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How Did We Get Here? The Story of the Credit Crisis

Part V of A NERA Insights Series

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Previous topics in this subprime lending series include:

- The Subprime Meltdown: A Primer
- Understanding Accounting-Related Allegations
- Subprime Securities Litigation: Key Players, Rising Stakes, and Emerging Trends
- The Use of Economic Analysis in Predatory Lending Cases: Application to Subprime Loans

Introduction

Since August 2007, approximately 40 banks, a major insurance company, government sponsored enterprises (Fannie Mae and Freddie Mac), and several investment banks have either failed or required substantial government assistance.² Still, the financial crisis has yet to show signs of coming to an end. One may wonder, how did problems that first manifested in a relatively small part of the mortgage market lead to a contagion affecting other types of credit including credit cards, student loans, and others, and then quickly spread to threaten the liquidity and possible solvency of many financial institutions around the world?

There is no easy answer to this question, but as the crisis unfolds, there are several possible explanatory factors. In this article, we examine the problems in the mortgage markets and the subsequent contagion that led to the current credit crisis, and provide a critical analysis of the possible contributing factors.

¹ We would like to thank Robert Mackay for his helpful suggestions. Anmol Sinha, Max Egan, Sungi Lee, and Jesse Mark provided excellent research assistance. All errors are ours.

² See the FDIC's "Failed Bank List," see: <http://www.fdic.gov/bank/individual/failed/banklist.html>.

As we write this article, the S&P has been oscillating through a wide range, lending remains anemic, and most of the major economies have now entered recession. On 17 September 2008, the yield on the 1-month Treasury bills dropped to almost zero, 0.07 percent to be exact, a rate unseen since 1941. Investors were willing to hold Treasury bills even without earning a yield, which is equivalent to keeping one's savings under a mattress. The yield on Treasury bills has been declining since January 2007 and dipped significantly around the collapse of Bear Stearns in March 2008 and then again in September, as illustrated in Figure 1. This level of market stress indicates extreme risk aversion and the extent of the current panic.

Figure 1. 1-Month Treasury Bill Rates
Daily Data from 2 January 2007 through 17 September 2008



Notes and Sources:

All data are obtained from the Federal Reserve.

The 17 September 2008 drop to 0.07% represents the lowest US Treasury yield since 1941 (*Financial Times*).

First Signs of the Credit Crisis in the Subprime Market

The current crisis started in the housing sector, unlike other financial crises in recent history. A combination of various industry trends, along with a change in the economic environment over the past five to seven years, led to a surge in delinquencies and foreclosures in the mortgage market. The first signs of trouble appeared in a relatively small portion of the mortgage industry known as subprime.

There is no legal definition for a subprime borrower, but lenders use a combination of characteristics to identify one, including:

- Borrowers with lower credit scores³
- High debt-service-to-income ratio, greater than 40 percent on average
- Higher loan-to-value ratio of 80 percent or more
- Smaller loan size of \$100,000 on average
- Less documentation
- Higher mortgage rates of 200 basis points on average over prime borrowers⁴

From the early 1990s to 2006, housing prices increased at a national level. This continuous growth in prices meant that even if a subprime borrower's personal finances were stressed, the increase in his home value often gave him the option to refinance or even sell instead of going into delinquency. Furthermore, because mortgage rates remained low for most of 2000 to 2005, one was usually able to refinance into another low-rate product. As a result, subprime mortgage originations and securitizations increased between 2001 and 2006 by 216 percent and 415 percent, respectively, as shown in Figure 2. During the same time period, all types of mortgage originations significantly increased, including prime, Alt-A, and jumbo mortgages.



Investors were willing to hold Treasury bills even without earning a yield, which is equivalent to keeping one's savings under a mattress.

³ Michael Staten, Professor and Director, Credit Research Center, Georgetown University, "Subprime Lending: Defining the Market and its Customers," Testimony before the United States House of Representatives Committee on Financial Services (March 2004).

⁴ Sumit Agarwal and Calvin Ho, "Comparing the Prime and Subprime Mortgage Markets," *Chicago Fed Letter* (August 2007).

Figure 2. **Subprime Mortgage Originations and MBS Issuance**
Annual Data from 2001 through 2006

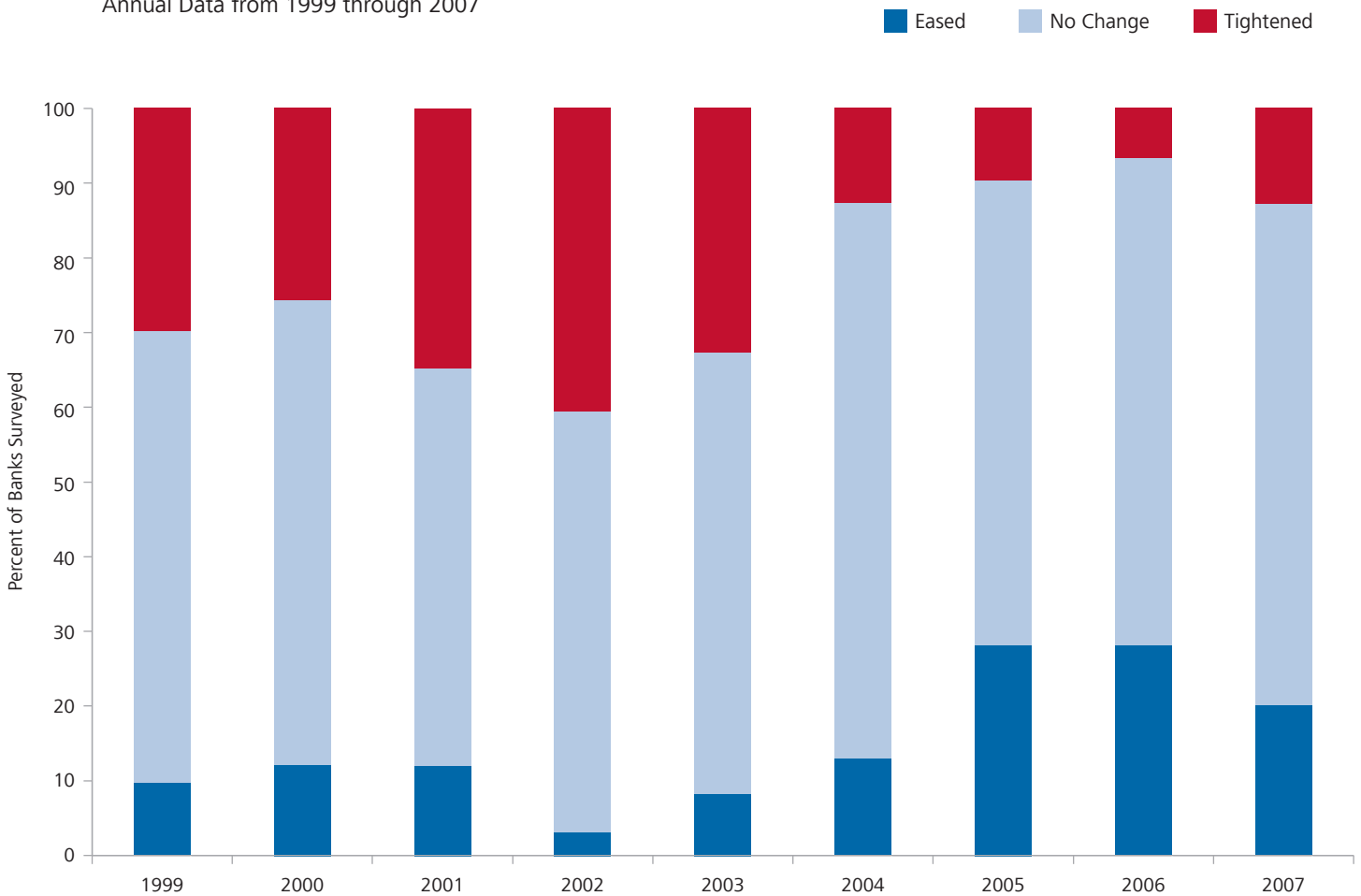


Source: Adam Ashcraft and Til Schuermann, "Understanding the Securitization of Subprime Mortgage Credit." Wharton Financial Institutions Center Working Paper No. 07-43; Federal Reserve Board of New York Staff Report No. 318 (March 2008).

**An estimated 80 percent of
subprime borrowers received
ARM or hybrid loans.**

Figure 3. **Changes in Retail Credit Underwriting Standards**

Annual Data from 1999 through 2007



Source: 2007 Survey of Credit Underwriting Practice, Office of the Comptroller of the Currency

Relatively Lax Underwriting Standards in Recent Years

According to annual surveys conducted by the Office of the Comptroller of the Currency (OCC), credit underwriting standards were eased during the years 2004 to 2006, as shown in Figure 3. The OCC surveyed the examiners of the largest 78 national banks regarding their assessment of the conditions under which credit was extended. The percentage of responders easing lending standards that year rose from 3 percent in 2002 to 28 percent in 2006, while those keeping lending standards the same that year rose from 56 to 65 percent during the same period. The survey is not specific to subprime lending; rather, it focuses on broader underwriting standards.

Similarly, the percentage of loans with full documentation was in decline during the same time period, as illustrated in Figure 4.

