



Federal Reserve Bank of Chicago

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Abstract: The financial crisis that started in 2007 exposed a number of flaws in the financial system. Many of these flaws were associated with financial instruments that were issued by the shadow banking system, especially securitized assets. The volume and complexity of securitized assets grew rapidly during runup to the financial crisis that began in 2007. The paper discusses how the financial crisis can be viewed as a possible but logical outcome of a system where investors are overconfident, busy, and investing other peoples' money and intermediaries are set up to take advantage of investors' tendencies. The investor-intermediary risk cycle in this crisis is common to other crises. However, there are a number of factors that may have made the 2007 crisis more severe. Among them are the length of the pre-crisis period, the shift from financial intermediaries to the shadow banking system, the increasing interconnectedness among financial firms, and the increased leverage at some financial firms.

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Too much right can make a wrong: Setting the stage for the financial crisis

The financial crisis that began in 2007 may change the way firms and individuals borrow and save. The period leading up to the crisis was one where there was a rapidly expanding array of products that facilitated funds getting from savers to borrowers. At least in part because of these products, it became easy to borrow, leading to an expansion of debt (Figure 1 shows the growth in consumer indebtedness). In retrospect, it appears that many borrowers were given loans they should not have been or given loans at interest rates that were too low to reflect the riskiness of the loan. The financial crisis brought a swift halt to this. In this paper, I describe the changes that preceded the crisis, then examine why they occurred and how they may have contributed to the crisis.

Much of the evolution of financial markets and institutions in recent years resulted in the movement of financing away from traditional bank lending (see, e.g., Adrian and Shin, 2009; Brunnermeier, 2009). Many of the new alternatives for borrowers and investors came, directly or indirectly, from what is sometimes called the shadow banking system (SBS).¹ The SBS is the term used for financial institutions that provide alternatives to traditional bank financing.² These firms can intermediate between borrowers and lenders, much as banks do. However, they offer a more complex array of products than just simple loans and they are often subject to less intensive regulation.

As part of the move from bank financing to the SBS, one way that financial markets changed dramatically from the mid-1980s through the onset of the financial crisis in 2007 was the rise of structured finance. While there is no single definition of structured finance, here I focus mainly on securitization (most market participants consider credit derivatives and other structured risk transfer products as part of structured finance, see, e.g., Davis, 2005). Securitization is the issuance of bonds backed by the payments on a pool of assets. It allows banks and other lenders to originate assets without the need to hold them on their balance sheets for an extended period of time. The initial securitizations involved pools of home mortgages, with the bonds issued called mortgage-backed securities (MBS). MBS were soon followed by so-called asset-backed securities (ABS), which were bonds backed by the payments on pools of loans such as automobile and credit card loans. In the last twenty years, the types of assets that were part of securitizations expanded to include large corporate loans and mortgages as well as more obscure assets (there was a securitization backed by the royalties on recordings by David Bowie). There have also been securitizations that are backed by the payments on pools of securitized bonds from different deals (collateralized debt obligations, or CDOs). The ability of lenders to easily sell loans into securitizations made the “originate-to-distribute” (OTD) business model possible. Instead of making a loan and holding it on its balance sheet until maturity, a lender could make (originate) a loan, then immediately sell it.

¹ The SBS is a slightly more expansive definition of non-bank alternatives than, for example, the securitized banking sector referred to by Gorton and Metrick (2009) and the market-based financial intermediation in Shleifer and Vishny (2009).

² The types of firms that are included as part of the SBS include investment banks, hedge funds, monoline insurance companies, the government-sponsored entities (GSEs), and a number of specialized entities that are set up to issue derivative financial securities. Banks can be part of the SBS to the extent that they participate in financing different from traditional lending. I discuss the purchase of securities created in the SBS below.

The ability of lenders to use the OTD model is frequently cited as one of the factors that contributed to the financial crisis. One argument goes as follows (Diamond and Rajan, 2009). A glut of foreign savings with a desire for safe securities led to an increase in demand for bonds such as highly-rated MBS (and ABS) securities. The demand for these securities gave banks an incentive to create them by originating and selling loans. Problems crept into valuations, but rising home prices covered up these problems and allowed lenders to keep originating and selling new loans. When home prices started falling, losses became apparent. Since many holders of MBS, including banks and derivative conduits such as structured investment vehicles (SIVs)³, were either leveraged (Adrian and Shin, 2008) or held longer-term assets along with short-term liabilities (Brunnermeier, 2009; Diamond and Rajan, 2009), the home price declines led to questions about the institutions viability. This, in turn, might have sparked a run on these institutions (Gorton and Metrick, 2009). Hidden in this line of thinking is why, as noted above, mispricing crept into valuations. That is, why did the problems that followed once housing prices started to fall seem to surprise so many market participants? I explore why several tendencies of investors, and the ability of intermediaries to take advantage of these tendencies, may have made seemingly surprising deviations of prices from fundamentals more likely.

The SBS facilitated innovations such as the advances in securitization, but many of the innovations shifted the responsibility for screening and monitoring borrowers. Traditionally, much intermediated finance was done by banks.⁴ A bank would make a loan which would be financed with a combination of equity capital and deposits. The bank, because it kept the loan on its balance sheet, would have an incentive to screen potential borrowers to make sure they were creditworthy and to monitor the loan to maximize the chance it got repaid. Many of the new products facilitated by the SBS shifted some of this responsibility from banks to investors. This introduced two possible problems. First, investors were at least one step further removed from the actual lending decisions, making their ability to screen and monitor more difficult. Second, many of the investors in securities made available by the SBS were in fact agents for other investors, leading to potential incentive problems. I discuss how these two potential problems, especially following a long period of stability and growth in the financial system, can make a crisis more likely.

Why would the financially sophisticated investors that participate in structured finance markets be willing to purchase extremely complicated securities? The strong performance of structured finance in general gave three incentives for investors to purchase structured securities such as securitized bonds. First, behavioral finance has identified a number of circumstances where overconfidence affected investor decision making (see, e.g., Malmendier and Tate, 2005). The high returns on structured securities in the runup to the crisis may have led investors to believe the securities were better than they actually were. Second, the credit ratings on these securities had proved reliable in the (recent) past (see, e.g., Moody's, 2006). It may have been rational for busy investors to rely on the recent track record of the securities and the rating agencies rather than to carefully examine each security they planned to purchase. Finally, many of these investors were investing for others (such as mutual fund managers acting on behalf of their fund investors), and this gave them an incentive to reach for yield and to follow the herd (see, e.g., Scharfstein and Stein, 1990, on herd behavior in Wall Street).

³ SIVs held long-term assets but issued primarily short-term liabilities (such as commercial paper) to purchase the assets. This exposed them to the risk that they would not be able to roll over their liabilities.

⁴ I am using the term 'banks' to refer to all kinds of depository institutions.

The factors that attracted investors to structured securities such as MBS also could explain some of the evolution of the securitization market over time. As noted above, securitizations became more complex over time. This is consistent with the intermediaries involved in issuing structure securities taking advantage of overconfidence and (rational) inattention, since overconfident investors are likely to believe they can evaluate the more complicated securities and inattentive investors are unlikely to notice as securities become gradually more complicated as long as credit rating agencies continue to give them strong ratings.

An important question in thinking about how to reform the financial system is whether the conditions and actions that led up to the crisis are quantitatively different from other incidents that did not lead to a worldwide crisis. The pattern in the years leading up to the crisis was: Investors successfully invested in new securities, often ones promising them extra return. The successful investments led to new investments and an increased reliance on simple guideposts. The investors were pushed toward similar but riskier investments by issuers or advisors. Finally, there was a reckoning as many of the risky securities saw a sharp decline in value. This investor-intermediary risk cycle fits not only the most recent crisis, but a number of prior examples such as the Asian currency crises in the late 1990s. Thus, the current crisis may have been more extreme than prior incidents, but a number of the factors the led to it were also present in previous incidents.

The remainder of the paper is organized as follows. The next section gives some background on the U.S. financial system and its evolution. There is a particular focus on lending and the role of the SBS. In Section II, I discuss why investors would buy securities that do not have a positive expected return. After that, I explore whether the runup to the 2007 crisis was fundamentally different from anything in the past. Finally, Section IV offers some concluding comments.

I. Background

This section gives some background on how the evolution of financial institutions and markets in the United States set the stage for the financial crisis. I start with a basic comparison of intermediated versus market-based financing and then discuss the specifics for the U.S. Understanding the rise of the shadow banking system means understanding both the financial system structure and the incentives of the participants in the financial system. The structure and incentives in 2006 arose in part because of choices made in the last major crisis in the 1930s.

The traditional role of banks is using deposits to fund loans. Depositors and other bank liability holders generally value liquidity, so most bank liabilities are short term. Borrowers, on the other hand, often want longer-term loans. This mismatch between the desired maturities of savers and borrowers leaves a role for financial intermediaries such as banks. Banks are able to manage balance sheets with many assets and liabilities of different maturities. This allows them to transform short-term liabilities into long-term loans (and small deposits into large loans). A value added from having banks do asset transformation is that they are set up to screen potential borrowers and then to monitor the borrowers they eventually lend to.

In contrast to the traditional role of banks, the traditional role of other financial market participants such as investment banks and securities dealers is to help the sale of securities in markets. In this role, investment banks and securities dealers serve as brokers, holding securities for at most a short time period

as part of the sale or underwriting process. In their traditional roles, investment banks and securities dealers help facilitate market-based finance. Market-based finance can have lower overhead costs than intermediated finance and can give borrowers access to a wider pool of potential investors.

Countries differ in the relative importance of bank-oriented and market-based finance. The U.S. has historically had a strong market-based finance sector. This is largely a function of laws and regulations that helped strengthen an independent investment banking sector.

The most important law that affected the structure of the financial sector in the United States in the period leading up to the financial crisis is the Glass-Steagall Act in 1933. Glass-Steagall, a response to the financial crisis that led into the Great Depression in the 1930s, effectively separated commercial banking from investment banking.⁵ So, in the late 1950s, commercial banks made loans and took deposits while investment banks underwrote publicly-issued securities. While the separation between commercial and investment banks was not complete, for the most part, each type of firm completed in its own type of market.⁶ The Glass-Steagall separation of commercial and investment banks meant that the U.S. had a strong independent investment banking sector.

