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Mortgage Securitization, Structuring and Moral Hazard: Some Evidence and Some Lessons from the Great Crash

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Securitization provides borrowers with access to capital markets, most notably as an alternative to bank lending. However, it has also used complicated structures in order to attract investors. Complicated structures can provide, and have provided, vehicles for hiding risk and inducing moral hazard, which were at the center of the Great Crash. This paper provides descriptions of structures and increasing complexity over time. It suggests where moral hazard would have been expected to show up, empirically, and provides some evidence of moral hazard based on the timing of the changes in the structures.

Keywords

Securitization, Subprime, Moral Hazard

1. Introduction

Securitization provides borrowers with access to capital markets, particularly as an alternative to bank lending. That is useful. Most securitization involves assets with default risk, which can be difficult for investors to understand. That property is generally good collateral mitigates default risk and makes mortgages prime targets for securitization. However, not all mortgage types are easy to securitize. While collateral does mitigate default, default behavior varies considerably across borrowers for the same collateral measure, e.g., loan to value (LTV) ratio, thus making valuation complicated and subject to "unobserved" heterogeneity.[1] Hence, there is potential for loan sellers to exploit the information deficiencies of loan buyers.

The structures that have supported securitization, particularly for "private label" securities, have been complicated, and the complications increased through the beginning of the Great Crash. They allowed risk to be hidden, exploiting unobserved heterogeneity, and appear to have been central to the rise in defaults after 2006. A particular complication is that the pieces of the pools became increasingly distant from the mortgages underlying them, thus making risk harder to unravel and easier to hide.

The next three sections survey the economics of securitization with emphasis on the structures used to fund loans in pools of mortgages and incentives to engage in moral hazard. A key notion, following Gorton (2010), is that complicated (information-intensive) structures make it easier to hide risk-taking, thus enabling moral hazard.

The penultimate section presents some broad-brush tests of moral hazard during the crash. The tests are to determine whether, after controls, instruments that are likely to be vehicles for moral hazard became riskier, after their market share increased, which was around 2005. The two vehicles are "silent second" mortgages (second mortgages that were not disclosed to pool investors) and adjustable-rate mortgages (ARMs). The data indicate that loans in general were worse beginning around 2005 and that ARMs and loans with LTV, or precisely "at-80" LTV (the loans most likely to be accompanied by silent seconds) that originated after 2005, had higher default rates than expected. This is consistent with the changing market structure thus increasing moral hazard.

The final section suggests conclusions and relevance to current structures. The link between the parts of the paper is that while the structures described in Section Four look quite similar, they are quite different in complexity and fragility. Complexity has increased over time, thus allowing moral hazard to be easier. While the discussion might seem like ancient history and old lessons now learned, it is important to revisit these problems, if only because some

[1] For instance, see Deng et al. (2000) on unobserved borrower heterogeneity.

markets are moving into structures and "shadow banks" that resemble some of the broken securitization deals. In particular, the rise of "Fintech" and shadow banking in China, and other places, are capable of producing the same sorts of distance between investor and borrower as those which occurred in pre-crash securities.

2. U.S. Mortgage Market: Some History[2]

The U.S. residential mortgage market has changed considerably over time. The modern changes began in the 1970s and 1980s with the advent of government-sponsored securitization. The market changed again around in 2003 with the rise of private securitization and again after 2008, with the crash of private securitization. In the 1970s and before the market consisted mostly of bank-type intermediation, we can classify the U.S. mortgage market over the last 50 years as dominated by three channels:

a. The "Agency" market, where mortgages were funded mortgage-backed securities (MBSs), and to some extent, debt, which was issued by government sponsored enterprises (GSEs) - Fannie Mae and Freddie Mac. These two were privately owned. The third Agency, Ginnie Mae, is a GSE that securitizes government- insured loans;
b. Private label securities (PLSs), where mortgages were funded by the issuance of "non-agency" MBS (without Agency guarantees); and
c. Bank finance (intermediation), where mortgages were funded through deposits or other bank liabilities and the dominant source of funding going into the 1970s.

The Agencies: Fannie, Freddie, and Ginnie
Fannie Mae, the oldest of the Agencies, was established in the 1930s as a secondary market for newly- created Federal Housing Administration (FHA) loans, which were insured by the government, but had trouble gaining acceptance by investors during the Great Depression. For much of its early history (until the 1980s), Fannie Mae operated like a national savings bank, gathering funds by issuing its own debt (short term debt rather than deposits) and buying mortgages that were held in portfolios. This was a particularly useful function during credit crunches when deposit rate ceilings limited the ability of banks to raise money. Fannie Mae was restructured as a private corporation with a special charter in the late 1960s.

Ginnie Mae, which grew out of the privatization of Fannie Mae in the late 1960s, was largely responsible for developing MBSs. The issuer of an MBS, perhaps a mortgage bank, passes the payments from a pool of mortgages (both principal and interest, net of its fee) through to the ultimate investors, who typically

[2] For recent work on the crash and mortgage markets, see Blinder (2013).

receive *pro rata* shares of the payments. The issuer also guarantees the payment of interest and principal even if the borrower defaults (the issuer is covered by government insurance for almost all of the foreclosure costs), and Ginnie Mae guarantees timely payment even if the issuer does not make the payments. Hence, its guarantee is on top of the federal insurance and the guarantee of the issuer. Since Ginnie Mae simply enhances the other guarantees, their costs are small, and Ginnie Mae has actually made money from the relatively small fee that they charge. As with most pass-through securities, those of Ginnie Mae are subject to interest rate risk.[3]

Freddie Mac was created in 1970 as a secondary market for the savings banks (typically savings and loans). Like Fannie Mae, Freddie Mac is a GSE, and the two GSEs have virtually identical charters. Freddie Mac initiated the first MBS program for "conventional" (not government insured) loans in 1971. Fannie Mae began its MBS program in 1981. The MBSs are similar to those of Ginnie Mae; for e.g., both protect investors against credit risk but not interest rate risk. Neither does more than a small amount of federally insured mortgages, which almost always go into the Ginnie Mae pools.

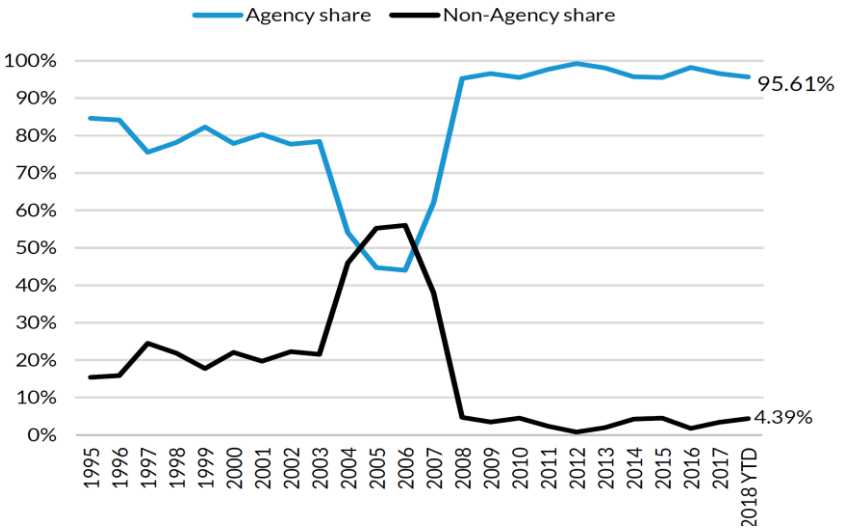
Since Ginnie Mae belongs to the government and is on the federal budget, their securities have a "full faith and credit" federal guarantee. Moreover, as Freddie Mac and Fannie Mae are both GSEs, which are private corporations, neither has an explicit guarantee, but both have lived off "implicit" or "conjectured" guarantees, because investors have believed that if these institutions fail, the government would protect debt-holders (although the government has no *legal* obligation to do so). This allows the GSEs to borrow (or sell MBSs) at interest rates lower than they would otherwise. This conjecture turned out to be true in 2008 when the Treasury injected capital into both companies to stabilize their markets.

