



Credit Supply Disruptions: From Credit Crunches to Financial Crisis

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Abstract

It is useful to reflect on how the financial environment changed in the interim between the bank credit crunch episode in the early 1990s and the recent financial crisis. What did we learn from the earlier crisis and how did the credit crunch literature help guide policy in the more recent crisis? Among the important changes were the consolidation of the banking sector and the dramatic growth in nonbank financial intermediaries, which are much more susceptible than banks to liquidity risks due to a lack of deposit insurance. This paper highlights the fact that while broker-dealers, money market mutual funds, and issuers of asset-backed securities were not particularly important in the early 1990s when the bank credit crunch occurred, they had grown dramatically over the subsequent two decades to become both a major source of financing and a key element in exacerbating the problems experienced during the recent financial crisis.

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Events that transpired during the recent financial crisis highlight the important role that financial intermediaries still play in the economy, especially during economic downturns. While the breadth and severity of the financial crisis took most observers by surprise, it has renewed academic interest in understanding the effects on the real economy of both financial shocks and the changing nature of financial intermediation. This interest in the real effects of financial shocks highlights a literature that began more than 20 years ago associated with the bank credit crunch of the early 1990s. It is useful to reflect on what we thought we had learned from that research and how that research has helped to guide policy in the more recent crisis.

The original research examined how problems at financial institutions that adversely affected bank loan supply could have a broader impact on the real economy. As in the recent financial crisis, the trigger for banking problems in the late 1980s and early 1990s was a decline in U.S. real estate prices. In the earlier episode, real estate prices did decline in particular regions of the United States, especially in New England, but the fall in real estate prices did not occur nationwide, unlike in the most recent crisis. However, because banking markets were more fragmented and localized at that time, the most severe effects of the localized shocks that impacted construction and commercial real estate loans were limited primarily to banks operating in a given region, so the regions that experienced significant declines in real estate values were also the ones that experienced significant increases in bank loan losses and the widespread failure of local banks.

The observation that the significant loss of bank capital could cause capital-constrained banks to shrink lending and that this loss of credit availability could have deleterious effects on the real economy was highlighted in a wide variety of empirical and theoretical papers in the last decade of the previous century. For example, Bernanke and Lown (1991), Hancock and Wilcox (1994), Kashyap and Stein (1995, 2000), and Peek and Rosengren (1995a, 1995b, 1997) all highlight the significant decrease in loan supply resulting from the actions of capital-constrained banks. Although it is extremely difficult to unambiguously separate declines in loan supply from declines in loan demand and to tie any decline in bank loan supply directly to real activity, Peek and Rosengren (2000) were subsequently able to provide a more direct link to the

real economy by showing that an adverse bank capital shock to Japanese banks—which was unrelated to U.S. loan demand—shrank Japanese bank lending in the United States and, importantly, had a significant impact on real activity in the U.S. economy. While it was noted that the real effects depended on bank behavior, for example, behavior related to the substitutability across elements of the banks’ own balance sheets and on borrowers’ ability to substitute between bank financing and other types of financing, the evidence had become reasonably compelling that the availability of credit could be highly relevant to the performance of the real economy when economic downturns were accompanied by problems with depository institutions. Policy circles were initially skeptical, but eventually Chairman Greenspan (for example, Greenspan 1991) began to regularly discuss “headwinds” to monetary policy, an indirect reference to the accumulated problems with credit availability.

Although in the early 1990s the importance of credit crunches, also referred to as bank capital crunches, was controversial (for example, Berger and Udell 1994; Oliner and Rudebush 1996; Sharpe 1995), it was widely assumed during the 2008 financial crisis that credit availability was indeed a problem. Therefore, many of the policy remedies proposed to alleviate credit crunches were, in fact, used during the early stages of the 2008 financial crisis to mitigate potential credit availability problems. These remedies included capital infusions into troubled banks, the provision of liquidity facilities by the Federal Reserve, and, in the initial stress test, a primary focus on raising bank capital rather than allowing banks to shrink assets to maintain, or regain, required capital ratios. These policies helped the banks remain viable and they also helped bank borrowers, including a wide variety of households and firms. Granted, these policy responses did not completely offset the credit availability problems at the time, but they did provide needed support for the recovery of the real economy. Despite the relative weakness of this recovery by historical standards, this policy support helped to situate the U.S. economy in a much better place seven years after the crisis than the positions of most developed economies today.

This paper reflects on the recent crisis through the lens of the earlier research. The next section discusses some of the ways in which the economic environment in the recent financial crisis differed from that of the earlier credit crunch. The paper focuses on two differences that

are particularly striking. The first is the rapidity of both the decline in lending and its subsequent recovery, as reflected both in total loans and especially in commercial and industrial (C&I) loans, beginning in 2008. Second, while depository institutions were important during the recent financial crisis, the real story is the important role played by financial intermediaries that were not traditional commercial banks in amplifying the effects of the crisis. Although the move toward even greater reliance on market-centric financing in the United States over the past 20 years had been assumed by some to reduce the risk of credit crunches, instead the growth of the “shadow banking” sector, the increased reliance on market financing, and the greater interconnectedness of the banking sector with the non-depository financial sector contributed importantly to a key difference between the two episodes, a difference that was reflected in the different labelling of the two crises: the earlier episode was referred to as a bank credit (capital) crunch, the latter as a much-more-widespread financial crisis.

