The Complexities of the Financial Turmoil of 2007 and 2008

Gregory A. Krohn
Bucknell University

William R. Gruver
Bucknell University

Sparked by rising defaults on subprime mortgages, the financial turmoil of 2007 and 2008 threatened the stability of the worldwide financial system and led to unprecedented interventions in financial markets by central banks and other governmental institutions. This essay describes and explains the complexities of the financial turmoil of 2007 and 2008 for students of the financial system so that they might understand better how problems in the mortgage market led to the possibility of collapse of the financial system and the controversial actions taken by the Federal Reserve and other governmental entities. We draw several lessons about the behavior of financial markets and financial regulation from this historic episode.

INTRODUCTION

The financial turmoil of 2007 and 2008 was sparked by the rising number of defaults on subprime mortgages, loans to borrowers with weak credit histories. It is astonishing that problems in what was thought to be a narrow segment of the United States financial markets could threaten the viability of numerous financial institutions and the stability of the worldwide financial system. The severity of the crisis is demonstrated by the extensive and, in some cases, unprecedented interventions in financial markets by the Federal Reserve and other governmental institutions during this time period.

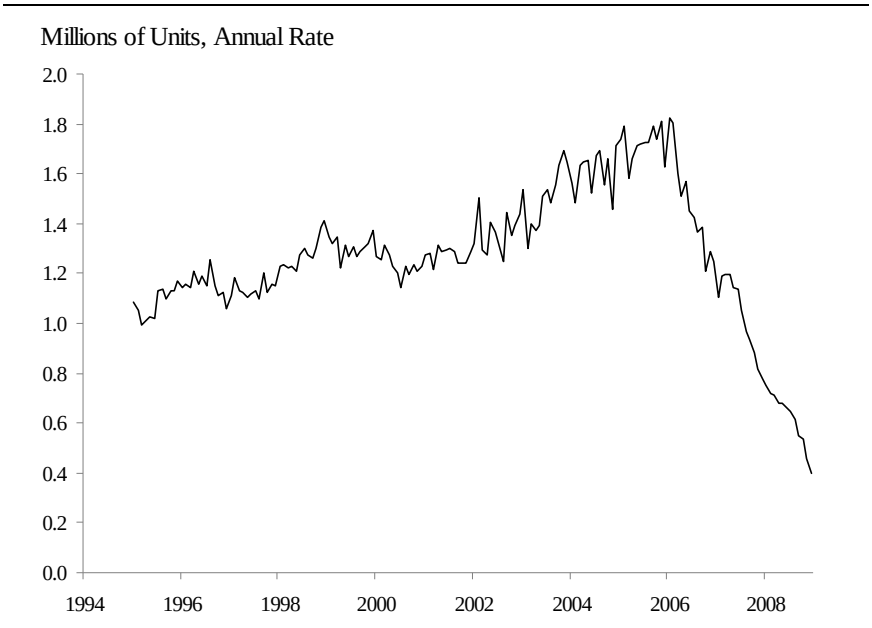
Understanding these developments requires some knowledge of financial concepts such as credit risk, liquidity, and leverage, as well as financial instruments such as mortgaged-backed securities and collateralized debt obligations, and financial institutions such as banks, hedge funds, and structured investment vehicles. Some of the financial instruments involved are complex, as is the web of relationships among the financial institutions. The aim of this essay is to describe and explain the complexities of the financial turmoil of 2007 and 2008 for students of the financial system so that they might understand better how problems in the mortgage market led to the possibility of financial collapse and the controversial interventions by the Federal Reserve and other governmental entities.

The next section describes developments in the housing and mortgage markets that precipitated the financial disruptions. To understand better how so many bad mortgage loans were made, the evolution of housing finance is surveyed in the third section. The fourth section explains how the problems in the mortgage market spread to the broader financial system. The actions taken by the government to address the threats to the financial and nonfinancial sectors of the United States economy are discussed in the fifth section. The final section concludes with some lessons that can be learned from this historic episode.

THE HOUSING AND MORTGAGE MARKETS

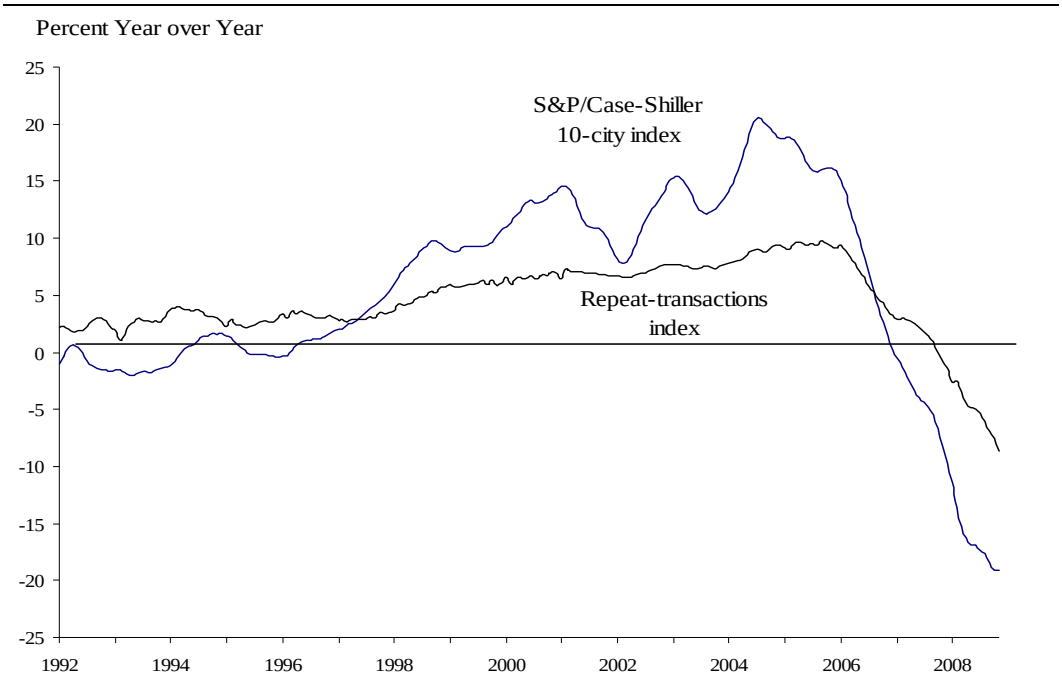
For several years through 2005, the United States housing market experienced a boom. Home construction and sales soared and prices rose sharply (Figures 1 and 2). A number of factors fueled the boom. One was a low level of global real interest rates. Another was that some buyers apparently thought that home prices would continue to rise and bought houses as investments, hoping to increase their wealth via speculative buying and selling (flipping) properties. Toward the middle of the decade, the housing boom was fueled by a surge in subprime mortgages (Board of Governors of the Federal Reserve System, 2008a). A beneficial result of the housing boom was that by 2005 the home ownership rate had jumped to an all-time high of 69 percent (Zandi, 2008, p. 48).

FIGURE 1
SINGLE-FAMILY HOUSING STARTS



Source: United States Department of Commerce

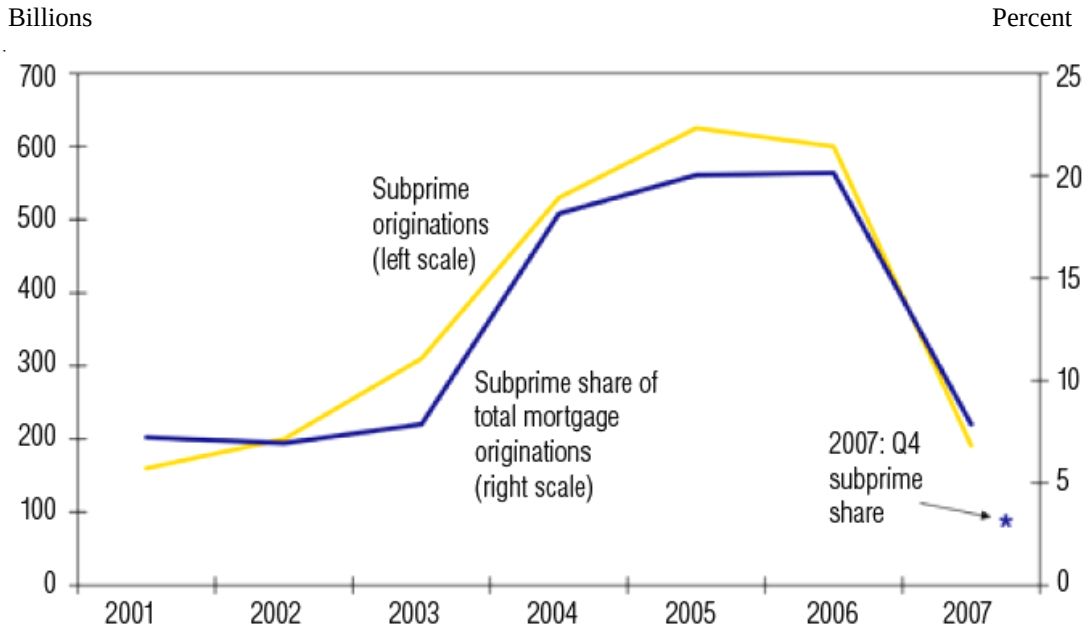
FIGURE 2
CHANGE IN PRICES OF SINGLE FAMILY HOUSES



Source: Standard & Poor's; Office of Federal Housing Enterprise Oversight

Rapidly rising house prices encouraged many borrowers to refinance their mortgages quickly because they could tap the new equity for other purposes and because the increase in equity improved their credit worthiness and allowed them to borrow on better terms. As a result, mortgage products designed to be refinanced became increasingly popular. These included adjustable rate mortgages (ARMs), whose interest rate is fixed for a few years and then is adjusted over the rest of the term of the loan according to movements in some market rate of interest; "interest only" ARMs, which have an introductory period where no principal is paid off; ARMs with "teaser rates," an introductory interest rate that is below market rates; and option ARMs, which offer the borrower the option to pay each month interest, principal, both, or part of either (Getter, et al., 2007). As long as house prices continued to rise, borrowers could easily refinance their loans or sell their homes at a profit, and delinquency rates remained low. Rising house prices and low delinquency rates encouraged lenders to make more loans with lower underwriting standards, as seen in the rapid growth of subprime mortgages (Figure 3).

