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Agency Conflicts in Residential Mortgage Securitization: What Does the Empirical Literature Tell Us?

W. Scott Frame

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Abstract: The agency conflicts inherent in securitization are viewed by many as having been a key contributor to the recent financial crisis, despite the presence of various legal and economic constructs to mitigate them. A review of recent empirical research for the U.S. home mortgage market suggests that securitization itself may not have been a problem, but rather the origination and distribution of *observably* riskier loans. Low-documentation mortgages, for which asymmetric information problems are acute, performed especially poorly during the crisis. Securitized low-documentation mortgages performed better when included in deals where security issuers were affiliated with lenders or had significant reputational capital at stake and investors priced the risk of low-documentation loans via larger required equity tranches and/or higher security yields.

JEL classification: G01, G21, G23, G28

Key words: mortgages, banks, securitization, financial crisis

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Agency Conflicts and Residential Mortgage Securitization:

What Does the Empirical Literature Tell Us?

1. Introduction

Securitization is a widely used form of financial intermediation that generally involves: (1) pooling financial assets, (2) transferring the assets to a bankruptcy-remote special purpose entity to alleviate recourse, and (3) having the arms-length entity issue securities representing claims to the cash flows of the underlying assets. Securitization is generally believed to create value for lenders and investors through improved liquidity, capital management, and asset diversification; while borrowers benefit through expanded credit availability. However, securitization also entails breaking apart the lending process into its component parts and therefore creates agency conflicts.¹

In the wake of the recent U.S. housing bust, many analysts, economists, and policymakers blamed resulting mortgage losses, in part, on the information-based agency conflicts inherent in the securitization process.² Specifically, lenders may have better *ex ante* information about loan quality than outside investors (an adverse selection problem) and/or weaker incentives to properly screen, monitor, and/or resolve securitized loans (moral hazard problems). Well before the crisis, these notions were identified in the academic literature, as Boot and Thakor (1993), Riddiough (1997), DeMarzo and Duffie (1999), and DeMarzo (2005) present models of loan sales/securitization featuring adverse selection, while Pennacchi (1988) and Gorton and Pennacchi (1995) focus on moral hazard issues.³ Importantly, securitization-

¹ See Ashcraft and Schuermann (2008) and Paligorova (2009) for detailed description and discussion of these issues.

² See, for example, Mishkin (2008), Geithner (2011), and U.S. Financial Crisis Inquiry Commission (2011).

³ These papers each seek to explain the presence of loan sales or securitization under asymmetric information and conclude that value can be created by structuring cash flows into: (1) “informationally insensitive” (riskless) senior securities for uninformed outside investors; and (2) “informationally sensitive” subordinate securities either retained by the issuer (as a signal of underlying asset quality or monitoring commitment) or sold to informed outside investors. Such logic is at the heart of recent supervisory efforts in the U.S. and abroad to require risk retention as part of securitization.

related agency conflicts have long been understood by market participants who attempt to mitigate them through the use of various legal constructs (e.g., representations and warranties, pooling and servicing agreements) and counter-veiling economic incentives (e.g., functional integration, reputation-building through repeated interaction, and risk retention). Of course, any tools used to mitigate the agency problems inherent in securitization are only effective if the lender remains in business – suggesting that sufficient equity capital is crucial.⁴

Taken together, it is not entirely obvious that information-based agency conflicts should have been important contributors to the U.S. mortgage crisis. This is ultimately an empirical question. In this essay, we review the recent empirical literature attempting to link U.S. residential mortgage default risk to the agency conflicts associated with securitization. We study the U.S. experience given the central role of securitization as a mortgage financing tool in that market, as well as its role in the recent financial crisis. In terms of agency conflicts, we focus on the literature ostensibly testing for adverse selection due to originators potentially having private information about loan quality, and for possible moral hazard-induced reductions in screening intensity by loan originators. Such studies represent the bulk of related research since the onset of the housing crisis.⁵

Our review of recent empirical research for the U.S. home mortgage market suggests that securitization itself may not have been a problem, but rather the origination and distribution of *observably* riskier loans. Low documentation mortgages, for which asymmetric information problems are acute, performed especially poorly during the crisis. Securitized low documentation mortgages performed

⁴ Boot, Greenbaum, and Thakor (1993), for example, present a financial contracting model that includes reputational and financial capital which demonstrates that a reputation for paying claims is only valuable if the firm has financial capital as well.