The bank credit crunch literature provided very useful insights during the financial crisis, but the financial environment had changed substantially by 2008: non-depository financial intermediaries had assumed a more important role, and, indeed, these nonbanks played a central role in the crisis. Although the differences between depository and non-depository financial intermediaries were not a focus of attention when the credit crunch literature began, it has become increasingly important to understand these differences. This highlights the need for economists to better understand the constraints faced by non-depository financial intermediaries during financial crises and to learn how to safeguard against the significant disruptions transmitted through these institutions, disruptions that contributed greatly to the severity of the recent financial crisis. In particular, this paper highlights the fact that while broker-dealers, money market mutual funds (MMMFs), and issuers of asset-backed securities were not particularly important in the early 1990s when the bank credit crunch occurred, they had grown dramatically over the subsequent two decades to become both a major source of financing and a central element in exacerbating the problems experienced during the recent financial crisis.

1. Credit Crunches Then and Now

Figure 1 shows total loans outstanding from 1984 to the present in constant 2014 dollars, with shading to reflect the timing of recessions. The decline in lending in the early 1990s spawned a series of articles on the potential spillover effects on the real economy of banking problems, commonly referred to as the bank credit crunch. Lending peaked in 1989:Q4 and did not return to that peak until 1994:Q4. It is striking that this decline in lending occurred despite the fact that the real estate and bank capital problems were not a nationwide phenomenon. The 1990 recession was relatively mild, with a peak unemployment rate of only 7.8 percent in June 1992, and many parts of the country did not experience significant declines in real estate prices or widespread bank failures. Figure 2 shows that while New England and the mid-Atlantic region were particularly impacted in the late 1980s and early 1990s, all regions of the country experienced notable declines in real estate prices during the 2008 financial crisis. The associated literature found that despite the more localized set of problems in the credit crunch, reductions in credit availability were significant and served as a headwind as monetary policy attempted to spur the national economic recovery.

Figure 3 repeats Figure 1 for commercial and industrial loans, whose trajectory similarly played an important role in stimulating the credit crunch literature, since much of this literature focused on constrained lending to firms rather than to households. This figure shows a more substantial decline in C&I lending than Figure 1 showed in total loans, with C&I loans peaking in 1986:Q4 and not regaining the previous peak until 1998:Q1. However, during the recent financial crisis, the decline in C&I loans was much steeper than in the earlier episode and the subsequent rebound was also much more rapid than in the early 1990s.

The credit crunch literature played an important role in the policy discussions associated with the Great Recession. Although the earlier literature was controversial in the immediate aftermath of the 1990 recession, the finding that banking problems could have real effects was not generally disputed by the early stages of the Great Recession. Thus, the knowledge that reductions in credit availability could have real effects informed and helped to tailor some of the earliest responses to the recent financial crisis.

By 2008, it was well understood that capital-constrained banks might choose to shrink assets to maintain their capital ratios above required minimums. Consequently, the initial decision to infuse banks with capital under the Troubled Asset Relief Program was designed in part to encourage banks to continue to lend and to refrain from dramatically reducing their lending capacity. Similarly, the initial stress test (the 2009 Supervisory Capital Assessment Program) required any capital deficiency (shortfall in the capital-to-assets ratio) to be met through increased capital. This forced banks to recapitalize by denying them the alternative of raising their capital-to-assets ratio by shrinking their assets. Although shrinking bank assets might have been less painful initially for shareholders, it would likely have been much more painful to potential borrowers. Thus, despite the severity of the Great Recession, with an unemployment rate that reached 10 percent, C&I lending recovered surprisingly strongly beginning in 2010:Q4.

One of the issues raised by the early literature was that banks substituting among the elements of their balance sheets and firms substituting between intermediated bank loans and direct market financing would reduce the impact of problems emanating from the banking sector (for example, Kashyap and Stein (1994)). Figure 4 shows that in 1989, when much of the earlier credit crunch literature began to be written, the assets of nonbank competitors were small relative to the assets of depository institutions. In fact, the combined assets of MMMFs, broker-dealers, and asset-backed paper issuers were only about 25 percent of depository assets in 1989:Q1. However, over the subsequent years leading up to the financial crisis, these nonbank (shadow bank) alternatives grew significantly, and by the beginning of the financial crisis the assets of these same competitors had grown to more than match the total assets of the depository institutions.

It was often assumed that these nonbank alternative sources of financing would likely be more resilient than banks to economic cycles and to downturns in the value of collateral. This was not the experience during the Great Recession. Rather than being a shock absorber, these nonbank alternatives turned out to be, in some cases, much less resilient than banks. In contrast to the sharp recovery in C&I lending after the financial crisis, the recovery of lending by these nonbank lenders has yet to occur. Figure 4 shows the significant decline in the combined assets

of MMMFs, broker-dealers, and issuers of asset-backed securities relative to the assets of depository institutions following the onset of the financial crisis.

The differences between banks and nonbanks were underappreciated prior to the financial crisis. One reason the credit crunch literature could focus on binding capital ratios at banks is that, with deposit insurance, the reaction of bank liabilities is more muted than the liabilities of other financial intermediaries facing financial difficulties. As a result, banking problems appear primarily as loan losses that impact bank capital and cause pressure on capital relative to assets. For financial intermediaries without deposit insurance, reactions to financial crises are often experienced most severely as a rapid loss of liabilities, which can lead to a fire sale of assets, with the degree of shrinkage determined by the run risk faced by the institution. For these institutions, initial illiquidity can result in an institution's rapid downward spiral into insolvency. Consequently, in many instances non-depository financial institutions suffered much more severely from the financial crisis than banks, and financial markets dependent on these financial intermediaries were much less resilient even after the crisis had subsided. Moreover, the amplitude of the problems at these nonbank financial intermediaries during the crisis led to increased and continuing regulatory scrutiny of their activities. The next section explores the impact of these developments, which were not experienced during the previous credit crunch episode, focusing on three types of intermediaries central to the crisis: broker-dealers, MMMFs, and issuers of asset-backed securities.

