sup>21</sup> Primary credit is available to depository institutions in sound overall condition to meet short-term, backup funding needs at a price above the federal funds rate target. Normally, primary credit will be granted on a “no-questions-asked,” minimally administered basis. There are no restrictions on borrowers’ use of primary credit.

<sup>22</sup> Guerrerain (2007) reported that Deutsche Bank borrowed from the discount window on the day of the teleconference. The following Wednesday, JPMorgan Chase, Bank of America, Wachovia, and Citibank also each announced discount window borrowings of \$500 million, including some on a term basis (Associated Press, 2007).

<sup>23</sup> Furfine (2003) documents a continued reluctance of banks to borrow from the Discount Window following the introduction of changes made to the facility in 2003 in order to reduce stigma.

primary credit interest rate. The figure provides data from January 2003 (when Discount Window policies were altered) through July 2008. The fact that institutions are willing to pay more in the inter-bank market than the interest rate at which they could borrow directly from the Federal Reserve suggests there is some stigma associated with the Discount Window.

While stigma is a compelling explanation of the data, the unwillingness of institutions to borrow from the Federal Reserve at the outset of the crisis can also be explained by the simple fact that FHLB advances have been a less expensive option for domestic depository institutions. The relative attractiveness of the Federal Reserve's Discount Window vis-à-vis the FHLB system is, for the most part, driven by the spread between the primary credit rate and the short term advance rate. However, differences in the haircuts applied across types of collateral, stock purchase requirements (and the associated dividends), and interest rate expectations all influence the cost of borrowing.

Figure 6 provides the average weekly borrowing of primary credit from the Discount Window together with an estimated all-in cost spread between a 30-day Discount Window loan and a 30-day advance from the New York FHLB collateralized by a AAA-rated Federal Agency mortgage-backed security. The method of deriving the respective all-in cost measures is provided in Appendix A. According to this measure, the relative attractiveness of the advance averaged about 80 basis points between January 2003 and August 2007.<sup>24</sup> The attractiveness of the FHLB advance then fell to somewhere in the 20–40 basis point range following the Federal Reserve's 50 basis point reduction in the spread of the primary credit rate over the federal funds rate target in August 2007.

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<sup>24</sup> Prior to January 2003, the interest rate charged at the Discount Window was typically 25-50 basis points below the federal funds rate. While the below-market rate for Discount Window credit created incentives for an institution to borrow, regulation required institutions to first exhaust other available sources of funds and explain their need for credit.

The FHLB System clearly played an important role as a government-sponsored source of liquidity during the first months of the liquidity crisis. While the stigma associated with borrowing from the Federal Reserve's Discount Window is one explanation for this fact, we document that FHLB members largely chose to simply borrow from the cheapest provider of funds.

### ***December 2007: The TAF and Swap Lines with Foreign Central Banks***

Despite the unprecedented increase in FHLB advances during the fall of 2007, term funding markets remained stressed. Figure 7 illustrates this by plotting the spread of one month LIBOR to the similar duration overnight indexed swap rate (OIS) between January 2007 and September 2008. This spread widened substantially in late 2007 and became a widely followed indicator of financial market stress.

In order to better understand the limited effect of FHLB advances on the LIBOR-OIS interest rate spread, it is insightful to look at the panel of 16 banking organizations that are surveyed to measure U.S. term dollar LIBOR.<sup>25</sup> Table 6 lists these banking organizations and indicates whether they have access to FHLB advances and/or the Federal Reserve's discount window. In the table, a banking organization is defined to have "direct access" to the FHLB System if it controls a U.S. depository institution that is a FHLB member and that institution is large relative to the banking organization. A banking organization is defined to have "indirect access" if it controls a U.S. depository institution that is a FHLB member, but that member is small relative to the banking organization. In practice, this excludes all foreign institutions

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<sup>25</sup> The LIBOR panel is surveyed each morning (11:00 a.m. local time) by the British Bankers Association about the rate at which it could borrow funds were it to do so by asking for and then accepting inter-bank offers in reasonable market size just prior to 11:00 a.m. Contributor panels comprise at least eight banks, and are intended to broadly reflect the balance of activity in the inter-bank deposit market. Contributed rates are ranked in order and only the middle two quartiles averaged arithmetically. This average rate becomes the "LIBOR fixing" for that particular currency, maturity, and date.

which control a U.S.-based FHLB-member bank since the size of their U.S. operations is small relative to the consolidated institution by any reasonable measure of size. Very few of the banking organizations participating in the LIBOR panel have direct access to the FHLB System.

One natural question is whether access to low-cost secured term funding through the FHLBs affected the demand for unsecured term dollar funding in the inter-bank Eurodollar market. During the pre-crisis period, banking organizations with direct FHLB access reported only 0.07 basis points less on average than non-members for term LIBOR funding. However, during the post-crisis period, banking organizations with direct FHLB access reported 0.70 basis points less on average, the difference being statistically significant at the one percent level. During some of the most stressful times in the term dollar LIBOR market (e.g., December 2007), banking organizations participating on the LIBOR panel with direct access to FHLB advances were reporting paying about 4.00 basis points less for unsecured funding than banks without such access (see Figure 8). The bottom line is that access to liquidity from the FHLB System may have affected the LIBOR quotes received by member banking organizations, especially when the market was under stress. One possible explanation is that banks were more willing to lend (or willing to lend at a lower rate) if the borrowing institution had access to a “stigma free” quasi-government liquidity backstop; thereby increasing the likelihood that the borrower would be able to return the money even in adverse conditions.

While access to FHLB advances is limited among the LIBOR panel contributors, Table 6 also illustrates that access to the Federal Reserve’s Discount Window is universal among this group of institutions. This fact suggests that the Federal Reserve might have an important role to play in moderating liquidity pressures by lending to institutions without access to the FHLB System, like foreign banks. This was achieved through the introduction of the Term Auction

Facility (TAF) in December 2007 and reciprocal currency swaps with the European Central Bank and Swiss National Bank.