Private Label Market

The PLS market has been around for some time, primarily securitizing loans that are not eligible for Agency purchase, for instance, those with balances above the maximum allowed for the Agencies. Initially, the PLS market largely dealt with home equity loans, but then expanded into first mortgages. The market exploded after 2003, as house price appreciation and the advent of structuring appeared to make PLS deals less information intensive and more transparent. House price growth covered up a lot of the risks of mortgages by building up borrower equity, and structuring, particularly subordination, thus allowing a large class of investors to avoid most risk with something similar to Agency guarantees - by foisting risk to other investors (and/or outside guarantors). The evolution of the market share of securitization is depicted in Figure 1.

[3] For more on MBSs, see Fabozzi (2001), Hayre (2001) and Hu (1997).

Figure 1 Agency Share of MBS Issuance



Source: Urban Institute (2018).

As market shares changed, so did product types. Figure 2 gives product share over time. The main change is the surge of ARMs that happened at about the same time as the surge in PLSs. ARMs that had rates fixed for two years and floating after that were a common vehicle for subprime lending.

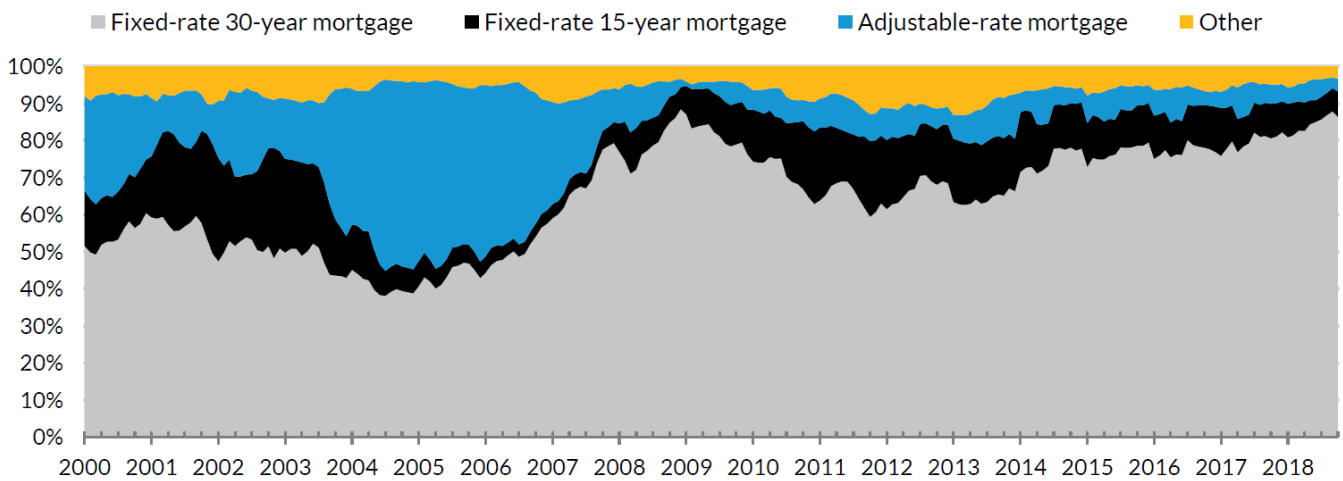
Results

Default rates, which had been modest for some time, even for subprime loans, increased precipitously for all types of mortgages, beginning around 2007. Figure 3 depicts defaults as measured by 90 day delinquency rates. Subprime loans had by far the biggest boost. These were predominantly in the PLS pools. However, Fannie and Freddie also had sharp increases, albeit from lower base levels.

In September 2008, the Federal Housing Finance Agency (FHFA), the GSE regulator, in conjunction with the Treasury Department and the Federal Reserve, placed Fannie Mae and Freddie Mac into conservatorship.[4] As a part of the conservatorship, the Treasury, in effect, guaranteed GSE liabilities by purchasing (net) approximately $140 billion USD of preferred stock and injecting over $180 billion USD. This along with the capital that Fannie and Freddie had going into the crisis amounted to a cumulative deficit of over $200 billion USD in just a few years. The government has become the major shareholder in both companies. Their securitization operations are more or less the same manner as before, although perhaps for different purposes.

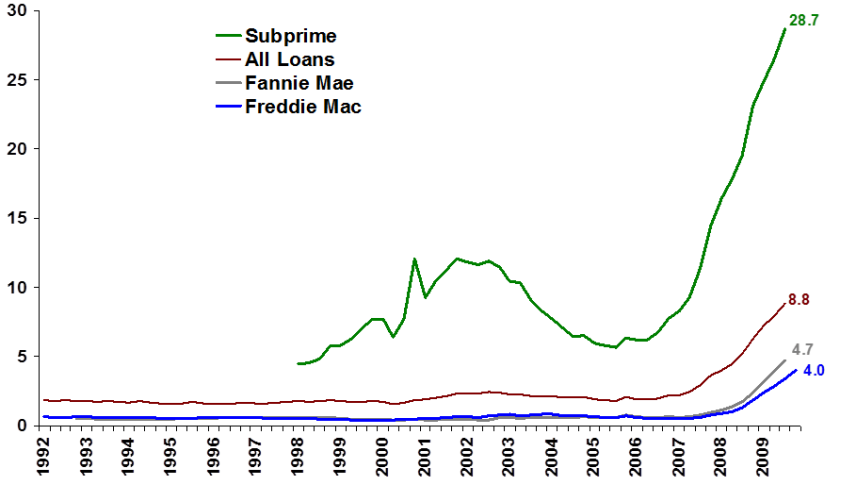
[4] Frame et al. (2015) discuss the conservatorship and some background and implications.

Figure 2 Mortgage Originations by Product Share



Source: Urban Institute (2018)

Figure 3 Share of Loans 90 days Delinquent, by Type (per cent).



Source: Kos Media (2003)

The PLS market collapsed in 2007 and 2008 (see Figure 1). The Agencies are again, after losing market share before the crash, the dominant forces in the mortgage market, more so than before.

3. Securitization Basics[5]

The point of departure is the much-celebrated "Modigliani-Miller irrelevance theorem" (henceforth "M-M"; see Modigliani and Miller (1958)). Briefly, the theorem is that under a set of assumptions, which mainly involve competitive markets, low transaction costs and widely agreed on information, the liability structure of a firm is irrelevant in the sense that changing the way that a firm finances its assets will not affect its "all-in" cost of funds. This is because different liability strategies are simply different ways of rearranging the same cash flows from the assets of the firm, and in a well-informed competitive market, arbitrage will ensure that all structures will be priced so that none has an overall advantage; the sum of the parts will equal to the whole, regardless of how the parts are chosen.

Taken literally, the theorem implies that while there are many possible institutional structures for funding mortgages and many liability structures within the institutional structures, the institutions (banks or securitizers) and structures (bond funded or deposit funded) that are chosen should not affect mortgage rates. A softer version is that the economic advantages of different

[5] See Gorton and Metrick (2011) for a survey

structures are likely to be small, although perhaps quite important to the different players.

The theorem is one of those ideas that when you think about it, it is obvious, but it is also wrong (in particular, asymmetric information is often the rule rather than the exception, and transaction costs often matter). Nonetheless, it is a good place to start because it makes us ask the right question: why should we expect one institutional setup to be better than another at financing a particular set of cash flows when they all compete in the same overall financial system? The theorem suggests that some rationales for securitization structures are wrong or at least suspect, like "getting assets off the balance sheet" (the price at which the banks sell the loans will be the same as the value of the loans if the banks hold them) or "the high cost of capital relative to debt" (risk-adjusted costs should be the same) or "allowing banks to shed the risk of low downpayment loans" (risk should be the same to the buyer of the loans who will pay the market price) or using tranching (see below) to generate more AAA bonds, pending analysis of the part of the M-M that is violated.