2. Sensitivity of Non-Depository Financial Intermediaries to Financial Crises

While shadow banking institutions had been assumed by many to be shock absorbers relative to commercial banks, the exact opposite turned out to be true during the financial crisis. Market-based financing that depended on financing at short maturities from MMMFs and on asset-backed securities was severely impaired during the financial crisis, as were some of the

longer-run financing mechanisms, which were harmed by the inability of broker-dealers to make markets, in turn severely impacting other types of financing.

2.1 Broker-dealers

Broker-dealers and, in particular, the large investment banks played a much more significant role in the financial crisis than in the earlier credit crunch episode. The problems first became severe with the failure of investment bank Bear Stearns, and then critical with the failure of another investment bank, Lehman Brothers. In both cases, the firms had relied heavily on short-term wholesale funding, were unable to issue insured deposits, and, prior to the crisis, had not been part of a bank holding company and therefore lacked direct access to normal discount window operations. In addition, both were regulated by the Securities and Exchange Commission (SEC), under regulatory frameworks that were less focused on prudential regulation than banks and were very different from the regulatory framework within which banks operate. By the time the recovery was under way, all large domestic broker-dealers were incorporated into large bank holding companies. Despite this change, as Rosengren (2014) has emphasized, incorporating broker-dealers into bank holding companies does not fully mitigate the potential risks that emerge when broker-dealers encounter financial difficulties.

Figure 5 illustrates the fact that the assets of broker-dealers in 1990 amounted to less than a trillion dollars, even measured in 2014 dollars. However, the activities of broker-dealers expanded dramatically over the ensuing two decades, with their collective assets growing approximately five-fold. This rapid growth was facilitated both by the liability structure and by the more lenient regulatory oversight of broker-dealers. Figure 6 shows that this growth was facilitated by the use of repurchase agreements (repos), which enabled broker-dealers to finance long-term securities with relatively inexpensive short-term collateralized financing. Because most repos were of very short duration, with many lasting only overnight, a significant spread could exist between the return on the underlying security and the cost of the repo. Furthermore, this spread was enhanced over time, as repos were increasingly used to finance securities that had credit risk, rather than Treasury securities, which did not have credit risk. In analyzing the

financial crisis, Gorton and Metrick (2012) highlight the important role of the run on repos, while Adrian and Shin (2009, 2010) focus on the role of broker-dealer balance sheet financing.

It had generally been assumed that repo financing would be stable during a financial downturn because the securities were fully collateralized, with significant haircuts designed to offset price fluctuations. Should a broker-dealer be unable to repay according to the repurchase agreement, the underlying security could then be sold. However, the liquidity risk embedded in this financing was underappreciated prior to the crisis, in part because of the limited transparency in the market. Even now, broker-dealers provide few details of the collateral they are financing with repos or the maturity structure of their borrowing, since the SEC FOCUS Report provides only *de minimis* information in the public filing (Rosengren 2014). This has enabled large broker-dealers increasingly to finance risky securities with little or no public scrutiny.

As a result of this financing structure, financial disruptions during the financial crisis were manifested very differently in broker-dealer activity than in the activity of more traditional depository institutions. Broker-dealers' initial problems began as a silent run on their ability to finance their securities portfolios. As these financing difficulties became more apparent, they were forced to sell securities. While Treasury securities could generally be sold in very liquid markets and tended to appreciate with the "flight to quality" response to financial problems, the less-liquid and credit-risky securities became illiquid and could be sold only with significant reductions in price. Unlike banks, which have deposit insurance and can therefore dispose of assets over time, broker-dealers are much more susceptible to runs and fire-sale pricing because of the very real run risk they face as a result of their heavy reliance on repos.

This problem was not present during the credit crunch analyzed in the earlier literature. Several facts may explain this difference. In the early 1990s, broker-dealers were small relative to commercial banks, and the use of repurchase agreements to finance riskier debt had not yet become widespread. In addition, the real estate price declines were more localized, so diversified portfolios of real estate assets were not impacted as severely. Furthermore, the securitization of assets was much less important. As a result, the potential for financial market disruption as broker-dealers faced runs and fire sales did not receive significant attention from

economists before the financial crisis. Even after the crisis and despite some changes, the risk to the financial stability of broker-dealers' financing structure is still receiving less attention than is warranted.

The regulatory response to this problem has been muted. Regulations for broker-dealers have not changed since the crisis. However, with most large domestic broker-dealers now embedded in bank holding companies, these broker-dealers are subject to bank holding company capital requirements and liquidity requirements. Nonetheless, as Rosengren (2014) has noted, the ability to finance a broker-dealer within a bank holding company structure is limited, and these limitations have increased with the passage of the Dodd-Frank Act. This is an area where more transparency and renewed attention to broker-dealer regulations would be helpful in the interest of avoiding future financial problems.

2.2 Money Market Mutual Funds

As with broker-dealers, relatively little academic attention was focused on money market mutual funds in the credit crunch literature. At the time of the credit crunch, as Figure 7 shows, MMMF assets were below one trillion dollars, even in 2014 dollars. However, from less than one trillion dollars, MMMF assets had grown to around four trillion dollars by the onset of the financial crisis.

One reason for the lack of attention to MMMFs was that they were perceived as being of relatively low risk. Under the SEC's 2A-7 rules, the riskiness of the assets that MMMFs could hold was constrained, being limited to those with relatively short maturities, and with most of the assets having credit ratings of A1/P1, indicating a relatively low probability of default, at least as viewed by the rating agencies. While MMMFs, like other mutual funds, hold no capital and did not (and do not) have the deposit insurance available to bank deposits, the perception of relatively low risk resulting from the SEC requirements to maintain short maturities and the apparently low credit risk caused many investors to view MMMFs as quite similar to bank deposits. Thus, both individuals and many institutional investors treated MMMF accounts as sufficiently safe to be used as a transactions account.