The TAF facility provides credit to institutions with access to the Discount Window and against the same range of collateral, but at an auction-determined interest rate rather than the administered primary credit rate. It was believed that the use of a market interest rate instead of an administered penalty rate would reduce any stigma associated with borrowing from the facility (Armantier, Krieger and McAndrews 2008). The Federal Reserve's swap lines with the European Central Bank and the Swiss National Bank allow U.S. dollars to be lent, on term, to foreign banks without access to the Discount Window or TAF. The ability of these central banks to lend directly to foreign institutions against collateral at a price lower than the term dollar LIBOR rate would presumably reduce the demand for term unsecured dollar funding by foreign institutions in the Eurodollar market.

In sum, the purpose of the TAF and swap lines was to increase U.S. dollar liquidity. However, the early evidence concerning the effectiveness is conflicting.<sup>26</sup> Taylor and Williams (2008) find that the daily LIBOR-OIS spreads (1-month and 3-month) are unaffected on TAF bid submission dates. By contrast, Wu (2008) finds that these spreads have been significantly lower since the original announcement of the TAF program. Finally, McAndrews, Sarkar, and Wang (2008) find that both TAF-related announcements and operations have significant effects on changes in the 3-month LIBOR-OIS spread. The authors also conclude that announcements with regards to the European swap lines have a larger effect, consistent with our conjecture that non-FHLB members were under greater stress in the LIBOR market.

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<sup>26</sup> The divergent results arise in part due the differences in the TAF-related announcements and operations examined and whether the level or changes in the LIBOR-OIS spread are affected.

The introduction of the TAF and swap lines also had important implications for the relative attractiveness of FHLB advances as most FHLB members are eligible for the TAF. Figure 9 displays the all-in cost of borrowing via the TAF for each of the auctions since its inception in December 2007 through June 2008 relative to an advance from the New York FHLB (see Appendix A for our all-in cost measure for the TAF). It illustrates that with the exception of the first two auctions, the TAF all-in cost was either on par with the FHLB or better as a source of funding according to our measure through March 2008. However, this changed in a dramatic way in April when the all-in cost spread between the TAF and the FHLB rose to 52 basis points as liquidity pressure returned to unsecured term funding markets. Since, May TAF has been a cheaper source than the FHLB and in part this can explain the leveling of in the amount of outstanding advances from March 2008 (see Figure 1).

While the FHLB System was the lowest-cost source of secured term funding for U.S. depository institutions during fall 2007, the new liquidity facilities created by the Federal Reserve in December 2007 complemented FHLB advances by extending “stigma-free” term dollar credit to non-FHLB members including foreign institutions.

### ***March 2008: Single-tranche OMO, TSLF, and PDCF***

Through the winter, liquidity pressures manifested themselves through the unwillingness of institutions to extend term unsecured credit. However, by the spring of 2008, liquidity pressures began to infect the secured funding markets. While pre-crisis Federal Agency repo interest rates were only nine basis points above Treasury repo spreads, these spreads had blown out into the 70-90 basis point range in early March. As highly-leveraged users of repo credit, broker-dealers were hit especially hard by these liquidity pressures. Notably, some of these institutions are owned by financial holding companies that are affiliated commercial banks. As discussed above, during the fall of 2007, the Federal Reserve granted a number of waivers of Section 23A

restrictions on lending by banks to affiliates in order to permit banks to support the liquidity needs of their broker-dealer affiliates. However, Table 7 documents that a number of large primary dealers did not have commercial banking affiliates, which limited their ability to deal with these liquidity problems.

The initial response of the Federal Reserve to alleviate these pressures was the introduction of the Single-Tranche Open Market Operation (Single-Tranche OMO) program on March 7, 2008. Then on March 10, 2008 the Federal Reserve announced an expansion of its securities lending program, the Term Securities Lending Facility (TSLF), to allow primary dealers to swap a range of securities (including AAA/Aaa-rated asset-backed securities) for U.S. Treasuries (for a fee). However, liquidity pressures in secured funding markets worsened that week and the most highly-leveraged primary dealer, Bear Stearns, had to accept a buyout from JP Morgan Chase in order to avoid bankruptcy.<sup>27</sup> After Bear Stearns, the Federal Reserve expanded access to the Discount Window by creating the Primary Dealer Credit Facility (PDCF).

The scale and scope of Federal Reserve lending increased significantly in March 2008 with the introduction of the single-tranche OMO, the TSLF, and the PDCF. Each of these facilities was designed to provide secured funding to primary dealers which did not have direct access to either FHLB advances or the Federal Reserve's Discount Window.

### ***July and September 2008: Concerns about Fannie Mae and Freddie Mac***

The reduction of the discount rate to 25 basis points over the federal funds target in March, 2008 established parity in terms of the all-in cost of Discount Window loans and FHLB advances

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<sup>27</sup> In order to facilitate the takeover, the Federal Reserve Bank of New York in consultation with the U.S. Treasury financed approximately \$30 billion of assets from Bear Stearns via the Maiden Lane LLC.

(according to our measure). During the following months, the Discount Window became more attractive from a pricing perspective (see Figure 6). An important reason for this was a negative change in investor attitudes towards Federal Agency debt issues, which raised their relative borrowing costs. Moreover, in July 2008 concerns about the financial health for Fannie Mae and Freddie Mac led Congress to grant temporary authority to increase the lines of credit for the housing GSEs to any amount deemed appropriate by the Secretary of U.S. Treasury. The FHLB System in part found itself “guilty by association” and saw additional pressures in terms of funding.

In September 2008, the Treasury announced a three-part plan aimed at stabilizing the residential mortgage finance market. First, the regulator of all three housing GSEs, the Federal Housing Finance Agency, placed Fannie Mae and Freddie Mac into conservatorship. Second, the Treasury established a Federal Agency MBS purchase program. Finally, the Treasury announced the creation of a GSE credit facility for Fannie Mae, Freddie Mac, and the FHLB System to be operated by the Federal Reserve Bank of New York. Such loans will be fully collateralized (using either Federal Agency MBS or FHLB advances) and priced at LIBOR plus 50 basis points. The direct effect of these three announcements was a marked tightening in the spreads between Federal Agency debt and mortgage-backed securities and comparable Treasury securities. However, given the terms of Fannie Mae's and Freddie Mac's conservatorships; the debt spreads for these two GSEs tightened more than those offered by the FHLB System.