Unbundling

The traditional financial intermediaries performed all aspects of the mortgage bundle: they originated the mortgages, serviced (i.e., managed payments) them, took the risk of default (perhaps along with a private or government insurer), and raised money in the deposit market to fund the mortgages. Securitization evolved by unbundling this package. Deals may have entirely separate entities performing the above tasks as money is moved from borrowers to investors.

Mortgage securitization has five major parts:

a. Deal sponsors, who put the deal together;
b. Mortgage originators, who sell the loans themselves (to the deal sponsor) or who (mortgage brokers) act as agents for mortgage bankers or depositories, who sell the loans;
c. Mortgage servicers who manage the movement of money form the borrower to the investor;
d. Secondary market institutions and mortgage insurers,[6] who take on some or all of the credit risk; and
e. Investors who buy MBSs and accept interest rate (and prepayment) risk and some credit risk, depending on the structure of the deal. The last function has become further unbundled with the advent of derivative securities.

Unbundling takes advantage of scale economies and division of labor and promotes competition among the suppliers of the various bundles, but occurs with a cost. The cost is that the players who focus on one part of the bundle

[6] It is typically the case that loans with down payments of less than 20% have private mortgage insurance. The insurance typically covers the first 20 to 25 cents on the dollar of loss.

depend on the players in the other parts to perform services for them as expected (e.g., sell them good loans) when it is not always in their interest to do so.

That is, there is a "principal/agent" problem: the principals (e.g., ultimate investors) depend on the agents (e.g., the institutions that originate and service the loans) to perform as promised, even though it may not be profitable for them to do so. A result of this (see the classic paper by Ackerlof (1970)) can be an equilibrium where only the worst securities are expected to be delivered and they are the ones that are in fact delivered—a race to the bottom. Unbundling is a generalization of the "Originate to Distribute" model (see Purnanandam (2011)) that has been used to analyze moral hazard problems in secondary markets.

For investors, or more broadly those who end up taking the risks, a major principal-agent issue has come from reliance on originators and servicers to originate good loans and service them properly. The major risks are that sellers, with superior information about loans, will select against them, keeping good loans and selling the ones that are riskier than they appear to be, relaxing monitoring, underwriting and servicing poorly, or making loans that are of low quality (occasionally this involves actual fraud, e.g., selling mortgages not associated with houses). This is particularly true for institutions that are in danger of bankruptcy, for which reputation is less valuable and "gambling for resurrection" is optimal. Hence, whoever is taking the credit risk needs to try to do things that align the incentives of originators and servicers with their own or get better information on risk.

Securitizing on a large scale, to keep fund-raising costs low, has required that those who accept the risks not spend a lot of resources on monitoring the credit risk of individual loans, which also fosters the benefits of division of labor. Hence, the burden of controlling credit costs has often fallen on: the performance of mortgage insurers, who insure loans with down payments of 20% or less; underwriting guidelines, which attempt to define the parameters of an acceptable mortgage; the ability to monitor and provide incentives to induce originators to make good loans; rating agencies; and ultimately, the ability to foreclose on borrowers who do not make their payments.

4. Structuring and Subordination

Securitization can be done simply, like a mutual fund, or by creating securities that rearrange ("structure") cash flows in non *pro rata* ways. The justification for going to the expense of creating structured securities must be that the M-M is violated. A common reason is that information about mortgages is heterogeneous, which creates Ackerlof problems. Structuring is meant to put the risks with more knowledgeable investors, while assuring the less knowledgeable that they are relatively safe. Quite often this is done by

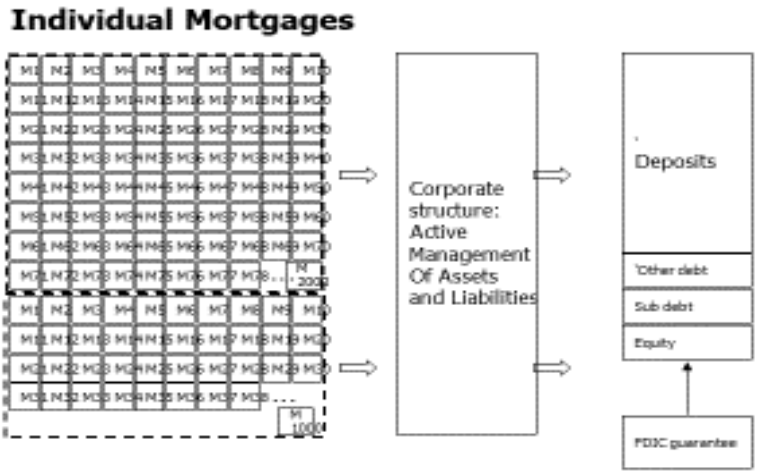
prioritizing payouts, so that those absorbing the risks most are paid off last and/or take default (or other) losses first. For these deals to work, there must be underlying cost or regulatory disadvantages for banks.

Most loans that are securitized are structured in some way, often by dividing cash flows into pieces or "tranches", which are designed to appeal to particular investor categories, or have outside guarantees on the credit risk. There are different reasons for structuring. For instance, some investors prefer (or are required to hold) assets with less credit risk, or less expense in evaluating credit risk, and will "pay up" for tranches that push risk off onto other investors. The underlying motivation is that mortgages have had relatively high yields, and there may be an arbitrage to be had. All structures have agency costs because of the inevitably heterogeneous information on underlying mortgages.

Archetypical Structures

Securitization deals are essentially limited purpose corporations. They are put together by sponsors who choose the mortgages and the way that the deal is structured. Unlike with banks, which hold similar loans, mortgage deals are typically separate structures that allow only minor modifications, if any, once they are set up. They are run through a "special purpose vehicle" (SPV), which owns the assets in the deal, getting them off the balance sheet of the seller, and is the *de facto* corporate structure that takes responsibility for the cash flows to investors. In the U.S., these structures are not subject to corporate income taxes. In that sense, they are like mutual funds, rather than banks. They are like banks in that they hold financial assets and have limited liability, but their structure is different. The first structure considered here is a bank (Figure 4).

Figure 4 A Bank (or Savings and Loan)

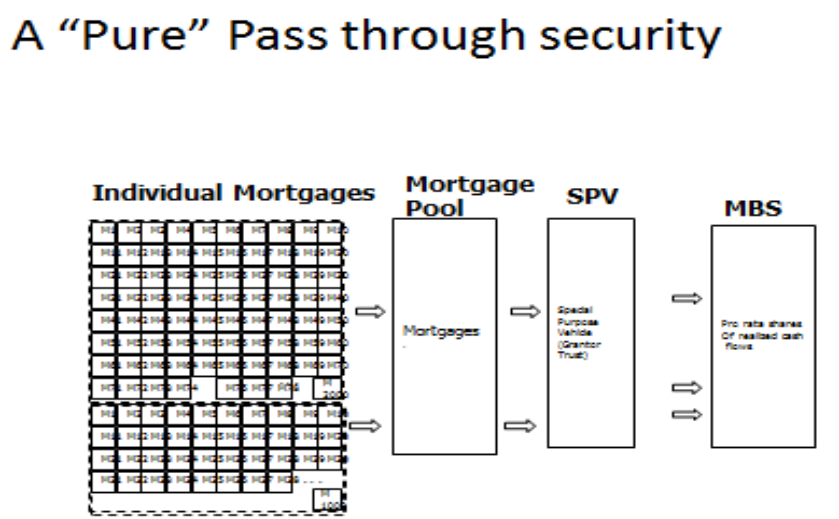


***Source*:** Van Order (2010)

A bank is a regular corporation, in this case with mortgage assets and a range of liabilities, dominated by deposits. The liabilities have a pecking order with equity being the residual that takes the first hit if losses cannot be covered by revenues and reserves. In the figure, the bank also has deposit insurance, which covers losses after equity and other debt have been exhausted. The funding of the bank usually involves a mismatch in that liabilities, especially deposits, have different terms to maturity from assets, which puts banks (equity holders and insurers) at risk if interest rates rise (interest rate risk) and/or if depositors want their money back before the assets have been paid off (liquidity risk).