Figure 4: **Share of Full Documentation Loans**
Annual Data from 2003 through 2007*

Year	Share of Subprime Mortgages Backing Private Label ABS with Full Documentation
2003	64%
2004	62%
2005	59%
2006	55%
2007*	52%

Notes and Sources:

OFHEO Presentation, June 2007.

* 2007 reflects data only through 1Q-2007.

Increase in Homeowners' Debt Burden

Another factor that led homeowners, particularly subprime borrowers, to be vulnerable to any changes in costs of credit was increasing indebtedness. Household debt burdens increased in the 2000 to 2006 period and reached hitherto unseen levels. As Figure 5 shows, homeowners had been borrowing against equity in their homes at unprecedented rates since 2000. This means that subprime and other types of borrowers relied on the availability of credit and the increasing value of their homes to be able to refinance and meet their obligations. At the same time, housing affordability was decreasing. According to the National Association of Realtors (NAR), the monthly payment of principal and interest for a mortgage on the median-priced family home peaked at a level in excess of 23 percent of median family income in 2006.

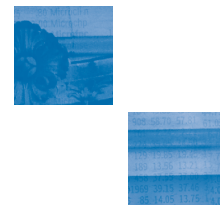
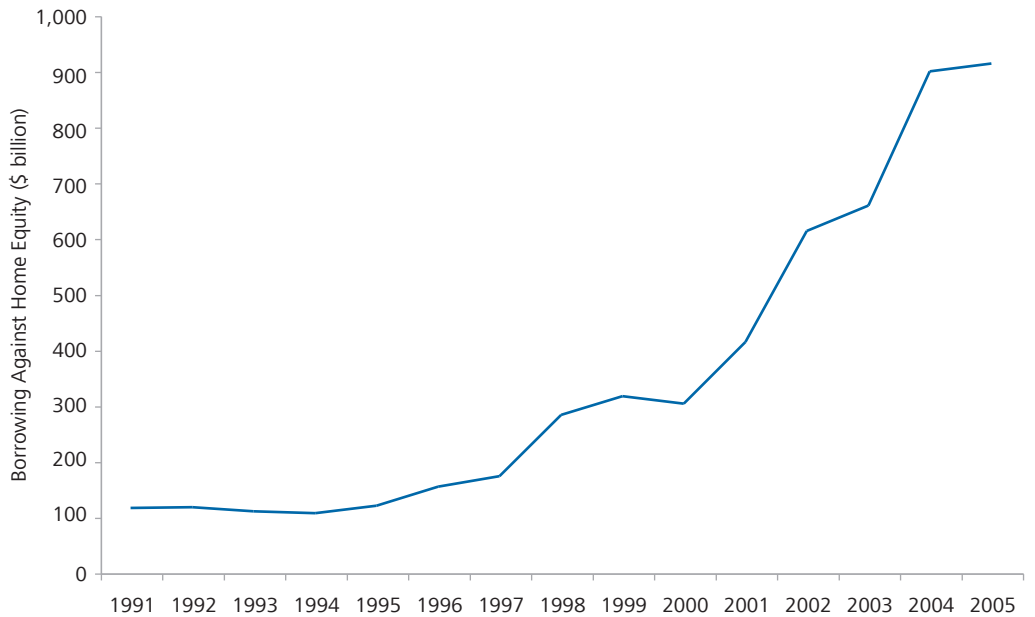


Figure 5. **Gross Equity Extraction Increased Significantly Since 2000**
Annual Data from 1991 through 2005



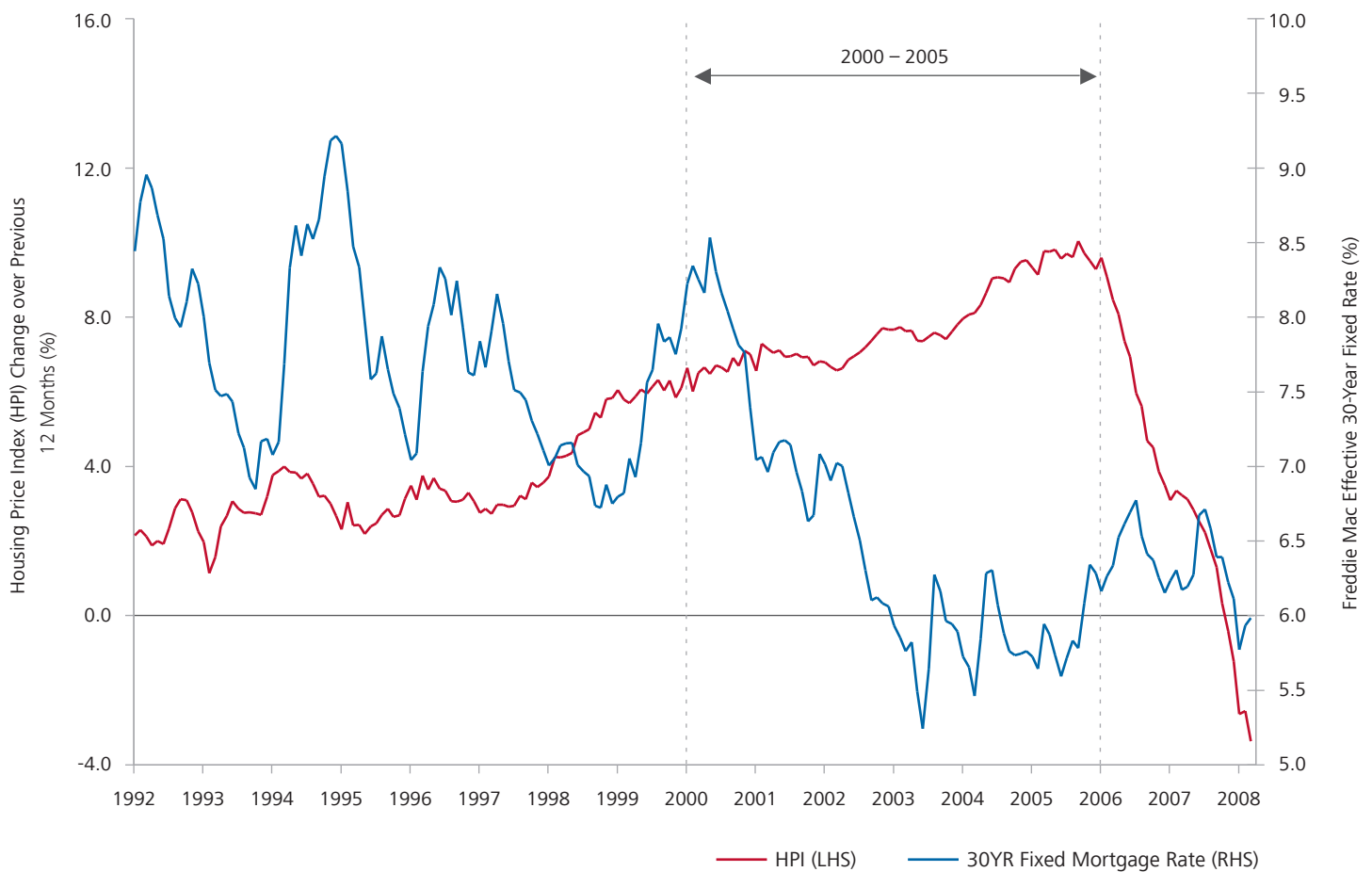
Sources: Alan Greenspan and James Kennedy, "Sources and Uses of Equity Extracted from Homes," Finance and Economics Discussion Series, Federal Reserve Board, 2007.

Combination of Low Cost of Credit and Increasing Housing Prices during the Period 2000 to 2005

The increase in housing prices and the decline in the cost of credit made the prospect of getting a mortgage seem less risky since the options of refinancing or selling the house were both viewed as viable. As shown in Figure 6, the opposing trends in housing prices and cost of credit are evident during the period 2000 to 2005. This led to a surge in subprime and other types of mortgage originations and securitizations until the deceleration occurred by the end of 2005 and beginning of 2006.

Opposing trends in housing prices and cost of credit led to a surge in subprime and other types of mortgage originations and securitizations until the deceleration occurred by the end of 2005 and beginning of 2006.