The separation of commercial and investment banking in the U.S. also resulted in investment banks that, in the 1950s, were not structured to compete with banks in the loan market. Realizing this, investment banks worked at innovations that would allow them to compete with banks. In part, the rise of the SBS in the U.S. can be viewed as an effort by non-bank financial firms to break down the Glass-Steagall barriers by stealing away banks' best customers.

Investment banks started to invade banks' territory by getting firms to move from bank loans to market-based debt. In the 1960s, investment banks got many large firms to replace loans with commercial paper (CP).⁷ CP is short-term debt issued by non-financial companies and it substituted directly for bank loans. To make CP attractive to investors, the borrowers typically had a backup guarantee of repayment, which often came from banks. Investment banks liked CP because it generated fees for them and investors liked it because it was a high-quality liquid security, but these features were not the only reasons for its success. One factor that contributed to the expansion of CP markets was regulatory arbitrage, by which I mean activities designed to get around regulations (or laws) while allowing parties to perform substantially the same activity. One big difference between the CP and loans is that a bank loan is reflected on the balance sheet of the bank. Banks are subject to capital requirements and reserve requirements. Capital requirements means that a bank has to raise some costly equity capital to finance the loan (8% of the loan amount under the Basel 1 capital guidelines) while reserve requirements mean that the bank has to hold a percentage of some deposits in cash (meaning that it may have to raise more than \$1 of deposits for each \$1 it wants to lend). Both of these requirements impose costs on banks that can be avoided – or arbitrated – if a firm funds in the CP market rather than by using a bank loan.

Later, investment banks pioneered high-yield bonds. Typically, the only firms that could issue public debt (bonds) were those with an investment-grade rating (BBB- or better) from the credit rating agencies.

⁵ The Bank Holding Company Act of 1954 separated commercial banking and insurance.

⁶ There were exceptions, for example, banks could underwrite government securities and privately-placed (as opposed to publicly-traded and registered) debt.

⁷ The CP market has been around for a long time in the U.S. and elsewhere. Interestingly, Goldman Sachs got its start issuing CP in 1869.

But starting in the 1980s, investment banks were able to market high-yield, or non-investment grade, debt. High-yield bonds served as a substitute for bank loans. Again, regulatory arbitrage may have been one of the factors that contributed to the start of the high-yield bond market. One characteristic of both the CP market and the high-yield bond market is that intermediated debt (bank loans) was replaced by market-based (non-intermediated) debt.

The private securitization market, which started in 1977, but did not expand rapidly until the late 1980s, was a different sort of innovation than CP and high-yield debt because securitization is a form of intermediation. In addition, participants include both traditional banks and investment banks. Securitization was one of the first activities where investment banks competed with commercial banks as intermediaries.

The first securitizations in the U.S. preceded the private securitization market. Starting in 1970, banks and other lenders put together pools of home mortgages that were then guaranteed by the government agency known as Government National Mortgage Association (GNMA, also known as Ginnie Mae). The broad structure of these securitizations, except for the GNMA guarantee, was similar to most of the deals that followed.

The lenders sold their loans to intermediaries sponsored by commercial and investment banks (see Rosen, 2007, for a fuller description of the securitization process). For legal reasons, the loans were owned by so-called special purpose vehicles (SPV; sometimes these are called special purpose entities) rather than by the sponsoring institution. A SPV would collect some loans into a pool, and then issue bonds known as mortgage-backed securities (MBS). The bondholders were repaid based on the payments on the loans in the pool. The initial GNMA securitizations passed through all payments (less fees). As an example, assume an issuer had collected 1,000 mortgages, each worth \$100,000 with a 30-year maturity and a fixed interest rate of 6.50% in a SPV. This \$100 million pool of mortgages could be used to back 10,000 bonds, each worth \$10,000 with a 30-year term and a fixed coupon rate of 6.00%. Each bond would share the same coupon rate and other features, and importantly, each would have a similar claim on all payments. MBS are structured so that interest payments on the mortgages are at least sufficient to cover the interest payments due on the bonds (plus the fees of the intermediaries). Principal payments (either scheduled payments or prepayments) on the mortgages are used to pay down the principal on the bonds. The role of GNMA was to guarantee principal repayment. This leaves bondholders exposed to interest rate risk and the risk that the mortgage loans would be repaid early.⁸

The next step in the evolution of the securitization market was the entry of the government-sponsored entities (GSEs), the Federal National Mortgage Association (known as Fannie Mae) and the Federal Home Loan Mortgage Corporation (known as Freddie Mac).⁹ Freddie Mac issued its first MBS in 1971 and was later joined by Fannie Mae. As with the GNMA, the GSEs guaranteed payments on the mortgages in the pool backing its MBS.

⁸ For some pools of loans, interest payments were not guaranteed, leaving bondholders exposed to the risk of missed interest payments as well.

⁹ The GSEs are government-chartered private companies. Their guarantees were not explicitly backed by the U.S. government, but when the GSEs got into financial trouble, the government stepped in to help them (technically, by taking them into conservatorship in late 2008).

The private securitization market started in 1977 when Bank of America issued an MBS without guarantees from Ginnie Mae or the GSEs.¹⁰ More private-label MBS followed, at first mostly sponsored by investment banks. The market did not grow appreciably, however, until a law was passed in 1984 that allowed regulated financial institutions such as banks to own MBS. Then, in 1985, the asset-backed securities (ABS) market started with securities backed by computer leases and automobile loans. Private-label MBS (those without guarantees from Ginnie Mae or the GSEs) and ABS have a basic structure much like the GNMA-guaranteed MBS, but with some important differences. The firm putting together a private-label MBS or ABS deal sets up a SPV to purchase a pool of securities, then issues bonds with payments that are based on the payments on the loans in the underlying pool. However, since private-label MBS and ABS do not have government or GSE guarantees, they are structured with built in protections, something I discuss below. The private-label MBS and ABS markets grew rapidly in the following years, as Figure 2 shows.

Securitization changes what banks do from screening, monitoring, and funding loans to originating loans after an initial screening, then selling the loans. This new process, known as the originate-to-distribute (OTD) model, can lead to an agency problem as it reduces the incentives of banks to carefully screen and monitor the loans they are planning to sell (e.g., Keys, et al., 2010). This is why most of the early securitizations involved large pools of small, somewhat homogenous loans such as mortgages and automobile loans. Banks rarely monitored these kinds of loans as long as the borrowers were current on payments. So, reducing the incentives to monitor was not a big issue. In addition, the banks that sold loans into a pool were able to give aggregate statistics on the loan pool, giving investors in the MBS a good idea of the overall default and prepayment characteristics of the pool. In addition to any contractual prohibitions against fraud, the desire to be able to sell future loans gave banks an incentive to report the information they learned from screening the loans.

Another feature common in private-label MBS and ABS is tranching. Starting in 1983, the securities offered in a securitization were split into different classes, or tranches. Many investors were willing to sacrifice some return for very safe, predictable payment streams while others were willing to accept more risk to get high yields. Bonds issued in a tranching deal generally differed in payment priority, and therefore risk. For example, a deal could have two classes of bonds, senior and junior. The interest payments on the underlying assets would be used to pay interest on both classes of bonds. Principal payments, whether scheduled or prepayments, would first be used to repay the principal of the senior bonds. Once these bonds were repaid, principal payments would be used to repay the junior bonds. Thus, the senior notes would have a shorter and more predictable maturity and be safer since initial principal losses would be borne by the junior bonds. Many securitizations had large number of tranches, leading to complicated payment dynamics if a large number of the underlying loans defaulted.

Most private-label MBS and ABS also use overcollateralization and excess spread to provide a default buffer for all bondholders. Overcollateralization refers to the difference between the principal balance on the loans in the pool and the principal balance on the outstanding MBS or ABS; excess spread is the difference between the interest payments coming in (loan payments minus any fees) and the weighted average payments going to bondholders. They are related in that excess spread can be used to build up overcollateralization. The first use of excess spread is to cover default losses. If any excess

¹⁰ Private-sector securitizations backed by mortgages are sometimes referred to mortgage asset-backed securities.

spread is left, it can be used to build up a cushion against future losses. As noted above, the tranche structure of a securitization can be extremely complicated as the payment and default risk are split up in different ways. One measure of a bond's place in the seniority structure is its level of subordination. The level of subordination is the share of claims in a deal that are junior to the bond's claim. A higher level of subordination means that there would have to be a larger share of defaults before the bond suffered a principal loss.

One objective of tranching is to get one or more class of bonds that are rated AAA by a credit rating agency. The intermediaries involved in issuing these bonds (henceforth, the issuers) often wanted to issue as large a percent of the bonds with a AAA rating as they could. There was a complicated dance between issuers and the credit rating agencies about the level of subordination of the AAA bonds. One of the ways that the credit rating agencies were accused of working with issuers during the boom was in structuring the tranches in a securitization so that the issuer had an attractive set of bonds to sell (Kane, 2008).

As the securitization market expanded and demand for securitized bonds increased, issuers started to include different types of assets in the pools backing the securitizations. Collateralized loan obligations (CLOs) are securities that are backed by the payments on a pool of commercial loans. CLOs differ from earlier ABS in part because the loans in the pool are large. Absent securitization, banks typically monitor even performing commercial loans. The need to monitor increases the agency problems with these loans, but market participants believed that the structure of the securitizations and reputational issues were enough to get the lenders to monitor.

CLOs were followed by collateralized debt obligations (CDOs). The pool of assets backing CDO bonds varied, but in the mid-2000s often included bonds from other securitizations and commercial loans including commercial real estate loans. There were also CDOs that included bonds from other CDOs (these were often referred to as CDO-squared). Most CDOs were very difficult to value because of their complexity.

The expansion of securitization rested on three pillars. One pillar was regulatory arbitrage (see, e.g., Kohler, 1998). As noted earlier, there are regulatory costs for keeping a loan on a bank balance sheet. The OTD model allowed banks to make loans without the need to have as much costly capital. In addition, under the risk-based capital guidelines banks that want to hold the exposure to a certain class of loans can reduce their risk-weighted assets by holding securitized bonds rather than whole loans.

The second pillar that facilitated the expansion of securitization was valuation. Technological advances made it easier to analyze large amounts of data in an attempt to price MBS and ABS bonds. Related to this was the willingness of credit rating agencies to rate the bonds. Together, these made investors comfortable purchasing what were often very complex securities. It is this second pillar that has crumbled during the recent crisis. As the rapid decline in value of some MBS and ABS bonds during the crisis shows, there were significant problems in the valuations and ratings. In the next section, I return to the question of why investors would purchase bonds that were difficult to price.