However, over time, MMMFs had begun to compete on yield. Some funds “reached for yield” by holding longer average maturities and/or taking on more credit risk in their investment portfolios. Among the assets purchased by some funds were structured investment vehicle paper and the commercial paper of more-troubled financial intermediaries that had not yet been downgraded, such as Lehman Brothers, and foreign banks, such as Dexia. With the failure of Lehman and the unraveling of many of the structured investment vehicles, many of the MMMFs experienced losses (for a description of the losses, see Brady, Anadu, and Cooper 2012). While most of the MMMFs had sponsors that were able to provide the support needed to make investors whole, the Reserve Primary Fund did not. When it became clear that the Reserve Primary Fund was going to “break the buck,” resulting in investors’ inability to withdraw the full value of their accounts dollar for dollar, many institutional investors began a run on MMMFs. The run was focused on prime funds that were allowed to hold paper other than government securities and therefore generally offered a slightly higher return.

This run was precipitous, causing a dramatic decline in the assets of prime money market funds in particular, as is apparent in Figure 7. While some investors moved their funds to insured bank accounts, others moved funds to MMMFs that invested only in government securities. To avert failure, the Treasury provided a guarantee for MMMF investors, and the Federal Reserve established a lending facility to support the ability of MMMFs to liquidate their asset-backed commercial paper. However, the run by MMMF investors and the need to dramatically increase liquidity at MMMFs had the effect of severely tightening the availability of short-term credit. MMMFs became less willing to hold commercial paper with credit risk and less willing to hold repurchase agreements on securities not issued or guaranteed by the federal government. This created problems for broker-dealers that were dependent on MMMFs to fund their securities holdings, as well as for companies that had counted on the commercial paper market to finance a wide variety of assets.

Since MMMFs hold no capital, the mechanism of shrinking credit availability is very different than the corresponding mechanism for capital-constrained banks. Again, the absence of deposit insurance made these intermediaries particularly susceptible to runs and fire-sale prices. Because of their relatively small collective size at the time of the credit crunch in the

early 1990s and their very different regulatory structure, the early credit crunch literature had devoted little attention to these organizations. Yet it was these organizations that were responsible for the significant seizing-up of short-term credit markets in the fall of 2008.

The SEC has significantly altered the regulation of MMMFs as a result of the problems during the crisis. In 2010, MMMFs became subject to enhanced liquidity requirements, and in 2014 the SEC adopted rules that required institutional prime MMMFs to adopt floating net asset values (NAVs). Both the enhanced liquidity requirements and the floating NAV for institutional prime MMMFs should help to mitigate any seizing-up of short-term credit in the future. However, the problems with MMMFs have not been fully resolved. For example, the new floating NAV requirement does not apply to retail prime MMMFs. In addition, the SEC allowed individual MMMFs to impose gates and fees on investors in funds experiencing a run. While this would stop a run on an individual fund by preventing investors from immediately accessing their funds that they may have thought were being held in transactions-like accounts, such actions could cause a much-more-widespread run, with investors fleeing all such funds to avoid the potential imposition of gates and fees by their own MMMFs. These omissions and provisions could cause severe problems in a future financial crisis.

2.3 Asset-Backed Securities Issuers

Figure 8 shows the growth in assets of issuers of asset-backed securities (ABS issuers). ABS issuers utilize a particular legal structure called special purpose vehicles (SPVs) to hold assets financed by issuing debt, such as mortgages, consumer loans, automobile loans, and student loans. Prior to the crisis, these structures were used to remove assets from the balance sheets of banks and finance companies. By securitizing these assets, financial institutions could collect fees but no longer needed to hold capital against the assets. This form of shadow banking was viewed as a way to move toward an even more market-centric financing structure. Moreover, as Shin (2009) notes, prior to the crisis many authors had assumed that the primary impact of securitization would be to enhance financial stability.

As mentioned above, ABS issuers received relatively little attention in the earlier credit crunch literature. In part, this is because they were collectively quite small, with much less than

one trillion dollars in assets at the time of the earlier credit crunch. As the figure shows, the assets of ABS issuers increased dramatically in the intervening period, with a marked acceleration just prior to the financial crisis. However, since the financial crisis, the creation of securitized assets has decreased significantly. Again, this type of intermediation became susceptible to investor runs. During the financial crisis, many of the assets that were being securitized had become riskier, resulting in lessened willingness on the part of investors to hold debt issued by an SPV. Moreover, regulatory changes made securitizing assets less attractive to banks and finance companies. In particular, a series of rules and regulations increased required risk retention, strengthened reporting requirements (SEC actions on disclosure), and required representations and warranties per Dodd-Frank (Section 943) that substantially increased the risk of litigation. Thus, the regulatory reaction to problems experienced with many securitizations during the crisis have substantially increased the costs to ABS issuers, and in some areas significant uncertainty surrounding the eventual evolution of securitization remains.

Securitization, which did not play a significant role in the earlier credit crunch episode, created problems during the financial crisis. As structures tied to securitization unraveled, more of the financing had to be provided by financial intermediaries that were already capital constrained by the losses they were experiencing. This significantly increased the cost of financing to many households and individuals. The eventual status of securitization will depend on rules and regulations not yet fully finalized. However, the experience from the financial crisis highlights the importance of undertaking more academic work aimed at understanding how these complicated financial structures work and how they can encounter problems.

3. Responses to Potential Credit Crunches

The credit crunch of the 1990s did engender a regulatory response, but the scale of the response was nowhere near the scale of the response to the financial crisis, which included the comprehensive Dodd-Frank Act, among other actions. In the response to the financial crisis, not only were actions taken to quickly recapitalize financial institutions, but lending facilities were

created to ameliorate the problems created by the runs on, and fire sales by, non-depository financial institutions. This was particularly striking because previously the attention had generally been focused on financing through depository, rather than non-depository, institutions.