Figure 6. **Low Cost of Credit and Rising Housing Prices**
 Monthly Data from January 1992 through March 2008



Source: OFHEO and Freddie Mac

Increase in the Use of Riskier Types of Non-Traditional Mortgage Products

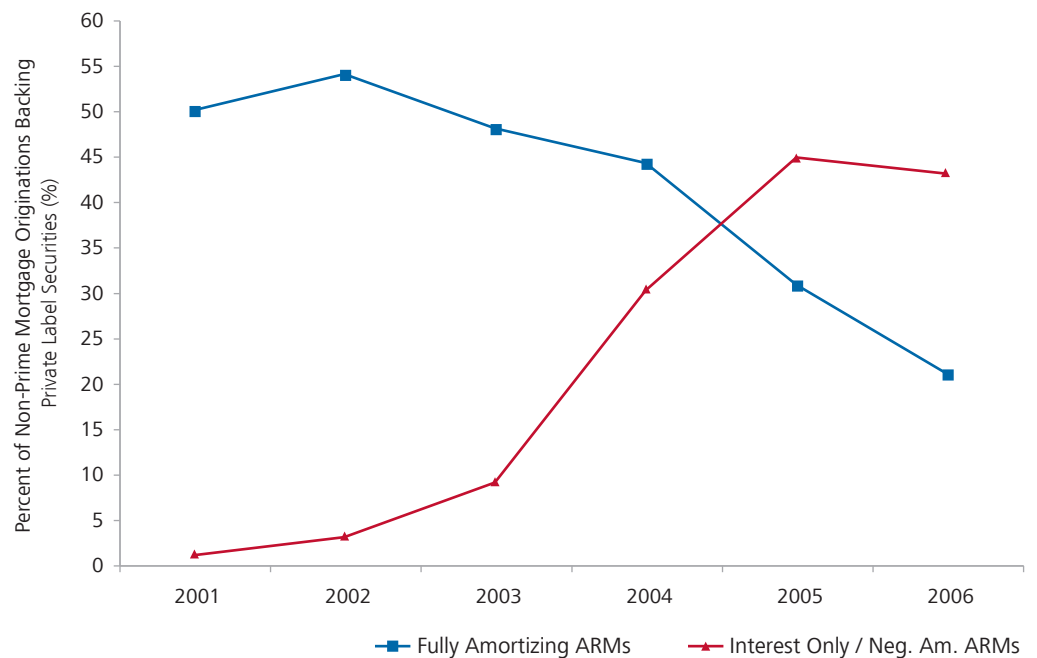
In addition to the macroeconomic conditions, the same time period witnessed an increase in the use of non-traditional mortgage products such as interest-only and negative amortization loans.⁷ The latter types were not restricted to subprime borrowers, but were perceived to be relatively riskier than the traditional mortgage products. Ben Bernanke, Chairman of the Board of Governors of the Federal Reserve, discussed some of the risks associated with such loans (2008):

[H]istorically, borrowers with little or no equity have been substantially more likely than others to fall behind in their payments. The large number of outstanding mortgages with negative amortization features may exacerbate this problem.⁸

As illustrated in Figure 7, the share of interest-only/negative amortization mortgages increased between 2001 and 2006, while the share of fully amortizing loans declined.



Figure 7. **Share of Interest-Only/Negative Amortization Mortgages Have Increased in Non-Prime Originations Backing Private Label Securities**
Annual Data from 2001 through 2006



Source: OFHEO, "Housing, Subprime, and GSE Reform: Where Are We Headed?" 18 July 2007

⁷ An interest-only loan is a loan in which, for a set term, the borrower pays only the interest on the principal balance, while the principal balance remains unchanged. A negative amortization loan refers to a loan structure in which mortgage payments are lower than the interest rate on the mortgage and so the difference is added on to the initial principal, thereby increasing the principal.

⁸ Ben Bernanke, Chairman of the Board of Governors of the Federal Reserve, "Reducing Preventable Mortgage Foreclosures," Speech at the Independent Community Bankers of America Annual Convention, Florida (March 2008).

The Reversal in Housing Prices and Interest Rates

Starting in 2006, several analysts began noting the slowdown in the housing market. For example, a study by the Federal Reserve in November 2006 noted, “[S]igns of a housing market slowdown are unmistakable. New and existing home sales have been declining since mid-2005...”⁹

Figure 8 illustrates the housing bubble and when it burst using the Case-Shiller Index.¹⁰ Analysts have long maintained that housing prices are expected to move in tandem with rents and building costs, a proposition that is supported by the data as far back as 1987. Starting in early 2000, housing prices adjusted for inflation began to increase to levels far exceeding the trends in rent and building costs. This deviation from fundamentals—often regarded as a sign of an asset bubble—peaked in 2005 and began to reverse in 2006. The correction is still in progress and is a key contributing factor to the current distress in the mortgage markets.

Around the same time period of 2004 to 2006, mortgage rates began to rise from their low levels, thus hindering the growth in originations and refinancing activities. As these alternatives started to disappear, delinquencies and foreclosures began to surge.

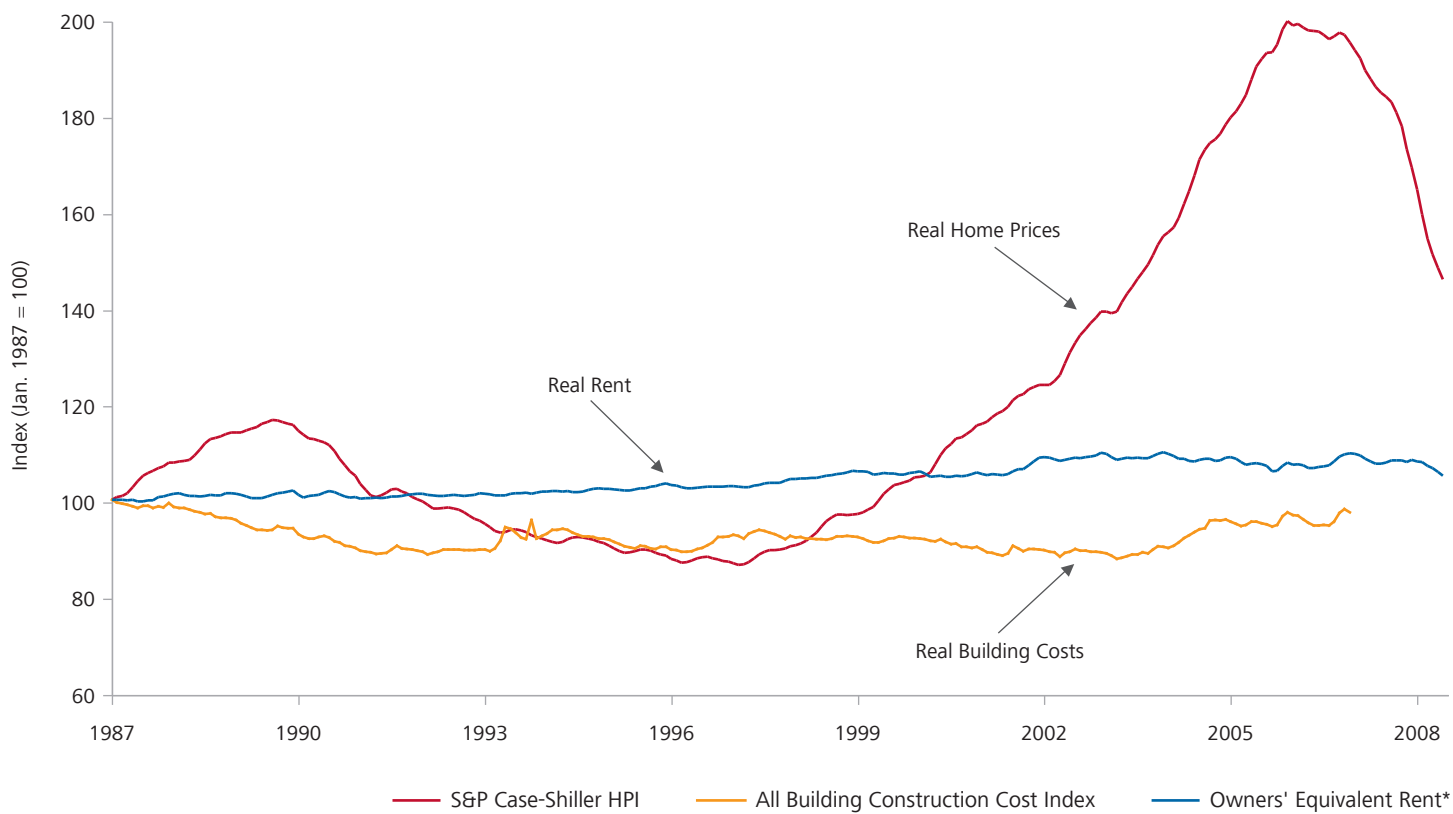


Starting in early 2000, housing prices adjusted for inflation began to increase to levels far exceeding the trends in rent and building costs, a key contributing factor to the current distress in the mortgage markets.

⁹ John Duca, “Making Sense of the US Housing Slowdown,” *Economic Letter—Insights from the Federal Reserve Bank of Dallas*, Vol. 1, No. 11 (November 2006).

¹⁰ The S&P Case-Shiller US National Home Price Index tracks the value of single family housing in the US and measures changes in housing market prices given a constant level of quality—changes in the types, sizes, or physical characteristics of the homes are specifically excluded. It utilizes a “repeat sales method” that only includes properties that have sold at least twice, thereby capturing the true appreciated value of each specific sales unit.

Figure 8. **Real Home Prices vs. Real Rent and Real Building Costs**
 Monthly Data from January 1987 through June 2008



Notes and Sources:

Data are from Federal Reserve Bank of St. Louis, Bloomberg, LP, Standard & Poor's, Bureau of Labor Statistics. Monthly data were first adjusted by CPI and then rescaled to Jan. 1987=100.

* Owners' Equivalent Rent "measures the change in the implicit rent a homeowner would pay to rent, or would earn from renting, his or her home in a competitive market" (see: <http://www.bls.gov/cpi/cpifact6.htm>).

Signs of a Full Credit Crisis

In 2007, it became evident that the credit deterioration extended well beyond subprime mortgages. Other collateral, including Alt-A and prime mortgages as well as credit cards, automobile loans, and student loans, all showed declines in credit quality. Figure 9 shows the surge in delinquency rates in both subprime and prime markets. This was consistent with the size of consumers' debt burdens, which surged in the fourth quarter of 2006 as measured by the Federal Reserve's Household Debt Service Ratio, defined as "the ratio of debt payments to disposable personal income."¹¹ See Figure 10.