### ***The Balance Sheets of the FHLB System and the Federal Reserve***

While both the FHLB System and the Federal Reserve have lent significant sums (with interest and against collateral) during the financial crisis, there are important differences in terms of balance sheet mechanics. As the FHLB System has increased lending, its balance sheet has expanded proportionately. FHLB advances are funded with consolidated obligations plus capital



stock that members are required to purchase as a condition of their advance borrowings. Hence, the leverage of the FHLB System remained unchanged in the face of its tremendous growth during the second half of 2007.

By contrast, the size of the Federal Reserve's balance sheet remained virtually unchanged through the August 2008, but the composition of assets was altered markedly. The Federal Reserve has lent out cash by either selling from its holdings of U.S. Treasuries or not replenishing its portfolio as issues matured. Consequently, the Federal Reserve's holdings of Treasury securities fell substantially over time (Figure 10).

If not for the FHLB System, the Federal Reserve would likely have faced a significant demand for borrowing at the Discount Window in August 2007 and onwards. In that case, the Federal Reserve would have had a very different balance sheet position when banks faced renewed liquidity pressures at the end of 2007 or primary dealers faced similar circumstances in March 2008. Under the counter-factual experiment of all new FHLB lending having instead been delivered via the Discount Window and sterilized, the amount of unencumbered outright holdings of U.S. Treasury securities on the Federal Reserve's balance sheet at the end of August 2008 would have been below \$100 billion. Hence, this could have influenced the Federal Reserve's design and funding of the various new liquidity facilities. Moreover, the Supplementary Financing Program (SPF) and the authority to pay interest on reserves would likely have been enacted earlier.

## **Conclusion**

The ongoing global financial crisis has provided an opportunity to learn about the roles of many often-overlooked financial institutions and financial markets. The often-overlooked FHLB System was one of the first institutions to emerge as an important provider of government-sponsored liquidity. Indeed, it was about eight months into the crisis before the Federal Reserve

eclipsed the FHLB System in terms of crisis-related lending to the financial system. Nevertheless, the FHLB System remains, by far, the largest lender to U.S. depository institutions while most of the Federal Reserve's liquidity operations have been for the benefit of non-depository or foreign financial institutions. Without the FHLB System, the Federal Reserve likely would have faced significant demand for borrowing at the Discount Window at a much earlier stage of the crisis.

It is commonly noted that the structure of the current supervisory framework and safety net for U.S. financial institutions is antiquated and fragmented. The lender of last resort framework is no exception in that regard. Besides the Federal Reserve's Discount Window (and related liquidity facilities) and the FHLB System, there also exists the Central Liquidity Facility for credit unions (managed by the federal credit union regulator, the National Credit Union Administration) and the credit facilities provided by the U.S. Treasury to each of the three housing GSEs. Nevertheless, despite the institutional complexity of the existing lender of last resort framework, the ultimate lender of last resort is the U.S. Treasury and, by extension, the American taxpayers.

The tremendous upheaval in global financial markets and the perceived ineffectiveness of U.S. financial regulation, suggests to us that it would be helpful for Congress to revisit the roles of the respective lender of last resort facilities. In particular, the fact that different lender of last resort facilities have at the same time complemented and competed with each other, raises important policy questions about which agencies of government should act as the lender of last resort and under what terms and conditions. The Federal Reserve's and Treasury's new, but ostensibly temporary, lending facilities coupled with the recent proposal to anoint the Federal Reserve as the "market stability regulator" (U.S. Treasury 2008) are clear indications of changes to come.

## Appendix A: All-in Cost Measures

A direct comparison of lending rates between the FHLB System and the Federal Reserve is complicated by several factors. First, unlike within the Federal Reserve System, advance rates vary across individual FHLBs. We choose the 30-day advance rate from the FHLB New York. Second, on the margin, any borrowing from a FHLB requires a simultaneous investment in capital stock. Consistent with the FHLB New York, we assume that this activity requirement is 4.5 percent of the borrowed amount and that this investment is financed at the one month LIBOR rate. The stock investment, however, also earns dividends that we assume are six percent. Third, borrowings from the Discount Window can be prepaid (and hence the rate reset), while the rate on 30-day advances is fixed for the duration. We use the spread between the one month overnight index swap rate and the federal funds target to control for expected changes discount rate. Fourth, while borrowings at both institutions have to be collateralized, the haircuts differ across collateral classes. The Discount Window haircuts have remained unchanged since September 2006 whereas the FHLB New York adjusted its haircuts upwards in April of 2008. In order to account for these factors, we computed the all-in costs for the Discount Window and the FHLB New York as:

$$\text{All-in cost at Discount Window} = (1 - \alpha_{DW}) \times (PCR + OIS - FFR) + \alpha_{DW} \times LIBOR \quad (1)$$

$$\text{All-in cost at TAF} = (1 - \alpha_{DW}) \times (TAF + OIS - FFR) + \alpha_{DW} \times LIBOR \quad (2)$$

$$\text{All-in cost at FHLB New York} = (1 - \alpha_{FHLB}) \times FHLBNY + (\alpha_{FHLB} + \theta) \times LIBOR - \theta \times DIV \quad (3)$$

where  $\alpha_{DW}$ : Discount Window haircut (7 percent),  $\alpha_{FHLB}$ : FHLB New York haircut = 10 percent (12 percent after April 9<sup>th</sup>, 2008),  $PCR$ : The primary credit rate (discount rate),  $TAF$ : Stop out rate from TAF,  $LIBOR$ : London interbank offer rate (one month, USD),  $FHLBNY$ : Federal Home Loan Bank of New York 30 day advance rate,  $OIS$ : Overnight index swap rate (one month USD),

*FFR*: Federal funds rate target,  $\theta$ : Capital stock purchase activity requirement (4.5 percent), *DIV*: Dividend rate (6.0 percent).