A particularly good indicator of the response can be seen by looking at two of the facilities designed to ameliorate the difficulties created by the liquidity and solvency problems of the large broker-dealers. Figure 9 shows the composition of borrowers from the Primary Dealer Credit Facility. Note that the borrowing spiked immediately upon the failure of Bear Stearns and then subsided until the dramatic spike at the time of the Lehman Brothers failure. This latter spike occurred even though Goldman Sachs and Morgan Stanley had become bank holding companies and several other broker-dealers had been acquired by bank holding companies, indicating that despite the exemptions granted for lending to nonbank affiliates, substantial demand remained on the part of those institutions for access to the liquidity available from the Primary Dealer Credit Facility.

Table 1 shows similar information for the Term Securities Lending Facility. This facility was designed to address the problem of broker-dealers obtaining financing for lower-credit-quality assets. Through this program, broker-dealers were able to swap lower-quality securities for Treasury securities that could then be financed. The extensive borrowing from this facility indicates how difficult it had become for broker-dealers to finance non-Treasury securities. By providing liquid financing, the program enabled broker-dealers to avoid selling their lower-quality securities at what would likely have been fire-sale prices during the height of the financial crisis, a development that would have further impaired the financing of securities, even for relatively healthy broker-dealers.

Borrowing from the Federal Reserve facilities was extensive and illustrates just how impaired financing was at many non-depository financial institutions. While these institutions had received relatively little academic scrutiny, they had become critical infrastructure for the continuing movement to more market-centric financing. However, unlike bank financial regulation, which had been designed to mitigate the impact of liquidity and capital shocks, broker-dealer regulation had not positioned these institutions well for either type of shock.

Nonetheless, the realization that credit shocks could be devastating and that restoring credit availability was critical to recovery was a valuable lesson learned from previous periods when the shocks had been more bank centric. This lesson informed the policies that were hastily improvised as the financial crisis accelerated.

The reaction to the financial crisis has resulted in significant changes to both bank supervision and bank regulation. Perhaps the most salutary effect has been movement toward much greater focus on stress tests. The stress tests have become a standard supervisory tool that takes into account capital distributions in the context of bank capital that would be available under stressful situations. To increase dividends or stock repurchases, the largest banks are required to show that such actions would not prevent the bank from maintaining required capital thresholds even under a stress scenario provided by bank regulators. The combination of regular stress tests and higher capital requirements included in the Dodd-Frank Act has resulted in a significant recapitalization of the banking system. Particularly striking has been the increase in capital at the largest, systemically important financial institutions.

Had stricter capital rules and stress tests been in place prior to the financial crisis, banks would have had far larger capital cushions to protect them from emerging problems. An additional innovation has been the substantial attention given to liquidity at large financial institutions. Liquidity issues emerged as a major problem at a number of the largest banks that experienced funding problems during the crisis.

In contrast to the significant improvements in bank regulation in the aftermath of the financial crisis, less success has been achieved in addressing problems in the non-depository financial sector. As Gorton and Metrick (2010) have highlighted, the regulatory response in this area has been much less aggressive, despite the significant role played in the crisis by MMMFs and securitization. Gorton and Metrick (2012) also highlight the significant gaps in liquidity regulation of non-depository financial institutions.

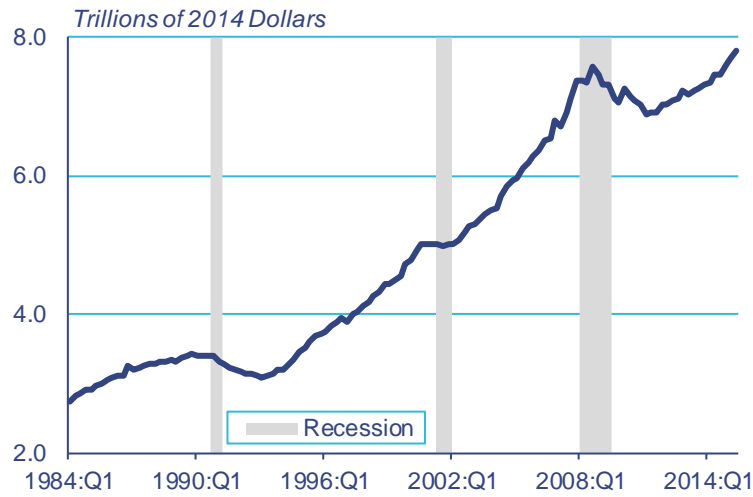
4. Conclusion

The earlier literature on credit crunches contributed importantly to economists' understanding of how financial shocks can impact the real economy. The real estate shock that caused capital-constrained banks to reduce credit availability to households and firms provided an important lesson learned from the 1990 recession and the academic work that followed. That literature provided a helpful guide as to how to respond to adverse credit shocks.

However, many of the financial innovations that occurred after the 1990 recession moved much of the issuance of credit to non-depository financial intermediaries. While the main problem facing banks was how to satisfy capital constraints when experiencing large declines in capital, these nonbank intermediaries were much more susceptible than banks to liquidity shocks, runs on liabilities, and fire sales of assets. Although the earlier literature provided important context, the nature of the problems was quite different for non-depository entities. Because these potential problems of nonbank intermediaries had not arisen in the earlier credit crunch, they were largely ignored in the subsequent credit crunch literature.

Significant regulatory improvements are being implemented for banks. However, for non-depository institutions, much remains to be done. Both policymakers and academics need to better understand the complex interaction of the traditional banking system with shadow banks if we are to be confident that the U.S. economy would be resilient to a future adverse financial shock of a similar magnitude.