⁵ Following the dramatic rise in U.S. residential mortgage defaults, additional research examined agency conflicts between servicers and investors relating to modifications of securitized loans. See Piskorski, Seru, and Vig (2010), Agarwal, Amromin, Ben-David, Chomsisengphet, and Evanoff (2011), and Adelino, Gerardi, and Willen (2013).

better when included in deals where security issuers were affiliated with lenders or had significant reputational capital at-stake; and investors priced the risk of low documentation loans via larger required equity tranches and/or higher security yields.

The remainder of the paper is structured as follows. Section 2 provides background on the structure of the U.S. residential mortgage market. Section 3 provides a critical review of the relevant empirical literature and identifies important gaps in our knowledge about the economic significance of incentive conflicts in U.S. residential mortgage securitization. Conclusions are provided in Section 4.

2. Background: U.S. Residential Mortgage Market

U.S. residential mortgages are unique. Virtually all of these loans fully amortize (i.e., do not require a “balloon payment”) and over very long periods of time (typically 15 or 30 years). Further, the majority of U.S. residential mortgages carry fixed rates of interest for the life of the loan. Adjustable rate loans are less popular, but nonetheless also carry fixed rates for terms ranging from 2-10 years (along with periodic and lifetime caps on interest rate adjustments). The vast majority of U.S. mortgages also include a prepayment option that allows the borrower to refinance without penalty. Green and Wachter (2005) and Gerardi, Rosen, and Willen (2010), among others, provide discussions of the historical evolution of the U.S. residential mortgage market.

U.S. residential mortgages are largely originated by depository institutions (commercial banks, savings institutions, or credit unions) or non-bank financial institutions (“mortgage banks”).⁶ Given their access to federally insured deposits, depository institutions have a significant funding advantage relative to mortgage banks. This implies that depository institutions subsequently choose whether to hold

⁶ Borrowers may deal directly with these originators or otherwise through a third-party mortgage broker.

mortgages on-balance sheet or sell them into the secondary market.⁷ Mortgage banks, by contrast, finance virtually all of their loan production by selling loans in the secondary market. The U.S. secondary mortgage market itself is segmented into three parts based on borrower and loan characteristics: government, conventional-conforming, and conventional non-conforming.⁸

The “government market” refers to loans carrying mortgage insurance provided by either the Federal Housing Administration (FHA), Veteran’s Administration (VA), or Rural Housing Service (RHS), which are generally targeted toward households with very low down-payments and/or weak credit.⁹ Virtually all government-insured mortgages are subsequently securitized by lenders through the Government National Mortgage Association (“Ginnie Mae”), which is an agency within the U.S. Department of Housing and Urban Development (HUD) created for this sole purpose. In this case, approved lenders issue the Ginnie Mae mortgage-backed securities (MBS), which carry an explicit U.S. government guarantee of the timely payment of all principal and interest. In exchange, approved lenders pay an insurance premium (known as a “guarantee fee”) to Ginnie Mae.

Conventional-conforming mortgages are those eligible to be purchased or securitized by either the Federal National Mortgage Association (“Fannie Mae”) or the Federal Home Loan Mortgage Corporation (“Freddie Mac”). These two government-sponsored enterprises (GSEs) were each created by Acts of Congress to fulfill a public mission: to enhance the liquidity and stability of the US secondary mortgage

⁷ This choice is informed by considerations such as portfolio diversification, asset-liability management, and regulatory capital requirements. Note that in the remainder of the essay, we use the term secondary market to refer specifically to securitization, rather than loan sales to another primary market lender (i.e., correspondent lending).

⁸ While the government market is truly segmented, the definition of a conventional-conforming loan was relaxed during the recent housing boom (in terms of acceptable credit scores and loan-to-value ratios, and levels of documentation) – meaning that there was greater substitutability between the conventional-conforming and conventional-nonconforming market segments.