The third pillar is the ability to distribute risk inherent in securitization. Tranching allows issuers to divide the risk in the underlying assets in an almost unlimited way. They can design bonds with a broad variety of payment and risk characteristics. In theory, this allows investors to buy bonds with the characteristics that most appeal to them. Of course, as noted below, banks ended up holding much of the risk from structured securities (Shin, 2009).

Underlying the move to securitization in particular and the SBS in general was an attempt of financial firms to capture business from their rivals. Investment banks attempted to break down the Glass-Steagall barriers by innovating around them with products such as CP, high-yield bonds, and securitization. At the same time, banks were attempting to get into the underwriting field formerly the province of investment banks. While some of these innovations offered potential improvements (such as securitization allowing risks to be divided), innovation was also aimed at regulatory arbitrage. In 1999, in an effort to level the playing field between banks and investment banks (and, coincidentally, reduce incentives for regulatory arbitrage), the U.S. implemented the Gramm-Leach-Bliley Act. Gramm-Leach-Bliley allowed commercial and investment banking in the same financial firm. This meant that the largest financial firms had both lending and investment banking arms, changing their incentives to innovate (Boot and Thakor, 1997).

The evolution of the financial industry and the rise of the SBS may have been motivated by efforts of industry players to capture revenue, but it drastically changed how firms profited from financial intermediation. As the lending process moved away from bank loans to either market-based alternatives such as CP or intermediation-based alternatives such as securitization, revenues for banks moved from interest-based to fee-based. This only accelerated once commercial and investment banks could merge. The move to fee-based earnings reduced the incentives for banks to worry about the long run, and in particular, to worry about the risk of the loans or securities they were selling. This risk was shifted to the buyers. As long as there was someone to buy them, the banks had an incentive to sell them. This leaves the issue of what motivated the purchasers.

II. Why would investors buy “bad” securities?

Many of the structured finance securities described in the last section were quite popular in period leading up to the financial crisis. Between 2002 and 2005, the value of mortgages that were issued to subprime borrowers and then securitized more than tripled (Figure 3). This reflected a general increase in the share of mortgage-backed securities that were issued without a government or GSE guarantee (Figure 4). When housing prices started to fall in 2006 and 2007, it was the most recent vintage of securities (those issued closest to the crisis) that did the worst (Demyanyk and Van Hemert, 2008). Why then did investors flock into these markets until sometime in 2006? One possibility is that the investors were right *ex ante*, but the crisis was just extremely bad luck. This hypothesis cannot be rejected, but given what is known today about the quality of some of the assets in structured securities, bad luck does not seem to be a complete explanation. In this section, I consider some alternative hypotheses.

One advantage of structured securities over alternative investments was their yield. ABS and MBS typically had higher yields than corporate bonds with equivalent ratings (Figure 5 gives yield spreads for some ABS).¹¹ While some of the yield spread was because structured securities had higher risk than similarly-rated corporate bonds, the popularity of many of these securities during the mid-2000s suggests that investors acted as if the difference in yields meant that structured security markets were imperfect in that the yield spread at least partially reflected money left on the table by others.

¹¹ Evidence for the extra yield for subprime MBS is more anecdotal. See, for example, Subprime Securities Market Began as ‘Group of 5’ Over Chinese,” Mark Pittman, Bloomberg News, December 17, 2007, which notes that there were times when AAA-rated securities based on home loans offered yields averaging a full percentage point higher than 10-year Treasuries.

In the remainder of this section, I discuss some reasons why investors may have purchased securities that, at least in retrospect, seem to be bad investments. The first set of reasons can explain why ‘rational’ investors can believe that markets leave money on the table by letting one security have a higher yield than another security with equivalent risk. The last reason can explain why investors may purchase a security that they believe has a worse risk-return tradeoff than alternative investments. In the background of these arguments is the role of the credit rating agencies.

A. *Overconfidence and inattention*

When making decisions, investors have access to several tools to help them evaluate a potential investment. There are also third-party evaluations available, including by the dealer selling a security. Still, for many of the complex securities, there is no consensus valuation, or even valuation method (see, e.g., Prince, 2006). This excess of material and lack of consensus on valuation complicates the decision of whether to buy a security at a given price.¹²

Given the complexity of structured securities, how should an investor, who may want to hold hundreds of different securities, evaluate each security? The literature on behavioral finance offers a number of psychology-based reasons why investors may not act as pure profit maximizers. One aspect of behavior evident from prior work is that investors tend to be *overly optimistic* or *overconfident* (I will generally use overconfidence to cover both over-optimism and overconfidence).¹³ That is, some investors tend to overestimate their performance or overestimate the precision of their beliefs. There is also evidence of confirmation bias, the tendency to interpret evidence in a way that is consistent with prior beliefs. Confirmation bias leads individuals to put more weight on evidence that confirms their prior beliefs than on evidence that contradicts the beliefs. These aspects of investor behavior may have played a role in the evolution of structured finance and in setting the conditions for the financial crisis that started in 2007.

In addition to any biases, there is reason to believe that busy investors may take shortcuts, collecting and evaluating only information that they think will have a material effect on the profitability of an investment. Several studies have explored whether so-called *rational inattention* can be used to explain macroeconomic phenomena (see, e.g. Sims, 2003, and Reis, 2006).¹⁴ The models in these studies show how capacity constraints for information or costly information processing may mean that individuals do not continuously update their knowledge. This can lead prices to deviate from their fundamental values.

¹² "The only entity that really understood the true value and risk in a mortgage-backed security or a CDO was the mortgage broker who originated the loans that made up the underlying assets," explains Niket Patankar, CEO of hedge fund advisory company Adventity. "And that person was long gone from the picture by the time they were sold as part of a CDO." From "Navigating subprime securities," Katie Benner, *Fortune Magazine*, August 2007.

¹³ There are a number of studies of overconfidence in financial markets. Evidence of overconfidence is found in stock trading and financial markets (Daniel, et al., 1998; Odean, 1998; Barber and Odean, 2001), managerial decision making (Ben-David, et al., 2007; Malmendier and Tate, 2005), and home purchases (Agarwal, 2007). See Malmendier and Tate (2008) for a review of some of the psychology literature on overconfidence and Rabin and Schrag (1999) for a discussion of confirmation bias. See also the chapters in the *Encyclopedia of Social Psychology* (2007) on belief perseverance, beliefs, and confirmation bias.

¹⁴ There is also empirical evidence of inattention (whether rational or not) in financial markets. For example, there is evidence that investors respond less to earnings announcements (and possibly other news announcements) that are made on Fridays (DellaVigna and Pollet, 2009). In addition, investors tend to be net buyers of stocks that are in the news more (Barber and Odean, 2008).

A form of rational inattention, especially when combined with overoptimism and overconfidence, may have helped set the stage for the financial crisis.

How should an investor make the decision to purchase a structured security? One way is to carefully analyze the prospectus and to make projections about future asset prices and default rates. This is extremely time consuming, and as noted above, there may be no consensus valuation method. An alternative is to spend less time on analysis, but instead to rely on some other party's valuation. For example, the investor could base investment decisions on the credit ratings provided by the Nationally Recognized Statistical Rating Organizations (NRSRO), primarily Moody's Investor Service, Standard and Poor's, and Fitch Ratings. These credit rating agencies have a long track record of evaluating securities. To be an NRSRO, a credit rating agency must be recognized by users as "an issuer of credible and reliable ratings" (SEC, 2003, page 9). As I discuss below, whether the credit ratings of the NRSROs should be considered credible and reliable is controversial (see, e.g., Partnoy, 1999). Still, there is reason to believe that investors relied more on ratings over time, at least prior to the recent financial crisis, perhaps because of the rating agencies' reputations (see, e.g., Covitz and Harrison, 2003). The track records of the rating agencies may have led investors to pay less attention to the complicated details of each deal and instead to use the ratings assigned by the credit rating agencies as a starting point (and possible ending place) for any analysis. In essence, the credit rating of a security may serve as an anchor around which the investor can interpret any additional evidence.¹⁵

Consider a busy investor trying to decide whether to invest in a subprime MBS in 2004. The investor may want the extra yield offered by the MBS, but not be certain of how to value the security. She may look into the details of subprime mortgage defaults, which were relatively stable and low for over five years prior to 2004, and evaluate prepayment risk. The implied losses on the MBS bonds based on outside assessments of mortgage default and prepayment rates at that point would imply that the subprime MBS bond yields provide adequate compensation for the risk. This is a reasonable amount of work, and still suggests that the MBS are a good buy. Given the anchor provided by the credit rating, her analysis may be enough to overcome any belief that there rarely is money left on the table by the market.¹⁶ This may happen even if the investor is aware of the debate surrounding the accuracy of credit ratings.

The point at which an investor stops her analysis may depend on how she rates her ability to price securities relative to others in the market. The more confident she is, the more willing she might be to believe that the market is mispricing the security. This may mean that more confident investors stop their analysis earlier than their less confident brethren. An overconfident investor can believe that a high yield on the security is money left on the table. If she considers herself better at analysis than the average investor, she may believe she can estimate default risk better than others. This means that for the securities she chooses to purchase, the overconfident investor incorrectly believes the high yields exist because other investors wrongly, in the mind of the overconfident investor, overestimate default risk. Also, if an overconfident investor believes she can make more precise estimates of the possible return paths of a security than other investors, she can place a lower price on true risk than other investors (since

¹⁵ Anchoring refers to a bias in how individual assess probabilities. People tend to anchor on certain pieces of information, effectively ignoring or underweighting other data (see, e.g., Tversky and Kahneman, 1974).

¹⁶ Investors who dug deeply enough to believe that the yield spreads for some of the MBS and ABS were insufficient to cover the risks of the structured securities would not have purchased them. Clearly, the growth in structured securities markets suggests that there relatively few investors like this (or that these investors were agents for others as discussed in the section on other people's money).

true risk is greater than her perception of risk). Thus, overconfidence can sway an investor toward structured securities because of their high yield relative to their credit rating. Enough overconfident investors can drive yields below a level commensurate with their risk, even if the yield stays high compared to alternative (traditional) securities.