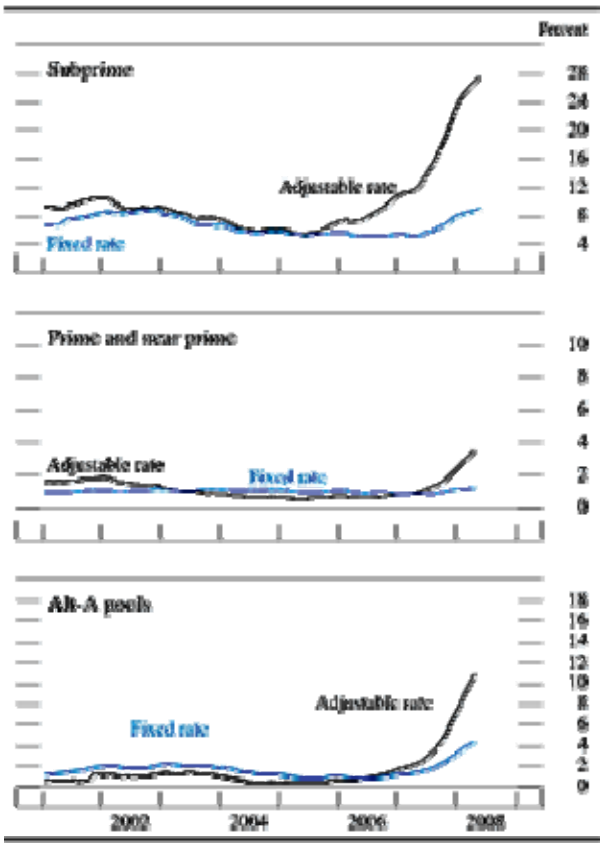
FIGURE 3
SUBPRIME MORTGAGE ORIGINATIONS



Source: Federal Reserve Bank of San Francisco

By the middle of the decade, house prices had reached very high levels, making housing less affordable. In addition, the Federal Reserve began to raise short-term interest rates in 2004, which increased mortgage rates. As a result, the volume of the sales of homes began to decline and the supply of unsold houses rose relative to sales. House prices decelerated sharply in 2006 and began to decline. With house prices decelerating, borrowers with high loan-to-value ratios (the ratio of the amount borrowed to the value of the home) were unable to build much equity in their homes, making refinancing difficult. Those with ARMs faced significantly higher rates on their mortgages once the initial rates reset. Delinquency rates on subprime ARMs rose sharply in 2006, and by early 2008, more than one-fourth of these loans were at least ninety days delinquent or in foreclosure. Delinquency rates on adjustable rate "Alt-A" mortgages began to rise sharply in 2007. "Alt-A" mortgages are a mix of prime, near-prime, and subprime mortgages with nonstandard features, often the lack of full documentation of income and assets (Rosen, 2007). Delinquency rates on prime mortgages, fixed-rate subprime mortgages, and fixed-rate Alt-A mortgages remained steadier, but began to edge up at the end of 2007 (Figure 4). Subprime mortgages accounted for only 7 percent of all first-lien mortgages, but more than half of the foreclosures in 2006 and 2007 (Board of Governors of the Federal Reserve System, 2008a and 2008b).

FIGURE 4
MORTGAGE DELINQUENCY RATES



Source: Board of Governors of the Federal Reserve

THE EVOLUTION OF HOUSING FINANCE

How did so many loans with lax lending standards get made? Some history of housing finance helps to answer this question.

Prior to the 1970s, a homebuyer typically paid a fraction of the purchase price (the down payment) and borrowed the remainder from a government-regulated commercial bank or savings institution ("bank") at a fixed interest rate for a 30-year term. The bank collected information about the borrower (income, assets, etc.) to determine the borrower's ability to repay the loan, and had the value of the home appraised. The home served as collateral for the loan, which reduced the bank's risk of losses from a default (credit risk). In the event that the borrower became delinquent and defaulted on the loan, the bank could repossess the house and sell it to defray its losses, or rework the terms of the loan so that the borrower could make the modified payments and keep the house. The higher the loan-to-value ratio, the greater the credit risk of the bank.

The bank financed the loan mostly with household savings deposits, and held the loan until it was paid off, earning a profit on the difference between the interest rates on the loan and deposits. In this fashion, the bank served as a financial intermediary channeling funds from local savers to local borrowers, transforming short-term deposits into long-term fixed-rate mortgages (Figure 5). A funding mismatch caused by borrowing short-term and lending long-term,

however, exposed the bank to interest rate risk, the risk that a rise in interest rates would lower bank profits and reduce the value of its loans.

FIGURE 5
TRADITIONAL BANKING SYSTEM

Note: Arrows show the flow of funds

One way that banks can reduce interest rate risk is to issue adjustable-rate mortgages. Prior to the 1980s, however, adjustable-rate mortgages were uncommon. Indeed, federally chartered savings and loan associations (S&Ls) were prohibited from making them. Rising interest rates in the late 1970s and early 1980s, however, imposed large losses on S&Ls who were forced to pay higher rates on deposits or to sell their fixed-rate mortgages at a reduced price. S&Ls were affected more by rising interest rates than commercial banks because the S&Ls held a greater portion of their assets in fixed-rate mortgages. One legislative response was to legalize ARMs at federal S&Ls to allow them to reduce their exposure to interest rate risk (White, 1991, p. 65-73). With ARMs, the returns from loans would rise along with interest rates and the cost of funds, keeping profits more stable. In other words, S&Ls could borrow short-term and lend short-term with ARMs. Although ARMs reduce the interest rate risk of the lender, they transfer it to the borrower, which increases the risk that the borrower will default. If interest rates rise, the monthly payments on the mortgages would increase, perhaps beyond the ability of the borrower to pay. To entice borrowers to take on the risk of rising interest rates, ARMs historically have offered a lower initial interest rate than fixed-rate mortgages, which makes ARMs less profitable for lenders on average. So ARMs reduce interest rate risk, increase credit risk, and lower expected profits of mortgage lenders.

Another significant development in housing finance since 1970 was securitization. Securitization refers to the process of pooling and packaging assets and then selling claims on them called asset-backed securities (ABSs). Mortgage-backed securities (MBSs) pay to investors a share of the interest and principal payments received on the pool of mortgages backing the securities. Securitization broadens the sources of funds for home mortgages, facilitates geographic diversification of credit risks, and makes home mortgages more liquid. The liquidity of an asset (market liquidity) can be defined as the ease with which the asset can be sold at its fundamental value, where fundamental value is measured by the present value of the asset's future income flows (Elul, 2008).

An increasing share of home mortgages has been securitized, and in recent years the value of MBSs has been over 50 percent of total mortgage debt outstanding (Rosen, 2007). With this rise in securitization, and despite its many advantages cited in the previous paragraph, a danger was also growing: the local lender with intimate knowledge of the credit worthiness of the borrower was increasingly separated from the investor now owning the mortgage.

Two government-sponsored enterprises (GSEs), Fannie Mae and Freddie Mac, accounted for 40 percent of MBSs issued in 2006. These privately-owned federally charted organizations purchase primarily conventional loans from qualifying lenders (commercial banks, savings and

loan associations, and mortgage banks*)* to back the MBSs the GSEs then issue, adding guarantees of timely payments to holders for a fee. They also purchase mortgages and MBSs for their own portfolio by issuing debt. The loans they purchase must meet their underwriting standards, including loan-to-value ratios, and conform to legal limits on the size of the loan (maximum of $417,000 in 2007) (Rosen, 2007). Fannie Mae and Freddie Mac enjoy certain regulatory and tax advantages over wholly private firms that participate in the secondary market and issue MBSs (Congressional Budget Office, 1991 and 2001). Based on their special benefits under federal law, Fannie and Freddie were thought to enjoy an implicit federal guarantee of their debt, a guarantee made explicit in July 2008 when the Federal Reserve granted them access to its discount window and Congress gave the Treasury Secretary broad authority to prevent the GSEs from failing (Paletta, 2008). Currently, Fannie Mae and Freddie Mac are regulated by the Federal Housing Finance Agency (FHFA), a newly created agency that replaced their previous regulator, the Department of Housing and Urban Development's Office of Federal Housing Enterprise Oversight (OFHEO).