For illustrative purposes, in Table A1 below, we compute the all-in cost measures using data from September 11, 2007. We focus on a AAA-rated Federal Agency mortgage-backed security with a market value of \$1 million that needs to be financed for one month. The all-in cost at the FHLB New York was 5.08 percent compared to the lending rate at 5.01 percent – a difference of seven basis points. At the time the primary credit rate stood at 5.75 but less than a week later the federal funds rate target was lowered by 50 basis points. The OIS indicated that the federal funds rate, on average, would be 34 basis points lower over the next month. Hence, the all-in expected cost of the discount window was 5.41 percent implying a spread in all-in costs between FHLB New York and the discount window of 33 basis points in favor of FHLB New York.

**Table A1: All-in Cost Measure Computation**

30-day Advance from FHLB New York versus 30-day Loan from Federal Reserve Discount Window  
Data for September 11, 2007

<b>30-day loan/advance</b>	<b>FHLB New York</b>	<b>Discount Window</b>
AAA-rated Agency MBS collateral pledged	1,000,000	1,000,000
Haircut	10%	7%
Advance (subtotal)	900,000	930,000
Activity Stock Purchase Requirement	4.50%	NA
Stock purchase	40,500	NA
Remaining left to fund	140,500	70,000
Lending rate	5.01	5.75
1-month LIBOR	5.80	5.80
Dividend rate	6.00	NA
One month OIS - Federal Funds Target	NA	-0.34
<b>All-in cost</b>	<b>5.08</b>	<b>5.41</b>

Source: Bloomberg and authors' calculations

## Tables

**Table 1: Federal Home Loan Bank Size and Membership by District as of 12/31/2007**

<b>FHLB</b>	<b>Total Assets</b>	<b>Number of Members</b>	<b>Membership Concentration (Five Largest Members)</b>	
	\$ Billion		Share of Capital	Share of Advances
<b>Atlanta</b>	\$189.7	1,217	47.3%	55.2%
<b>Boston</b>	\$78.3	457	52.3%	61.2%
<b>Chicago</b>	\$89.1	841	30.0%	42.1%
<b>Cincinnati</b>	\$87.5	725	50.5%	61.9%
<b>Dallas</b>	\$63.6	886	49.5%	58.7%
<b>Des Moines</b>	\$60.8	1,243	47.9%	51.6%
<b>Indianapolis</b>	\$56.1	421	48.3%	57.2%
<b>New York</b>	\$109.7	291	47.4%	48.3%
<b>Pittsburgh</b>	\$101.2	332	66.7%	72.2%
<b>San Francisco</b>	\$323.0	405	74.9%	79.0%
<b>Seattle</b>	\$64.2	380	58.0%	70.5%
<b>Topeka</b>	\$55.4	877	41.0%	53.3%

Source: Federal Home Loan Banks 2007 Combined Financial Report, authors' calculations

**Table 2: Federal Home Loan Bank System Combined Balance Sheet as of 12/31/2007**

	<b>Amount (\$ Billions)</b>	<b>Share of Assets (%)</b>
<b>Assets</b>		
Advances	\$875.1	68.7
Cash & Investments	299.0	23.4
Mortgage Loans (Net)	\$91.6	7.2
Other Assets	\$8.8	0.7
Total Assets	\$1,274.5	100.0
<b>Liabilities and Capital:</b>		
Consolidated Obligations (Net)	\$1,178.9	92.5
Other Liabilities	\$42.0	3.3
Membership Capital Stock	\$50.3	3.9
Retained Earnings	\$3.7	0.3
Other Comprehensive Income	(\$0.4)	0.0
Total Liabilities and Capital	\$1,274.5	100.0

Source: Federal Home Loan Banks 2007 Combined Financial Report, authors' calculations

**Table 3: Largest Dollar Increases in Advances by FHLB Members: 2007:Q2 to 2007:Q4**

	Change in Advances Q2 - Q4 2007	Advances Q4 2007	Assets Q4 2007	Advances/Assets Q2 2007	Advances/Assets Q4 2007
	\$ Billions			Percent	
<b>Washington Mutual</b>	42.4	63.9	325.8	6.9	19.6
<b>Bank of America</b>	25.5	57.2	1,667.4	2.2	3.4
<b>Countrywide, FSB</b>	18.9	47.7	121.1	28.9	39.4
<b>Merrill Lynch</b>	11.7	11.7	115.8	-	10.1
<b>Wachovia Corp.</b>	11.3	41.9	740.8	4.5	5.7
<b>Wells Fargo &amp; Co</b>	11.1	11.3	529.8	0.0	2.1
<b>Citigroup</b>	8.3	102.0	1,351.3	7.6	7.6
<b>PNC</b>	7.3	8.7	131.2	1.2	6.6
<b>Capital One</b>	5.9	6.8	132.3	0.7	5.2
<b>US Bank</b>	5.7	17.2	238.4	5.1	7.2
<b>Total/Average</b>	148.1	368.3	5,354.0	4.6	6.9

Note: Merrill Lynch = Merrill Lynch Bank USA and Merrill Lynch Bank & Trust Co., FSB

Source: Call and Thrift reports

**Table 4: Aggregate Call and Thrift Reports**

**Panel A. Q1 2006 to Q2 2007 (average quarterly growth rate and change)**

	<b>Percent of Assets</b>	<b>Large Percent Growth</b>	<b>Change in Ratio to Assets</b>	<b>Percent of Assets</b>	<b>Small Percent Growth</b>	<b>Change in Ratio to Assets</b>
<b>Assets</b>						
Cash	3.96%	3.99%	0.08%	3.09%	0.52%	-0.04%
Securities	15.07%	0.12%	-0.24%	17.77%	-0.46%	-0.44%
Fed Funds and Repos	5.10%	1.78%	0.00%	1.89%	1.76%	0.00%
Trading Assets	7.21%	5.90%	0.27%	0.13%	55.79%	0.02%
Total Loans	58.82%	1.45%	-0.14%	71.31%	2.50%	0.41%
Mortgage Loans	35.24%	1.33%	-0.12%	56.18%	2.54%	0.34%
Non-Mortgage Loans	24.20%	1.59%	-0.02%	15.94%	2.32%	0.06%
Total Assets		1.68%			1.91%	
<b>Liabilities</b>						
Deposits	62.01%	1.77%	0.05%	78.29%	1.94%	0.02%
Fed Funds and Repos	7.94%	1.54%	-0.01%	2.80%	3.06%	0.03%
Trading Liabilities	3.07%	1.45%	-0.01%	0.01%	38.45%	0.00%
Other Borrowing	11.44%	1.18%	-0.06%	7.79%	0.45%	-0.12%
Of Which: FHLB Advances	4.94%	0.37%	-0.07%	7.54%	0.23%	-0.13%