Rational inattention may explain why an investor would shift from doing her own analysis of a particular type of security to relying on a credit rating. The investor has access to two public signals: the payments on the security and the credit rating. During the 2000-2006 period, most structured securities based on pools of mortgages or other assets had very low defaults.¹⁷ Thus, these securities were performing at least as well as their credit rating implied. After doing a detailed analysis once (or more) and finding the credit rating provided a floor for the risk, the investor may decide that the credit rating is reliable enough to allow her to purchase the securities without doing a full analysis. A busy investor allocates her time toward decisions where she believes it is best used. When the securities are performing and there is no external signal to suggest an increase in the expected default rate in the underlying assets, she can choose to be inattentive to the detailed information and rely instead on the credit rating because her initial analysis suggests the information from the rating is a good enough signal to allow her to avoid costly information acquisition.¹⁸ This is especially true for very safe securities, which rarely provide negative signals to investors. There is evidence that investors in AAA securitization were less informed about the quality of the securities than investors in lower-rated securities (Adelino, 2009).

An investor may not bother to do a detailed analysis even for new securities as long as they seem to her to be close in structure to securities she is already comfortable with since the cost of the analysis may not be worth the expected improvement in valuation. Confirmation bias would likely push the investor toward believing that a reliance on credit rating was a good decision, reducing her perceived need to do a detailed analysis of new securities. Similarly, confirmation bias also suggests that even some noise in the signals, such as the early news about the housing bubble, may not be enough to shake an investor's belief that things are going well. Thus, it may not be until well after there are risk signs that an investor starts to pay careful attention to the details about a particular class of securities. An investor more confident about her ability to evaluate securities is likely to need a bigger change in securities or signals to prompt careful attention.

The above argument suggests that investors may react to a strong track record for a particular type and rating of structured security (or any other investment) by spending less time investigating the details of the investment and, if they are overconfident, becoming more certain that they can analyze the securities better than other investors. These possibilities give issuers an opening to slightly change the structure of the securities they issue so as to increase risk but maintain the same credit rating. This is important because issuers have a strong incentive to add risk because they get fees for arranging

¹⁷ Each year from 2003-2005, the rate of default on both investment grade and high-yield structured securities was lower than in the prior year (Moody's, 2006). By 2005, the default rate was at an all-time low.

¹⁸ Brunnermeier and Oehmke (2009) argue that there can be information overload with complex securities, implying there is a limit to the ability of an investor to analyze information. When this happens, how information is released is crucial, perhaps more than how much information is released. The credit rating can serve as an anchor, as I argue, for investors' analyzing the overload of information.

securitization deals, and to arrange deals, the issuer needs underlying assets.¹⁹ It is easier to get assets if the issuer can broaden the quality range that the SPV will buy.

The evolution of deals suggests that over time SPV pools got riskier and this led to riskier securitized bonds. Take, for example, subprime MBS. One measure of risk of a subprime mortgage is whether the mortgage was written with full documentation of income, assets, and employment as opposed to those written without full documentation (so-called low-doc or no-doc mortgages). Not surprisingly, low-doc loans were more likely to default than full-doc loans. Consistent with a move toward riskier securities, the share of low-doc loans in subprime security pools increased from 2000-2006 (no-doc loans made up less than one percent of all subprime loans in pools during the period). In general, there is evidence that “the quality of [subprime] loans deteriorated for six consecutive years before the crisis and that securitizers were, to some extent, aware of it” (Demyanyk and Van Hemert, 2008).²⁰ The fact that subprime lending and the share of private-label MBS (which was mostly subprime MBS) both increased during this period, especially from 2002-2005 (as shown in Figures 2 and 3 earlier), is a sign that investors did not stop purchasing subprime MBS as they got riskier. Thus, the evolution of subprime MBS is consistent with overconfidence, confirmation bias, and rational inattention given the anchor of credit ratings.²¹

One can tell similar stories for the structured finance market as a whole. The new securities that were introduced as the market evolved were often somewhat riskier innovations on prior securities. For example, subprime MBS were similar to prime MBS but slightly riskier because subprime mortgage default rates were historically higher and more variable than prime mortgage default rates. Collateralized loan obligations looked like other ABS such as those based on pools of automobile loans in the sense that both were based on the payments on pools of loans. But, because CLOs included a small number of large loans that required monitoring rather than a large number of small loans which were not monitored unless payments were missed, there were bigger moral hazard problems than in other ABS. Securities like collateralized debt obligations based on pools of MBS and ABS securities were yet more complicated. Investors may have been lulled into a false sense of security by the high yields offered, the strong performance of structured securities in general, and the credit ratings. Thus, overconfident and inattentive investors could be led into riskier securities without requiring compensating yield increases. That is, the fact that a structured security offered a higher yield than an equivalently-rated corporate bond may have attracted investors, but the excess yield may not have been enough to compensate for the additional, but somewhat hidden, extra risk.²²

One feature running through this entire argument is the role of credit ratings. The argument relies on the premise that a credit rating did not reflect the true risk of a security, and that this problem was magnified for later vintages of structured securities. This suggests that the credit rating agencies did not

¹⁹ There is evidence that firms try to take advantage of investor overconfidence and inattention (e.g., DellaVigna and Pollet, 2009; Daniel, et al., 2002).

²⁰ Note that this view, while held by many, is not universal. See Bhardwaj and Sengupta (2009).

²¹ In addition, some investors may have understood what was happening, but overconfidently believed they could sell the overpriced subprime MBS to others. In theory, such beliefs can support a deviation of prices from fundamentals (Scheinkman and Xiong, 2003).

²² Of course, the risk differences were not that hidden. The historical default rate on structured securities of a particular rating was much higher than the historical default rate on corporate bonds of the same rating as data published by the ratings agencies showed.

do a good job. But that suggestion depends on what credit rating agencies thought that their job was. The role of the credit rating agencies was controversial, even before the financial crisis. There has long been a debate about how well credit ratings anticipate future defaults, as evidenced their failure to accurately anticipate the default of bonds issued by firms such as Washington Public Power System and Enron (Partnoy, 1999; Hill, 2009). It has been argued that credit rating changes lag changes in risk (Altman and Rijken, 2004). Some believe that these problems at least partially stem from conflicting incentives that can lead the credit rating agencies to sacrifice ratings accuracy in an effort to satisfy other concerns (Mason and Rosner, 2007; Partnoy, 2006). The credit rating agencies get most of their revenues from issuers, and this could give them a reason to please issuers at the expense of ratings accuracy. These incentives may be especially severe in structured finance, which was a rapidly growing market from 2002-2006, providing over half of Moody's revenues at its peak (Mason and Rosner, 2007). Moreover, ratings agencies know that issuers can shop around for ratings, which may increase the incentives to bend ratings to issuers' desires (Fons, 2008). This is likely to be a bigger problem for structured securities than for traditional corporate bonds, because one big issue in rating structured securities is setting up the tranche structure. It is claimed that choosing the tranche structure often can be an iterative process where the rating agencies give feedback to the issuer, who then can modify the proposed structure (Mason and Rosner, 2007). There is a lot of room for subtle changes in risk through small changes in subordination.²³ A conclusion from this line of reasoning would be that credit rating agencies, by working with or for issuers, abetted an increase in risk for structured securities that was not apparent to many investors (Kane, 2008).²⁴

An alternative for why credit ratings may not have fully reflected the risk of structured securities and why the differences between actual risk and credit rating agency estimates may have increased over time is based on the models the agencies use to estimate risk. Whether or not it was due to conflicts of interest, there is evidence that credit ratings agencies did not account for the predictable risk of some structured securities, and that this problem was strongest right before the financial crisis in 2007 (Mason and Rosner, 2007; Ashcraft, et al., 2009). Structured securities were often very complicated and hard to price. This was especially true when the pools of assets were divided into a large number of tranches. Additionally, the estimated value of some securities was very sensitive to the assumptions on asset default. The models use by credit ratings agencies may have missed many of the subtleties because they use simplifying assumptions for tractability. The risk estimates were also based largely on historical data. This was an issue for many securities because recent history generally did not include a major downturn. Also, because of changes in lending patterns, some of the history was probably not relevant to current pools of assets. As evidence of the last point, consider subprime mortgages. The typical subprime mortgage borrower in 2005 was probably much riskier than the typical subprime mortgage borrower in 2001. So, using default rates on 2001 subprime mortgages to predict default rates on 2005 mortgages would likely underestimate true risk. An analysis based on old default rates would mean that a AAA

²³ An increase in average subordination does not necessarily mean that risk goes down. There is evidence that while the subordination on AAA-rated subprime MBS went up from 2001 to 2007, the pool of underlying assets increased in risk enough so that the MBS issued in later years were riskier than those issued in earlier years (Ashcraft, et al., 2009).

²⁴ Investors could have know about the incentive problems with credit ratings, but there is evidence that in general, investors do not discount enough for the effects of the incentives of interested parties such as the ratings agencies (Daniel, et al., 2002).

rating in 2005 implied a higher risk than the same rating in 2001. While investors could have learned some of the details about rating agency models, it is likely that few of them spent the time to do this. An open question is the extent to which issuers exploited this quirk in the rating agencies' models (and in investors' learning habits).

To sum up, overconfidence and inattention may have contributed to the expansion of the SBS and to the severity of the financial crisis. Whatever their motivations for purchase, early investors did well. The strong performance of the economy as a whole, and housing in particular, during the 2001-2006 period meant that very few structured securities defaulted. This strong performance reinforced the opinions of investors and may have led them to rely more on credit ratings (that is, become less attentive). Given the issues with credit rating agencies, this all meant there was room for issuers to produce riskier securities at a given credit rating, something they did.

B. Other people's money

Another reason for the evolution of the structured security market may be that many purchasers used other people's money. In Section I, I discuss the differences between direct and intermediated finance. But within intermediated finance, there are differences in the number of steps between savers and borrowers. In traditional bank financing, a saver deposits with a bank, which then makes loans. However, the process for structured securities and other investments can be much more complicated. The chain from a saver to the ultimate borrower can be long (see Shin, 2009, for some examples). These long chains can increase agency problems.