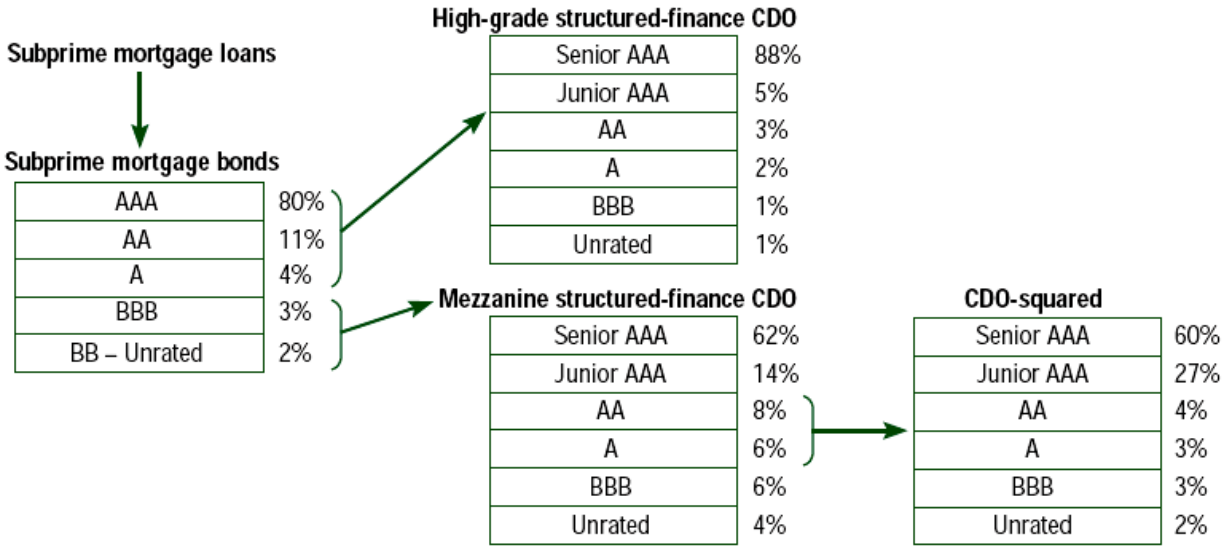
Other MBSs are issued by private sector financial institutions, such as investment banks like Bear Stearns. Due to the advantages of Fannie Mae and Freddie Mac in securitizing conforming loans, most of the private-sector MBSs are backed by nonconforming (jumbo) loans, subprime loans, or Alt-A loans. The share of MBSs backed by subprime and Alt-A mortgages increased rapidly over the past decade, rising from 47 percent of total private sector MBS issuances in 1996 to 71 percent in 2006 (Rosen, 2007).

The original and simplest MBSs were pass-throughs: a share of the interest and principal payments on the mortgages were passed through to the owner of each mortgage-backed security. To better satisfy investors with various appetites for risk, collateralized mortgage obligations (CMOs) were invented in 1983. Mortgages were pooled just as in a pass-through, but the pool was sliced, or tranched, originally into three segments, each with its own securities. The top tier, which might represent 80 percent of the value of the mortgages, had first claim on all cash flows. It is unlikely that 20 percent of a conventional mortgage pool would default, so the top-tier securities received the highest credit rating (triple-A) and were paid a commensurately lower yield (interest rate). The second tier, or mezzanine tranche, had second claim on the interest and principal payments on the mortgages and promised a somewhat higher yield. The third tier was the first to absorb all losses. Although this third tier was very risky, this equity tranche, or "toxic waste" as it was called, could offer very attractive yields because the yield on the top-tier securities was less then the average yield on the underlying loans (Morris, 2008, p.39). Renamed residential mortgage-backed securities (RMBSs) in the 1990s, CMOs transformed mortgages into safe, moderately risky, and very risky securities similar to corporate bonds of different ratings. The pooling of securities and then dividing the cash flows into tranches paid to different holders is part of the opaque world referred to as structured finance (International Monetary Fund, 2008a, p. 56).

MBSs had a profound impact on the mortgage industry. Instead of a single mortgage lender making, holding, and servicing a loan, the industry fragmented into sub-sectors. Mortgage brokers screened applicants. Mortgage banks bid for the loans and securitized them. Investment banks designed and marketed the MBSs. Servicing specialists managed collections and defaults (Morris, 2008, p. 40). The model for mortgage lending became "originate to distribute" rather than "originate to hold," separating the party familiar with the credit worthiness of the borrower and the investor now owning the underlying mortgage.

To transfer risk even further, collateralized debt obligations (CDOs) were created out of tranches of MBSs and other asset-backed securities. High-grade CDOs resecuritized MBS and other tranches rated A- and above. Mezzanine CDOs resecuritized BBB-rated MBS and other tranches. To complicate matters, risky tranches of mezzanine CDOs were recycled into CDOs of CDOs (CDO^2s), most of which were AAA-rated tranches (International Monetary Fund, 2008a, p. 59). Highly-rated securities materialized from low rated securities almost magically (Figure 6).

FIGURE 6
MBSs, CDOs, AND CDO^2s



Source: International Monetary Fund

Riskier loans were preferred by creators of CDOs because the higher yields paid on riskier loans offer greater flexibility in structuring the CDO. There is enough yield left over after the triple-A rated tranche is constructed to create marketable higher-yield securities for the lower tiers (Morris, 2008, p. 77).

Securitization and structured finance became major factors behind the growth of the subprime mortgage market. From essentially zero in 1993, subprime mortgage originations grew to $625 billion by 2005, one-fifth of total mortgage originations in that year. Approximately 12 million new homeowners were created over this period of time, largely first-time homebuyers, racial and ethnic minorities, and lower-income households who could not get prime mortgages. Unlike the prime mortgage market featuring long-term fixed-rate mortgages made under tight supervisory conditions, a very large share of subprime mortgages were adjustable-rate, often with low “teaser rates” the first few years that subsequently reset to high rates, and over half were made by independent lenders without any federal supervision. Unlike in the prime market, subprime lenders often would not escrow taxes and insurance, and prepayment penalties were widespread, which made it difficult to get out of these mortgages (Gramlich, 2007).

In the boom years of 2005 and 2006, at least 40 percent of the securities in CDOs were subprime mortgages or second-lien home equity lines of credit. By assuming that the 6 to 12 percent default rates of subprime mortgages during the early 2000s would continue, it was possible to create families of CDOs such that 80 percent had triple-A or double-A ratings even though 70 percent of the supporting assets were subprime (Morris, 2008, p. 78). The CDOs were made even more attractive by guarantees of payment by bond insurers (like Ambac and MBIA) who expanded their traditional business of insuring municipal bonds to include structured credit products (International Monetary Fund, 2008a, p. 13).

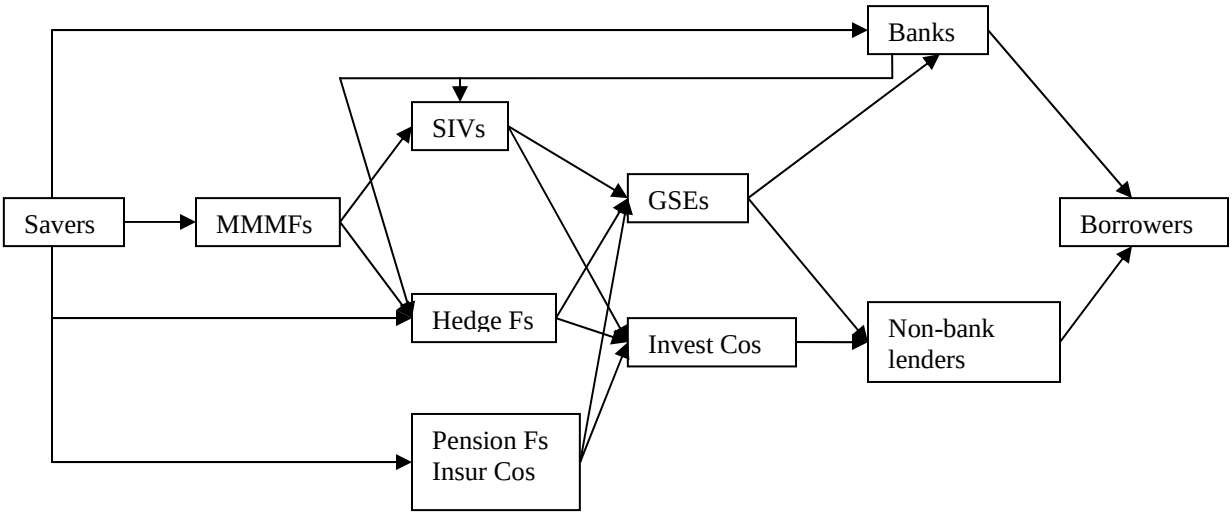
The MBSs and CDOs were sold to banks, insurance companies, pension funds, and other financial institutions located mostly in the United States and Europe (International Monetary Fund, 2008a, p. 11-13). Among the institutions who became the owners of these instruments, two are noteworthy for their roles in the recent turmoil: structured investment vehicles (SIVs) and hedge funds.

Many large United States and European banks established SIVs to profit from securitized loans. SIVs invest in a wide range of long-term debt instruments, including subprime MBSs and CDOs, financed by selling short-term commercial paper and medium-term debt. Commercial paper is held by money market funds, which serve as relatively safe and liquid alternatives to bank accounts and certificates of deposits for individual savers. Banks earned fees for creating and managing the SIVs, but the SIVs were structured so that their assets did not appear on the banks' balance sheets. Therefore, banks were not required to hold capital against the assets of the SIVs, but most SIVs had lines of credit with their parent banks to provide short-term loans in the event that enough commercial paper could not be sold. If bank loans to the SIV were to increase to give the bank the majority exposure, accounting rules would force the bank to consolidate the SIV into the bank's balance sheet. At their peak in mid-2007, SIVs held $1.4 trillion in subprime MBSs and CDOs (Zandi, 2008, p. 22-23, 121-122, and International Monetary Fund, 2008a, p. 73).