Figure 5 is a representation of the simplest sort of securitization deal, basic residential mortgage-backed securities (RMBSs).

Figure 5 Basic Residential Mortgage-Backed Security



Source: Van Order (2010)

RMBSs have the same assets as banks, but cash flows are shared in a *pro rata* manner by investors. Interest rate risk is borne equally by investors and there is no liquidity risk. RMBSs are the purest form of securitization, and basically a mutual fund made up of mortgages.

The two structures have similarities and differences; they are ways of funding mortgages through limited liability financial institutions. The securitization structure is different not only in funding source, but also in operation. Banks, like other real corporations, have active management; they are constantly changing their assets as liability mix. Securitizations have little, if any, active

management after the pool is formed, and the deal generally lasts only as long as the assets do.[7]

The securitization deal in Figure 5 would be a hard sell because typical bond market investors would need information at the level of individual loans to determine the risk of the deal. If they believe that loan originators and/or better informed investors could select against them, the Ackerlof problem would lead them to avoid buying into the pool. For deals to work, there usually has to be some sort of credit enhancement to catch the interest of investors, particularly investors who are constrained to hold highly-rated assets. A simple sort of enhancement is excess collateral, i.e., collateralizing the deal with more assets than the value of the securities sold to investors.

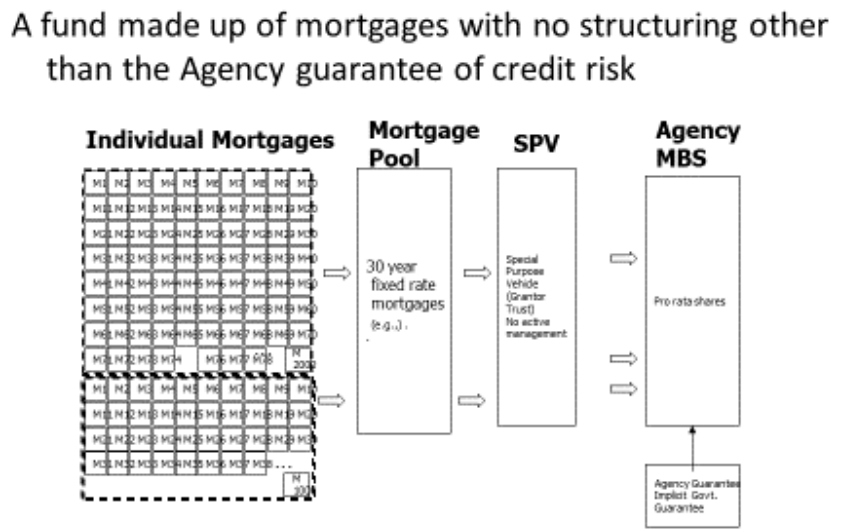
Covered bonds are popular in Europe and essentially how the Federal Home Loan Banks in the U.S. support member banks. Here, the loans are set aside in a segmented part of the balance sheet of a bank. The value of the covered bonds is less than the value of the mortgages set aside (that is, the over-collateralization), and the deal is set up to be bankruptcy remote in the sense that if the bank is bankrupt, the assets in the covered bond deal are still retained by the covered bond owners.[8]

Fannie, Freddie and Ginnie, the "Agency" market"[9]
In the agency market, the issuer, often a specialized mortgage bank, passes the payments from a pool of mortgages (both principal and interest, net of its fee) through to the ultimate investors, who typically receive *pro rata* shares of the payments, see Figure 4. The Agencies, however, provide an extra guarantee (e.g., beyond default insurance on some individual loans) that investors will get the promised cash flow on time. Figure 6 depicts the structure of an Agency MBS.

The Agency guarantee has effectively taken credit risk off the table for investors, thus allowing them to focus on interest rate and prepayment risk. The credibility of the guarantee by the Agencies was greatly enhanced by the perception (which has turned out to be accurate) that the Agencies would be covered by the government if they were unable to pay off.

[7] Some deals have active management-e.g., with securitized credit card receivables, new assets are added to replace old ones. For MBSs, this is less important.
[8] An important element of this is that the excess collateral comes at the expense of assets that would have funded the rest of the liability of the bank - perhaps creating a sort of moral hazard.
[9] See Weicher (1999) for some of the history of the secondary market.

Figure 6 Agency MBS



Source: Van Order (2010)

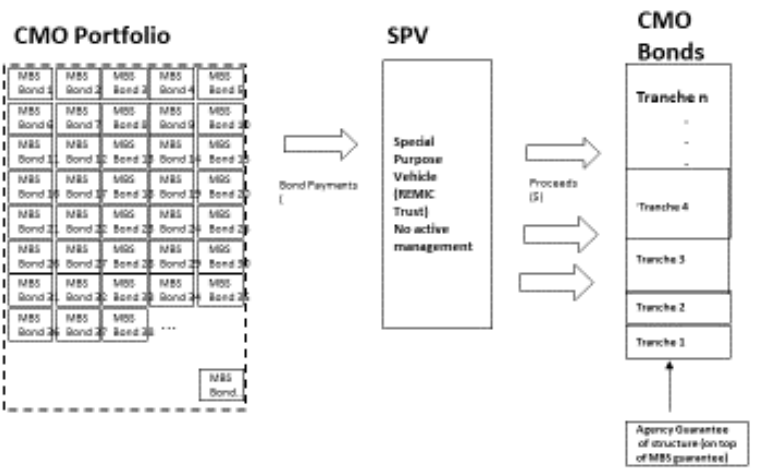
First tranches: Collateralized mortgage obligations

Prepayment risk is an important part of the U.S. single family mortgages (less so for multifamily and commercial mortgages). Borrowers generally have the right to prepay the unpaid balance when they want, perhaps with a fee, giving them in effect a call option on their mortgages. As a result, investors have limited gains when interest rates fall as borrowers pay off mortgages at their par value (the unpaid balance) rather the market value of the loans if the borrowers could not prepay. Managing this risk is difficult, in part because it is difficult to model individual (quite heterogeneous) prepayment behavior, which has sometimes been an obstacle in getting bond market investors into MBSs.

Prepayment risk aside, some investors want money back sooner than the payoff on a typical long term loan. Furthermore, some dislike being stuck with fixed interest income for long periods of time. This is especially the case with banks, whose deposit costs can vary sharply over time.

Collateralized mortgage obligations (CMOs) create tranches out of existing pools of mortgages, typically Agency pools where the credit risk is already guaranteed. The structuring leaves some investors with less prepayment and/or interest rate risk. This leaves (the deals are self-contained) other investors with higher concentrations of risk. The idea is to place these tranches with investors who are better able to understand and manage the risks. Figure 7 is a depiction of a CMO backed by an Agency MBS.

Figure 7 Tranching: An Agency CMO



Source: Van Order (2010)

Deals with Agency collateral have guarantees, beyond the Agency credit guarantee, that the deal will work as promised-that regardless how high or low interest rates go, the parts of the deal will pay off as planned.

The Non-Agency (PLS) Market

The PLS market securitizes mortgages without using Agency collateral or guarantees; it has operated mostly in areas that are not eligible for the Agencies, and is the typical model in most countries. A historically large part of this market in the U.S. has been loans with balances that are too large for Agency purchase. More recently, beginning in the 1990s and accelerating around 2003, the subprime market, which consists largely of loans to borrowers with poor credit histories, grew very rapidly and was largely securitized.