Consider the simple case of an individual investing in a bond mutual fund (see Figure 6). The mutual fund manager, acting as an agent for the individual, uses the investment to purchase securities, including perhaps structured securities. The structured securities are put together by an issuer who buys the underlying assets from lenders such as banks. The banks lend to the borrowers. How should the mutual fund manager choose what to invest in? The fund manager is likely aware that investors tend to put more money in funds that outperform their peers (see, e.g., Sirri and Tufano, 1998). The fund flows may not be predictive of future returns, and there is some thought that these investors are 'dumb money' (Frazzini and Lamont, 2008). In order to increase her compensation, the fund manager needs to attract investors. This gives her an incentive to report high returns both relative to her peers and overall.²⁵ Structured securities offer a good way to do this. Thus, even if a fund manager believes that the yields on structured securities are insufficient to compensate for their risk, she may still (rationally) invest in them.

A fund manager's choice of whether to invest in structured securities will depend on the risk of the securities and the fund manager's discount rate, but it can also depend on what other fund managers do. There is evidence of return persistence among mutual funds that perform worse than their peers (Hendricks, et al, 1993). To avoid being categorized as a poor performer, a fund manager would want to avoid having her fund perform poorly when other similar funds were performing well. This gives her an incentive to follow the herd (see Scharfstein and Stein, 1990, on herd behavior). So, if enough fund managers start investing in structured securities to get new investors, other managers will have an incentive to follow them.

²⁵ Mutual fund flows tend to be negative correlated across categories of fund (Goetzmann, et al., 2001).

Combining the incentives to chase yield to attract new customers and the incentives to herd with overconfidence only reinforces the attractiveness of structured securities. It also gives issuers more reason to be innovative. Securities with high yields where risk is concentrated are likely to be attractive to those investing money for others. High yields are popular with the ultimate investors, and concentrated risk means it is unlikely the agent investing for others will look bad (although when things get bad, they can be very bad). These characteristics are consistent with the evolution of structured finance and the SBS.

One theme running through the argument so far is that smart issuers innovated to take advantage of investors. One potential criticism of this story is that most of the losses from the financial crisis that started in 2007 were borne by banks and other financial firms. One estimate is that financial firms would suffer roughly one-half of potential losses from subprime mortgages (Greenlaw, et al., 2008). Not all of these losses were from structured securities, but there is abundant evidence that investment banks and commercial banks had major losses on structured securities in 2007 and 2008.²⁶ Some of these came from their role as issuers. When the payments on a pool of assets are divided into tranches, there can be tranches that are difficult to sell. In order to keep the fees coming, issuers sometimes keep bonds from the tranches that are less attractive to the market.²⁷ Investment and commercial banks also suffered significant losses from proprietary trading. This may have been a function of overconfidence on the part of traders. But it also may have reflected a culture of risk taking, perhaps related to compensation schemes (Diamond-Rajan, 2009). There is a saying in banking that some trades are good because “I.B.G.-Y.B.G.” (I’ll be gone and you’ll be gone).²⁸ That is, the traders will get their bonuses if the trade works and, if not, there would be no negative bonus. So, people in different parts of a financial firm can have different incentives. The firm can be both intermediating the sale of risky securities and buying them at the same time.

As a side note, for the overall argument here to hold, it is not necessary that all investors were overconfident, inattentive, or agents for others. There may have been investors that made decisions about whether to purchase structured securities based on a purely profit maximizing basis. However, the rapid increases in the sale of these securities and the losses investors took on them suggest that the profit-maximizing investors may not have been setting the prices for the securities. Why did these investors not short the securities to benefit from any mispricing caused by overconfident and inattentive investors? One possible reason is that it may not be optimal for investors with limited capital to try to bet against non-profit-maximizing investors (see, e.g., DeLong, et al., 1990).

III. How this crisis was different

The early 2000s, the period leading up to the crisis in 2007, was characterized by significant financial innovation with, by and large, investor acceptance of (if not enthusiasm for) the new instruments. As I describe above, one feature of the innovation was the production of more complex securities that often have significant risk. However, this risk may not have been fully priced into the securities. Above, I argue that investor overconfidence and agency problems contributed to this by giving issuers an incentive

²⁶ See the many stories on hedge fund and other losses at Bear Stearns, Lehman Brothers, and other financial firms.

²⁷ See, e.g., “Wall Street’s money machine breaks down,” in *Fortune* magazine, November 12 2007.

²⁸ See the quote in footnote 12 and “What’s Really Wrong with Wall Street Pay” in the Economix section of the *New York Times*, September 18, 2009.

to produce more complex securities. In this section, I first provide several examples to show that this pattern is not an isolated incident. Then, I explore some possible reasons why the 2007 crisis was especially severe.

The pattern in the recent crisis mirrors that in prior incidents. A particular investment or class of investments has realized returns that are higher than many other investment opportunities. Investors flock to this apparently hot market. As investors crowd in, the investment opportunities change. In particular, the investments get riskier. Investors, perhaps because of overconfidence and inattention resulting from strong recent performance, increase their exposure to the risky securities. These incidents can end with investors suffering large losses. This investor-intermediary risk cycle is apparent in other crises and bubbles. One example is the investment in emerging market countries in the period ending with the currency crises in 1997 and 1998. Focusing on Asia, many countries were relaxing regulations on financial markets and capital accounts in the early 1990s. In part because of this, capital flows into these countries increased dramatically. Net private capital flows in the five Asian countries that later suffered from currency crises (Indonesia, Malaysia, the Philippines, South Korea, and Thailand) went from \$11 billion in 1989 (near the 1971-1989 maximum of \$13 billion) to \$61 billion in 1995 and \$63 billion in 1996.²⁹ During this period, these countries offered high realized returns for investors. As evidence of this, the Dow Jones South Asia Index returned about three percentage points more per year than the S&P 500 from the start of 1992 through the end of 1996. However, the increases in capital flows occurred following economic growth and appear not to have increased growth (Chan-Lau and Chen, 1998). One could argue that investors were chasing high returns. Over time, it is likely that investments became riskier on average.³⁰ Nonetheless, capital continued to flow in. There is some evidence that investment banks used the desire of investors to enter markets such as these as an opportunity to sell high-margin products.³¹ In the end, the investments in emerging market economies caused large losses for investors when the economies weakened and the countries' currencies lost significant value. A similar pattern happened in what were then called less developed countries (LDC) in the 1970s. Famously, when asked about the riskiness of investing in LDC debt, Walter Wriston, the then-chairman of Citicorp, said that countries do not go bankrupt. Of course, later, some LDC countries defaulted on their debt. The rise of the technology bubble in the 1990s also had investors moving into risky securities following a period of strong performance on existing securities, in this case, technology stocks.

The evolution of investments from those that are safe and easy to understand to those that are risky and hard to understand is present for individual firms as well. In the 1990s, Bankers Trust (BT) entered into a number of interest rate swap agreements with Gibson Greetings, a midsize company specializing in greeting cards and related products. The evolution of the swaps shows a pattern similar to the evolution of MBS ten years later (the history here follows Overdahl and Schachter, 1995). Companies can use swaps to hedge interest rate risk, and the first swap Gibson Greetings entered into with BT was designed

²⁹ This data is from the World Economic Outlook Database provided by the International Monetary Fund and the figures are in 1995 U.S. dollars.

³⁰ In the decade before the crises, investment efficiency fell, the share of bank credit to GDP rose, and the share of short-term external debt to foreign exchange reserves rose in the affected Asian countries (Bustelo, et al., 1999). This made the economies of these countries riskier.

³¹ "Hot Ticket: Emerging Market Derivative; For Banks, Profit Margins 20 Times Those of Plain Vanilla" (Jill Hamburg and Michael Smith, *American Banker*, August 22, 1996) discusses the sale of derivatives on emerging market currencies.

to do that. The initial swap, in late 1991, was a plain vanilla swap where the net payment by BT to Gibson would increase proportionally to any decrease in the London interbank offer rate (LIBOR). Given the realized change in the LIBOR, by July 1992 Gibson was ahead \$260,000 on the swap. After BT and Gibson settled the plain vanilla swap, BT convinced Gibson to enter a series of swaps, where each swap was typically riskier and more complex than the prior one.³² The riskier swaps were essentially more leveraged bets on the path of interest rates. It is possible that overconfidence and inattention led Gibson to agree to the risky swaps, since there appeared to be little business reason to enter into them (that is, they provided little clear hedging of Gibson's risks). Initially, the realized path of interest rates meant that Gibson made money on the swaps. This may have led Gibson to believe that they were able to understand and make money from their swap contracts. Over time, this overconfidence may have led Gibson to pay less attention to the details of each subsequent swap. But, when interest rates started rising in 1994, Gibson began losing money on its swaps. They announced a first quarter 1994 loss from the swaps of \$16.7 million, more than 60 times as large as the gain on the first plain vanilla swap. This fits the broad pattern of the investor-intermediary risk cycle that led to the 2007 financial crisis: Initial success may have fed overconfidence and inattention to details for the investor (Gibson Greetings). This, in turn, encouraged the issuer (BT) to offer investments that were riskier and harder to evaluate, but more profitable for the issuer. The overconfident investor may not fully examine the risks, leading to big losses when conditions changed.³³

The above examples show that patterns of investor and financial institution behavior similar to those in the runup to the 2007 crisis. However, while some of the earlier situations led to localized crises, none led to anything near the magnitude of the 2007 crisis. There are a number of factors that may have made the 2007 crisis more severe. Among them are the length of the pre-crisis period, the shift from financial intermediaries to the shadow banking system, the increasing interconnectedness among financial firms, and the increased leverage at some financial firms.

The evolution of products offered during the runup to a crisis suggests that the longer the runup period, the riskier are the products eventually offered. Overconfidence, inattention, and potentially agency problems give issuers more scope to issue risky products when investors as investors have a longer track record of successful investments. Thus, one potential explanation for the magnitude of the 2007 crisis was that, for whatever reason, there was a longer than usual period of higher returns on the affected asset class, in this case securitizations and other structured securities.

There are also structural reasons why the 2007 crisis may have been particularly severe. As the originate-to-distribute model increased in popularity, more intermediation moved from banks to the SPVs underlying securitizations. This introduced screening problems, as inattentive investors may have allowed issuers to include lower quality loans into securitization pools. Adding to this problem, one difference between the intermediation done in banks and that done using structured securities is the length

³² The swaps moved from plain vanilla to 'ratio swap' to 'periodic floor' to 'spread lock' to 'Treasury-linked' to 'knock-out call' to 'wedding band.'