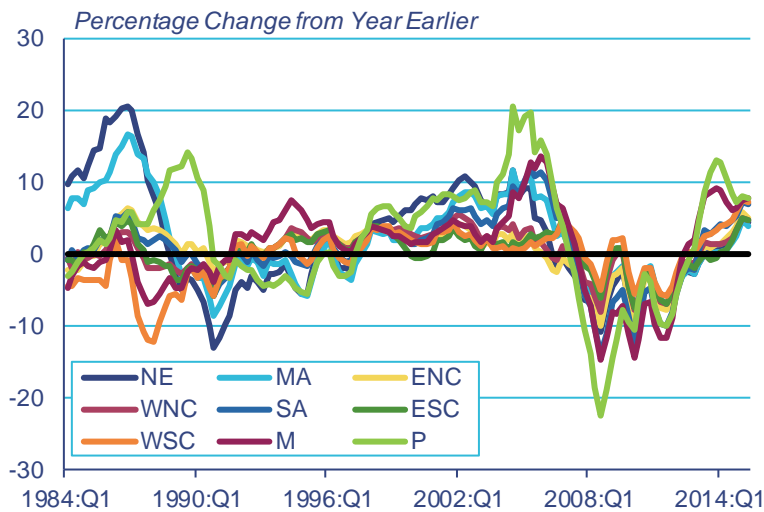
Figure 1: Total Loans Outstanding at Commercial Banks, 1984:Q1–2015:Q2



Note: Figures are adjusted for inflation using the GDP Deflator.

Sources: Commercial Bank Call Reports, BEA, NBER, Haver Analytics

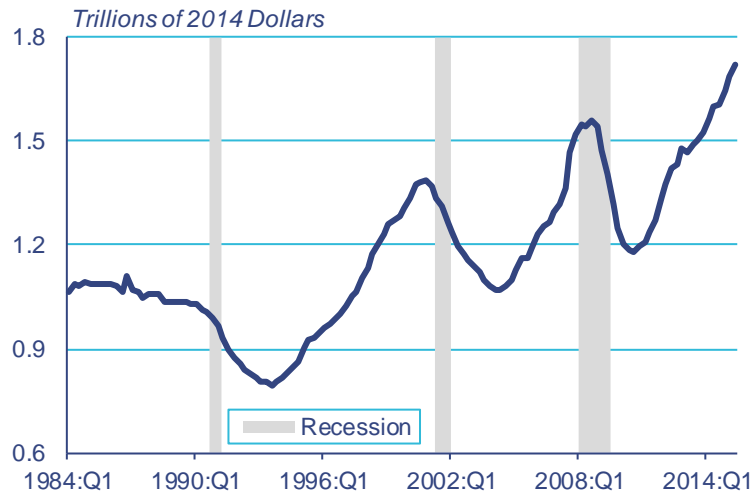
Figure 2: Growth in Real House Prices by Census Region, 1984:Q1–2015:Q2



Note: The nine census regions are: New England (NE), Middle Atlantic (MA), East North Central (ENC), West North Central (WNC), South Atlantic (SA), East South Central (ESC), West South Central (WSC), Mountain (M) and Pacific (P).

Sources: Federal Housing Finance Agency, BLS, Haver Analytics

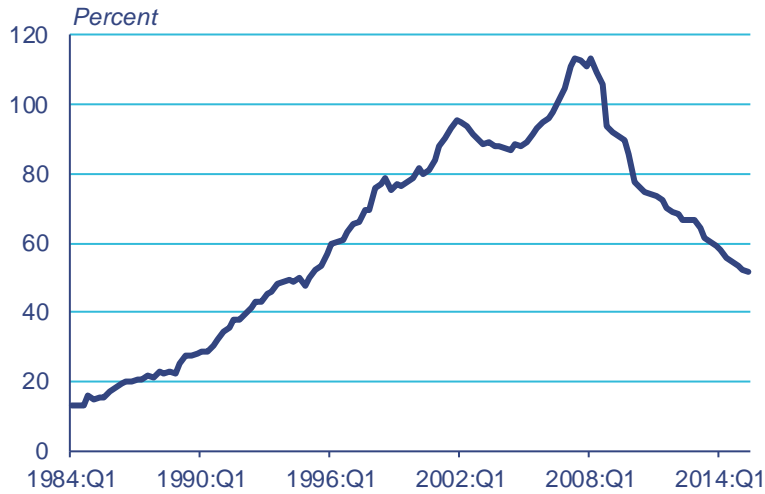
Figure 3: C&I Loans Outstanding at Commercial Banks, 1984:Q1–2015:Q2



Note: Figures are adjusted for inflation using the GDP Deflator.

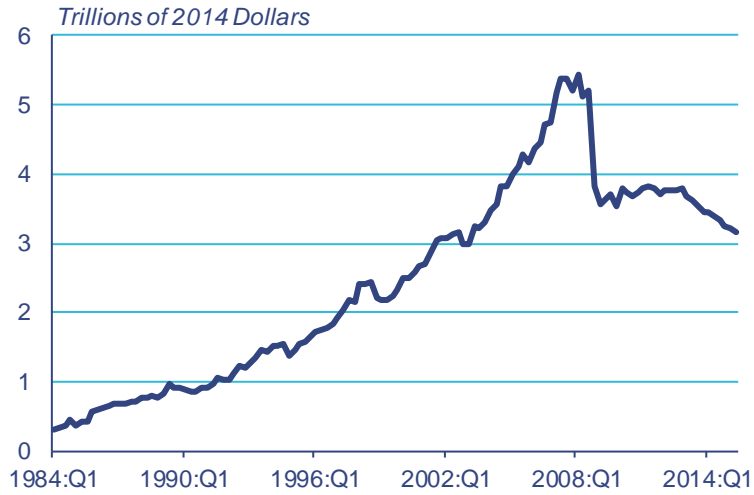
Sources: Commercial Bank Call Reports, BEA, NBER, Haver Analytics