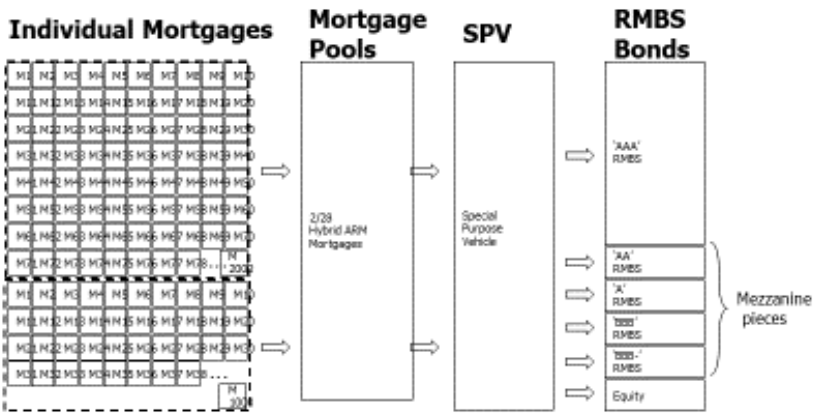
A related market is for "Alt-A" loans, which are loans that are prime except for some flaws like low documentation of income and wealth. The securitization of the two combined grew from around 5% in the 1990s to 10% in the early to 2000s and then to a third in 2005 (see Figure 1). Commercial mortgages have also been funded with PLSs (commercial mortgage-backed securities (CMBS)). They are structured in ways that are similar to RMBSs and share some similar problems. Indeed, the model for the RMBS tranches was largely taken from the model for CMBS tranches, which evolved in the 1990s.

A key factor in selling PLS pools is diversification, and measures of diversification have been an important part of the analysis of the quality of the pools. In the limit, one could imagine a perfectly diversified pool of risky loans; the pool would have high default rates, but default costs would be known-e.g.,

a fixed but high default rate. There could simply be a piece of the pool set aside to cover default costs and another to pay interest and principal. The latter could sensibly have an AAA rating.

Since diversification is never perfect and asymmetric information problems are especially important for pools of riskier loans, credit risk is typically managed by subordination. Typically, there are a series of subordinated tranches that take the default losses up to some amount and senior tranches, which take the rest. This allows the bulk of the credit risk to be taken by investors with better information or less risk aversion, with the senior part (which typically has an AAA rating) open to a wide range of less informed investors.[10] This is depicted in Figure 8 in a structure known as a "six-pack". The example is of a self-identified subprime security, where the loans have fixed rates for two years and float thereafter and are made to borrowers with low credit scores.

Figure 8 A Private Label (in this case "Subprime") Security



Source: Van Order (2010)

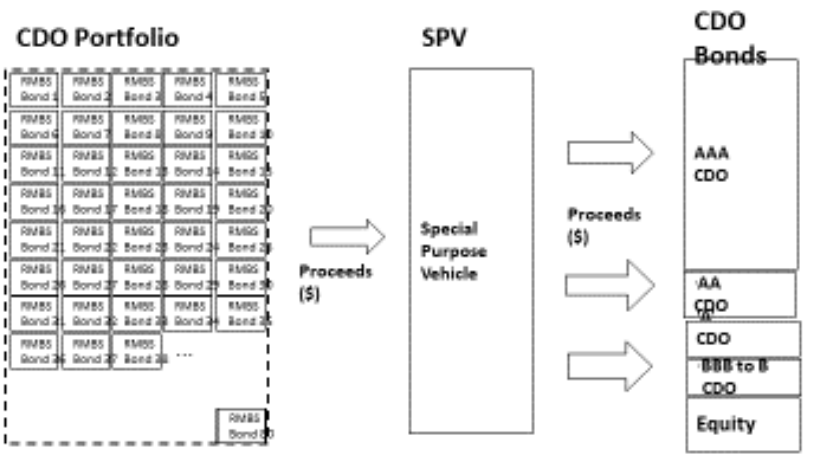
These and the broader class (not necessarily mortgage-backed) of asset-backed securities (ABSs) are set up in ways that are quite similar to corporations with debt and equity classes and not dissimilar to banks. The key differences from banks are that the debt is likely to be longer term and not deposits (although some pieces can be short term) and managers of PLS deals are limited in what they can do after pools are formed. A way of adding to the credit enhancement is the credit default swap (CDS) market, which in its simplest form, sells guarantees against default on various pieces of the deal.

[10] A factor in this has been that bank capital rules do not take account diversification, so that a bank can hold less capital against a securitized pool than the same loans themselves. This is offset by the capital in the deal in the form of subordination.

Resecuritizing and Collateralized Debt Obligations

However, the goal of setting up deals is often to get as much of a deal rated AAA as possible. This attracts funds from institutional investors and investors who are regulated to hold AAA or comparable assets and willing to pay up for the PLS tranches that have higher interest rates than other AAA securities. A way of doing this is "re-securitize" by putting pieces of RMBS deals together into new deals that look like the first stage. These new structures are called collateralized debt obligations (CDOs). This has been the most controversial part of the U.S. securitization business. In principle, they are no different from structured PLS deals. They do have the potential to increase diversification by putting together deals with pieces of mortgage deals that are mixed with ABS from non-mortgage deals. A problem with the evolution of CDOs before the crash was that there was less diversification than investors thought and higher correlations among assets. See Figure 9 for an example of a CDO.

Figure 9 Collateralized Debt Obligation



Source: Van Order (2010)

The CDO looks like the deal in Figure 8, but the deals can be very sensitive to non-diversifiable risk, for instance, if they are concentrated in one industry, like mortgages. Consider a CDO made up entirely of BB rated pieces of mortgage PLSs. Suppose there is a nationwide decline in property values and sharp increase in defaults, and that all of the BB pieces (e.g., in Figure 9) lose half their value. The senior pieces of the PLS deal will still be protected, but unless the AAA rate pieces of the CDO have at least 50% subordination in front of them, the AAA pieces of the CDOs will lose money.[11]

[11] See Cordell et al. (2012) on problems with CDOs.

Other related structures are "CDO-squareds" which re-securitize CDOs. These all have the effect of increasing the overall share of AAA rated bonds, but only work to the extent that diversification continues as we move down the food chain. Finally, a related product is synthetic (non-cash) CDOs, which instead of having actual assets in the structure have payoffs that depend on how "referenced" pools perform, rather like making side bets or buying or selling options on stocks. These allowed investors (who were selling something like insurance) to take positions in what were essentially the same as CDOs without owning them, and for the insurance buyers (who made payments to the CDO investors) to hedge or speculate by shorting the mortgage market.

Comments
The above structures look similar, and indeed they are similar in the use of structures and tranching. However, they became increasingly complicated as the market moved toward CDOs and CDO-squareds, which makes them more deceptive. For CDOs, the distance between the pieces of the securities and the underlying mortgages in the first stage is large, and it is very difficult for investors to understand the details of what they hold, thus leading to information asymmetries. An obvious question is why value is created by reshuffling the same securities. It is unlikely to be lower costs from unbundling, which has been accomplished at the lower levels of securitization. The answer is that there is something special about AAA rated bonds, e.g., for the regulatory reasons cited above. These structures squeeze more AAA out of the same basic product, clearly not an affirmation of the M-M theorem.

It was the CDOs (rather than the first-level RMBS deals) that were the overwhelming source of security losses in the crash, and their issuance exploded around 2005 (see Cordell et al. (2012) on both where the losses were and timing). With respect to moral hazard, one would expect that as securities become more complicated, the temptation to take advantage of heterogeneity increases. In the recent crash, the initial shock was the increase in property values, which covered up for weak underwriting and enabled increased securitization, which peaked around 2005. The hypothesis in what follows is that the expanding market moved to more complicated products, which facilitated moral hazard. The next section looks at a simple proposition about moral hazard - incentives to increase moral hazard increased after 2005, and analyzes increases in silent second mortgages and ARMs that enable moral hazard.