³³ Gibson's actions may have been influenced by the fact that the managers of Gibson Greetings were agents for the shareholders, and this agency problem may have led them to choose investments that generally gave high returns. At least one of the riskier swaps was setup such that, given the expected paths of interest rates, the vast majority of the time, BT would pay \$600,000 to Gibson with Gibson paying a much larger amount to BT a much smaller percentage of the time. One could argue that this was optimal for Gibson's managers if shareholders did not understand where the extra \$600,000 came from.

of the intermediation chain (Shin, 2009). For the most part, in traditional bank financing, the bank balance sheet sits directly between savers and borrowers. With securitization, there is at least one more link in the intermediation chain as the SPV stands between a lender and the ultimate investor. As discussed above (and in Shin, 2009), the chain can be much more complex. Each link in the chain introduces potential agency problems and the possibility of overconfident or inattentive decision makers. This increases the scope for bad assets to be funded, specifically those that are riskier than investors think they are. This can happen by a breakdown in screening or through innovations such as CDOs that are so opaque as to be nearly impossible to evaluate.³⁴ As discussed in the previous section, these problems become more severe during sustained good times. It should also be clear that the problems become more severe the longer the intermediation chain. This suggests that while securitization in particular and long intermediation chains in general may have some advantages in broadening the potential investor base and spreading risk (and avoiding regulatory costs), they bring with them the problem that misaligned incentives get worse during boom periods.

There are also some other differences between the current crisis and previous ones. In recent years, banks and other financial institutions have become more intertwined, in part because of securities issued in the SBS (Gorton, 2008). This means that damage to one institution can spread to others more easily than in past years. In addition, the leverage of intermediaries was much higher in the mid-2000s than in earlier periods (in part because investment banks had higher leverage than commercial banks). Once there is a precipitating event, high leverage causes market participants to worry about the solvency of banks. Since both commercial and investment banks are largely financed with short-term debt (Diamond and Rajan, 2009), the event can lead to a run, much as some argue the losses on subprime mortgages did in 2007 (e.g., Gorton, 2008). While the broad structure of the financial industry is not new, its intertwined nature and high leverage may have made the shocks in 2007 propagate more widely than prior shocks did.

The evidence suggests that the investor-intermediary risk cycle that was at the root of the runup to the financial crisis that started in 2007 was common to other crises, but that there were aggravating factors that may have made the 2007 crisis more severe than earlier crises. This suggests the need to address both the risk cycle and the aggravating factors when considering reforms to the financial system.

IV. Concluding comments

The financial crisis that started in 2007 exposed a number of flaws in the financial system. Many of these flaws were associated with financial instruments that were issued by the shadow banking system. The growth of the SBS as an alternative to traditional banking products had been going on for a number of years, but accelerated rapidly with the expansion of securitization in recent years. In particular, the expansion of securitization included many new, intrinsically riskier securities. I explore how natural tendencies of investors may have allowed issuers of securitized bonds (and other SBS products) to increase the risk of these securities without investors realizing it.

Paradoxically, the good news of the years up to 2006 may have led to the bad news that started in 2007. The strong performance of structured securities such as securitized bonds fed into the natural

³⁴ Some CDOs seem to have been purchased by investors who may not have known which securities were in the pool backing the bonds (see, e.g., “The challenge of CDO squared,” *Risk*, March 2005).

overconfidence of some investors. The performance reinforced the decisions of these investors to buy structured securities. It also may have led investors to rely more on credit ratings, since the high credit ratings many bonds received seemed to be confirmed by their performance. Busy investors may have become more willing to trust the ratings since that would allow them to focus their scarce attention elsewhere. The strong performance in the early part of the 2000s also put pressure on investors that were using other peoples' money to show high returns. This could have led these investors to reach for the high yields offered by structured securities even if they thought that the high yield was insufficient to compensate for the risk of the securities.

A mix of overconfidence, inattention, and desire for high yields on the part of investors gives the intermediaries in the SBS an incentive to create securities that had high yields but a lot of possibly hidden risk. Beyond that, since many investors were relying on credit ratings, it would be more valuable to the intermediaries if they could issue securities that had more risk for a given level of credit rating. It appears now that the intermediaries were able to do this.

The financial crisis can be viewed as a possible but logical outcome of a system where investors are overconfident, busy, and investing other peoples' money and intermediaries are set up to take advantage of investors' tendencies. There are other examples of similar behavior by investors and intermediaries, although the consequences in the earlier cases were less severe than in the current financial crisis. Thus, when thinking about how to reform the financial system, one question is whether to attempt to break this investor-intermediary risk cycle or attempt to minimize its impact. Many of the current regulatory reform proposals take on one or the other of these options.

The proposals to break the investor-intermediary risk cycle include credit rating agency reform and reducing the role of the shadow banking system. Credit rating agency reform is intended to make credit ratings more accurate by reducing agency problems at the rating agencies. More accurate ratings would reduce the costs for investors of being inattentive to the details of debt securities. Of course, believing that ratings accuracy has increased may lead more investors to rely on ratings rather than their own research, so the impact of ratings agency reform may be limited. Reducing the role of the SBS may mitigate the effects of agency problems by shortening the intermediation chain (Shin, 2009). While this would be useful, it may be difficult to accomplish in the long run. Among the reasons for the rise of the SBS were innovations that increased efficiency and arbitrated around regulatory restrictions. The incentives to increase efficiency and evade regulation will remain.

The 2007 crisis was made worse because some financial firms were highly levered and interconnected (Gorton, 2008). Proposals that reduce leverage and interconnectedness, or at least reduce the impact of shocks to banks, may reduce the multiplier impact of a financial shock.

Finally, the argument that the investor-intermediary risk cycle combined with shifts in screening and monitoring caused by the movement from banks to SBS made a financial crisis more likely does not absolve other agents from blame. In this paper, I do not focus on whether regulators contributed to the problems that led to the recent crisis. Sub-optimal actions by regulators (and other parties) could have exacerbated the problems caused by a shift to the SBS. In addition, the highly levered structure of financial intermediaries combined with the maturity mismatch of their balance sheets may have contributed to magnifying the effect of the shock to underlying assets (Diamond and Rajan, 2009).

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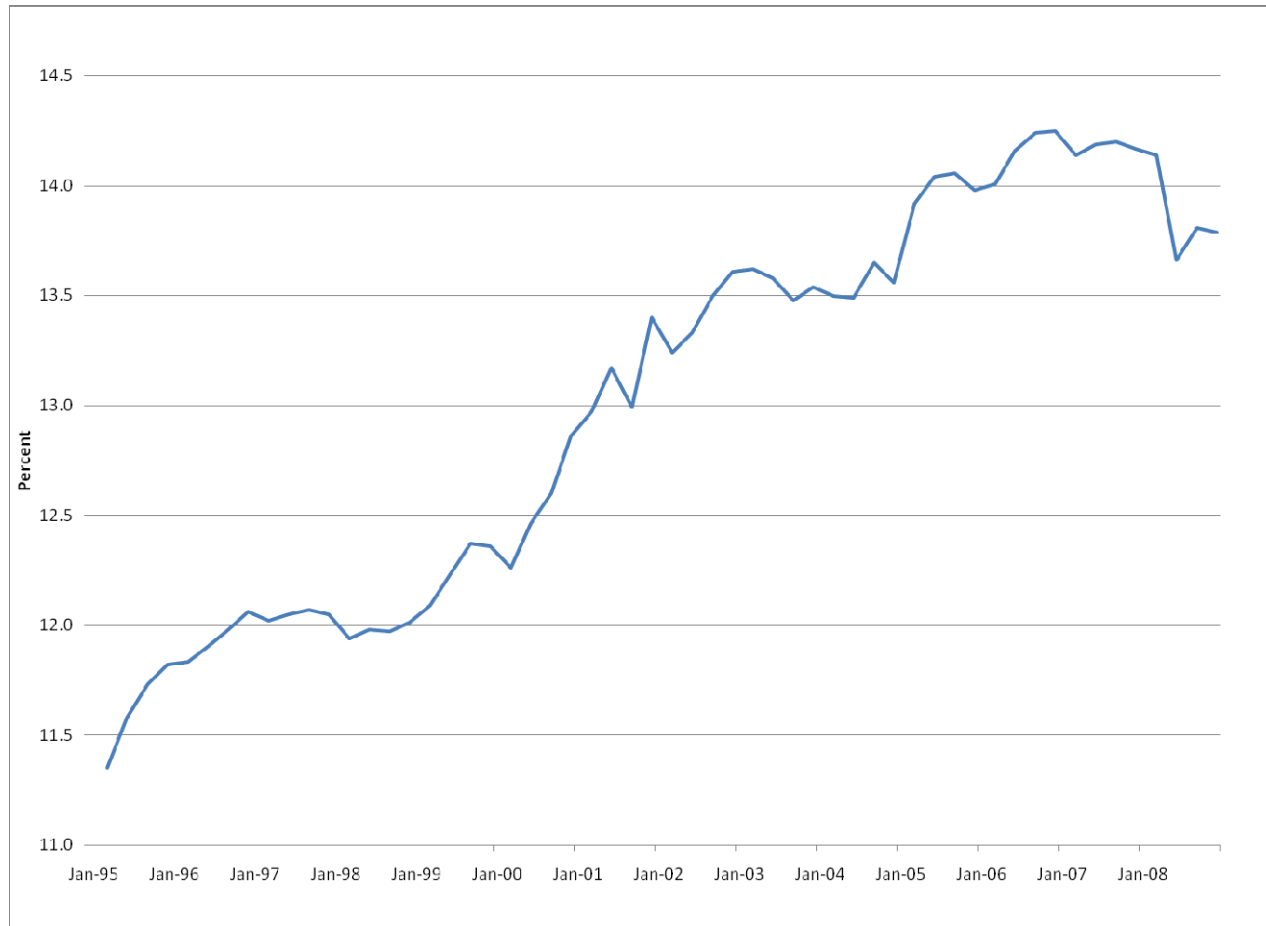
Table 1. Amount of mortgage-backed securities and asset-backed securities issued, by quarter, 2004-2009.