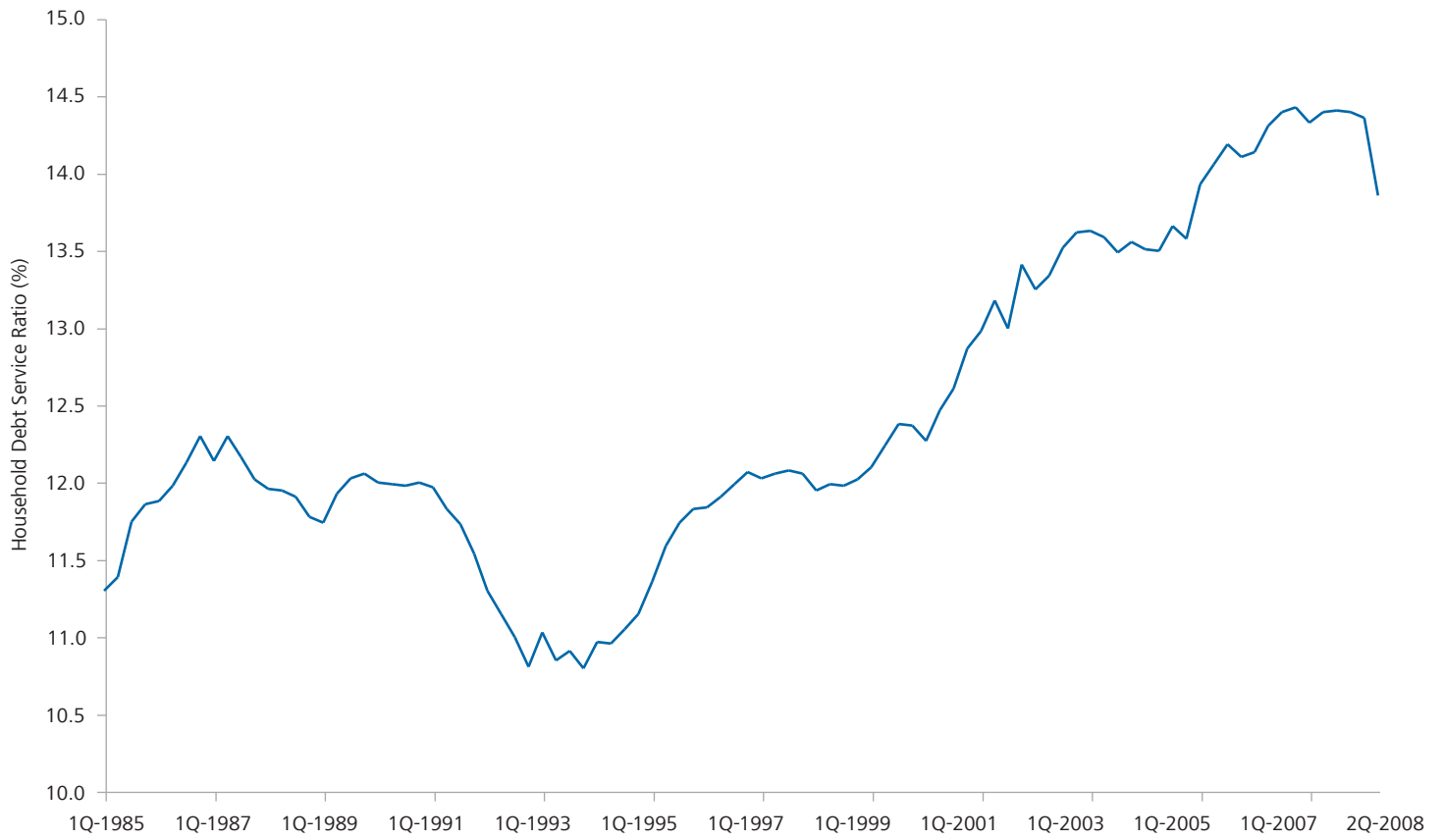
Figure 9. **Prime and Subprime Delinquency Rates**
 Quarterly Data from 1Q-2000 through 4Q-2007



Source: Bloomberg LP

¹¹ The Federal Reserve, see: <http://www.federalreserve.gov/releases/housedebt/>.

Figure 10. **Household Debt Service Ratio**
Quarterly Data from 1Q-1985 through 2Q-2008



Source: Federal Reserve

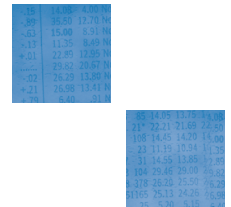
The Role of Structured Finance

There is a controversy over the role of structured finance and other financial products in the crisis and whether innovation may have served to magnify its impact.¹² In this section, we will briefly describe the role of various financial instruments with special emphasis on collateralized debt obligations (CDOs), credit default swaps (CDS), structured investment vehicles (SIVs), and the interrelationship of these with leverage and short-term borrowing. Many of these products have been in existence for decades and have been used to increase liquidity and the availability of credit in the financial markets. This section will focus on the conditions under which securitized collateral may have magnified the exposure to, and losses from, the current crisis.

Securitization and Mortgage-Backed Securities

Securitization is the process of turning pools of financial obligations, whether they are mortgages, credit cards, leases, or others, into securities. Since the early 1980s, securitization has been a tool used to generate liquidity for lenders and to increase access to capital for consumers and various corporations. The mortgage market is the largest to employ securitization technology. In recent years, there has been significant growth in mortgage securitization by the government sponsored agencies (Fannie Mae and Freddie Mac) and non-agency actors, as well.¹³

In brief, the securitization process involves the creation of a special purpose entity or a trust which becomes the owner of the loans. The trust is usually a bankruptcy-remote, special purpose vehicle (a subsidiary of either the originator or an investment bank) that underwrites the securities. The trust structure is used because it is exempt from taxes, allows the originator to treat the transaction as a loan sale, and insulates investors from the liabilities of the originator and issuer. A mortgage-backed security (MBS) is a bond whose cash flow is derived from the principal and interest payments of mortgages.



¹² According to the International Swaps and Derivatives Association, Inc. (ISDA), the term “structured products” refers to a variety of financial instruments that combine various cash assets and/or derivatives to provide a particular risk/reward profile that allows investors access to broader investment opportunities. The return of a structured product is usually derived from the performance of one or more underlying assets, including interest rates; a particular equity or debt instrument; a basket of securities; a securities index or indices; an individual commodity or commodities; a commodities index; an individual currency or currency basket; creditworthiness of a security or basket of securities; or any combination thereof.

¹³ See *The Handbook of Mortgage-Backed Securities*, Frank J. Fabozzi, ed. (New York: McGraw-Hill, 2006), for a detailed description of the securitization process.



Fannie and Freddie guarantee the timely payment of principal and interest for a fee, so the credit risk of the borrowers is not at issue unless the government sponsored agencies default. However, as Fannie and Freddie's securitized products (agency pools) are believed to have a government guarantee, default risk is not a key issue as it is for non-agency or private label products. Non-agency pools of loans expose the investors to credit risk and hence, some form of "credit enhancement" is required in order for these securities, including subprime MBS, to obtain credit ratings. Such enhancement mechanisms can come from unrelated parties, or be part of the deal structure itself. As such, they are referred to either as external or internal credit enhancements, respectively. The most common internal forms of credit enhancements include tranching, over collateralization, and subordination. Following a process known as credit tranching, the securitized loans are divided into different classes according to their level of risk. The top tranches are the AAA and AA rated bonds. Below these are the lower-rated classes. At the lowest level is the "equity" or "first-loss" tranche, which is usually not rated.

Since MBS derive their value from the underlying collateral, it is not surprising that the value of these securities declined as the delinquency and defaults of mortgages surged beyond expected levels. A variety of investors hold MBS, including banks, hedge funds, insurance companies, collateralized debt obligations, and conduits known as structured investment vehicles. We discuss the latter two entities in more detail below.

Collateralized Debt Obligations

A CDO is a special purpose entity that holds debt as collateral and issues long-term liabilities in the form of tranching securities.¹⁴ The underlying collateral can be corporate bonds, MBS, asset-backed securities (ABS), other CDOs, or other products. CDOs differ in their structures and purposes. Almost all CDOs issue multiple classes of securities that are tranching with respect to seniority in bankruptcy and timing of repayment.¹⁵ The process of forming a CDO is similar to the formation of an MBS as described above. There are different purposes for issuing CDOs. Some CDOs are set up to hedge credit risk and reduce regulatory capital—known as balance sheet CDOs—and others are designed to exploit management expertise, earn management fees, and collect interest on high-yield assets—known as arbitrage CDOs.¹⁶

Although CDOs have existed since 1987, the market experienced significant growth during the period 2000 to 2006. In 2004, there was approximately \$157.4 billion in global CDO issuance. In 2006, there was \$551.7 billion in issuance, a growth of approximately 250 percent. CDOs with structured collateral have been an increasing fraction of all CDO issuance. In 2006, CDOs with structured finance products as the underlying collateral comprised almost 57 percent of the global CDO issuance.¹⁷ Specifically, mortgage products have constituted a large share of the underlying collateral:

¹⁴ There are many primers written on structured products, CDOs, CDS, and other derivatives. Our article will not discuss the products in detail, but please see JPMorgan's "CDO Handbook" for a detailed discussion of CDOs.