5. Testing for Moral Hazard

This section tests for moral hazard with a set of aggregated data on default and a simple identification strategy. The identification strategy is to look at sharp changes in market activity and compositions that are likely to enable moral

hazard and see if they are followed by changes in indicators consistent with moral hazard.

The year 2005 appears to have been a critical year. Mian and Sufi (2009) present evidence, derived from changes in the subprime market share by zip code, that the increase in defaults after 2005 was caused by supply shocks from the PLS market via an increase in the supply of subprime lending from 2002-2005.[12] They reject hypotheses that the increased subprime share was due to demand shocks or increases in house price growth expectations. So 2005 might be a break point where regimes changed and moral hazard incentives increased.

Support for a change in strategy around 2005 came from testimony before the Financial Crisis Inquiry Commission (FCIC; 2011, pp 178-187) by around twenty executives and Fannie Mae and Freddie Mae. Both GSEs had major internal differences about strategy in 2005 in the face of lost market share during the 2003- 2005 period,[13] which ended in increases in risk-taking. Indicators of risk-taking might be found in characteristics of pools of loans. For instance, as discussed above, ARMs increased sharply in share at about the same time the PLS market grew rapidly. Such an increase could be an indicator of extra risk taking.

A summary of important characteristics is contained in Ashcraft and Schuerman (2008). Table 1 below presents their summary measures of the characteristics of subprime and Alt-A PLS pools over time.

Pool composition changed somewhat over the period. LTV ratios worsened some, but credit scores improved some. On balance, these were not big changes. More interesting is the sharp increase in "silent second" mortgages. As discussed above, a silent second is a second mortgage, typically behind an 80% LTV first mortgage, that provides a downpayment, typically on an 80% LTV first mortgage. The key is that it is not recorded at the same time as the first mortgage. This means that when the first mortgage is sold into a pool, it looks like an 80% LTV loan without a second mortgage. Table 1 shows sharp increases beginning around 2004 and 2005. First mortgages behind such loans are expected to have default rates that are underestimated to the extent the information about the seconds is not disclosed to investors in pools.

The first mortgages behind silent seconds are expected to have LTV ratios exactly at 80%. This is because 80 is a rule of thumb cut-off for risk in the sense that loans with LTV above are classified as low down-payment, and often required to take private mortgage insurance. Also there is no point, especially for a cheater, to have an LTV just below 80 because mortgage rates change only

[12] They do not explicitly consider Alt-A loans, but as can be seen from Figure 2, the Alt-A market moved in more or less the same way as the subprime market.
[13] C.f. Chapter 9 of FCIC Final Report: "Fannie Mae and Freddie Mac: Two Stark Choices".

over larger intervals. In this sense, the analysis is parallel to Keys et al. (2010), who look at loans with FICO scores at 620, which is also viewed as the cutoff. They show that loans at a little above 620 are worse than those just below it.

Table 1 Composition of Private Pools over Time

	CLTV*	Full Doc	Purchase	Investor	No Prepayment Penalty	FICO	Silent 2nd
Panel A	Alt-A Loans						
1999	77.5	38.4	51.8	18.6	79.4	696	0.1
2000	80.2	35.4	68.0	13.8	79.0	697	0.2
2001	77.7	34.8	50.4	8.2	78.8	703	1.4
2002	76.5	36.0	47.4	12.5	70.1	708	2.4
2003	74.9	33.0	39.4	18.5	71.2	711	12.4
2004	79.5	32.4	53.9	17.0	64.8	708	28.6
2005	79.0	27.4	49.4	14.8	56.9	713	32.4
2006	80.6	16.4	45.7	12.9	47.9	708	38.9
Panel B	Subprime Loans						
1999	78.8	68.7	30.1	5.3	28.7	605	0.5
2000	79.5	73.4	36.2	5.5	25.4	596	1.3
2001	80.3	71.5	31.3	5.3	21.0	605	2.8
2002	80.7	65.9	29.9	5.4	20.3	614	2.9
2003	82.4	63.9	30.2	5.6	23.2	624	7.3
2004	83.9	62.2	35.7	5.6	24.6	624	15.8
2005	85.3	58.3	40.5	5.5	26.8	627	24.6
2006	85.5	57.7	42.1	5.6	28.9	623	27.5

* Combined LTV: sum of first and second mortgages if there is one.

Note: All entries are in percentage points except FICO.
Source: Loan Performance (2007) via Ashcraft and Schuerman (2008)

However, we need more than the importance of a "notch" at 80 to establish moral hazard. There can be other reasons why notches matter. It may well be that an 80 LTV has always been a well-known effect because borrowers are stretching their finances to get to a cutoff. For example, a 90 LTV is traditionally also an important notch because loans with high LTVs are often required to buy private insurance and prices change at 90. This can be important. Bubb and Kaufman (2014) refute Keys et al. (2010) by showing that there are important notches for FICO effects at other notches and for other reasons. The tests here differentiate between normal notches and moral hazard by looking at how effects vary when reacting to shocks that are expected to cause moral hazard to increase. In the case of silent seconds, it is expected that the effect happened after 2005 when silent seconds increased, and mostly did so in PLS pools and for 80 LTV loans.

It is also the case that the surge in ARMs around 2005 might be a signal of moral hazard, and ARMs after 2005 would have higher than expected defaults. Hence, our identification comes from two surges, in ARMs and silent seconds. These were probably motivated by the risk induced by the expanded CDOs. Our tests are of what followed these surges.

Testing is done with a data set provided by the FHFA. The data provide information on default for various categories of loan. They provide the average default rates for loans that are aggregated by loan type, loan characteristic and origination year, with 3,072 mortgage categories, sorted by LTV and FICO categories, payment type (fixed or adjustable rate), and funding channel (GSE or PLS), originated over eight vintage years (2001 to 2008). All loans included in the data are first mortgages. GSE loans come from GSE data bases, and PLS-funded loans are provided by the CoreLogic Loan Performance data base. All explanatory variables are categorical. The variables used are given in the Appendix.

Table 2 presents a comparison of one of the best (2003) and one of the worst (2006) origination years via a difference-in-difference model that models differences in average default rates (the average probability of ever being ninety days delinquent by 2009, for each origination year), by category (see Appendix). Explanatory variables are LTV, credit score, whether the loans were bought by GSEs or put into PLS pools, and loan type. The parameter estimates reflect the extent to which each covariate caused the change in the default rate to increase or decrease between the two origination years by more than for the base case. Having an LTV at 80 and being funded by the PLS market caused the difference in the default rate to increase, after controlling for other factors. The two boldface lines are effects of being at-80 and at-90. Both are significant, so there is some sort of notch effect. The estimates also suggest that ARMs played a role.

Thomas and Van Order (2018) use the same data to estimate hazard models of default. The model estimates the determinant of the average default rate for mortgage category i which originated in vintage year v. The default (or hazard) rate is $h_{i,v}$. It is one minus the fraction of loans in that category that were never delinquent divided by the number of exposure years.

The estimated equations are given by:

$$h_{iv} = h_0 \exp(x_{iv}\beta_i) \tag{1}$$

where h_0 provides the "baseline" hazard rate, and the parameters can be interpreted as multipliers for the default rate for being in category x_i relative to being in a base case.

Table 2 Difference in Difference Regression, 2003 and 2006 Vintage Years

This table provides a "difference in difference" regression where the dependent variable is the difference between the 2003 and 2006 average cumulative default rates for each category of mortgages.