⁹ Following the housing bust, the availability of private mortgage insurance became very limited in affected areas. As a result, the profile of government mortgage borrowers changed as many households with good credit (but small down-payments) came into the programs.

market and thereby promote access to mortgage credit, particularly among low- and moderate-income households and neighborhoods. The GSEs' federal charters provide important competitive advantages that, taken together, implied US taxpayer support of their financial obligations.¹⁰ This implicit guarantee became much stronger when the two institutions were placed into federal conservatorship in 2008 and subsequently received almost \$188 billion from the U.S. Treasury.¹¹

The term "conforming" generally relates to: (1) legal limitations on eligible mortgage size (i.e., the "conforming loan limit"); and (2) minimum requirements for a 20 percent down payment or equivalent credit enhancements (i.e., privately issued mortgage insurance or a second mortgage).¹² As with Ginnie Mae, Fannie Mae and Freddie Mac each provide blanket guarantees on the MBS that they issue to investors in exchange for guarantee fees. Collectively, these mortgage-backed securities are typically referred to as "Agency MBS". The perceived lack of credit risk associated with these securities has long facilitated their purchase by a wide variety of domestic and international financial institutions. U.S. government backing (actual or perceived) eliminates an agency conflict for investors with respect to securitizers, although the three institutions still face an adverse selection problem with lenders.¹³ However, the monopolist role of Ginnie Mae in the government market and the duopoly of Fannie Mae and Freddie Mac in the

¹⁰ See, for example, Frame and White (2005) and the references cited therein for information about the specialness of Fannie Mae and Freddie Mac.

¹¹ See Frame, Fuster, Tracy, and Vickery (2015) for a detailed discussion of the GSEs' failure and related government takeover of the two institutions.

¹² The conforming loan limit is linked to an index of housing prices and adjusted annually by the U.S. Federal Housing Finance Agency. The conforming loan limit has actually been constant since 2006; but legislation in 2009 raised the limit in certain parts of the country with higher housing prices. In 2015, the conforming loan limit was \$417,000 in most of the U.S. but could be as high as \$625,500 in certain high-price areas. See U.S. Federal Housing Finance Agency (2015, Table 24) for a time series of the conforming loan limits.

¹³ Investors have nevertheless been historically concerned about adverse selection with Fannie Mae and Freddie Mac MBS along the prepayment dimension. Specifically, before being placed into federal conservatorship, the two GSEs were the largest investors in Agency MBS and could have potentially leveraged an existing informational advantage generated from their securitization business. See Downing, Jaffee, and Wallace (2009) for a discussion and related empirical analysis.

conventional-conforming market should naturally allow the three securitizers to more aggressively enforce contracting provisions (including rescinding access to the programs).

The conventional non-conforming (i.e., private) residential mortgage market was historically composed (almost exclusively) of loans that simply exceeded the conforming loan limit – referred to as "jumbo mortgages". Given the absence of government guarantees in the secondary market, many jumbo mortgages were held by depository institutions. However, when securitized, the structure was generally like that of other consumer credit products: Lenders would typically work with an investment bank to create a set of securities backed by a loan pool -- with security cash flows structured and prioritized for different investor classes.¹⁴ Besides the simple priority of claims, additional "credit enhancements" for privately issued asset-backed securities were also used, such as: over-collateralization of the asset pool in an effort to create an equity layer to protect investors; and/or the creation of a reserve account to accrue "excess spread" between the amounts that the mortgage borrowers pay and the amounts that investors receive (net of expenses) – again as a loss absorbing buffer.¹⁵

As U.S. home prices grew in the early 2000s, residential mortgage credit supply expanded to meet the credit demands of marginal borrowers; and the once niche segments of subprime and low documentation (or "Alt-A") mortgage lending became mainstream. (Subprime mortgages are typically those with a very low or no down-payments to households with poor credit; while low documentation mortgages were traditionally for households with a down-payment and good credit, but volatile or difficult to verify income.) Once obscure loan products, such as those with negative amortization or interest-only features, also became popular in an

¹⁴ To illustrate, a very simple example would involve the creation of a "subordinate" security that would be the first to absorb losses from defaults by the underlying borrowers and a "senior" security that would be protected against losses (at least until the losses exceeded the investment in the subordinate security).

¹⁵ The most senior securities sometimes also had financial guarantees, or wraps, purchased from monoline bond insurance companies.

effort to improve home affordability. Mayer, Pence, and Sherlund (2009), among others, document these trends in terms of mortgage volumes and underwriting characteristics. Notably, the vast majority of subprime and Alt-A mortgages were privately securitized.¹⁶