¹⁵ Christopher Flanagan and Thomas Sam, "CDO Handbook," JPMorgan Global Structured Finance Research (April 2002).

¹⁶ *Ibid.*

¹⁷ See SIFMA's Global CDO Issuance Market Data:
http://www.sifma.org/research/pdf/SIFMA_CDOIssuanceData2008q2.pdf.

The FDIC reports that 81 percent of the \$249 billion of CDO collateral pools issued in 2005, or \$200 billion, was made up of residential mortgage products. (FDIC Outlook, Fall 2006) Moody's CDO Asset Exposure Report for October 2006 reveals that 39.5 percent of the collateral within the 678 deals covered by Moody's consists of RMBS, just over 70 percent of that in subprime and home equity loans and the other 30 percent in prime first-lien loans. Hence, CDOs hold a lot of RMBS.¹⁸

As housing prices declined at the national level, recent vintages of the ABS CDOs experienced significant rating downgrades because of their exposure to subprime and other non-agency collateral: "During 2007, Moody's downgraded 31 percent of all the ABS CDO tranches it had rated. In some cases, these downgrades have reached to the top of the CDO capital structure: 14 percent of tranches initially rated AAA were downgraded."¹⁹

Several factors may have led to the poor performance of CDOs and in particular the ABS CDOs. Many analysts incorrectly assumed that housing prices would either continue to increase or remain flat. Even when analysts ran sensitivity analyses or stress testing assuming a decline in housing prices, the extent of the actual decline was not foreseen. The housing bubble and its subsequent burst created a chain reaction that impacted various aspects of the valuations and risk structures of these mortgage-related products.

Incorrect assumptions about correlation risk also contributed. Many securitized products including CDOs are structured based on the assumption of a certain degree of diversification in the performance of the underlying collateral. However, contrary to the correlation assumptions underlying many CDO valuations, different types of collateral underperformed at the same time following the decrease in housing prices. Mortgage borrowers, whether subprime or prime, relied on the increase in housing prices to be able to refinance their houses and other expenses, but when housing price growth started to stall at the national level in 2006, delinquencies and defaults of prime, Alt-A, jumbo, and subprime mortgages all suffered. Therefore, even if the valuation models had taken into account a certain degree of correlation among the pooled assets, the decline of housing prices at the national level could and did increase the correlation to unprecedented levels. The collateral underlying the structured CDOs were all exposed to the same systemic shock as housing prices continued to decline. The correlation of the performance among the pooled assets and the time-varying correlation are key factors that complicate the valuation of CDOs.

In addition, the default triggers in some ABS CDOs may force liquidations. A trigger can divert funds away from the junior tranches or give the holders of the senior tranches the option to liquidate once the performance of the underlying collateral reaches a certain level. According to the Basel Committee on Banking Supervision, "Around 50 ABS CDOs hit default triggers before the end of 2007, with about half entering liquidation."²⁰



¹⁸ Joseph Mason and Josh Rosner, "How Resilient are Mortgage Backed Securities to Collateralized Debt Obligation Market Disruptions?" Working Paper (February 2007), p. 28. Available at SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1027472.

¹⁹ Basel Committee on Banking Supervision, "Credit Risk Transfer," July 2008, p. 12.

²⁰ *Ibid*, p. 13.

Structured Investment Vehicles

SIVs are another type of investor in mortgage-backed securities and collateralized debt obligations. SIVs are off-balance sheet entities that usually are set up by large financial institutions.²¹ They rely on short- and medium-term borrowing by issuing asset-backed commercial paper and medium-term notes and then use the proceeds to invest in a variety of securities including tranches of CDOs. Because they rely on short-term financing, SIVs meet the debt service on these obligations using the cash flow generated from their investment assets, which are longer-term, as well as other sources such as rolling over debt and acquiring liquidity lines from banks.

Various financial entities, including money market funds, invest in the asset-backed commercial paper and can be indirectly exposed to the credit risk of the collateral underlying these securities.

Short-Term Borrowing and Leverage

SIVs were not the only financial entities that relied on short-term borrowing and leverage. Many other participants, including SIV lites, banks, hedge funds, insurance companies, and others, followed suit. For banks in particular, short-term, collateralized borrowing was a cheaper and easier source of funding than either borrowing long-term (generally unsecured) or raising equity financing.²² This was due to the fact that borrowing against collateral provides an easier means of procurement, and banks' assets that serve as collateral are generally short-term in nature. Moreover, many of these entities combined a reliance on short-term financing with a high degree of leverage—in some cases exceeding 70 times capital. With such an approach, relatively low levels of losses on the underlying collateral could and did lead to large losses on the equity and borrowed capital, which effectively led to higher levels of leverage. In turn, the losses led to asset sales as these participants sought to delever.

In summary, the increased use of ABS CDOs in recent years, along with the increased leverage and reliance on short-term funding, increased the number of market participants who were (directly or indirectly) exposed to the housing market. The market participants in question were then exposed to a systemic risk related to the value of houses. When housing prices collapsed, investors fled to quality, and credit disappeared together with the ability to leverage, leading to magnified losses.

²¹ There are other types of conduits that invested in structured products, but we will focus the discussion on SIVs.

²² For a discussion of why short-term debt became an important source of funding for banks, see Kashyap, et al., "Rethinking Capital Regulation" Paper prepared for the Federal Reserve Bank of Kansas City Symposium at Jackson Hole (August 2008).



Credit Default Swaps

Some analysts argue that the problems were compounded by derivative exposures via instruments such as CDS, and we assess some of the controversy over CDS. A CDS is a contract that provides insurance against the risk of a default by a particular entity.²³ The company is known as the reference entity and a default by the company is known as a credit event. The buyer of the insurance has the right to sell a particular bond issued by the entity at par value when a credit event occurs. The bond is known as the reference obligation and the total par value of the bond that can be sold is known as the swap's notional principal.²⁴ These are bilateral over-the-counter agreements and are often used to spread the cost of a credit event, such as default or bankruptcy, and enable participants to hedge against the creditworthiness of companies or even countries.

The notional exposure of CDS is often cited as evidence that this market is far greater than that represented by the underlying securities. But it is misleading to rely on the notional value of CDS. As shown in Figure 11, the notional amount outstanding of CDS in 2007 was \$62 trillion, which is close to the level of the world gross domestic product that year. However, the notional value of outstanding CDS does not represent the outstanding liabilities for several reasons. First, parties with offsetting CDS contracts would actually offset their credit exposure to the reference entity. The Bank for International Settlements notes that approximately 55 percent of the notional amount outstanding as of December 2007 was with reporting dealers, for whom net exposure is a more meaningful metric.²⁵ Second, all reference entities upon which credit default swaps are written would have to default *simultaneously* for the entire outstanding notional amount to be paid. This would mean that the primary reference entities, including General Motors, Brazil, Daimler Chrysler, Telecom Italia, Italy, Turkey, Russia, and others, would all have to default at the same time.²⁶



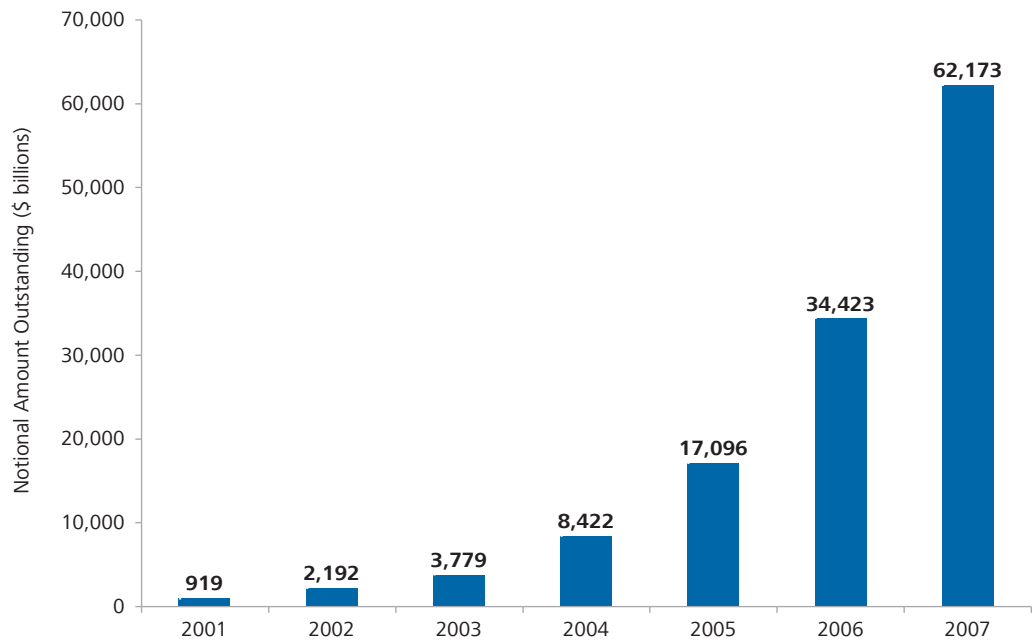
²³ John Hull and Alan White, "Valuing Credit Default Swaps I: No Counterparty Default Risk." *The Journal of Derivatives* 8 (1), 29-40 (April 2000).