Year	Quarter	Government and GSE securities	Private-label MBS	ABS
2003	1	326	153	52
2003	2	429	211	75
2003	3	295	251	61
2003	4	284	249	58
2004	1	271	242	52
2004	2	297	299	92
2004	3	370	328	65
2004	4	322	322	83
2005	1	287	285	62
2005	2	303	303	74
2005	3	299	282	75
2005	4	271	276	68
2006	1	320	272	72
2006	2	370	258	79
2006	3	358	124	55
2006	4	340	53	64
2007	1	373	22	43
2007	2	430	25	73
2007	3	288	2	46
2007	4	221	9	19
2008	1	377	5	17
2008	2	651	24	50

Note: All figures are billions of dollars. Government and GSE securities are those issued or guaranteed by Ginnie Mae, Fannie Mae, or Freddie Mac; private-label MBS are all other MBS; and ABS are bonds issued in securitizations that are not backed by residential mortgages.

Source: Inside Mortgage Finance.

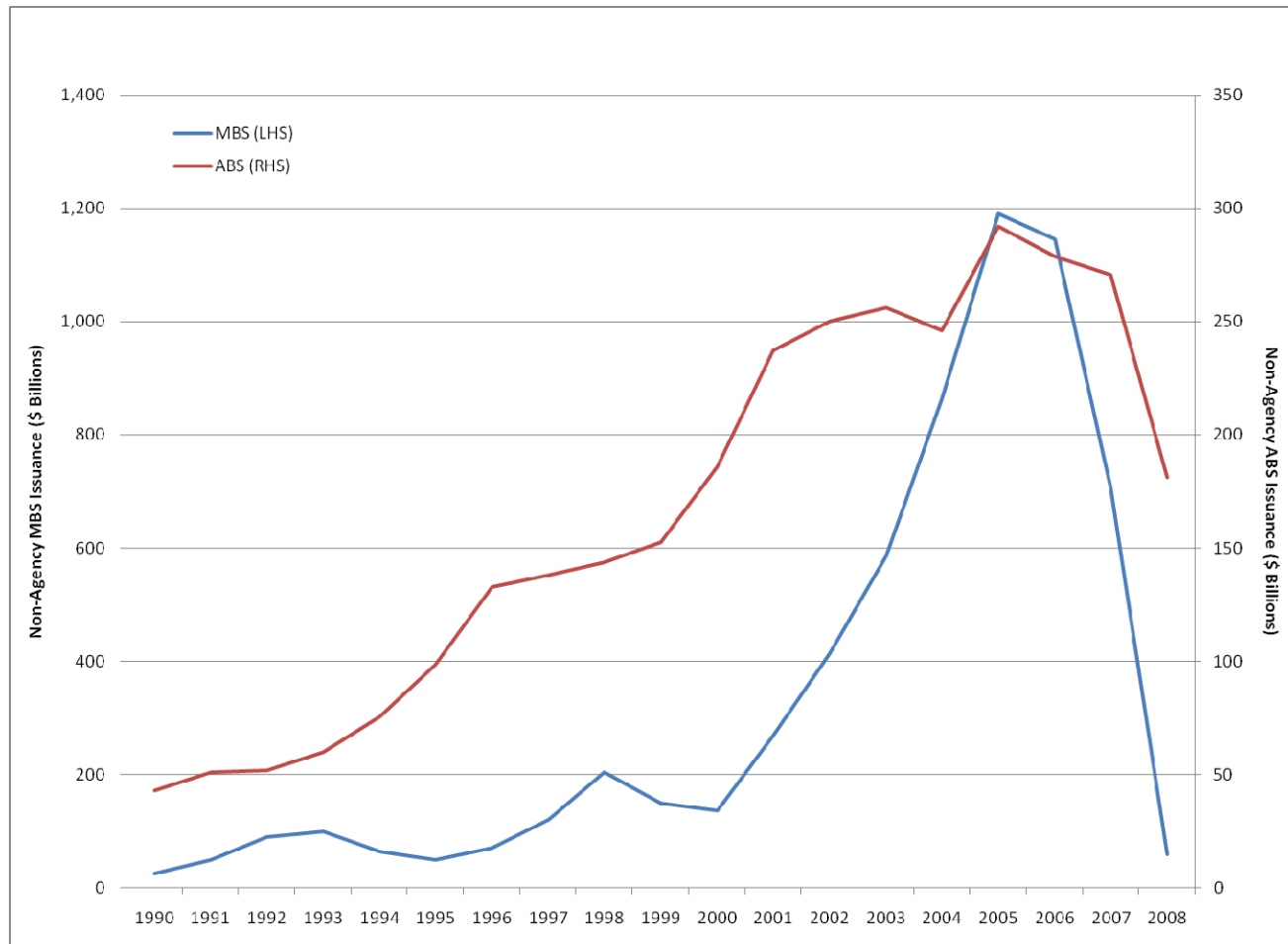
Figure 1. Household Debt Servicing Ratio, 1995-2008



Note: Household debt servicing ratio is defined as the ratio of debt payments to disposable personal income. Debt payments consist of the estimated required payments on outstanding mortgage and consumer debt.

Source: Federal Reserve Flow of Funds data as reported by Haver Analytics.

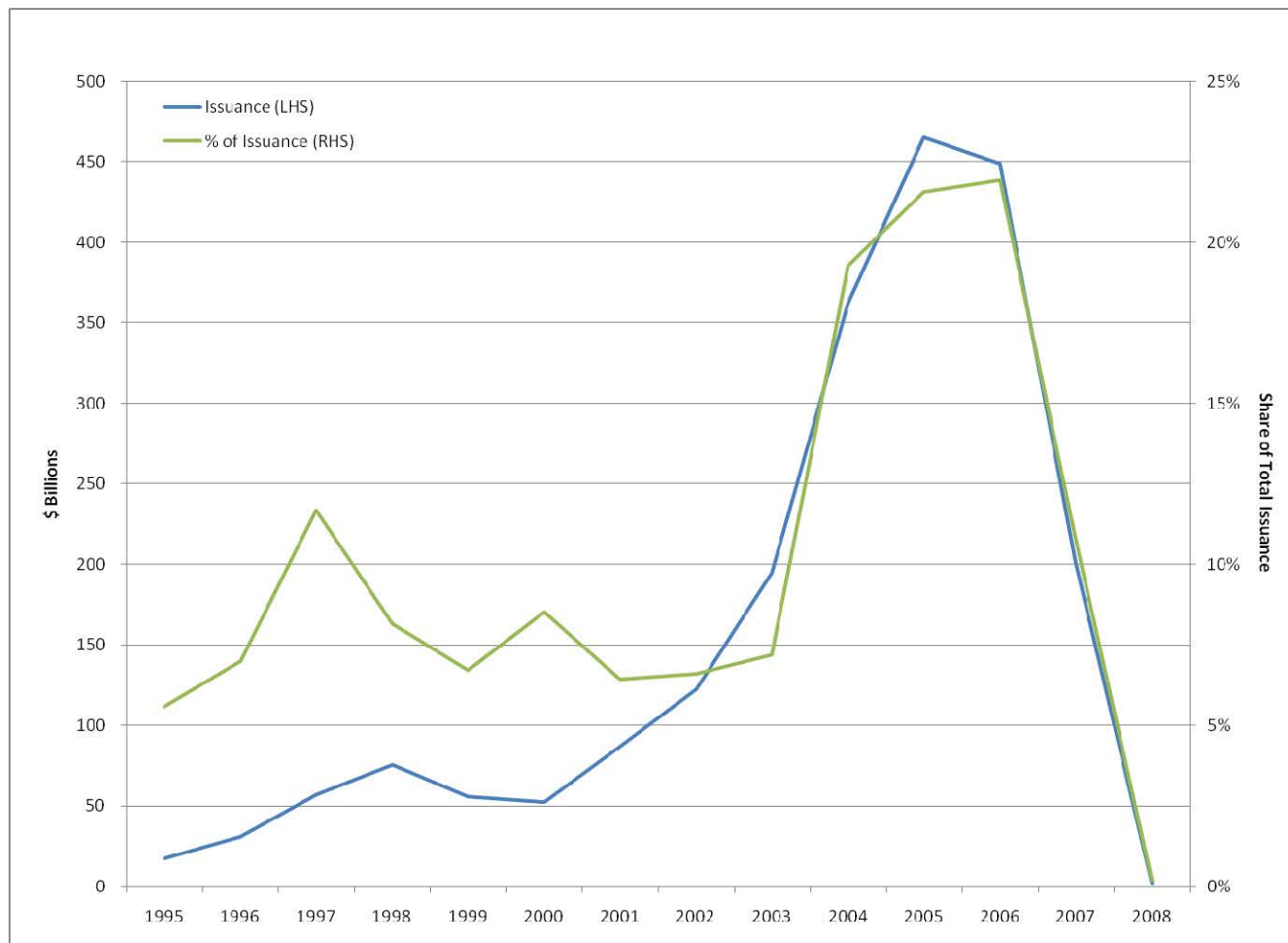
Figure 2. Issuance of securitized bonds, 1990-2008.



Note: Non-agency MBS are MBS not issued or guaranteed by Ginnie Mae, Fannie Mae, or Freddie Mac; and ABS are bonds issued in securitizations that are not backed by residential mortgages.

Source: Inside Mortgage Finance.