Hedge funds are unregulated investment vehicles that manage funds for financial institutions and wealthy individuals. They are willing to take risky positions to earn superior returns for their shareholders and high fees for their managers. To amplify their returns, they borrow funds from their prime brokers, who handle their day-to-day trading and custody functions, and other financial institutions. A large segment of hedge funds concentrated in CDOs, especially the riskiest classes, and as of mid-2007 hedge funds accounted for about a third of CDO trading (Morris, 2008, p. 109).

As a result of securitization and structured finance, funding for mortgage and other loans came increasingly from non-bank institutions. Loans were pooled, sliced, and the pieces combined and sold to a wide range of investors, many of whom used short-term funding to purchase the securities. These institutions—insurance companies, pension funds, hedge funds, SIVs, and others—formed a "shadow banking system" subject to little regulatory oversight. By the second quarter of 2007, the shadow banking system provided $6 trillion in credit, nearly as much as traditional banks (Zandi, 2008, p. 120).

FIGURE 7
TRADITIONAL AND "SHADOW" BANKING SYSTEMS



Note: Arrows show the flow of funds

Securitization and the shadow banking system help to explain how so many bad subprime loans were made in the mid-2000s. More loans could be originated by non-banks, many of which were not subject to supervision and the underwriting guidance issued by federal regulators (Getter, et al., 2007). Non-bank mortgage lenders had an incentive to make as many subprime loans as possible because they sold them for a fee on the secondary market. Investors had little incentive to ensure that an individual loan was likely to be repaid. Only a tiny piece of any subprime loan was backing any single MBS or CDO. Most of the securities were top-rated and guaranteed by bond insurers. Yield-hungry investors in a low interest rate environment were willing to take the risk of the lower-rated securities. As long as default rates on subprime loans remained at their historic levels, investors would get the returns on mortgage securities they expected. When housing prices stopped rising in 2006, however, defaults on subprime ARMs surged and investor losses mounted.

HOW PROBLEMS IN MORTGAGE MARKETS SPREAD

It was estimated early in 2008 that defaults on home mortgages will result in losses on mortgages and mortgage securities of approximately $500 billion. Although this is as substantial sum, it amounts to less than 5 percent of the $11 trillion in total U.S. mortgage loans outstanding and less than 0.5 percent of the $140 trillion in loans and debt securities held by banks and other financial institutions around the world (Zandi, 2008, p. 176). How could rising defaults on U.S. home mortgages cause widespread disruptions in the global financial system? The simple answer is that credit problems in the opaque and complex world of structured finance led to a liquidity crisis.

One feature of liquidity crises is the interaction between liquidity and asset prices. Suppose that asset prices unexpectedly fall. Lending to institutions that borrow money to acquire assets will be reduced (funding illiquidity), and some borrowers will have to sell assets to meet margin

(collateral) requirements or capital requirements set by lenders or regulators. As a result of the forced sales, asset prices fall even further, discouraging buyers who fear capital losses and making assets less liquid (market illiquidity). Falling market liquidity reduces asset prices even more, and so on. The result is a "liquidity spiral," in which falling asset prices and falling liquidity mutually reinforce one another. These dynamics can spill over across markets as increased margin calls in illiquid markets are met by sales of more liquid assets. Liquidity spirals can quickly result in the insolvency of financial institutions as falling asset prices reduce their capital (Elul, 2008, and International Monetary Fund, 2008a, p. 86-94).

Accounting standards can compound market instability during a liquidity spiral. Assets that might be sold before maturity are "marked-to-market," meaning that they are valued at observable prices for the same instrument. Heavy discounting of assets during a liquidity crisis, however, may produce prices much lower than the assets' underlying expected future cash flows would imply. This may generate unnecessary reported losses for firms and contribute to forced sales of assets and the downward spiral of their prices (International Monetary Fund, 2008a, p. 58-66).

Liquidity spirals can be reinforced by liquidity hoarding due to uncertainty. Here uncertainty is referring to unmeasurable risk, a gamble where the probabilities of the possible future outcomes are not known (Knight, 1921, p. 233). If market participants are "uncertainty averse," they may use the most pessimistic probability assessments. In a liquidity crisis, borrowers and lenders may become overly concerned about extremely unlikely risks and hoard liquid funds to guard against those risks (Elul, 2008).

Another feature of liquidity crises is a "flight to quality." Nervous investors sell risky assets and buy assets considered safe. This lowers the price of risky assets relative to that of safe assets, and increases the yield spread between risky and safe assets (Elul, 2008).

In the summer of 2007, the global credit markets experienced the beginning of a liquidity crisis. The crisis was sparked by troubles at two Bear Stearns hedge funds that invested in double-A and triple-A rated CDOs of subprime mortgaged-backed securities. Even though the highly rated CDOs were not in default, they were estimated to have lost 28 percent of their value since the beginning of the year. With delinquency rates on subprime mortgages rising sharply (Figure 4), the protection offered by lower tranches was dissolving fast, and the senior tranches no longer justified a triple-A rating, leading to the loss in value (Getter, et al., 2007 and Morris, 2008, p. 114-115).

Hedge funds commonly use leverage—borrowed funds—to boost returns, but leverage also amplifies declines – in this case the value of CDOs. To illustrate this effect of leverage, consider the following example. Suppose a fund with $100 in assets and $85 in debt was required by its lenders to hold equity of at least 15 percent of assets (a margin requirement of 15 percent). Leverage ratios at credit-related hedge funds typically were 5 to 10 (meaning that assets were 5 to 10 times the value of owners' equity), so a 15 percent margin requirement is plausible (Morris, 2008, p. 112). Now the value of its securities falls by 5 percent. Its assets would be worth $95, its debt $85, and its equity $10. Equity is now only 11 percent of assets, well below the margin requirement. If the fund cannot raise additional equity, which is difficult in a market downturn, it must reduce asset holdings to $67 to meet the 15 percent margin requirement, and debt is lowered to $57. The asset sales necessary to meet the margin requirements reinforce the initial decline in asset prices. If asset prices decline by 15 percent or more, the hedge fund is wiped out.

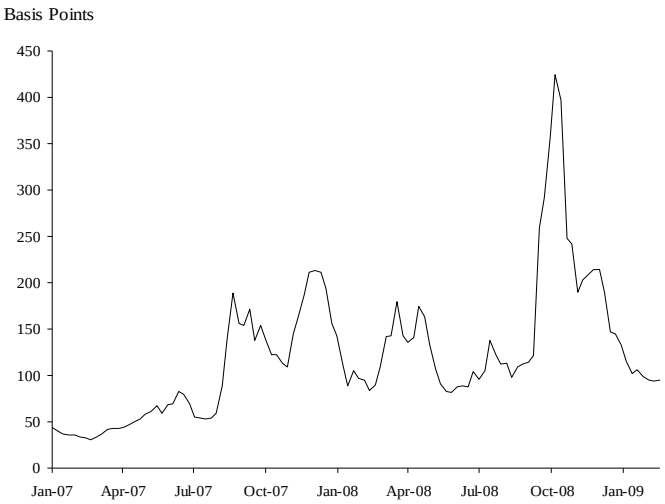
This is what happened to the two Bear Stearns hedge funds, and they were closed in July 2007. Losses on highly-rated CDOs held by the Bear Stearns hedge funds raised doubts about the

value of similar securities and suspicions that other holders of subprime MBSs might be experiencing similar, yet undisclosed losses. Losses on U.S. mortgage securities at a French and a German bank confirmed these suspicions. Traders and lenders became less willing to deal with any financial institution known or suspected to have relatively large holdings of subprime MBSs (Getter, et al., 2007). Funding liquidity was shrinking for these institutions.

For example, money market mutual funds began to shun asset-backed commercial paper issued by SIVs, fearing that they would not be paid back as losses on MBSs mounted. The asset-backed commercial paper market collapsed. In response, SIVs drew on lines of credit with the banks that created them. Late in 2007, it seemed that most SIVs were about to fail, which would cause the sale of their assets and plunging asset prices. Instead, the SIVs' assets and losses were brought back onto the balance sheets of the banks that owned them (Zandi, 2008, p. 122-123).

Evidence of banks increasing reluctance to lend to one another can be found in the London Interbank Offered Rate (LIBOR). The LIBOR is an interest rate on short-term loans between global banks. Generally, the LIBOR is not much higher than the interest rate on Treasury securities of similar maturity. Treasuries are risk-free and usually short-term interbank loans are not very risky either. When banks become nervous about making loans to one another, they ask for higher interest rates to compensate for the increase in risk, and the LIBOR rises relative to the Treasury rate (Zandi, 2008, p. 175-176). During the financial turmoil of 2007-2008, the 3-month LIBOR rate spiked nearly 4 percentage points above the 3-month Treasury bill rate, and the spread remained unusually wide through 2008 (Figure 8). A "flight to quality," however, can lower Treasury rates and widen the spread even if the LIBOR rate does not change. A more preferred measure of liquidity hoarding is the spread between the LIBOR rate and the federal funds rate expected by derivative traders. This measure of the LIBOR spread also remained elevated through 2008 (Board of Governors of the Federal Reserve System, 2009, p. 7).

FIGURE 8
LIBOR—TREASURY RATE SPREAD



Note: Three-month LIBOR minus the three-month Treasury bill rate.
Source: Board of Governors of the Federal Reserve, British Bankers Association, and authors' calculation.