**Panel B. Q3 2007 (actual quarterly growth rate and change)**

	<b>Change in Ratio to Assets</b>	<b>Large Percent of Assets</b>	<b>Change in Ratio to Assets</b>	<b>Percent of Assets</b>	<b>Small Change in Ratio to Assets</b>	<b>Percent of Assets</b>
<b>Assets</b>						
Cash	3.65%	-2.42%	-0.24%	2.84%	-6.12%	-0.24%
Securities	14.15%	0.35%	-0.51%	17.63%	2.38%	0.13%
Fed Funds and Repos	5.38%	10.19%	0.30%	1.62%	-7.04%	-0.15%
Trading Assets	7.69%	10.16%	0.43%	0.11%	-10.77%	-0.02%
Total Loans	58.92%	3.40%	-0.32%	71.83%	1.88%	0.17%
Mortgage Loans	34.76%	1.66%	-0.79%	56.76%	1.96%	0.17%
Non-Mortgage Loans	24.82%	6.10%	0.50%	15.90%	1.62%	0.00%
Total Assets		3.97%			1.65%	
<b>Liabilities</b>						
Deposits	60.82%	2.05%	-1.15%	77.41%	0.53%	-0.86%
Fed Funds and Repos	7.28%	-4.59%	-0.65%	2.73%	4.99%	0.09%
Trading Liabilities	3.36%	13.74%	0.29%	0.01%	11.63%	0.00%
Other Borrowing	13.13%	18.85%	1.64%	8.51%	9.24%	0.59%
Of Which: FHLB Advances	6.33%	31.68%	1.33%	8.26%	9.07%	0.56%



**Panel C. Q3 2007 (actual quarterly growth rate and change)**

	<b>Percent of Assets</b>	<b>Large Percent Growth</b>	<b>Change in Ratio to Assets</b>	<b>Percent of Assets</b>	<b>Small Percent Growth</b>	<b>Change in Ratio to Assets</b>
<b>Assets</b>						
Cash	3.79%	6.51%	0.14%	3.12%	11.72%	0.27%
Securities	13.37%	-2.86%	-0.75%	17.35%	0.39%	-0.31%
Fed Funds and Repos	5.89%	12.40%	0.52%	1.59%	-2.27%	-0.07%
Trading Assets	8.25%	9.86%	0.55%	0.09%	-11.03%	-0.01%
Total Loans	58.79%	2.28%	-0.16%	71.83%	2.32%	0.09%
Mortgage Loans	34.34%	1.36%	-0.41%	56.84%	2.43%	0.13%
Non-Mortgage Loans	25.22%	4.05%	0.36%	15.84%	2.06%	-0.02%
Total Assets		2.57%			2.20%	
<b>Liabilities</b>						
Deposits	61.08%	3.05%	0.29%	76.77%	1.28%	-0.70%
Fed Funds and Repos	7.21%	1.57%	-0.07%	2.96%	11.77%	0.25%
Trading Liabilities	3.34%	2.00%	-0.02%	0.01%	6.50%	0.00%
Other Borrowing	13.20%	3.05%	0.06%	9.00%	8.91%	0.55%
Of Which: FHLB Advances	6.43%	3.96%	0.09%	8.75%	9.19%	0.56%

**Table 5: Changes in the Correlation of FHLB Advances with Balance Sheet Items**

	(1) Before crisis	(2) Q207 to Q307	(3) Q307 to Q407
<b>1. Large Institution</b>	-0.003 (0.001)***	-0.002 (0.002)	-0.000 (0.002)
<b>2. (Change in Cash)/Assets</b>	0.304 (0.007)***	0.498 (0.018)***	0.368 (0.018)***
<b>3. Large*(Change in Cash)/Assets</b>	0.038 (0.099)	-0.287 (0.165)*	-0.158 (0.205)
<b>4. (Change in Fed Funds and Repos)/Assets</b>	0.385 (0.006)***	0.433 (0.012)***	0.392 (0.013)***
<b>5. Large*(Change in Fed Funds and Repos)/Assets</b>	-0.317 (0.045)***	0.150 (0.084)*	-0.321 (0.084)***
<b>6. (Change in Trading Assets)/Assets</b>	0.051 (0.018)***	0.287 (0.123)**	0.139 (0.107)
<b>7. Large*(Change in Trading Assets)/Assets</b>	0.154 (0.101)	0.117 (0.319)	-0.149 (0.181)
<b>8. (Change in Mortgage Loans)/Assets</b>	0.506 (0.005)***	0.587 (0.011)***	0.521 (0.011)***
<b>9. Large*(Change in Mortgage Loans)/Assets</b>	-0.109 (0.034)***	0.068 (0.054)	-0.287 (0.087)***
<b>10. (Change in Non-Mortgage Loans)/Assets</b>	0.483 (0.007)***	0.566 (0.016)***	0.517 (0.016)***
<b>11. Large*(Change in Non-Mortgage Loans)/Assets</b>	-0.387 (0.050)***	-0.770 (0.187)***	-0.305 (0.110)***
<b>12. (Change in Funding)/Assets</b>	-0.451 (0.004)***	-0.508 (0.009)***	-0.470 (0.010)***
<b>13. Large*(Change in Funding)/Assets</b>	0.231 (0.032)***	0.007 (0.057)	0.251 (0.081)***
<b>14. Observations</b>	21,593	4,379	4,473
<b>15. R-squared</b>	0.38	0.48	0.42

Notes: Standard errors in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 6: LIBOR Panel Banks and their Access to FHLB Advances and the Discount Window**