²⁴ International Swaps and Derivatives Association, Inc., see: <http://www.isda.org/>.

²⁵ Bank for International Settlements, "OTC derivatives market activity in the first half of 2008" (November 2008).

²⁶ David Mengle, "Credit Derivatives: An Overview," International Swaps and Derivatives Association (2007).

Figure 11. **Notional Amount of Credit Default Swaps Outstanding**
Annual Data from 2001 through 2007



Source: ISDA

A more appropriate estimate of exposure to CDS would be the “gross replacement value,” akin to the market price of equities.²⁷ The Bank for International Settlements estimates that the gross market value of the total CDS outstanding as of December 2007 was approximately \$2 trillion.²⁸

Derivatives are meant to redistribute existing risk between market participants and allow participants to hedge risk.²⁹ One of the risks associated with CDS is counterparty risk, which relates to the potential for either of the CDS parties to be unable to fulfill the terms of the contract. However, large, aggregate exposure to the same counterparty, such as AIG, may cause disruptions in the marketplace if the viability of the protection seller is in question.

²⁷ Dr. Richard Lindsey, Testimony before the Committee on Agriculture, Nutrition, and Forestry, United States Senate (October 14, 2008).

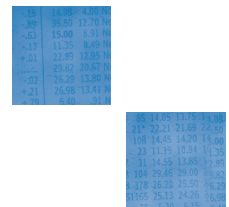
²⁸ Bank for International Settlements, “OTC derivatives market activity in the first half of 2008” (November 2008).

²⁹ David Skeel and Frank Partnoy, “The Promise and Peril of Credit Derivatives.” University of Pennsylvania, Institute for Law & Economics Research Paper No. 06-22 (2006).

According to its second quarter 2008 SEC filing, AIG participated in the US residential mortgage market through a variety of methods, among them the use of CDS. It provided credit protection on the super-senior risk layer of diversified portfolios of investment-grade corporate debt, collateralized loan obligations (CLOs), and multi-sector CDOs, as well as some protection on tranches below the super-senior level.³⁰ As of the second quarter of 2008, AIG had approximately \$440 billion in total notional exposure in its super-senior CDS portfolio and had recorded a fair value unrealized loss on the portfolio of approximately \$26 billion.³¹ As of 31 July 2008, AIG estimated that a downgrade by Moody's to "A1" and by S&P to "A+" would allow counterparties to request approximately \$13 billion in additional collateral.³² The size of AIG's exposure as a provider of credit protection was a key factor in the Federal Reserve's decision to provide an \$85 billion secured loan to avoid bankruptcy on 16 September 2008. As its reasoning, the Fed stated, "The Board determined that, in current circumstances, a disorderly failure of AIG could add to already significant levels of financial market fragility...."³³

Disruptions caused by counterparty failures may create a "domino" effect and imply *multiples* of the losses on the underlying securities being transmitted to various agents in the capital markets. While there are corresponding gains (because of the contracts' bilateral nature), concentrated losses can lead to the distress, and in some cases failure, of market participants. If the market perceived a key counterparty to experience significant problems, this could lead to novation requests as counterparties try to reduce their exposure to the troubled firm.³⁴ The firm may then find itself facing additional collateral requirements and other problems leading to self-fulfilling results.³⁵

In addition, the subprime credit derivative indices, known as the ABX, are of particular relevance to the current crisis. The ABX is comprised of a series of CDS based on twenty deals that consist of subprime mortgages. ABX contracts are commonly used by investors to hedge or to speculate against the risk of defaults on mortgage securities. ABX swaps offer protection if the securities do not perform as expected in return for regular insurance-like premiums. A decline in the price of ABX indices signifies investor belief that subprime mortgages will suffer increased financial losses. Likewise, an increase in the ABX indices signifies investor belief that subprime mortgages are more likely to perform better. The prices of the ABX indices can be used to infer information about the market's assumptions regarding default and recovery rates of the collateral, under normal market conditions.



³⁰ A collateralized loan obligation is a securitization of bank loans, generally commercial and industrial loans.

³¹ AIG's Form 10-Q, filed on 6 August 2008, pp. 39 and 42.

³² *Ibid.* p. 40.

³³ See the Federal Reserve Press Release (16 September 2008), <http://www.federalreserve.gov/newsevents/press/other/20080916a.htm>.

³⁴ In legal terminology, a novation is a mutual agreement among all concerned parties to substitute a new contract in place of an existing one.

³⁵ Dr. Richard Lindsey, Testimony before the Committee on Agriculture, Nutrition, and Forestry, United States Senate (14 October 2008).

As Figure 12 illustrates, a \$100 investment in the 07-01 BBB ABX index in January 2007 was worth \$5 in September 2008. This drop in value suggests significant losses on the underlying collateral that have not yet completely materialized. The corresponding ABX AAA index also lost more than half of its value during the same time period. There is an ongoing dispute among economists as to the role of the ABX indices in the crisis. Gorton (2008), for example, argues that the ABX indices provided information to the market about the subprime mortgages that was not previously available.³⁶ There are several other home equity indices that have been used to hedge exposure to home equity, including the Lehman and Merrill home equity indices; both have been available for several years. In addition, investors in subprime asset-backed securities have access to detailed information about the performance of the collateral underlying the securities from the periodic reports they receive from the trustees as well as analyses from the rating agencies and other data sources.



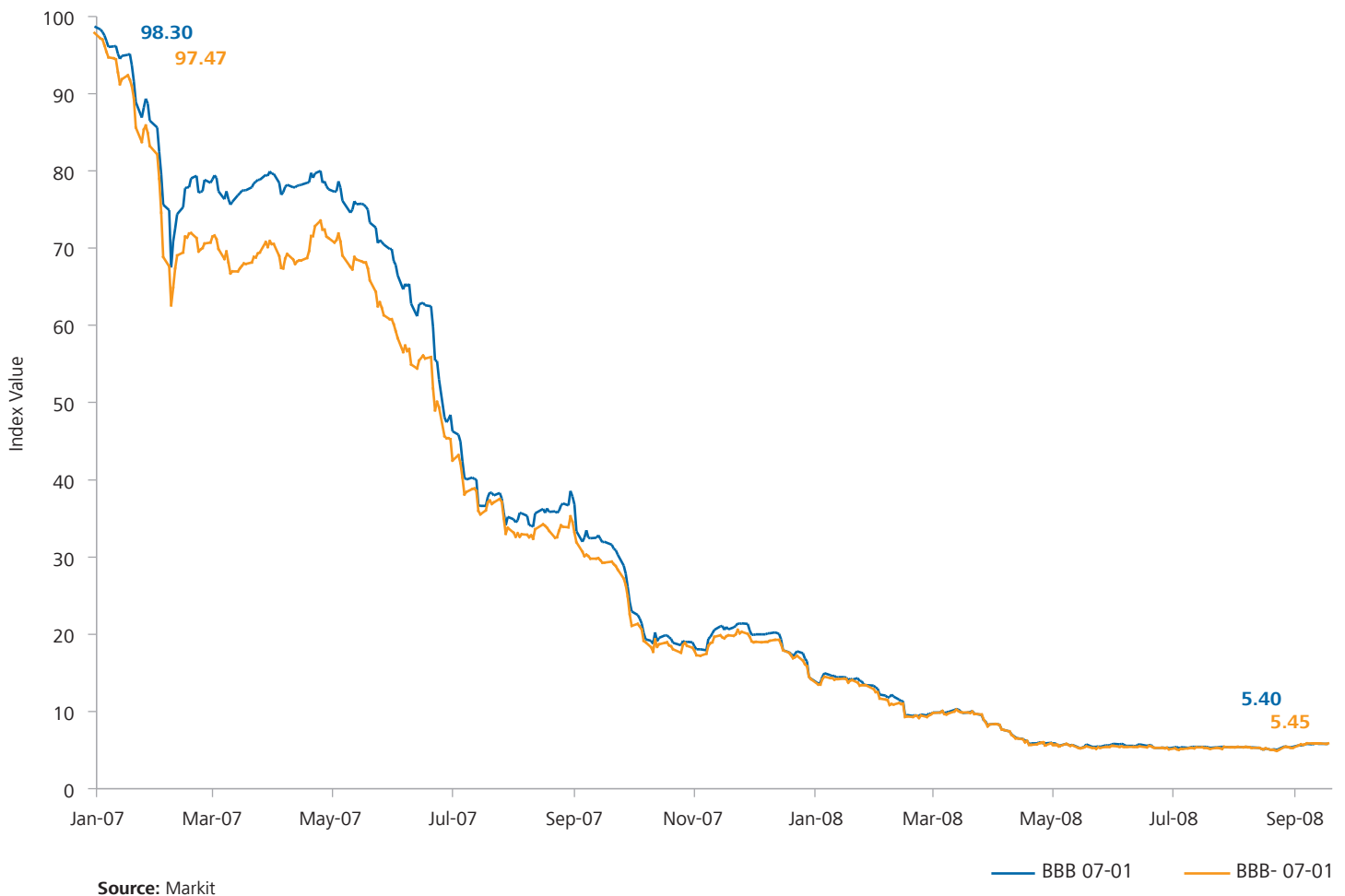
Other economists have examined the factors leading to the significant drop in the value of the ABX indices. The question is, to what extent does the decline in the ABX indices reflect actual (or projections of) losses on the underlying collateral? Fender and Scheicher's (2008) empirical analysis shows that a declining risk appetite and increased concerns about market liquidity have contributed to the significant drop in the ABX values.³⁷ Their results suggest that the drop in value of the ABX indices may not reflect actual losses on the subprime collateral. Others wonder why there is no demand for the ABX indices if the market price does not reflect actual or projected losses. Given the current freeze in the subprime markets and relative difficulty in obtaining dealer marks, it is too early to fully explain the significant drop in the value of the indices.