Another contributor to the liquidity crisis was credit default swaps (CDSs). A CDS is similar to an insurance contract on a bond, loan, or derivative security in which the buyer pays a fee to the seller in exchange for a guarantee of the payments in the event of a default. CDSs allow the credit risk of a portfolio of debt instruments to be transferred from one party to another without having to sell the underlying securities. Sellers of the swaps, or guarantors, are primarily banks and hedge funds. The notional value of the credit default swaps—the value of the securities covered by credit default agreements—grew from $1 trillion in 2001 to about $45 trillion in mid-2007. Some put the notional value as high as $62 trillion (Palmer, 2008). There is some double counting in these figures as sellers buy CDSs for protection against the guarantees they have sold. But the sums have grown large enough, and positions are generally not backed by collateral, so most hedge funds could not survive payoff demands of a few percentage points of the notional value of the swaps (Morris, 2008, p. 124-126).

Unlike trading on future exchanges where positions are netted each day and cash margins are posted to cover adverse changes via a publicly responsible clearing organization, CDSs are private contracts between parties without such centralized third party settlement arrangements. The risk that one party fails to fulfill its side of an agreement is called counterparty risk. If a guarantor defaulted on CDSs it sold, guaranteed portfolios would have to be written down to reflect their intrinsic credit risk, increasing their owners' risk of insolvency and threatening the owners' creditors and counterparties. But the counterparties to sellers of CDSs are unknown to all but the seller. As mortgage delinquencies rose and the value of mortgage-backed securities fell, counter-party risk of CDSs grew and contributed to uncertainty and liquidity hoarding during the liquidity crisis.

Mortgage-related losses were also amplified by synthetic CDOs created out of credit default swaps. Clever financial engineers could arrange a family of CDSs that will pay the same returns as some normal cash-flow CDO: a synthetic CDO. The attraction of synthetic CDOs is that they avoid the cost and financial risk of buying and warehousing securities while the CDO is being constructed and sold. The importance of synthetic CDOs is that their volume is not constrained by the value of the underlying reference securities. In other words, the value of the subprime mortgages in cash-flow and synthetic CDOs could easily be larger than the value of subprime mortgage loans, but investors will reap the same rewards from synthetic CDOs as from real ones. In 2006 and the first part of 2007 before the CDO market froze, the volume of synthetic CDOs issued exceeded the volume of new cash-flow CDOs (Morris, 2008, p. 75-76).

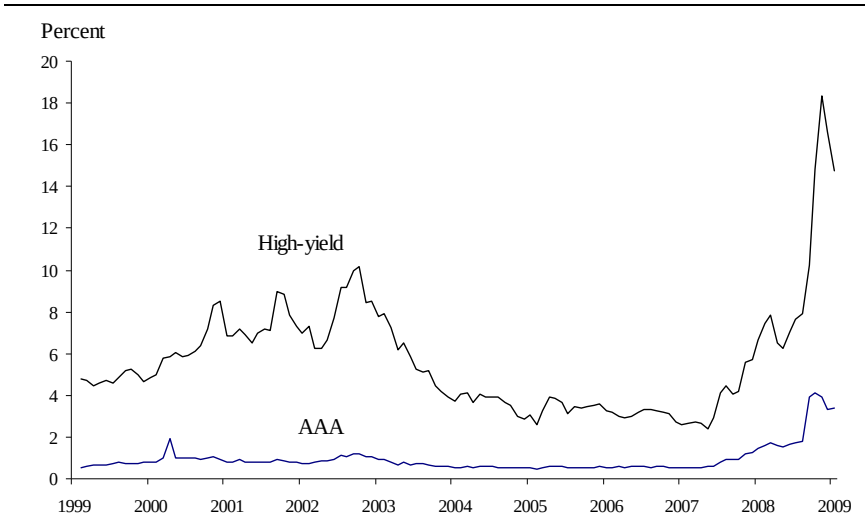
Problems in the markets for residential mortgages spilled over into the market for commercial mortgage-backed securities (CMBSs). Like a residential mortgage-backed security, a CMBS is backed by interest and principal payments on mortgages, but these are mortgages on office buildings, factories, apartments, and other commercial buildings. Although most commercial mortgages are fixed-rate loans, loan-to-value ratios had risen and lending standards had loosened on them prior to mid-2007. Due to rising uncertainty about future losses, interest rate spreads on CMBSs rose in the second half of 2007 and their prices fell, imposing losses on the institutions that held them (International Monetary Fund, 2008a, p. 7 and Zandi, 2008, p. 179-180).

The subprime mortgage meltdown also brought strains to the corporate debt market, especially to high yield bonds and leveraged loans. High yield bonds (junk bonds) are risky, below investment-grade bonds. Similarly, leveraged loans are high risk bank loans, usually made in connection with leveraged buyouts of companies. In the first half of 2007, the difference

between the yields on junk bonds and default risk-free Treasury bonds were at an all-time low, and the conditions placed on issuing firms were unusually loose. This made it cheap for private equity firms to buy public companies and take them private. The plan was to reorganize a business to make it more profitable, and later take it public again and sell it at a higher price. Private equity firms typically would finance their purchase with bank loans, which would either be paid off after the bought-out firm issued its junk bonds or securitized into collateralized loan obligations (CLOs) and sold to hedge funds and other investors (Zandi, 2008, p. 178-179).

When the liquidity crisis began in the summer of 2007, investors began to demand higher risk premiums for holding junk bonds, and funding liquidity dried up for investors in CLOs. The spreads between junk bonds and Treasury yields soared, reflecting a "flight to quality" (Figure 9). The prices of junk bonds, leveraged loans, and CLOs all fell. The private equity buyout binge came to a sudden stop, leaving banks with $300 billion to $400 billion in unwanted takeover loan commitments. Coincidentally, this amount is approximately the same value of the assets brought back onto banks' balance sheets from SIVs (Morris, 2008, p. 117-121).

FIGURE 9
CORPORATE BOND—TREASURY YIELD SPREADS



Source: Barclays Capital

The financial turmoil even spread to the obscure market for auction-rate securities. Auction-rate securities are long-term municipal bonds with interest rates set once a week in an auction run by an investment bank. The rates typically were lower than for comparable fixed-rate bonds, making them attractive to municipalities issuing debt. To ensure the smooth functioning of the auctions, the investment banks would step in and buy the bonds themselves if need be. Worries grew, however, about the implications of rising defaults on subprime mortgages for the ratings of the companies that insured both CDOs and municipal bonds (Ambac and MBIA, for example). If the ratings of the bond insurers fell below triple-A, the prices of the bonds they insured would fall. In early 2008, these worries apparently caused investors to stop participating in the auctions for auction-rate securities, and investment banks, concerned about their own risk exposure, refused to play their role as a backstop. As a result, the interest rates on auction-rate securities soared, higher than even the rates on junk bonds, raising the interest payments of municipalities

and straining their budgets. The turmoil set off by subprime mortgage defaults had engulfed state and local governments (Zandi, 2008, p. 182).

In April 2008, the International Monetary Fund estimated potential losses on loans and securities to financial institutions from the financial turmoil and weakening economies to be approximately $945 billion. Other estimates available early in 2008 also put the losses close to $1 trillion (Morris, 2008, p. 130-131 and Zandi, 2008, p. 173-174). By October, the IMF had increased its estimate of losses to $1,405 billion. The IMF total is broken down into $750 billion for U.S. residential loans and securities, $250 billion on commercial real estate loans and securities, $360 on corporate loans, bonds, and CLOs, and $45 billion for consumer loans (Table 1). Global banks are likely to bear over half of the potential losses: $725 billion to $820 billion, with insurance companies, pension funds, hedge funds, and other institutions accounting for the balance. Potential losses at European banks are sizeable, but somewhat less than at U.S. banks (International Monetary Fund, 2008b, p. 14-17).

TABLE 1
ESTIMATES OF POTENTIAL LOSSES OF THE FINANCIAL SECTOR

Billions of dollars	
U.S. residential loans and securities	750
Commercial real estate loans and securities	250
Corporate loans, bonds, and CLOs	360
Consumer loans	45
Total	1,405
Global banks	725-820
Insur Cos, Pension Fs, GSEs, Hedge Fs, others	585-680

Source: International Monetary Fund and authors' calculation

Losses on loans and securities to leveraged financial institutions can negatively impact the supply of credit and economic activity. Suppose that banks and other leveraged financial institutions have an average leverage ratio (assets/equity) of 10. For every $1 of equity lost, these leveraged institutions would have to reduce their asset holdings by $10. Furthermore, there is evidence that leverage ratios fall when assets are shrinking, so the decline in loans and other securities might be even greater. In the face of imperfect capital markets and credit-constrained consumers, the resulting decline in the supply of credit could reduce spending on capital goods and consumer goods, and slow down the pace of economic activity (Greenlaw, et al., 2008).

Quantifying the effects of the recent financial turmoil on the United States economy is not simple. One study attempted to assess the impact of losses on mortgage assets alone on the supply of credit and gross domestic product (GDP). The study began with an estimate of $400 billion of losses on residential mortgage loans and securities, some $350 billion less than the October 2008 IMF estimate. After accounting for mortgage securities held by foreign institutions and for claims financial institutions hold against one another, it was estimated that the mortgage losses would reduce credit to households and businesses by $910 billion. This contraction in credit is calculated to reduce real GDP growth by 1.3 percentage points over the following year (Greenlaw, et al., 2008). This estimate is imprecise and admittedly low. It does not include the

effects on GDP of losses on non-mortgage related assets, the initial decline in residential investment, or the decline in wealth due to falling house prices. It does suggest, however, that impact of the financial turmoil on the economy could be substantial.