Figure 4: Assets of Security Brokers and Dealers, MMMFs, and ABS Issuers Relative to Assets of U.S.-Chartered Depository Institutions, 1984:Q1–2015:Q2



Sources: Federal Reserve Board, Financial Accounts of the United States, Haver Analytics

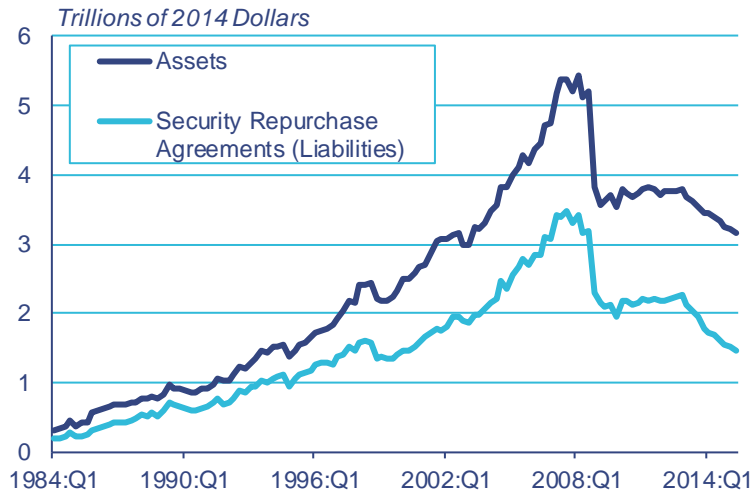
Figure 5: Assets of Security Brokers and Dealers, 1984:Q1–2015:Q2



Note: Figures are adjusted for inflation using the GDP Deflator.

Sources: Federal Reserve Board, Financial Accounts of the United States, BEA, Haver Analytics

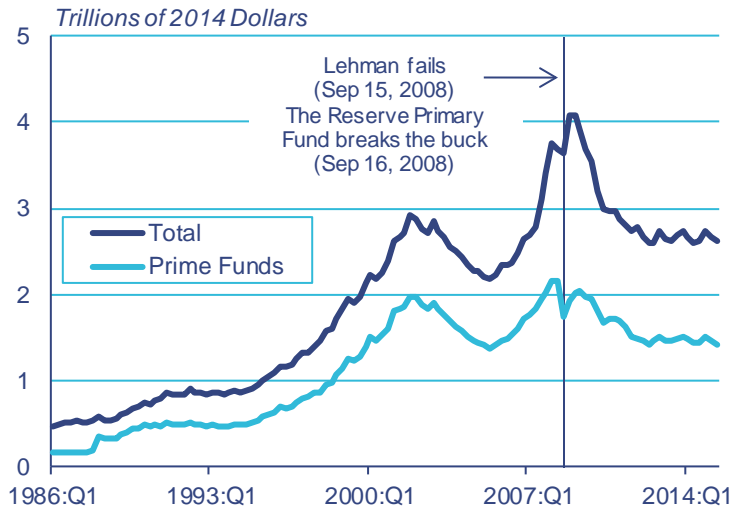
Figure 6: Selected Balance-Sheet Items of Security Brokers and Dealers, 1984:Q1–2015:Q2



Note: Figures are adjusted for inflation using the GDP Deflator.

Sources: Federal Reserve Board, Financial Accounts of the United States, BEA, Haver Analytics

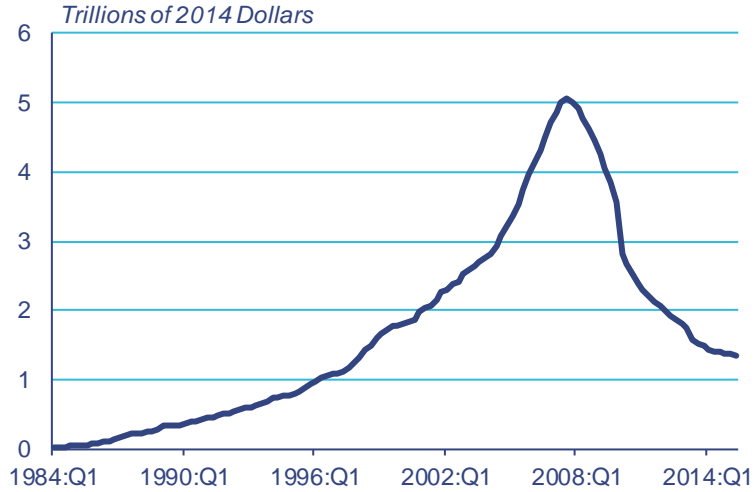
Figure 7: Money Market Mutual Fund Assets Under Management, 1986:Q1–2015:Q2



Note: Figures are adjusted for inflation using the GDP Deflator.

Sources: iMoneyNet, BEA

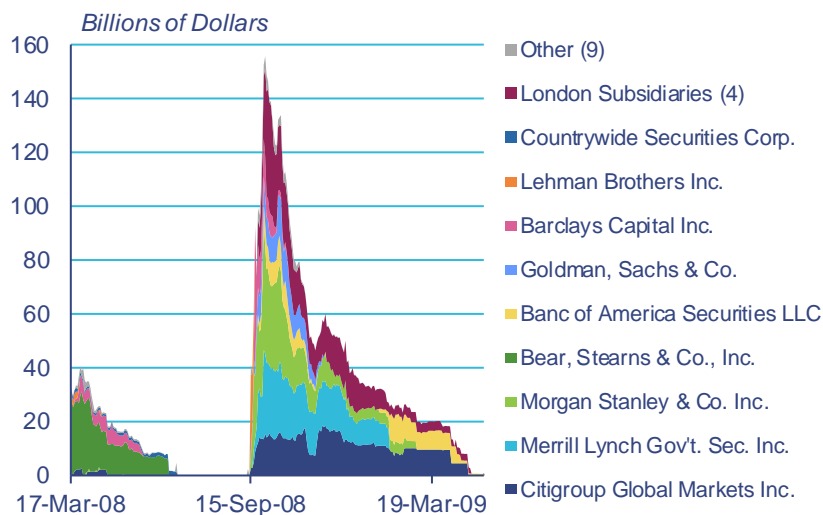
Figure 8: Assets of ABS Issuers, 1984:Q1–2015:Q2



Note: Figures are adjusted for inflation using the GDP Deflator.