Based on the S&P CoreLogic Case-Shiller National House Price Index, U.S. house prices peaked in July 2006 and soon began a precipitous decline – falling over 27 percent over the next 5 1/2 years. A large fraction of mortgage borrowers – especially recent subprime and Alt-A borrowers -- quickly found themselves in a position of “negative equity” (i.e., having the mortgage balance exceed the value of the property). Negative equity is considered to be a necessary condition for mortgage default; although a second trigger, such as a shock to the borrower’s monthly income or expenses, is also generally required as a sufficient condition.¹⁷ The rapid decline in home prices and wave of mortgage defaults decimated the private mortgage securitization market in 2007 – a state from which it has not recovered. As discussed above, these securities were backed by very risky mortgages in terms of standard underwriting criteria (e.g., loan-to-value ratios and credit scores). What was clearly under-appreciated by most market participants (borrowers, lenders, securitizers, investors, and regulators) was the probability of such a swift and severe house price decline.¹⁸

Table 1 breaks out holders of U.S. residential mortgage credit risk annually for 2000 through 2015 using the Federal Reserve’s Flow of Funds data (in dollars and as a percent of total residential mortgage credit). Three primary categories are created: (1) whole mortgages held by depository institutions; (2) Agency MBS issued and whole loans held by Fannie Mae, and Freddie Mac; and (3) MBS issued by private conduits.

¹⁶ Gorton (2009) provides an in-depth discussion of the underlying features of subprime and Alt-A mortgages and privately issued MBS, including the critical role of house price appreciation in loan and security design.

¹⁷ See Foote, Gerardi, and Willen (2008) for a detailed discussion of these issues.

¹⁸ Gerardi, Lehnert, Sherlund, and Willen (2008) find that analysts at large investment banks at the time understood that a decline in housing prices would have a serious effect on subprime mortgage default rates, but largely believed that a substantial and widespread decline was highly unlikely.

The table shows that total U.S. residential mortgages outstanding grew rapidly with home prices in the early-2000s and peaked in 2007 (\$11.2 billion), at which time almost 21 percent was privately securitized. Since that time, there has been virtually no new privately issued MBS – and the amount outstanding has fallen from \$2.2 billion to \$0.6 billion owing to defaults and refinancing.

Given the rapid growth and subsequent massive losses in the private residential mortgage securitization market, many have speculated that securitization itself was to blame. The securitization process does involve parsing many traditional lending functions and hence creates agency conflicts. However, these conflicts have long been understood by market participants who attempt to mitigate them through the use of various legal and economic constructs. Moreover, U.S. house prices fell almost over 27 percent in 5 ½ years on a national basis – a very unlikely event that wiped-out the equity of nearly one-quarter of all U.S. mortgages. So, taken together, it is not clear that securitization itself was a problem. Let us now review the related empirical evidence.

3. Empirical Literature Review

As described above, while securitization can enhance the efficiency of financial intermediation, it does create additional informational frictions that result in incentive conflicts. However, such conflicts have long been understood by market participants and various contracting devices are used to better align interests. Hence, it is unclear whether securitization-related incentive conflicts should have an economically meaningful relation with loan performance and security payoffs after controlling for observable borrower, loan, and security issue characteristics as well as macroeconomic trends.

In the wake of the U.S. housing crisis, research has examined related questions. First, are observably riskier mortgages more likely to be securitized? Second, does the secondary mortgage market suffer from adverse selection insofar as securitized mortgages more likely to default even after controlling

for observable risk factors? Third, does securitization result in weak screening incentives due to moral hazard? Finally, do investors price the risks associated with informationally opaque mortgages?

Before reviewing the related literature, it is important to identify the key underwriting variables and define the information structure of the U.S. home mortgage market. Mortgage servicing data, such as that available from LPS Applied Analytics or Corelogic, provides key loan and borrower characteristics, including product type, interest rate, amortization period, loan-to-value ratio, credit score, income, and occupancy status. Barring missing data or fraud, such transferrable “hard information” should be equally valuable to a mortgage originator holding a loan in portfolio or selling it into the secondary market. So, while there will always be asymmetric information between borrowers and lenders, securitization should not generally exacerbate the problem. However, there are a couple of notable exceptions: indicators of whether a mortgage was originated by a third-party (broker or correspondent) and/or low documentation. These mortgages will have more asymmetric information in general, and lenders may have superior knowledge about their quality (vis-à-vis outside investors).¹⁹ Of course, investors should understand this and price the associated risk.

A. Are Observably Riskier U.S. Residential Mortgages More Likely to be Securitized?

Some papers have empirically analyzed whether there are *observable* differences in the characteristics of securitized mortgages versus whole mortgages held in depository institution portfolios.