ACTIONS OF THE GOVERNMENT

The early response of government policymakers to the liquidity crisis and resulting "credit crunch" of 2007 and 2008 was measured, but as the crisis wore on and at times intensified, the government's response became more vigorous and in some cases unprecedented. The Federal Reserve greatly expanded its lending programs to financial institutions to provide liquidity and ease financial strains, lowered interest rates to stimulate spending, and issued new rules to ban unfair and deceptive mortgage lending practices. Fannie Mae and Freddie Mac were taken over by their regulator, and the Federal Reserve took over a very large insurance company. To relieve the "credit crunch," Congress authorized the U.S. Treasury to purchase up to $700 billion of illiquid assets from financial institutions and to purchase shares of stock in them.

The Federal Reserve System was founded by Congress in 1913 to provide a safer, more flexible, and more stable monetary and financial system. Over the years, its role in the financial system and the economy has expanded. At present, its duties include conducting monetary policy by influencing monetary and credit conditions to promote maximum employment and price stability, providing stability to the financial system, and supervising and regulating banking institutions (Board of Governors of the Federal Reserve System, 2005, p. 1). Two key tools used by the Federal Reserve to conduct monetary policy and to promote financial stability are open market operations and lending through the discount window.

Open market operations, the purchases or sales of securities by the Federal Reserve, are the most frequently used means of implementing U.S. monetary policy. The Federal Reserve conducts open market operations with primary dealers, not on an organized exchange. When the Federal Reserve buys securities, it adds to the reserve balances of the dealer's bank held at Federal Reserve Banks. When the Federal Reserve sells securities to a dealer, the reserve balances of the dealer's bank are reduced. To increase bank reserves permanently, the Federal Reserve purchases U.S. Treasury securities and holds them to maturity. To add to bank reserves temporarily, the Federal Reserve engages in repurchase agreements, a form of collateralized loan where a primary dealer sells a security to the Federal Reserve and agrees to repurchase it on a specified date for a higher price. The Federal Reserve accepts Treasury, federal agency, and mortgage-backed securities guaranteed by federal agencies in its repurchase agreements (Board of Governors of the Federal Reserve System, 2005, p. 37-40).

Through the adjustment of the supply of bank reserves, open market operations influence the federal funds rate, the interest rate on unsecured overnight loans of reserves between depository institutions. In recent years, the federal funds rate has been the operating target set by the Federal Open Market Committee. When the Federal Reserve wishes to reduce the federal funds rate, it adds to bank reserves by buying securities. To increase the federal funds rate, the Federal Reserve reduces bank reserves by selling securities. Through its control of the federal funds rate, the Federal Reserve attempts to influence other interest rates and financial conditions to promote its economic goals of maximum employment and price stability (Board of Governors of the Federal Reserve System, 2005, p. 27).

Lending at the discount window is the primary means by which the Federal Reserve serves as "lender of last resort" in the financial system. At times when the normal functioning of financial

markets are disrupted, discount loans can become a principal source of liquidity for depository institutions. The Federal Reserve also has the authority to extend credit to entities that are not depository institutions in "unusual and exigent circumstances"; however, such lending had not occurred since the 1930s until the recent financial turmoil. The loans are offered at a predetermined, publicly posted percentage known as the discount rate. Discount loans are secured by collateral that exceeds in value the amount of the loans. Acceptable collateral includes most loans not past due and investment grade securities.

Since 2003, Federal Reserve Banks offered three discount lending programs to depository institutions: primary credit, secondary credit, and seasonal credit. Primary credit is extended on a short-term basis (typically overnight) to depository institutions in sound financial condition as reflected in their supervisory ratings and capital. Depository institutions ordinarily are not required to provide reasons for requesting primary credit. Until August 2007, the interest rate on primary credit was set one percentage point higher than the target federal funds rate. Secondary credit is available to institutions that do not qualify for primary credit. Secondary credit provides a source of liquidity provided that its use is consistent with the borrower's timely return to a reliance on market sources of funds or with the orderly resolution of a troubled institution's difficulties. Reflecting the less-sound condition of borrowers, the discount rate on secondary credit had been set one-half percentage point higher than the rate on primary credit. Seasonal credit is available to small depository institutions that experience recurring swings in funding throughout the year—usually institutions in agricultural or tourist areas. The interest rate on seasonal credit is based on market interest rates (Board of Governors of the Federal Reserve System, 2005, p. 45-50).

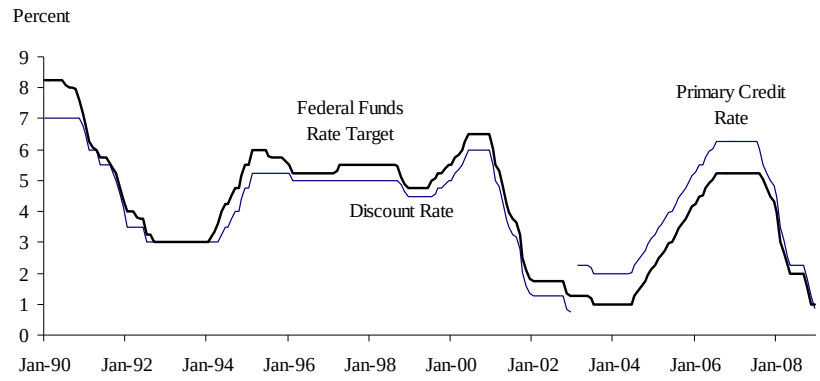
When concerns of market participants about funding liquidity and counterparty risks grew in August 2007, the Federal Reserve eased the terms of discount loans. The spread of the primary credit rate over the target federal funds rate was reduced one-half percentage point and the maximum loan term was extended to 30 days. The European Central Bank and other central banks provided substantial funds in overnight funding markets. To diminish the adverse effects of the housing contraction and tightening of credit on economic activity, the Federal Open Market Committee lowered the target for the federal funds rate by one-half percentage point at its September 2007 meeting, and by an additional on-quarter percentage point to 4 ½ percent at it October meeting. The modest actions were explained by strength of economic growth in the third quarter and by concerns about upward pressure on inflation stemming from increases in commodity prices and the decline in the foreign exchange value of the dollar (Board of Governors of the Federal Reserve System, 2008a).

Despite the easing of rates, banks were reluctant to borrow through the discount window, perhaps out of fear that it would signal that they were in financial trouble and scare away depositors and other creditors. In response, the Federal Reserve created an additional tool of monetary policy in December 2007: the Term Auction Facility (TAF). Through the TAF, predetermined amounts of loans with terms of about one month and the same collateral as for discount window loans were auctioned off every two weeks to depository institutions. The TAF appears to have overcome the reluctance of banks to borrow through standard discount loan programs in part because it is not designed to meet urgent funding needs, and a large number of banks (50 to 90) have participated in auctions (Board of Governors of the Federal Reserve System, 2008a). As of August 2008, 84-day loans will be auctioned in addition to the 28-day loans (Reddy, 2008).

In conjunction with the introduction of the TAF, the Federal Reserve also established foreign exchange swap arrangements with the European Central Bank and the Swiss National Bank to address elevated pressures in short-term dollar funding markets overseas.

Economic conditions had weakened in the fourth quarter of 2007 and equity prices declined sharply in January 2008. Concerns grew that these developments could lead to a substantial cutback in credit availability. The Federal Open Market Committee responded aggressively, slashing the federal funds rate target by three-quarters percentage point in an unscheduled emergency meeting, and cut the target rate again by an additional one-half percentage point at its regularly scheduled January meeting a few days later. The two rate cuts in January combined were unprecedented (Zandi, 2008, p. 200). By the end of April, the federal funds rate target had been reduced to 2 percent (Figure 10).

FIGURE 10
FEDERAL FUNDS RATE TARGET AND THE DISCOUNT RATE



Source: Board of Governors of the Federal Reserve

Liquidity problems began to appear early in the year in the markets for short-term repurchase agreements, creating strains on primary dealers who trade in these markets. To enhance the ability of primary dealers to obtain term funding, the Federal Reserve initiated a special program of 28-day term repurchase agreements. The Federal Reserve also created the Term Securities Lending Facility, in which the Federal Reserve lends Treasury securities against the collateral of triple-A rated asset-backed securities and conventional open market operations collateral, a list expanded months later to include all investment grade debt securities. These actions proved to be insufficient.

In March, Bear Stearns advised the Federal Reserve that its funding liquidity had deteriorated significantly and that it would be forced to file for bankruptcy unless funds became immediately available. Like other investment banks, Bear Stearns was highly leveraged, with a leverage ratio of 33 to 1 at the end of 2007 (Gongloff, 2008), making it especially vulnerable to falling prices of its assets. Leverage at large investment banks had risen after the Securities and Exchange Commission (SEC) in 2004 exempted them from capital requirements on their brokerage units in exchange for consenting to the supervision of previously unregulated affiliates and the parent holding company. The intent was to allow the SEC to act quickly in response to financial or operational weakness that might place regulated entities or the broader financial system at risk.

According to the Office of the Inspector General, the SEC "failed to carry out its mission in its oversight of Bear Stearns" (Labaton, 2008 and Kotz, 2008).

The Federal Reserve reasoned that a Bear Stearns bankruptcy would be devastating:
"A bankruptcy filing would have forced the secured creditors and counterparties of Bear Stearns to liquidate the underlying collateral, and given the illiquidity of markets, those creditors and counterparties might well have sustained substantial losses. If they had responded to losses or unexpected illiquidity of their holdings by pulling back from providing secured financing to other firms and by dumping large volumes of illiquid assets on the market, a much broader financial crisis would have ensued with consequent harm to the overall economy" (Board of Governors of the Federal Reserve System, 2008b).