Sources: Federal Reserve Board, Financial Accounts of the United States, BEA, Haver Analytics

Figure 9: Primary Dealer Credit Facility Loans Outstanding, March 17, 2008–May 12, 2009



Note: The London subsidiaries are securities subsidiaries of Citigroup, Goldman Sachs, Merrill Lynch, and Morgan Stanley

Source: Federal Reserve Board

Table 1: Term Securities Lending Facility, March 28, 2008–August 14, 2009

Borrower	Number of Loans	Total Borrowed (\$ Millions)
Citigroup Global Markets Inc.	65	297,297
RBS Securities Inc.	58	250,399
Deutsche Bank Securities Inc.	52	239,248
Credit Suisse Securities (USA) LLC	53	224,535
Goldman, Sachs & Co.	53	193,020
Barclays Capital Inc.	65	159,284
Merrill Lynch Government Securities Inc.	39	154,192
UBS Securities LLC	21	109,041
Morgan Stanley & Co. Incorporated	34	101,571
Lehman Brothers Inc.	18	87,023
Banc of America Securities LLC	23	80,189
J.P. Morgan Securities Inc.	23	59,612
BNP Paribas Securities Corp.	21	34,965
Countrywide Securities Corporation	10	6,650
HSBC Securities (USA) Inc.	11	3,000
Cantor Fitzgerald & Co.	9	2,598
Bear, Stearns & Co., Inc.	2	2,000
Dresdner Kleinwort Securities LLC	2	1,073
Total	559	2,005,697

Source: Federal Reserve Board

References

- Adrian, Tobias, and Hyun Song Shin. 2009. "Money, Liquidity, and Monetary Policy." *American Economic Review* 99(2): 600–605.
- _____. 2010. "Liquidity and Leverage." *Journal of Financial Intermediation* 19(3): 418–437.
- Berger, Allen N., and Gregory F. Udell. 1994. "Did Risk-Based Capital Allocate Bank Credit and Cause a 'Credit Crunch' in the United States?" *Journal of Money, Credit and Banking* 26(3), Part 2: 585–628.
- Bernanke, Ben S., and Cara S. Lown. 1991. "The Credit Crunch." *Brookings Papers on Economic Activity*, 1991(2): 205–239.
- Brady, Steffanie S., Ken E. Anadu, and Nathaniel R. Cooper. 2012. "The Stability of Prime Money Market Mutual Funds: Sponsor Support from 2007 to 2011." Federal Reserve Bank of Boston Risk and Policy Analysis Working Paper, August.
- Gorton, Gary, and Andrew Metrick. 2010. "Regulating the Shadow Banking System." *Brookings Papers on Economic Activity* (Fall), 261–312.
- _____. 2012. "Securitized Banking and the Run on Repo." *Journal of Financial Economics* 104(3): 425–451.
- Greenspan, Alan. 1991. "Remarks." 20th Annual Convention of the Securities Industry Association, December 6.
- Hancock, Diana, and James A. Wilcox. 1994. "Bank Capital and the Credit Crunch: The Roles of Risk-Weighted and Unweighted Capital Regulation." *Journal of the American Real Estate and Urban Economics Association* 22(1): 59–94.
- Kashyap, Anil K., and Jeremy C. Stein. 1994. "Monetary Policy and Bank Lending." in Mankiw, N. Gregory (ed.) *Monetary Policy* Chicago: University of Chicago Press, 221–261.
- _____. 1995. "The Impact of Monetary Policy on Bank Balance Sheets." *Carnegie-Rochester Conference Series on Public Policy* 42(1): 151–195.
- _____. 2000. "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?" *American Economic Review* 90(3): 407–428.
- Oliner, Stephen D., and Glenn D. Rudebusch. 1996. "Is There a Broad Credit Channel for Monetary Policy?" *Federal Reserve Bank of San Francisco Economic Review* 1: 3–13.
- Peek, Joe, and Eric S. Rosengren. 1995a. "The Capital Crunch: Neither a Borrower nor a Leader Be." *Journal of Money, Credit and Banking* 27(3): 625–638.

- _____. 1995b. "Bank Regulation and the Credit Crunch." *Journal of Banking & Finance* 19(3-4): 679–692.
- _____. 1997. "The International Transmission of Financial Shocks: The Case of Japan." *American Economic Review* 87(4): 495–505.
- _____. 2000. "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States." *American Economic Review* 90(1): 30–45.
- Rosengren, Eric S. 2014. "Short-Term Wholesale Funding Risks." Presented at Conference on Global Banking Standards and Regulatory and Supervisory Priorities in the Americas, Lima, Peru, November 5.
- Sharpe, Steven A. 1995. "Bank Capitalization, Regulation, and the Credit Crunch: A Critical Review of the Research Findings." Finance and Economics Discussion Series 95-20. Board of Governors of the Federal Reserve System.
- Shin, Hyun Song. 2009. "Securitisation and Financial Stability." *The Economic Journal* 119(536): 309–332.