An early study by Ambrose, LaCour-Little, and Sanders (2005) use a pooled sample of conventional-conforming and jumbo fixed rate mortgages originated between 1995 and 1997 (with

¹⁹ For example, Ambrose, Conklin, and Yoshida (2016) analyze mortgage data from the now defunct New Century Financial that not only indicated documentation status, but also whether the borrower was self-employed or not. The authors find that low documentation loans to borrowers who could have verified their income (i.e., not self-employed W-2 earners) performed especially poorly. Such selection was observable by the lender, but would not have been to outside investors. Jiang, Nelson, and Vytlačil (2014) also present evidence suggesting that some borrowers falsified their income when obtaining low documentation mortgages.

performance histories through most of 2000) by a single large national lender. The authors conduct a two-step experiment that first uses the 1995 and 1996 mortgages to estimate a standard competing risks model of mortgage default and prepayment conditional on several borrower and loan characteristics. The estimated parameters are then applied to the 1997 data to construct a measure of expected default for these loans. A logistic regression identifies a positive relation between an indicator for loan held in portfolio and the expected default measure, which is consistent with observably riskier loans being more likely to be retained by the lender. An important limitation of this study for our purposes is that the data pre-dates the mid-2000s housing boom.

Calem, Henderson, and Liles (2011) use Home Mortgage Disclosure Act (HMDA) data for 2005 and 2006 to examine single family, home purchase, first lien mortgages that were “high cost” and/or originated by “subprime lenders” as identified by the U.S. Department of Housing and Urban Development. After controlling for a number of lender and local market factors, these authors find that two measures of loan risk (the ratio of the loan amount to annual borrower income and financing an investment property) are positively related to secondary market transfer. Importantly, however, the HMDA data does not include the two most important loan risk characteristics (loan-to-value ratio and credit score) or information about mortgage type or features. Further, this analysis is limited to subprime loans, and there is no accounting for product type or securitization outlet (i.e., government, GSE, or private).

Jiang, Nelson, and Vytlačil (2013) study a sample of residential mortgage loans originated by a single lender between 2004 and 2008. Their sample loans were primarily securitized and cover various primary market segments (government, conventional-conforming, jumbo, prime, subprime, Alt-A, and second liens). The authors find that loans with little equity (i.e., high combined loan-to-value ratio) or weak credit scores were less likely to be securitized – consistent with lenders retaining riskier mortgages. However, certain loan types (e.g., option ARMs; low documentation; stated income) and loan features

(e.g., prepayment penalties) associated with riskier lending are found to be positively related to the probability of loan sale.

Krainer and Laderman (2014) examine the determinants of securitization for conventional first lien California mortgages originated between 2000 and 2007 using the LPS Applied Analytics data. The authors estimate a multinomial logit model for (private and GSE) securitization relative to portfolio loans – pooling together all types and sizes of mortgages as well as some measures of bank performance and recent house price trends. They find that while privately securitized mortgages had higher credit scores, such loans also had higher loan-to-value ratios and were more likely to have limited documentation and be classified as “subprime” in the data. Loans securitized by Fannie Mae or Freddie Mac tended to have higher credit scores, lower loan-to-value ratios, more documentation, and were less likely to be classified as subprime. Taken together, these results suggest that privately securitized California mortgages were generally riskier than portfolio loans, but that the opposite was true for mortgages presented to Fannie Mae and Freddie Mac.

Perhaps the most comprehensive analysis of this sort was conducted by Agarwal, Chang, and Yavas (2012). These authors use the LPS Applied Analytics data pooled annually for 2004-2007 and delineate between “prime-like” and “subprime-like” mortgages and study the probability of securitization annually using a two-step competing risks methodology. The first step involves estimating default and prepayment hazards for each annual cohort using two years of performance data from an “estimation sample”, which is then used to construct two-year default and prepayment probabilities for a “holdout sample”. The second step relates whether a loan is securitized to the two-year probabilities and financial market conditions. The authors find that securitization of “prime-like” loans is generally negatively related to the two-year probability of default – both when securitizing with the GSEs or the private market. One exception is in 2007 when this relationship is positive for the GSE market – consistent with those

institutions taking on more risk as the market turned. Results for “subprime-like” loans are mixed and generally weak.