	Estimate	*T* Statistic
(Intercept)	0.00	0.17
FICO 0 - 619.9	0.07	3.55
FICO 620 - 639.9	0.09	4.87
FICO 640 - 659.9	0.06	3.27
FICO 660 - 679.9	0.08	4.03
FICO 680 - 699.9	0.07	3.96
FICO 700 - 719.9	0.05	2.88
FICO 720 - 739.9	0.03	1.79
LTV 60 - 69.9	0.09	3.82
LTV 70 - 74.9	0.16	6.86
LTV 75 - 79.9	0.18	7.99
LTV 80	**0.23**	**10.22**
LTV 80.1 - 84.9	0.16	7.07
LTV 85 - 89.9	0.18	7.96
LTV 90	**0.21**	**9.19**
LTV 90.1 - 94.9	0.15	6.63
LTV 95 - 97.4	0.20	8.59
LTV 97.5 - 104.9	0.17	7.55
LTV 105 +	-0.03	-1.28
ARM	**0.14**	**14.51**
GSE	**-0.11**	**-11.78**

Source: Thomas (2012)

Tables 3 and 4 present estimates of the betas (1) for representative estimates in Thomas and Van Order (2018). Explanatory variables are LTV (at origination), credit score, whether the loans are bought by GSEs or put into PLS pools, loan type, origination year and controls for property value changes (not shown in the tables). The results of interest here are robust across specifications and controls in Thomas and Van Order (2018).

Table 3 presents estimates of effects on default over the 2001-2008 origination years for the data as a whole, and the GSEs and PLS separately. Controls for property value changes are not shown in the table. The key results are in boldface. There is a clear shift around 2005, as given by origination year fixed effects. The coefficient of at-80 is significant, but only for the PLS estimates. The notch for at-90 is significant all around. ARMs as a whole are not particularly important, but ARMs after 2005 are significantly worse. Hence, the

indicators of moral hazard are significant, but only for PLS and only after 2005, as CDOs and silent seconds expanded.

Table 3 Hazard Specification for All Data and GSE and PLS Separately

The dependent variable is the log of the hazard rate for each mortgage category. The parameter estimates represent the additive (log) impact of the mortgage category on the baseline hazard rate. The four variables below LTV interact adjustable-rate mortgage (ARM) dummies with vintage year and subprime FICO (<620). There are controls for national house price changes via updated LTVs. Almost all variables are statistically significant.

Model	(1) All data	(2) GSE only	(3) PLS only
(Intercept)	-3.95	-4.79	-3.85
FICO 0 - 619.9	2.08	2.33	1.84
FICO 620- 639.9	1.62	1.86	1.40
FICO 640- 659.9	1.45	1.65	1.26
FICO 660- 679.9	1.24	1.40	1.09
FICO 680- 699.9	1.02	1.19	0.86
FICO 700- 719.9	0.80	0.94	0.66
FICO 720- 739.9	0.54	0.65	0.45
ARM	0.00	0.01	-0.02
GSE	**-0.78**	-	--
2001 vintage	-0.84	-1.15	
2002 vintage	-1.65	-1.86	-1.45
2003 vintage	-1.81	-1.79	-1.84
2004 vintage	**-0.96**	**-0.91**	**-1.01**
2005 vintage	**0**	**0**	**0**
2006 vintage	**0.91**	**0.89**	**0.93**
2007 vintage	1.35	1.37	1.33
2008 vintage	1.27	1.09	1.84
LTV 60 - 69.9	0.77	0.81	0.73
LTV 70 - 74.9	1.24	1.27	1.21
LTV 75 - 79.9	1.49	1.50	1.46
LTV 80	**1.72**	**1.70**	**1.74**
LTV 80.1 - 84.9	1.72	1.89	1.56
LTV 85 - 89.9	2.00	2.11	1.88
LTV 90	**2.23**	**2.34**	**2.11**
LTV 90.1 - 94.9	2.09	2.21	1.99
LTV 95 - 97.4	2.37	2.46	2.29
LTV 97.5 - 104.9	2.55	2.80	2.31
LTV 105 +	2.62	2.83	2.40
2007ARM	**0.70**	**0.89**	**0.52**
2006ARM	**0.60**	**0.73**	**0.51**
2005ARM	**0.33**	**0.40**	**0.29**
SubARM	-0.18	-0.20	-0.14
R-Squared	0.92	0.94	0.92

A better look at the evolution of the coefficients can be seen in Table 4, which estimates the model separately for each originating year by using combined GSE and PLS data.

Table 4 Hazard Specification for Each Vintage Year

This table reports the results from separate proportional hazard regressions for each vintage year. The baseline hazard rate reported in the table is the exponentiated intercept term in each regression. The parameter estimates represent the additive (log) impact of the mortgage category on the baseline hazard rate for each origination year. The 2008 vintage year is excluded because of insufficient PLS observations.

Vintage	2001	2002	2003	2004	2005	2006	2007
Baseline Hazard Rate	**0.52%**	**0.25%**	**0.13%**	**0.25%**	**0.56%**	**1.13%**	**1.42%**
FICO: 0 - 619.9	2.68	2.53	2.28	1.95	1.58	1.32	1.46
FICO: 620 - 639.9	2.04	2.04	1.79	1.58	1.31	1.18	1.26
FICO: 640 - 659.9	1.81	1.74	1.64	1.40	1.22	1.05	1.15
FICO: 660 - 679.9	1.43	1.49	1.37	1.18	1.04	0.97	1.02
FICO: 680 - 699.9	1.15	1.17	1.11	0.97	0.89	0.85	0.92
FICO: 700 - 719.9	0.78	0.83	0.88	0.75	0.70	0.69	0.79
FICO: 720 - 739.9	0.41	0.48	0.57	0.52	0.56	0.48	0.59
LTV: 60 - 69.9	0.26	0.34	0.41	0.52	0.73	0.85	0.85
LTV: 70 - 74.9	0.61	0.59	0.66	0.79	1.07	1.26	1.20
LTV: 75 - 79.9	0.74	0.83	0.85	0.94	1.20	1.39	1.36
LTV: 80	**0.98**	**1.09**	**1.04**	**1.10**	**1.44**	**1.61**	**1.53**
LTV: 80.1 - 84.9	1.03	1.12	1.05	1.00	1.12	1.35	1.42
LTV: 85 - 89.9	1.24	1.38	1.24	1.18	1.30	1.48	1.56
LTV: 90	**1.42**	**1.55**	**1.44**	**1.37**	**1.54**	**1.65**	**1.67**
LTV: 90.1 - 94.9	1.19	1.47	1.36	1.22	1.27	1.39	1.54
LTV: 95 - 97.4	1.45	1.58	1.50	1.40	1.54	1.63	1.73
LTV: 97.5 - 104.9	1.49	1.85	1.74	1.63	1.56	1.64	1.83
LTV: 105 +	1.69	2.01	1.72	1.80	1.22	1.04	1.51
GSE	-1.23	-0.98	-0.58	-0.57	-0.67	-0.68	-0.51
ARM	**-0.11**	**-0.18**	**-0.11**	**-0.67**	**0.08**	**0.31**	**0.56**

Note that this table does not control for economic conditions, which are a part of the constant terms for each origination year, so we cannot separate vintage effects from economic effects. The table shows how the at-80 effect increased over time, while at-90 does not. This suggests that the at-80 effect was generated by the increase in silent seconds and low doc loans, while at-90 was due to something (insurance pricing change?) that was not affected by the moral hazard variables. Note also that the evolution of the at-80s is that they became relatively more like the at-90s, which is a bit like what they actually were, because they had less equity, from the perspective of the borrower, than the real 80s. Note also the sharp deterioration in ARMs in the last two years.

6. Comments

The above uses old data, from a market that now barely exists, the U.S. Private Label Mortgage-backed Securities Market, to look at what might be, if not a new problem, a recurring one. The data are consistent with the following story:

a. The private label market expanded rapidly around 2003 and afterwards, probably because rapid house price growth made it easier to compete with the Agencies. The ability to break the deals into tranches allowed deals to have AAA pieces, which were appealing to many regulated investors.
b. By 2005, the CDO market was expanding to resecuritize lower grade parts of previous PLS deals. The CDOs looked like the initial PLS structures, but were further removed from the underlying mortgages and easier vehicles for hiding risk.
c. A reason for the resecuritization was most likely squeezing extra AAA pieces out of the initial deals by re-tranching the lower grade pieces. It is hard to justify this in terms of lowering costs or fundamental economic value.
d. As this happened, there was a surge in a particular instrument, ARMs, and in an obviously moral hazard-ridden way of funding down-payments, silent second mortgages.
e. These surges were signals of increased moral hazard, which was indicated by positive differences in defaults on all loans after 2005 and especially ARMs that originated after 2005 and loans with LTVs at-80 (indicators of silent-seconds), relative to more standard loans and time periods.