³⁶ Gary Gorton, "The Subprime Panic." Yale International Center for Finance Working Paper No. 08-25 (September 2008).

³⁷ Ingo Fender and Martin Scheicher, "The ABX: How Do the Markets Price Subprime Mortgage Risk?" BIS Quarterly Review (September 2008).

Figure 12. **ABX BBB and BBB- 07-01 Indices**

Daily Data from 19 January 2007 through 7 October 2008



A \$100 investment in the 07-01 BBB ABX index in January 2007 was worth \$5 in September 2008. This drop in value suggests significant losses on the underlying collateral that have not yet completely materialized.

Flight to Quality and the Contagion

As the crisis deepened and the spillover effects became evident in various parts of the financial markets, investors fled all but the safest investments (generally Treasuries). Spreads on various debt securities began to rise. The TED spread, two-year swap spreads, and the London inter-bank offered rate (LIBOR) – overnight index swap (OIS) spread also reached recent highs, as illustrated in Figure 13. The TED spread is the difference in the dollar rate for three-month inter-bank borrowing and the US Treasury’s three-month borrowing costs. The two-year swap spread is the cost of exchanging two-year US fixed-rate interest payments for floating rates. The cost is expressed as the premium of the swap over comparable Treasuries. In times of increasing uncertainty and risk-aversion, spreads rise as investors demand higher premiums for providing fixed-rate interest payments. The two-year swap spread reached a high of 170 basis points on 3 October 2008. Similarly, an increase in the LIBOR-OIS spread indicates a decline in banks’ willingness to lend. It is measured as the spread between the rate banks charge for loans in London and the OIS rate.³⁸ The TED spread and the LIBOR-OIS spread reached highs on 10 October 2008, of 457 basis points and 366 basis points, respectively. At the same time, the CDS market indicated increased concerns about counterparty risk.

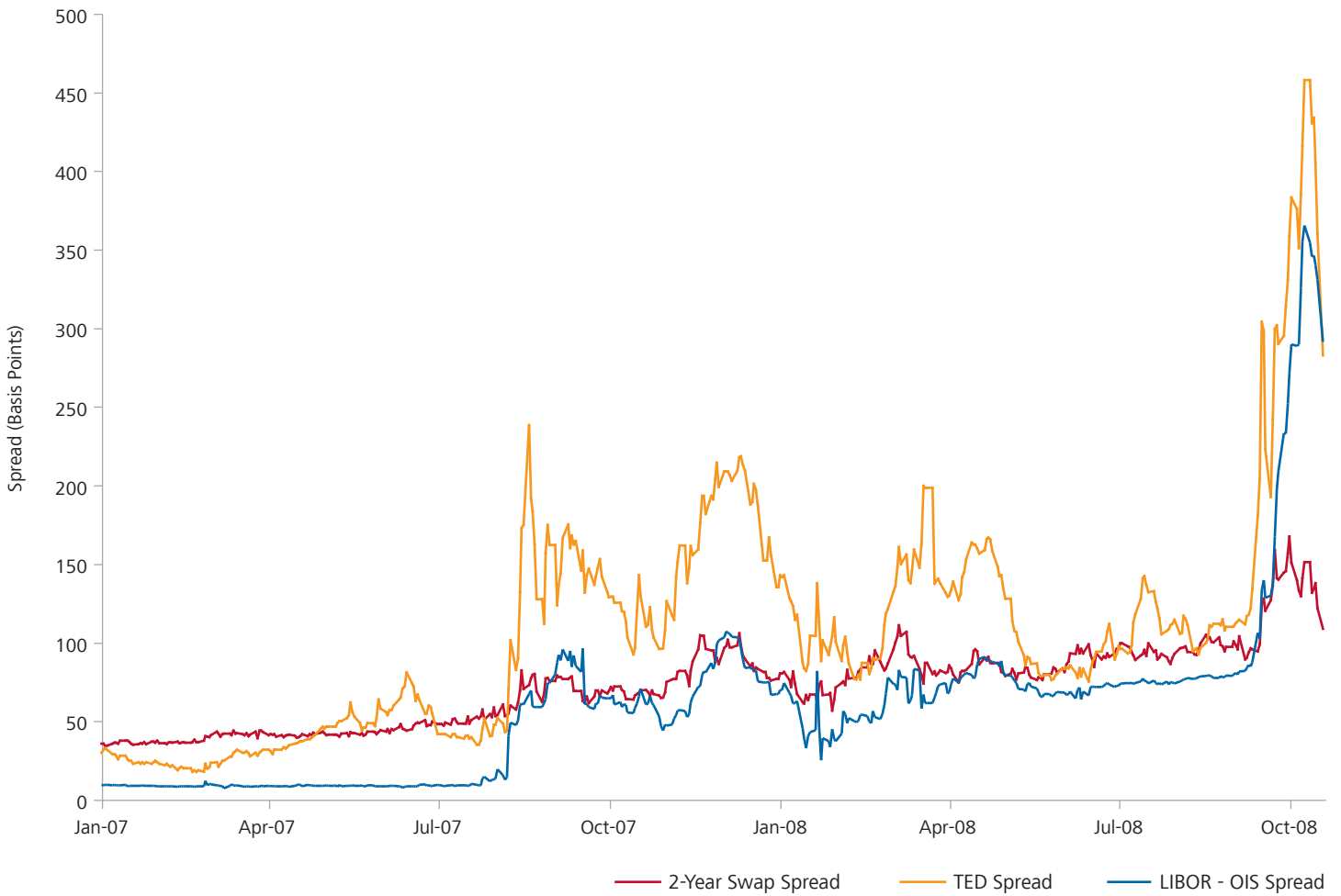


15.98	0.51	10/10/08
11.25	0.48	10/09/08
12.45	11.56	10/08/08
59.02	10.87	10/05/08
25.22	13.20	10/02/08
18.98	11.91	10/01/08
6.10	31	10/01/08
38.25	19.28	10/01/08

³⁸ The overnight index swap (OIS) represents the market expectation of the federal funds rate. Thus, the LIBOR-OIS spread is seen as a measure of the credit risk premium - see McAndrews et al., "The Effect of the Term Auction Facility on the London Inter-Bank Offered Rate" Federal Reserve Bank of New York Staff Report No. 335 (July 2008). Former Federal Reserve Chairman Alan Greenspan recently wrote in an article for *The Economist* that the LIBOR-OIS spread was a measure of market perceptions of potential bank insolvency and therefore of extra capital needs. See Alan Greenspan, "Banks Need More Capital" *The Economist* (18 December 2008).

Figure 13. 2-Year Swap Spread, TED Spread, and LIBOR – Overnight Index Swap Spread

Daily Data from 2 January 2007 through 20 October 2008



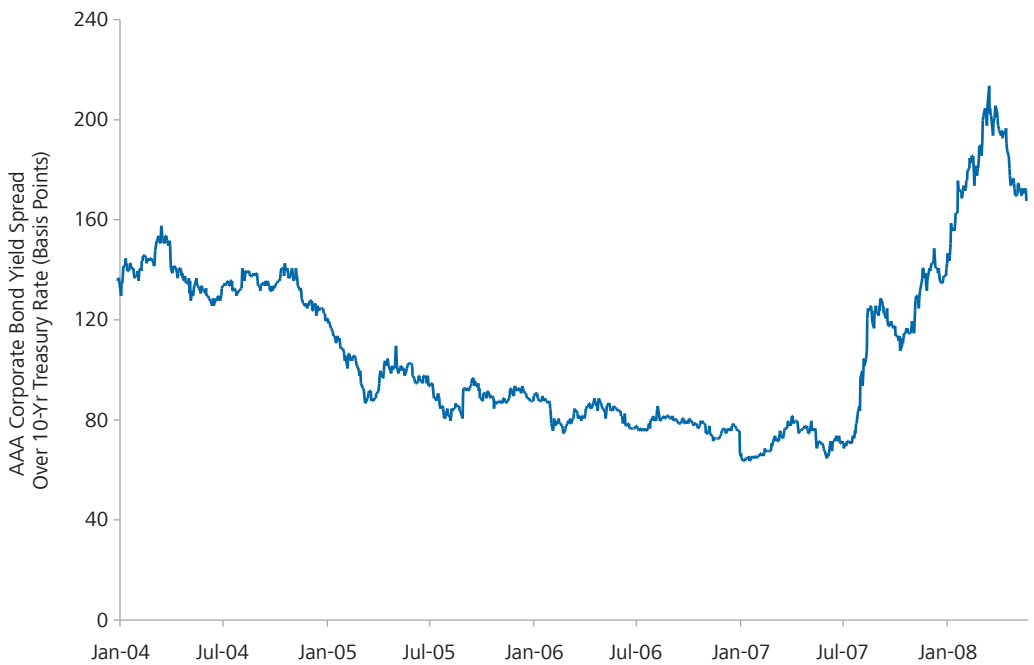
Source: Bloomberg LP

Even Highly-Rated AAA Corporate Bonds Experienced Widening Spreads

The AAA corporate bond yield spread measures the difference between the yields on AAA corporate bonds and risk-free assets. The spread indicates the premium that investors require in order to invest in AAA corporate bonds. A smaller spread indicates that investors view lending to corporations as less risky, and vice versa. As of June 2007, the spread was 70 basis points. As investors became increasingly wary of the uncertainties about prices of various securities, the spread jumped to almost 125 basis points by August 2007 and over 200 basis points by March 2008, as illustrated in Figure 14. Thus, the cost of borrowing to corporations significantly increased over a relatively short period of time. The levels that the spread reached during 2007 and 2008 are not unprecedented; they are below the levels seen, for example, in September 2001. However, combined with the other conditions of the credit markets, they remain a sign of investors' risk-aversion and concern over the viability of even highly-rated corporations.