Overall, it seems that lenders tend to transfer safer mortgages to the GSEs, but that the relation between loan risk and securitization is mixed for subprime mortgages. In any event, these borrower and loan characteristics were observable – suggesting that investors were comfortable with the attendant risks. Put another way, these studies do little to inform whether agency conflicts plague securitization, since adverse selection and moral hazard are theories which rely on the presence of private (unobservable) information.

B. Are Securitized Loans More Likely to Default After Controlling for Observable Risk Factors?

Another strand of the literature focuses on the *ex post* performance of securitized mortgages relative to those held in depository institution portfolios. Specifically, these studies estimate mortgage default regressions with an indicator for whether a loan was securitized and holding a large number of observable risk factors constant. The idea is to measure a “treatment effect” of securitization, which may be interpreted as reflecting unobserved private information about loan quality or underwriting effort.

Jiang, Nelson, and Vytlačil (2013) use their sample of residential mortgage loans originated by a single lender between 2004 and 2008 that securitized a large fraction of the sample loans (89 percent). The authors find that, after controlling for borrower and loan characteristics, sold mortgages perform better than those held on balance sheet, although the effect goes away once “early payment defaults” are dropped. (This provides some support for market discipline as loan seasoning, or performance for some initial period, was often a pre-condition of private securitization.) Finally, the authors find that non-standard mortgage products and loans with greater informational opacity (low documentation, broker-originated) defaulted at a significantly higher rate.

Krainer and Laderman (2014) estimate default hazard models separately for adjustable rate mortgages (ARMs) and fixed-rate mortgages (FRMs) using their sample of conventional California loans from the LPS data. The authors find that securitized FRMs (both private and GSE) default at a lower rate than similar portfolio loans after controlling for some observable risk factors. For the ARM sample, GSE securitized mortgages again performed better than similar portfolio loans, although privately securitized mortgages fared worse. These authors also report that, among ARMs, non-standard mortgage products and low documentation loans defaulted at a significantly higher rate.

Elul (2015) examines single-family, owner-occupied first-lien mortgages originated in 2005 and 2006 using the LPS Applied Analytics data. He separately examines prime adjustable-rate mortgages (ARMs), prime fixed-rate mortgages (FRMs), subprime ARMs, and subprime FRMs (where loans are defined as “prime” or “subprime” based on servicer classification) and controls for a large number of loan characteristics. Among the two types of *prime* loans, the author finds that privately securitized mortgages perform worse than those guaranteed by Fannie Mae/Freddie Mac or retained in portfolio. By contrast, among the two types of *subprime* loans, privately securitized mortgages actually perform better than other loans. However, this effect is found to be driven exclusively by loans defaulting during the first six months staying with originators – a result consistent with Jiang, Nelson, and Vytlačil (2013). The author also generally finds that low documentation, third-party originations, and non-standard product features generally default at a significantly higher rate.

In a related study, Purnanandam (2010) examines the effect of securitization on mortgage performance at the bank-level using regulatory filings (including newly available information on mortgage loan sales/securitization) and aggregated loan-level information from HMDA. The author finds that banks relying more heavily on securitization just before the housing collapse (2006:Q3–2007:Q1) experienced higher mortgage default rates during the bust (2007:Q2–2008:Q1). A key issue in this paper is whether the results indicate that securitization-intensive banks became more lax in their screening or whether

they were simply making more observably risky loans. While the paper attempts to control for borrower credit risk (using average bank-level mortgage characteristics from HMDA) – critical pieces of information (e.g., credit scores, loan-to-value ratios, and product types) are unavailable.

Taken together, these papers provide some mixed results in terms of the overall association between mortgage default and private securitization. Interestingly, both Jiang, Nelson, and Vytlačil (2013) and Elul (2015) find that securitized subprime mortgages performed about as well as similar portfolio loans due to investor-required seasoning -- one important way to combat private information about loan quality. The literature also finds that non-standard loan products, low documentation, and third-party originations performed worse than otherwise similar loans (irrespective of securitization). Such findings may reflect borrower selection into products and/or private information on the part of borrowers, brokers, or lenders.

Future research should analyze individual product categories, as it is well understood that borrower risk sensitivities (as reflected in reduced-form parameter estimates) can vary considerably. An analysis of interactions between securitization treatment and product characteristics also seems important – especially for characteristics associated with greater asymmetric information (e.g., low documentation loans and those originated by third parties). Furthermore, outside of Elul (2015), none of the papers control for the current loan-to-value on the mortgaged properties using local house price indices. This is a critical omission since a ratio above one is a necessary condition for mortgage default.²⁰ Finally, these very large mortgage samples tend to have material covariate imbalance across sub-groups; hence researchers should consider using matched samples to better identify the treatment effect of securitization.