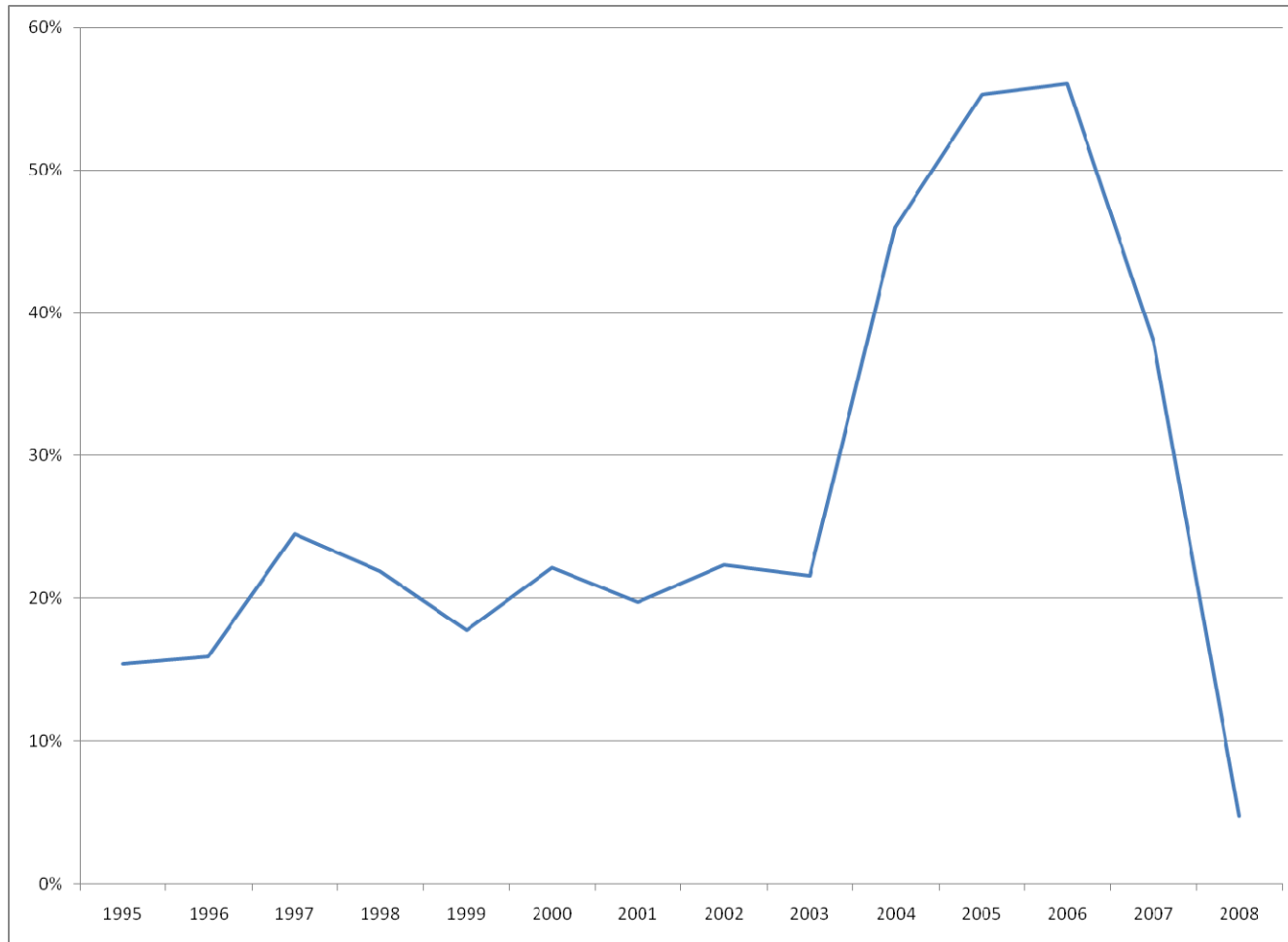
Figure 3. Subprime MBS issuance, 1995-2008.



Note: Percent issuance is dollar value of subprime MBS divided by dollar value of all MBS.

Source: Inside Mortgage Finance.

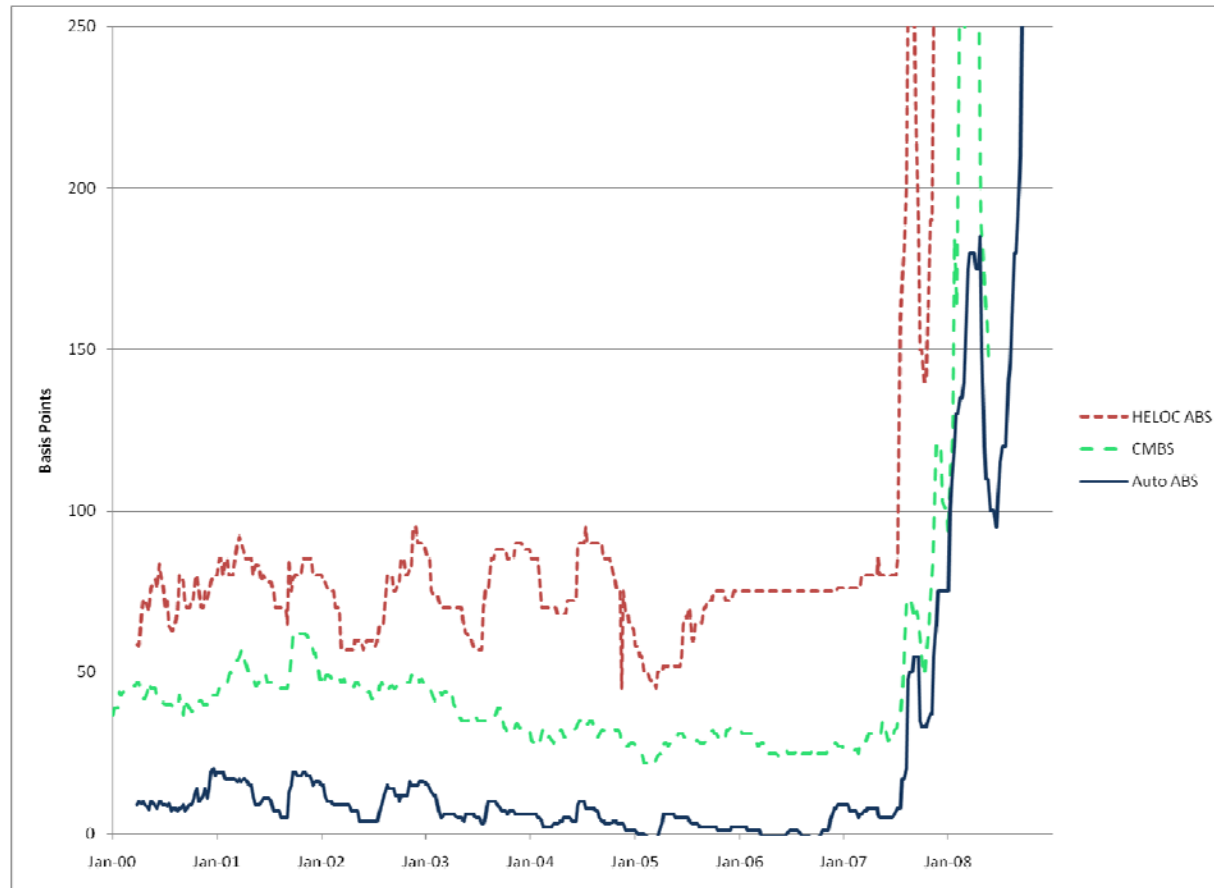
Figure 4. Share of MBS issued without a government or GSE guarantee, 1995-2008.



Note: Share of MBS issued without a government or GSE guarantee is the ratio of the dollar value of MBS not issued or guaranteed by Ginnie Mae, Fannie Mae, or Freddie Mac to the total dollar value of MBS issued.

Source: Inside Mortgage Finance.

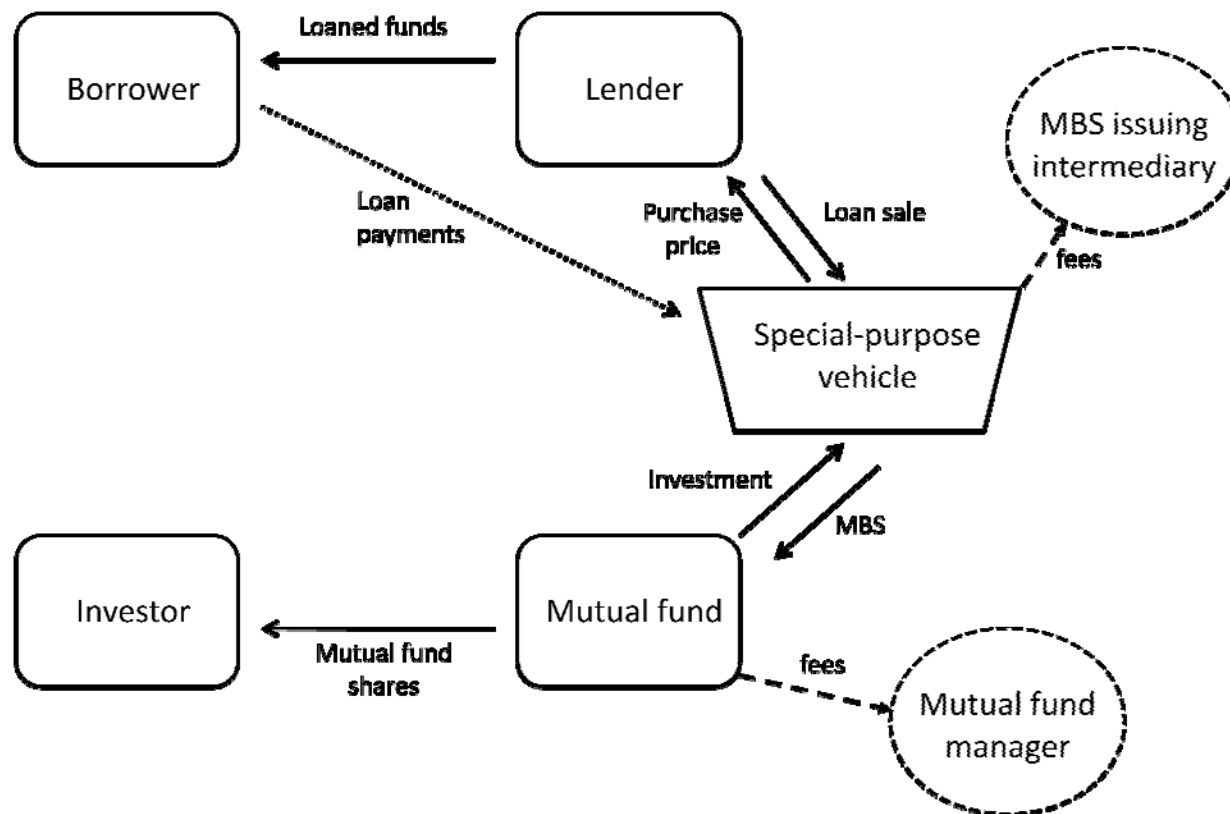
Figure 5. Yield spreads for selected ABS, 2000 – 2008.



Note: CMBS series ends in May 2008. Some spreads exceed 250 basis points in 2007-2009 period (HELOC ABS reaches 2500 BP in November 2008, CMBS spread reaches 335 BP in March 2008; and Auto ABS reaches 575 in November 2008).

Source: Bloomberg. HELOC ABS are spreads on ABS based on home equity lines of credit (DEUH5YR); CMBS are spreads on commercial mortgage-backed securities (LISPAAA1); and Auto ABS are spreads on ABS based on automobile loans (DEUA3YR).

Figure 6. Intermediation chain for the purchase of securities through a mutual fund.



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