Following Gorton (2010), it is clear that securitization did not work very well for information intensive assets as the CDOs became complicated. The nature of securitization, which uses division of labor, relative to banks, invites moral hazard, both in terms of mortgage type and deal structure. This may be important in understanding possibilities for recent financial innovations that come under the heading of "Fintech" and shadow banking. These too are trying to raise money in capital markets via what is essentially securitization of assets that are possibly information intensive.[14] The markets could be subject to the risk of abrupt changes in strategy in the same way as the U.S. PLS market. An indicator of trouble, as was the case a decade ago, would be sharp changes in the market structure, like the rise in ARMs, the PLS market and silent seconds in the U.S.

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[14] See Lai and Van Order (2018) for a discussion of Fintech and networks and relation to PLSs.

References

Akerlof, G. (1970). "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism". *Quarterly Journal of Economics*. 84 (3): 488–500.

Ashcraft, A. and Schuerman, T. (2008). Understanding the Securitization of Subprime Mortgage Credit. *Foundations and Trends(R) in Finance*, 2(3), 191-309

Blinder, A. (2013). *After the Music Stopped: The Financial Crisis, the Response, and the Work Ahead*. New York: Penguin

Bubb, R. and Kaufman. A. (2014). Securitization and Moral Hazard: Evidence from Credit Score Cutoff Rles. *Journal of Monetary Economics*, 63(C), 1-18

Cordell, L., Huang, Y. and Williams, M. (2012). Collateral Damage: Sizing and Assessing the Subprime CDO Crisis, Working Paper No. 11-30/R, Federal Reserve Bank of Philadelphia.

Deng, Y., Quigley, J.M. and Van Order, R. (2000). Mortgage Terminations, Heterogeneity and the Exercise of Mortgage Options, *Econometrica*, 68(2), 275-307.

Fabozzi, F.J. (2001). *The Handbook of Mortgage-Backed Securities* (5th edition), New York: McGraw-Hill.

Financial Crisis Inquiry Commission (2011). The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States. Washington, D. C.: Government Printing OffiCe. Available at http://www.fcic.gov/resource/reports

Frame, W.S., Fuster, A., Tracy, J. and Vickery, J. (2015) The Rescue of Fannie Mae and Freddie Mac. *Journal of Economic Perspectives*, 29(2): 25-52.

Gorton, G. (2009). Information, Liquidity, and the (Ongoing) Panic of 2007, *American Economic Review*, Papers and Proceedings, 99(2), 567-572.

Gorton, G. and Metrick, A. (2011) Securitization, NBER Working Paper

Hayre, L. (2001) A Concise Guide to Mortgage-Backed Securities (MBSs), in Lakhbir Hayre (ed.), *Salomon Smith Barney Guide to Mortgage-Backed and Asset-Backed Securities*. New York: John Wiley & Sons, 9-68.

Hu, J. (1997) *Basics of Mortgage-Backed Securities*. New Hope, Penn.: Frank J. Fabozzi Associates.

Keys, B.J., Mukherjee, T., Seru, A. and Vikrant, V. (2010) Did Securitization Lead to Lax Screening? Evidence from Subprime Loans, *The Quarterly Journal of Economics*. 125(1), 307-362

Kos Media (2003). Available at: https://www.dailykos.com/stories/2013/2/18/1179340/-Mortgages-Ed-Pinto-And-A-Vast-Conspiracy-Of-Silence

Lai, R.N. and Van Order, R. (2018). Fintech Finance, Shadow Banking and Fragility, *8th International Research Workshop in Microfinance, "Microfinance and Financial Inclusion: A Promising Banking Model?",* the Center of Research on Social Enterprises and Microfinance, Oslo Metropolitan University Oslo, Norway.

Mian, A. and Sufi, A. (2009). The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis. *The Quarterly Journal of Economics*, 124(4), 1449-1496

Modigliani, F. and Miller, M.H. (1958). The Cost of Capital, Corporation Finance, and the Theory of Investment, *American Economic Review* 48(3), 261–97.

Mortgage Bankers Association. (2012). National Delinquency Survey, Available at: http://s3.documentcloud.org/documents/408515/mbaforeclosures.pdf

Purnanandam. A (2011). Originate-to-distribute Model and the Subprime Mortgage Crisis, *The Review of Financial Studies*, 24(6), 1881–1915,

Thomas, J. (2012). Credit Risk and Return Predictability in Corporate and Residential Finance, PhD Dissertation. George Washington University.

Urban Institute (2018). Housing Finance At A Glance: A Monthly Chartbook, Available at: www.urban.org/research/publication/housing-finance-glance-monthly-chartbook-december-2018/view/full_report

Van Order, R. (2009). The U.S. Mortgage Market: A Model of Dueling Charters, *Journal of Housing Research*, 11, 233-255.

Van Order, R. (2010). An Introduction to the Economics of Securitization. George Washington University, Working Paper.

Weicher, J.C. (1999) The Development of the Housing GSEs, In *Fannie Mae and Freddie Mac: Public Purposes and Private Interests*, Volume 1, Wallison, P.J. (ed.), Washington D.C.: American Enterprise Institute.

Appendix

Variables Used

Baseline Mortgage Category

(1) Originated in 2001;
(2) Borrower's FICO>740;
(3) LTV at origination <60;
(4) Funded by private label securities (PLSs);
(5) fixed-rate mortgage (FRM).

Categorical Covariate

FICO 0 - 619.9:	Loans where the borrower's FICO score was less than 620.
FICO 620 - 639.9:	Loans where the borrower's FICO score was between 620 and 639.
FICO 640 - 659.9:	Loans where the borrower's FICO score was between 640 and 659.
FICO 660 - 679.9:	Loans where the borrower's FICO score was between 660 and 679.
FICO 680 - 699.9:	Loans where the borrower's FICO score was between 680 and 699.
FICO 700 - 719.9:	Loans where the borrower's FICO score was between 700 and 720.
FICO 720 - 739.9:	Loans where the borrower's FICO score was between 729 and 740.
ARM:	Adjustable-rate mortgage loans.
GSE:	Loans funded by Fannie Mae or Freddie Mac
2002 vintage:	Loans originated in 2002.
2003 vintage:	Loans originated in 2003.
2004 vintage:	Loans originated in 2004.
2005 vintage:	Loans originated in 2005.
2006 vintage:	Loans originated in 2006.
2007 vintage:	Loans originated in 2007.
2008 vintage:	Loans originated in 2008.
LTV 60 - 69.9:	Loans with an LTV at origination between 60 and 69.9
LTV 70 - 74.9:	Loans with an LTV at origination between 70 and 74.9
LTV 75 - 79.9:	Loans with an LTV at origination between 75 and 79.9
LTV 80.00:	Loans with an LTV at origination of exactly 80.
LTV 80.1 - 84.9:	Loans with an LTV at origination between 80 and 84.9
LTV 85 - 89.9:	Loans with an LTV at origination between 85 and 89.9
LTV 90.00:	Loans with an LTV at origination of exactly 90.
LTV 90.1 - 94.9:	Loans with an LTV at origination between 90.1 and 94.9
LTV 95 - 97.4:	Loans with an LTV at origination between 95 and 97.4
LTV 97.5 - 104.9:	Loans with an LTV at origination between 97.5 and 104.9
LTV 105 +:	Loans with an LTV at origination of more than 105.