To avoid potentially devastating consequences of a Bear Stearns bankruptcy, the Federal Reserve used its emergency lending authority to supply $29 billion of funding secured by $30 billion in Bear Stearns assets to JPMorgan Chase & Co. to facilitate its purchase of Bear Stearns. In taking this action, however, the Federal Reserve was worried about creating a "moral hazard," a principle rooted in the insurance industry that says that people will take greater risks if they are insured against the consequences. The concern was that by lessening the losses of investors in Bear Stearns, the Federal Reserve would encourage greater risk-taking by investors in the future and make the financial system more unstable (Zandi, 2008). To minimize this possibility, the Federal Reserve insisted that JPMorgan pay a low price per share for Bear Stearns so that investors would not think that the Federal Reserve would protect them from losses in the future.

To prevent a further downward spiral in financial markets, the Federal Reserve also used its emergency authority to create the Primary Dealer Credit Facility, which allows primary dealers (including investment banks) to borrow at the discount window, a privilege previously available only to depository institutions (Board of Governors of the Federal Reserve System, 2008b). In September, collateral accepted under this program was expanded beyond investment grade securities to include types of collateral pledged in repurchase agreements of major clearing banks.

More unprecedented action was taken in the summer of 2008 to support Fannie Mae and Freddie Mac, which play a huge role in the mortgage markets, holding or backing more than $5 trillion of the $11 trillion in mortgages outstanding (Solomon, et al., 2008a). Fannie Mae and Freddie Mac are highly leveraged, facing a statutory capital requirement of only 2.5 percent of total assets (Office of Federal Housing Enterprise Oversight, 2008). Concerns about their financial conditions and capital positions led the Federal Reserve to establish an arrangement to extend discount loans to Fannie Mae and Freddie Mac if necessary, supplementing the Treasury's authority to lend to them (Board of Governors of the Federal Reserve System, 2008b). Later in July 2008, Congressional legislation was enacted that allows the Treasury Department temporarily to extend an undefined line of credit to Fannie Mae and Freddie Mac, and to buy stock in either company if necessary. With this action, the implicit backing of Fannie and Freddie by the federal government became explicit. The law also created a new agency—the Federal Housing Finance Agency (FHFA)—to oversee Fannie Mae, Freddie Mac, and the 12 Federal Home Loan Banks, raised the conforming loan limit in high cost areas to as much as $625,000 and allows the Federal Housing Administration to insure as much as $300 billion in new refinanced mortgages (Paletta, 2008).

It did not take long for the Treasury and FHFA to exercise their new authority. In September, the FHFA placed Fannie Mae and Freddie Mac into conservatorship, replacing their chief executives and taking over management of the companies. Dividends on common and preferred

stock were eliminated at both companies. The Treasury will ensure that Fannie and Freddie maintain a positive net worth, and in exchange the Treasury will acquire $1 billion of senior preferred shares of stock and warrants for the purchase of 79.9 percent of the common stock in each company. These measures in effect guarantee the debt of Fannie and Freddie and provide for injections of capital as needed. The Treasury also established a secured lending facility for them and initiated a program to purchase their mortgage backed securities. Both efforts are scheduled to expire at the end of 2009 (Hagerty, et al., 2008).

To support the housing finance market further, the Federal Reserve announced plans in September to purchase short-term debt obligations issued by the housing-related government-sponsored enterprises (GSEs), and two months later announced a program to purchase the GSEs' long-term obligations and the mortgage-backed securities they guarantee (Board of Governors of the Federal Reserve System, 2009).

Another dramatic intervention took place in September when the Federal Reserve loaned $85 billion to American International Group Inc. (AIG), one of the largest insurance companies in the country. In return, the Federal Reserve charged a high interest rate—8.5 percent above the London Interbank Offered Rate, took an equity stake of nearly 80 percent, and replaced the chief executive officer. AIG had suffered large losses on credit default swaps it sold, forcing it to put up billions more in collateral. Downgrades from rating agencies made it harder for the company to borrow. Private lenders were unwilling to lend AIG the estimated $80 billion it needed. Given its size and complexity, federal officials feared the failure of AIG could be catastrophic for the financial system and decided to take it over (Reddy and McKinnon, 2008, and Langley et al. 2008).

The drama continued in September as a money market fund "broke the buck" (its shares were valued at less than one dollar) because of its investments in the commercial paper of Lehman Brothers, which had gone into bankruptcy the prior weekend. A run on money market mutual funds followed, and to discourage further withdrawals from this important source of short-term financing to corporations, the Treasury temporarily extended insurance similar to that on bank deposits to money market mutual funds, a $3.4 trillion industry (Gullapalli, et al., 2008a and 2008b). To further improve the liquidity of money market instruments, the Federal Reserve authorized in October the creation of the Commercial Paper Funding Facility (CPFF) to provide credit to a special purpose vehicle (SPV) that, in turn, purchases commercial paper. The Federal Reserve also announced the creation of the Money Market Investor Funding Facility (MMIFF) to finance the purchase of commercial paper and certificates of deposit issued by highly rated financial institutions, including U.S. money market mutual funds (Board of Governors of the Federal Reserve System, 2009).

On October 3, President Bush signed into law the Emergency Economic Stabilization Act of 2008, the main part of which was the Troubled Assets Relief Program (TARP) (Evans and Krolicki, 2008). This $700 billion plan would ease credit conditions by replacing illiquid assets with funds that could be lent and, depending on the prices paid for the securities, might increase bank capital. The plan also would remove uncertainty about the conditions of financial institutions and thereby reduce counterparty risk and foster lending between banks. While lending by the Federal Reserve addresses the liquidity problem in financial markets; asset purchases by the Treasury might relieve the credit crunch caused by the shortage of bank capital (Solomon, et al., 2008b).

On October 14, the plan changed and, instead of buying up the illiquid assets, the first $350 billion of the plan would purchase senior preferred stock and warrants in the nation's banks (U.S.

Department of the Treasury, 2008). It was felt that this direct equity infusion, like a similar plan that had already been implemented in the United Kingdom, was simpler than the government valuing and purchasing the illiquid assets. By injecting capital directly into the banks it was hoped that the banks would resume lending more quickly. TARP funds were used in November, for example, when the U.S. government entered into an agreement with Citigroup to provide a package of capital, guarantees, and liquidity access. Preferred shares in AIG were also purchased with TARP funds, which allowed the Federal Reserve to reduce the total amount of credit available to AIG from $85 billion to $60 billion and to restructure its lending (Board of Governors of the Federal Reserve System, 2009).

In November, the Federal Reserve announced plans for the Term Asset-Backed Securities Loan Facility (TALF) to support the issuance of asset-backed securities collateralized by student loans, automobile loans, credit card loans, and loans guaranteed by the Small Business Bureau by making loans to holders of these securities (Board of Governors of the Federal Reserve System, 2009). Through this and other newly created lending facilities, the Federal Reserve is acting in its role as lender of last resort, but in this case through the securities markets rather than through the traditional banking system.

In addition to the extraordinary measures taken by the U.S. government to address the liquidity crisis and credit strains, the Federal Reserve has undertaken regulatory and supervisory actions to reduce the likelihood of a high rate of mortgage foreclosures in the future. After proposing new rules to ban unfair and deceptive mortgage lending in December 2007 and receiving comments on the proposal, the Board of Governors issued new rules in July 2008. The rules "prohibit lenders from extending credit without regard to a borrower's ability to repay, require lenders to verify income and assets they rely upon in making loans, require lenders to establish escrow accounts for taxes and insurance, and prohibit prepayment penalties unless certain conditions are met" (Board of Governors of the Federal Reserve System, 2008b).

CONCLUSION

Widespread problems with subprime mortgages resulted from rapidly rising then falling home prices, low interest rates, and securitized lending through lightly regulated financial institutions. Although securitization spread risk and increased the funds available for mortgages, the separation of the arranger of the loans and the investors that ultimately held them contributed to lax and sometimes deceptive lending practices. This resulted in the explosion of subprime loans and ultimately in higher default rates on those loans. The complexity and opacity of securities backed by mortgages, the triple-A ratings of many of these securities, and the ability to buy insurance against default contributed to the carelessness of investors.

Problems in the markets for subprime mortgages and mortgage securities led to a liquidity crisis beginning in August 2007. Falling prices of securities caused highly leveraged institutions to sell assets to meet capital requirements imposed by creditors and regulators. Growing uncertainty about the value of complex securities reduced funding for institutions that held them or insured them. The result was a downward spiral of liquidity and asset prices that spilled over into other financial markets. Credit risk evolved into liquidity risk.

Starting in August 2007, the Federal Reserve took action to resolve the liquidity crisis. It lowered the discount rate and extended the terms of discount loans, introduced new lending facilities, opened the discount window to primary dealers and government sponsored enterprises, made a multi-billion dollar secured loan to finance the acquisition of Bear Stearns by JPMorgan,

and made an even larger loan to AIG to prevent it from failing and took it over in the process. European central banks took similar actions, injecting large sums into European financial institutions.

Congress made explicit its previously implicit backing of Fannie Mae and Freddie Mac by authorizing an undefined line of credit with the U.S. Treasury and giving the Treasury the authority to acquire equity of Fannie and Freddie if necessary, authority exercised when the Federal Housing Finance Agency took them over. The Congress also approved a plan providing up to $700 billion to purchase assets from financial institutions and inject capital into them to increase the flow of credit.