Figure 14. **Corporate Bond Yield Spreads Began to Rise**
Daily Data from 1 January 2004 through 22 May 2008



Source: Moody's, Federal Reserve

Asset-Backed Commercial Paper was Hit in the First Part of August 2007

Investors' flight to quality in the face of the news about subprime-related losses and the poor performance of various collateral had a significant impact on even the most liquid part of the markets, asset-backed commercial paper.³⁹ Companies used this market to meet their short-term financing needs. As the summer of 2007 began, there were indications that the mortgage problem had spread beyond subprime. In July, Moody's downgraded \$5 billion in securities backed by subprime assets and S&P placed \$12 billion on watch for possible downgrades.⁴⁰ Various hedge funds including Basis Capital, Absolute Capital, and Sowood Capital either had to halt redemptions or sell assets at fire-sale prices and close funds. In addition, German lender IKB, Paris-based asset manager AXA IM, and Singapore-based United Overseas Bank all reported subprime related troubles. By the first week of August, two Bear Stearns funds had filed for bankruptcy, and academics noted, "During the week of August 6, 2007, a number of high-profile and highly successful quantitative long/short equity hedge funds experienced unprecedented losses."⁴¹

The mounting losses and the speed with which they seemed to be spreading created a virtual panic that led to a flight to quality by investors—even from the liquid asset-backed commercial paper markets—and spurred immediate central bank action. During the first week of August 2007, the Federal Reserve as well as other central banks around the world had to interfere to inject about \$290 billion into the markets to ensure liquidity. Figure 15 illustrates the decline in the asset-backed commercial paper market.

The significant decline in the commercial paper market had a direct impact on the real economy as it was a major source of short-term funding for industrial and commercial corporations such as AT&T and General Electric. The freeze meant that funding for highly-rated corporations had become more difficult and more expensive.

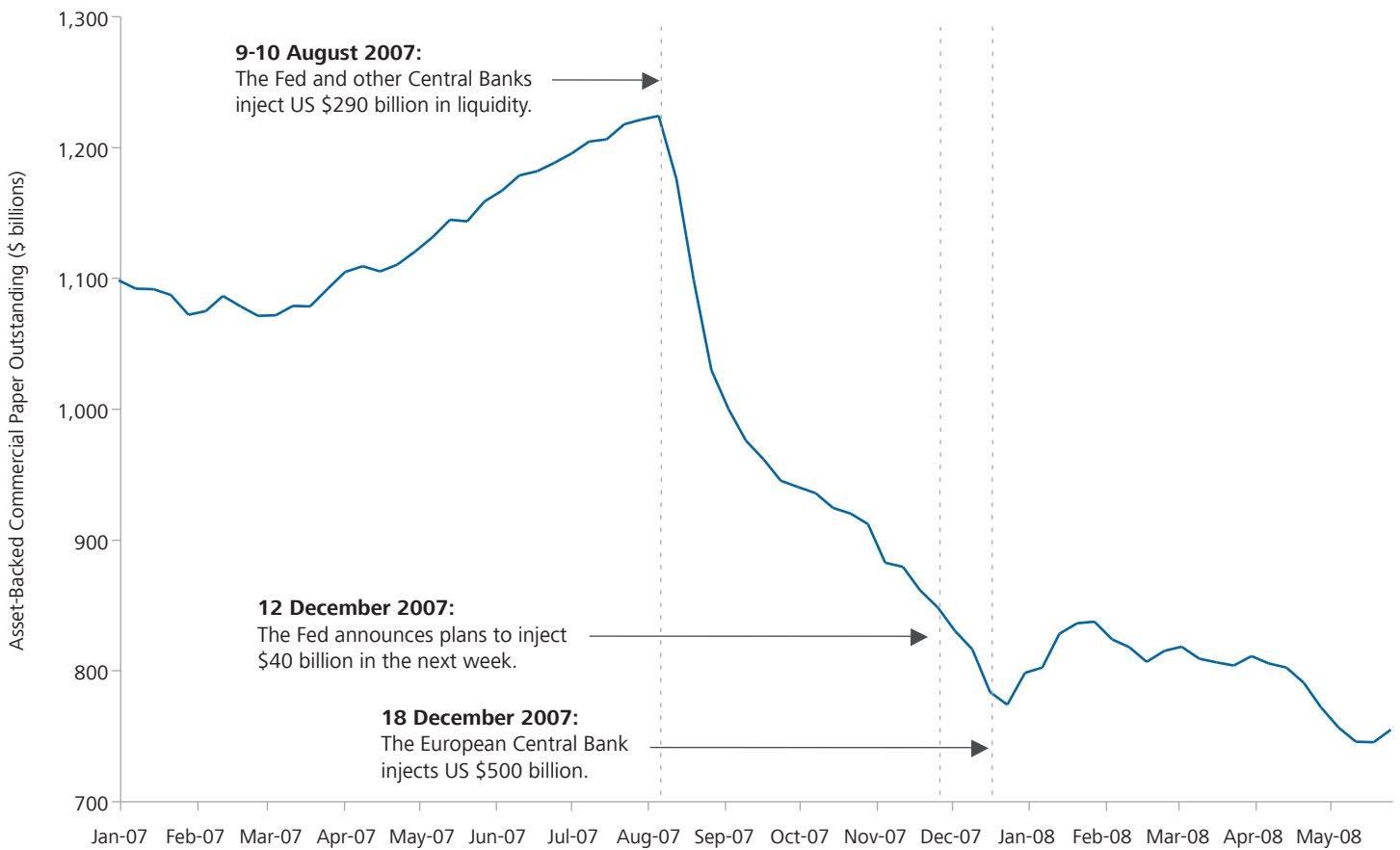


³⁹ Asset-backed commercial paper is a short-term investment vehicle with a maturity that is typically between 90 and 180 days. The notes are backed by physical assets such as mortgages, and are generally used for short-term financing needs.

⁴⁰ Saskia Scholtes, "FT.com: Subprime Bonds in Ratings Downgrades," *Financial Times* (10 July 2007).

⁴¹ Amir Khandani and Andrew Lo, "What Happened to the Quants in August 2007?" Working Paper (September 2007). Available at SSRN: <http://ssrn.com/abstract=1015987>.

Figure 15. **Asset-Backed Commercial Paper Market**
Weekly data from January 2007 through May 2008



Source: Bloomberg LP

The mounting losses and the speed with which they seemed to be spreading created a virtual panic that led to a flight to quality by investors—even from the liquid asset-backed commercial paper markets—and spurred immediate central bank action.

LIBOR

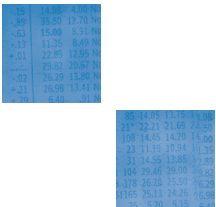
The crisis also spread to lending between banks. As banks became concerned about the quality of other banks' assets and also sought to conserve their own cash (in part to deal with other banks' concerns regarding their quality), LIBOR rose.⁴² This meant that banks became reluctant to lend to each other as they became increasingly uncertain about the viability of their counterparties. A higher LIBOR means less liquidity in the markets. Moreover, other rates such as the Treasury-Eurodollar spread and the LIBOR-OIS spread showed that this panic was widespread.

Summary

The credit crisis continues as we write this article. The bubble that was brewing in the housing market since at least 2000 finally burst in 2006. As housing prices continue to decline at the national level, delinquencies and defaults on subprime and prime mortgages, credit cards, auto loans, and others continue to increase. The flight to quality has led to a severe liquidity crisis that has extended to all sectors of the world economy. The decline in the commercial paper market has made it quite costly for large corporations to fund their short-term needs. LIBOR remains elevated and securitization has dropped significantly in all sectors, further drying up liquidity. Governments in all countries have taken extraordinary measures to restore order to the markets and confidence to investors, including direct capital injections in some financial institutions, guarantees of bad debts, and other unconventional means. Even after the credit crisis is over, it is not clear that the financial markets will ever be the same again.



⁴² LIBOR is a guide for the rate banks use to lend each other.



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