<b>Libor Panel</b>	<b>FHLB Member?</b>	<b>Discount Window</b>
Bank of America	Yes	Yes
Bank of Tokyo - Mistubishi UFJ	Union Bank of CA	Union Bank of CA
Barclays Bank plc	No	Yes
Citibank NA	Yes	Yes
Credit Suisse	No	Yes
Deutsche Bank AG	No	Yes
HBOS	No	Yes
HSBC	HSBC Bank USA, NA	HSBC Bank USA, NA
JP Morgan Chase	Yes	Yes
Lloyds TSB Bank plc	No	Yes
Rabobank	Rabobank, NA	Yes
Royal Bank of Canada	RBC Centura	Yes
The Norinchukin Bank	No	Yes
The Royal Bank of Scotland Group	Citizens Bank of Pennsylvania and RBS Citizens, NA	Yes
UBS AG	No	Yes
West LB AG	No	Yes

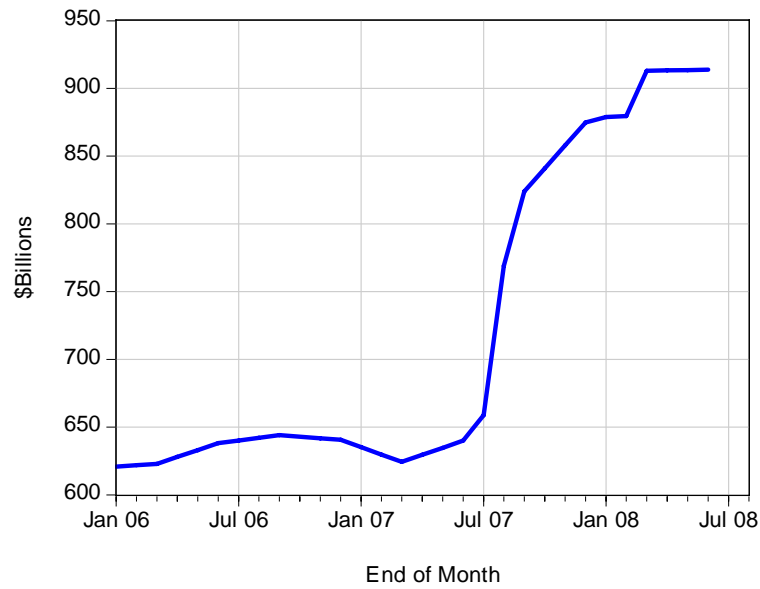
Source: British Banker's Association, Federal Home Loan Bank System, and Call and Thrift Reports. Membership measured over the period July 2007 through March 2008

**Table 7: Primary Dealers**

<b>Primary Dealers</b>	<b>Commercial bank affiliate?</b>	<b>Section 23A waiver</b>
BNP Paribas Securities Corp	Foreign bank	No
Banc of America Securities LLC	US Depository institution	Yes
Barclays Capital Inc.	Foreign bank	Yes
Bear, Stearns & Co., Inc	No	No
Cantor Fitzgerald & Co.	No	No
Citigroup Global Markets, Inc	US Depository institution	Yes
Credit Suisse Securities (USA) LLC	Foreign bank	No
Daiwa Securities America Inc.	Foreign bank	No
Deutsche Bank Securities Inc	Foreign bank	Yes
Dresdner Kleinwort Securities Inc	Foreign bank	No
Goldman, Sachs, & Co.	No	No
Greenwich Capital Markets, Inc.	Foreign bank	Yes
HSBC Securities (USA) Inc.	Foreign bank	No
J.P. Morgan Securities, Inc.	US Depository institution	Yes
Lehman Brothers, Inc.	No	No
Merrill Lynch Government Securities Inc.	US Depository institution	No
Mizuho Securities USA Inc	Foreign bank	No
Morgan Stanley & Co. Inc	US Depository institution	Yes
UBS Securities	Foreign bank	No

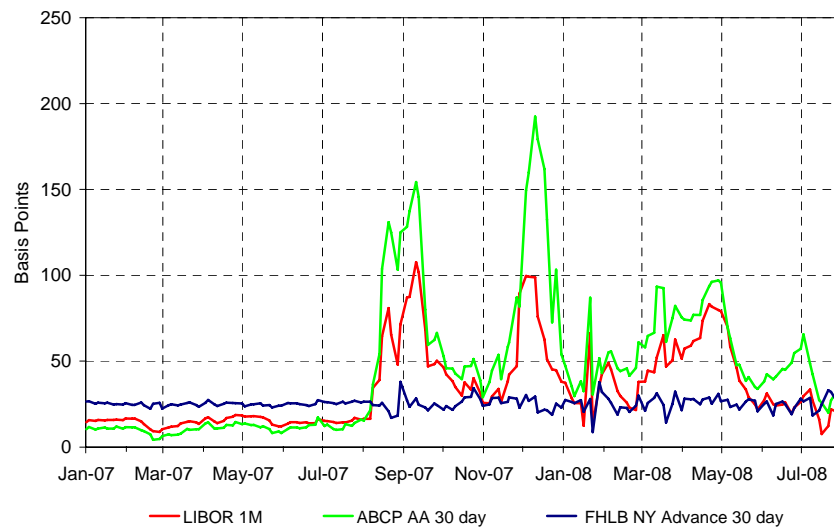
Source: Federal Reserve.