To soften the consequences of the financial turmoil on the national economy, the Federal Reserve lowered its target for the federal funds rate to a range of 0 to ¼ percent by the end of 2008 and issued new lending rules to prevent abuses outside of the heavily regulated banking sector. Congress also took direct action to address economic weakness, passing the Economic Stimulus Act of 2008, providing tax rebates and reductions estimated to total $152 billion in 2008 (Congressional Budget Office, 2008).

The financial system in the United States remains fragile. Losses on mortgages and the difficulty of valuing illiquid asset-backed securities raise doubts about the solvency of many financial institutions. Carefully evaluating the policy actions taken thus far and the various policies that have been proposed is beyond the scope of this essay, but there are some lessons to be learned from this historic episode. Among the many lessons that could be drawn, eight are identified below.

First, when the originator of loans and the investors are separated as in the originate-to-distribute model, there must be standardized terms, transparency of the securities, or regulation of lenders to avoid a dangerous level of bad loans. The Federal Reserve's new mortgage lending rules may help in this regard, but it remains to be seen if large quantities of complex and opaque asset-backed securities will resurface in the future. Triple-A ratings on such securities are not enough, as the ratings can drop quickly if delinquencies on a class of loans become elevated. Investors must be able to perform independent due diligence when evaluating securities if there is not adequate oversight by regulators.

Second, in a liquidity crisis, the prices and returns of risky assets become highly correlated, despite their lower historical correlations. The benefits of diversification in normal times can disappear in a liquidity spiral. Private guarantees of payments become less valuable as widespread losses threaten the viability of the guarantors.

Third, in a liquidity crisis the most highly leveraged financial firms are at greatest risk of failing. In 2008, the highly leveraged government sponsored enterprises and the largest investment banks did not survive in their previous forms. Fannie Mae and Freddie Mac were taken over by the government, investment banks Bear Stearns and Merrill Lynch were acquired by banks, Lehman Brothers declared bankruptcy, and Goldman Sachs and Morgan Stanley changed their charters to become bank holding companies (Lucchetti and Sidel, 2008).

Fourth, the combination of leverage and capital requirements creates a credit crunch during a liquidity crisis. Losses on loans and other assets of highly leveraged financial institutions such as banks reduce their capital. If the lost capital is not replaced by new equity investments, which is unlikely for an insolvent or nearly insolvent firm, the amount of credit extended will be reduced by a multiple of the lost capital. The higher the leverage ratio, the greater is the reduction of credit. The reverse is true when asset prices are rising. Rising asset prices raise the capital of leveraged financial institutions, increasing their supply of credit by a multiple. Analysts and

regulators are reconsidering the design of capital requirements to determine if their procyclical effects on credit can be muted.

Fifth, easing a liquidity crisis does not restore lost capital or prevent a credit crunch. Providing liquidity may stem a liquidity spiral, but liquidity does not replace capital. Adhering to capital and margin requirements necessitates a reduction of credit following a widespread loss of capital. The Federal Reserve has powerful tools for addressing a liquidity crisis, but its ability to mitigate a credit crunch resulting from a loss of bank capital is limited. The $700 billion Troubled Assets Relief Program (TARP) was adopted in recognition of these limits.

Sixth, if the stability of the financial system is in jeopardy, public funds can provide the capital to prevent the failure of key institutions. Infusions of private capital require confidence in both the entity seeking the capital and in the entire financial system. Due to events since August 2007, domestic and foreign private sources of capital are scarce. New equity investors are needed, but few are stepping forward. In such conditions, the government is faced with using public funds to provide the necessary capital, as was done with Fannie Mae, Freddie Mac, AIG, and Citigroup, or risking the collapse of the financial system.

Seventh, policies to address liquidity crises and the risks they pose to the financial system and entire economy can be mischaracterized as bailouts. In the 2007-2008 episode, investors in financial firms lost hundreds of billions of dollars, executives and other employees lost their jobs, and some were charged with crimes (*The Economist*, 2008, p. 71). Bear Stearns is a prominent example. These losses provide incentives to evaluate risks more carefully in the future. Perhaps if governments did nothing to address the liquidity crisis, the losses of risk-takers would have been greater and incentives for better risk assessment strengthened, but losses would have multiplied and spread further to citizens who were not taking calculated risks to obtain high returns. Preventing a liquidity spiral from becoming an economic disaster by injecting public funds benefits everyone, even the trouble-makers; nevertheless, real losses are incurred by participants in financial markets.

Eighth, more effective and better coordinated oversight of less-regulated financial institutions that pose potential threats to the stability of the financial system is needed so that policy-makers can take action to prevent crises before they develop. The specifics of the oversight, regulations, and enforcement mechanisms will need to be determined, but private financial institutions, even those designed to facilitate risk sharing, have proven unable to provide enough stability in financial markets to prevent financial crises.

REFERENCES

Board of Governors of the Federal Reserve System (2005). The Federal Reserve System: Purposes and Functions, Ninth Edition, Washington, D.C.: Board of Governors of the Federal Reserve System.

Board of Governors of the Federal Reserve System (2008a). Monetary Policy Report to the Congress, February 27.

Board of Governors of the Federal Reserve System (2008b). Monetary Policy Report to the Congress, July 15.

Board of Governors of the Federal Reserve System (2009). Monetary Policy Report to the Congress, February 24.

Congressional Budget Office (1991). Controlling the Risks of Government Sponsored Enterprises, April.

Congressional Budget Office (2001). Federal Subsidies and the Housing GSEs, May.

Congressional Budget Office (2008). Economic Stimulus Act of 2008, February 11.

Elul, R. (2008). Liquidity Crises. Business Review, Federal Reserve Bank of Philadelphia, Q2, 13-22.

Evans, E. & Krolicki, K. (2008). Congress Passes Bailout, focus shifts to fall out. Reuters, October 3.

Federal Reserve Bank of San Francisco (2007). The Subprime Mortgage Market. 2007 Annual Report.

Getter, D., Jickling, M., Labonte, M. & Murphy, E. (2007). Financial Crisis? The Liquidity Crunch of August 2007. Congressional Research Service, September 21.

Gongloff, M. (2008). Crunch Proves A Test of Faith For Street Strong. The Wall Street Journal, March 17.

Gramlich, E. (2007). Booms and Busts: The Case of Subprime Mortgages. Economic Review, Federal Reserve Bank of Kansas City, Fourth Quarter, 105-113.

Greenlaw, D., Hatzius, J., Kashyap, A. & Shin, H. (2008). Leveraged Losses: Lessons from the Mortgage Market Meltdown. Manuscript presented at the US Monetary Policy Forum, February 29.

Gullapalli, D., Anand, S., & Maxey, D. (2008a). Money Fund, Hurt by Debt Tied to Lehman, Breaks the Buck. The Wall Street Journal, September 17.

Gullapalli, D., Anand, S., (2008b). A Safety Net For Investors In Money Funds. The Wall Street Journal, September 30.

Hagerty, J., Simon, R., & Paletta, D. (2008). U.S. Seizes Mortgage Giants. The Wall Street Journal, September 8.

International Monetary Fund (2008a). Global Financial Stability Report: Containing Systemic Risks and Restoring Financial Soundness, April.

International Monetary Fund (2008b). Global Financial Stability Report: Financial Stress and Deleveraging; Macro-Financial Implications and Policy, October.

Knight, F. (1921). Risk, Uncertainty, and Profit, Boston: Houghton Mifflin Company.

Kotz, H.D. (2008). SEC's Oversight of Bear Steams and Related Entities: The Consolidated Supervised Entity Program, Report No. 446-A. U.S. Securities and Exchange Commission, Office of Inspector General, September 25. Internet on-line. http://www.sec.gov/about/oig/audit/2008/446-a.pdf. [October 4, 2008].

Labaton, S. (2008). Agency's '04 Rule Let Banks Pile Up New Debt. The New York Times, October 3. Internet on-line. http://www.nytimes.com. [October 3, 2008]

Langley, M., Solomon, D. & Karnitschnig, M. (2008). Unheard Pleas, Lost Chances Pushed Ailing AIG to Brink. The Wall Street Journal, September 18.

Lucchetti, A & Sidel, R. (2008). Banks' Shift Could Come At High Price Of Regulation. The Wall Street Journal, September 23.

Morris, C. (2008). The Trillion Dollar Meltdown, New York: Public Affairs.

Office of Federal Housing Enterprise Oversight. (2008). Capital Requirements. Internet on-line. http://www.ofheo.gov/. [October 3, 2008].

Paletta, D. (2008). Bush Signs Housing-Relief Bill Into Law. The Wall Street Journal, July 31.

Palmer, A. (2008). A special report on International Banking. The Economist, May 17.

Reddy, S. (2008). Fed Extends Lending Programs as Threats Persist. The Wall Street Journal, July 31.

Reddy, S. & McKinnon, J. (2008). A Big Unknown: Cost of Bailouts. The Wall Street Journal, September 18.

Rosen, R. (2007). The role of securitization in mortgage lending. Chicago Fed Letter, The Federal Reserve Bank of Chicago, November.

Solomon, D., Corkery, M., & Rappaport, L. (2008a). Mortgage Bailout is Greeted With Relief, Fresh Questions. The Wall Street Journal, September 9.

Solomon, D, Enrich, D., & Fitzpatrick, D. (2008b). Bailout Proposal Gets Hung Up Over Central Issued: Will It Work? The Wall Street Journal, September 26.

The Economist (2008). Hall of shame. August 9.

U.S. Department of the Treasury (2008). Treasury Announces TARP Capital Purchase Program Description. Oct 14.

White, L. (1991). The S&L Debacle. New York: Oxford University Press.

Zandi, M. (2008). Financial Shock. Upper Saddle River: FT Press.