## Figures



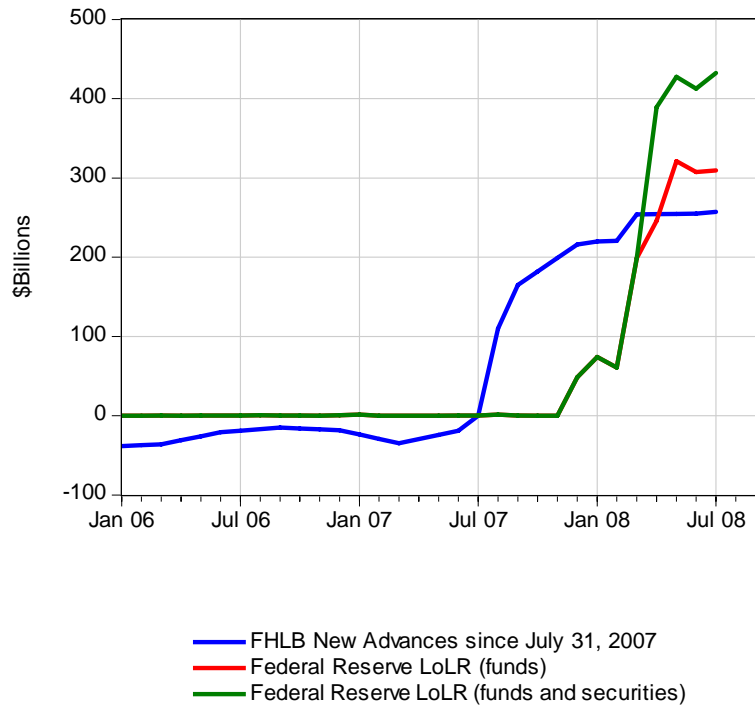
Source: Office of Finance

**Figure 1: Federal Home Loan Bank Advances**



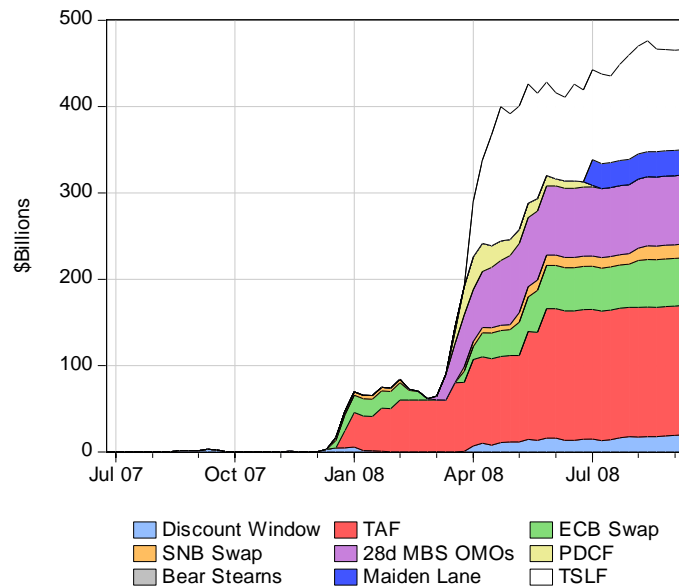
Source: Office of Finance, Bloomberg

**Figure 2: Spread of Selected Funding Rates to 4 Week FHLB Discount Note**



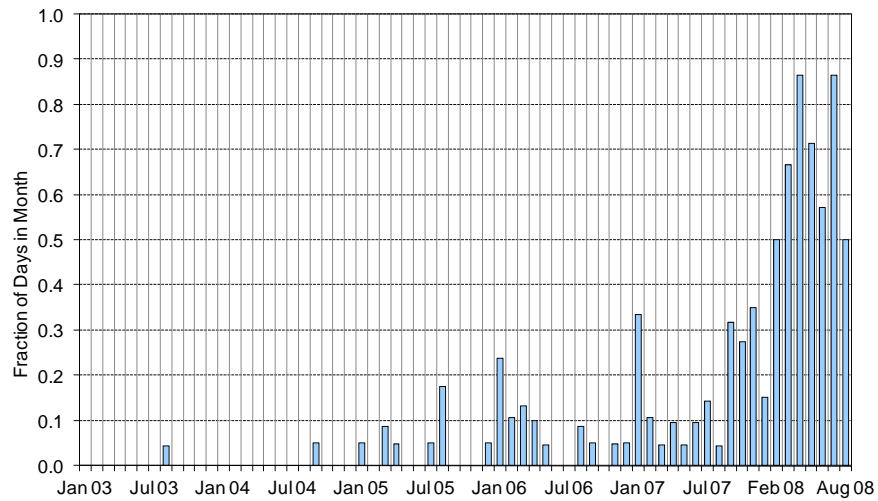
Source: Weekly average values from Federal Reserve Board H.4.1. Release; Federal Reserve Bank of New York; and Federal Home Loan Banks Office of Finance

**Figure 3: Liquidity provided by the Federal Reserve and Federal Home Loan Bank System**



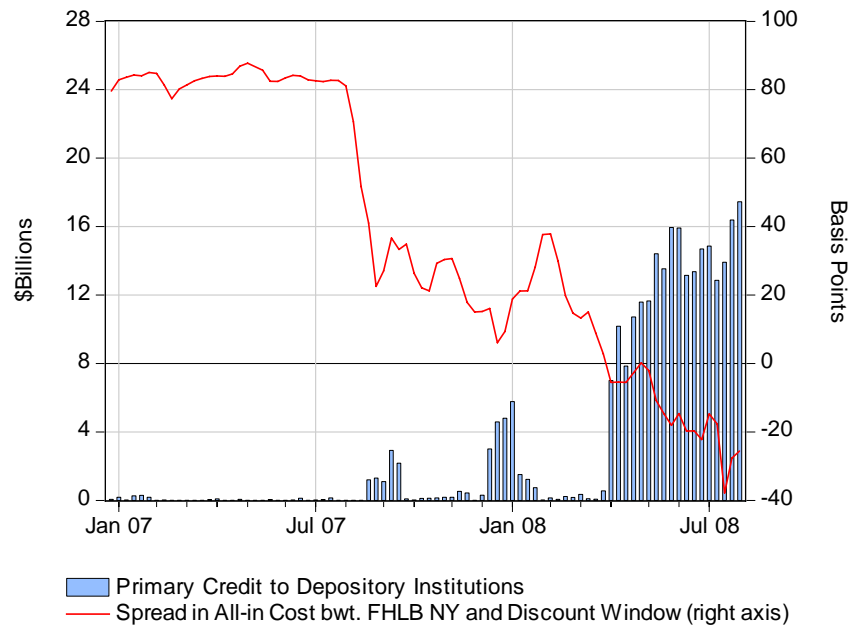
Source: Weekly average values from Federal Reserve Board H.4.1 release and the Federal Reserve Bank of New York

**Figure 4: Liquidity provided by the Federal Reserve**



Source: Federal Reserve Bank of New York

**Figure 5: The Fraction of Days Where Federal Funds Intraday High Exceeds Primary Credit Rate**



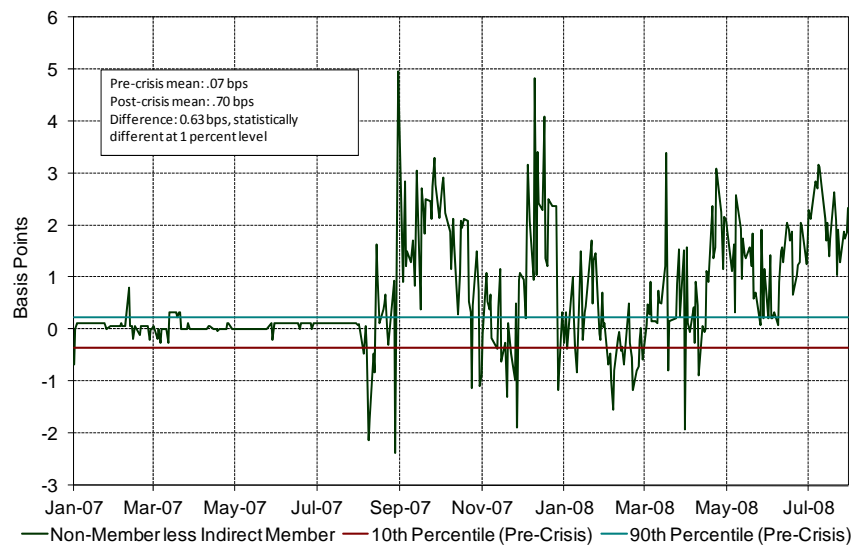
Source: Federal Reserve Board H.4.1. release, the Federal Reserve Bank of New York and the Office of Finance

**Figure 6: Discount Window Borrowings and Spread in All-in Costs between the Federal Reserve and the Federal Home Loan Bank System**



Source: Bloomberg

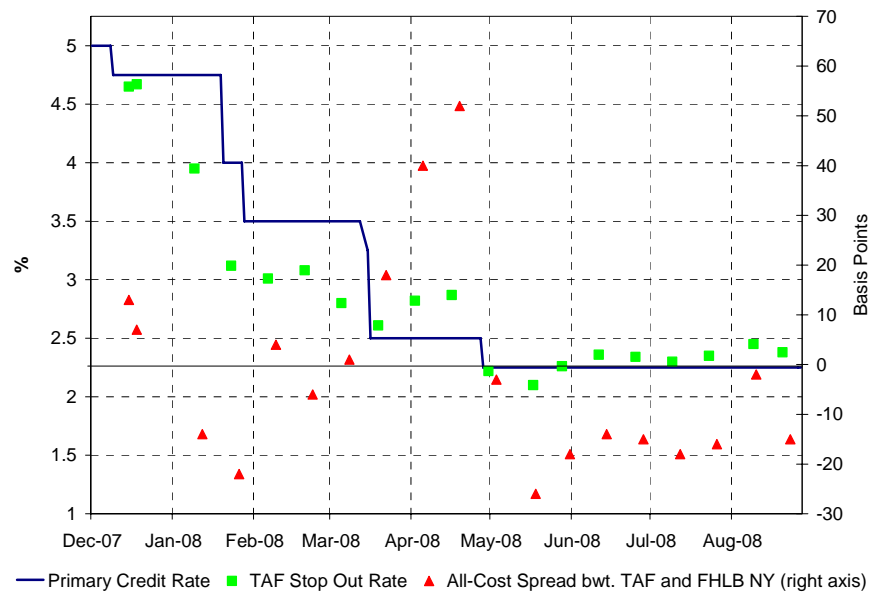
**Figure 7: One Month LIBOR – Overnight Index Swaps Spread**



Source: LIBOR bids from Reuters; FHLB membership from Call and Thrift Reports, FHLB websites, National Information Center

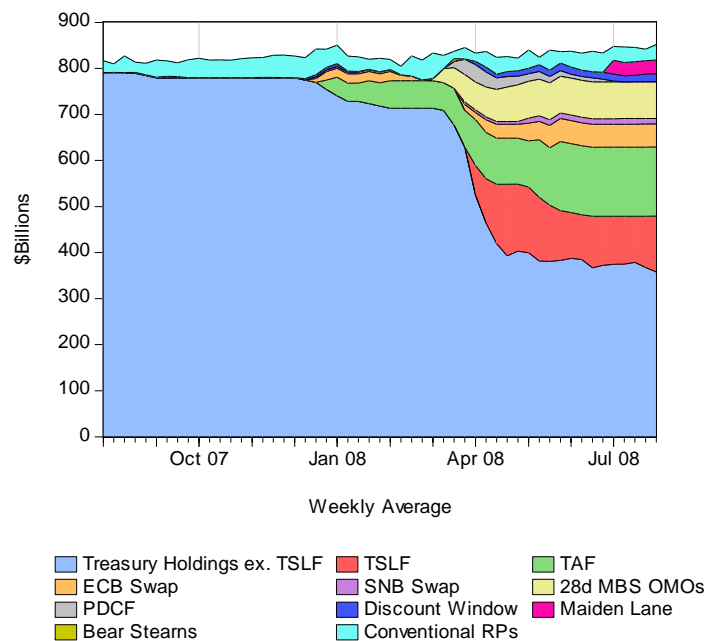
**Figure 8: Non-FHLB member less full member 1-Month Dollar LIBOR Bids, Daily observations, January 2007 to August 2008**





Source: Federal Reserve Bank of New York, Bloomberg, Authors calculations

**Figure 9: Primary Credit Rate, TAF Stop Out Rate and All-in Cost Spread bwt. TAF and FHLB Advance**



Source: Federal Reserve Board H.4.1 release and the Federal Reserve Bank of New York.

**Figure 10: Federal Reserve Domestic Financial Assets**

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