C. Does Securitization Affect Lender Screening Incentives Due to Moral Hazard?

²⁰ Virtually all mortgage data is further limited by the fact that second liens are generally unrecorded.

Several studies have argued that the secondary mortgage market established credit score cut-off points – particularly a FICO score of 620 -- that may have affected lender screening incentives and the likelihood of securitization, with consequences for mortgage performance. Research documents this “cut off” through published guidance issued by Freddie Mac for its securitization program in the early 2000s. A key issue in this segment of the literature is whether this guidance actually induced lessened or heightened screening of marginal loans. Related empirical tests employ a regression discontinuity framework applied to mortgages to borrowers with FICO scores just above and below the credit score cut-off.

In the original paper, Keys, Mukherjee, Seru, and Vig (2010) studied a sample of securitized, subprime, low documentation, home purchase loans originated between 2001 and 2006 from the CoreLogic database. The authors find that there were twice as many of these mortgages originated just above the FICO=620 credit score cut-off; but that these loans defaulted at a significantly higher rate. The paper interprets this as evidence of lax screening on the part of lenders. Two important weaknesses of this paper are: (1) that it only analyzes securitized loans and hence cannot test a central tenant of the hypothesis (i.e., the credit score cut-off affected the probability of mortgage securitization); (2) the limited sample (i.e., subprime, securitized, low documentation, home purchase mortgages).

These issues are addressed in subsequent work by Keys, Seru, and Vig (2012) using the LPS data for the same 2001 to 2006 period for conventional, owner-occupied, home purchase loans. The authors find that there is indeed a discontinuity in the securitization rate and securitization timeline at FICO=620, albeit only for low documentation loans aimed at the private (non-Agency) securitization market. (The paper delineates mortgages aimed at the Agency versus non-Agency markets are estimated using a propensity scoring approach.) They also find that for low documentation mortgages intended for non-Agency securitization, the delinquency rate is much lower just below the credit score cut-off (as with their previous paper). The authors find no differences in securitization rates or default rates for mortgages

aimed at the Agency market (irrespective of documentation status) or full documentation loans aimed at the non-Agency market.

Bubb and Kauffman (2014) reexamine the results and interpretation provided in the prior two papers. The authors propose an “origination rule-of-thumb” theory (and refer to the interpretation above as a “securitization rule of thumb” theory) which posits that the Freddie Mac guidance pertaining to mortgages with credit scores below 620 actually induces greater lender screening. The paper also critiques the earlier literature’s special focus on low documentation loans because doing so implies selecting on outcome of interest – lender screening. Empirical analysis is conducted using mortgage originations present in the LPS data between 2003 and 2007. For the full sample of loans, the authors confirm large discontinuities in both the number of loans and the default rate at both FICO=620 and FICO=660, but find no material changes in securitization rates. The authors also compare examine the number and default rate of mortgage sub-groups (Agency securitized, non-Agency securitized, and portfolio loans) – finding discontinuities in loan volumes and default rates at FICO=620 for each category, although it is most striking for portfolio loans. This undercuts the notion that lender screening of subprime mortgages declined as a result of securitization.

The take-away from this strand of literature is that securitization itself is unlikely to have resulted in lax screening beyond that implied by the existence of low documentation mortgages.

D. Do MBS Investors Price Heightened Asymmetric Information and Agency Conflicts?

At the outset, we noted that the agency conflicts associated with securitization have long been understood by market participants and that various legal constructs and counter-veiling economic incentives are used to mitigate informational costs. Below, we review three recent empirical studies examining whether investors in the private mortgage securitization market priced the risk associated with low documentation loans.

Demiroglu and James (2012) study privately issued Alt-A mortgage-backed securities issued between 2003 and 2007 using data from ABSNet coupled with hand-collected information from offering prospectuses. (The focus on Alt-A deals is driven by the fact that these have a disproportionate share of “low documentation” loans in them, which are those with arguably the most private information.) The authors find that the *ex post* performance of deals (cumulative loss rate and foreclosure rate) was better for those where the lender was affiliated with either the securitizer/sponsor or servicer. However, this effect is driven by the one-half of sample deals with the largest fraction of low-documentation loans (“low doc deals”). Consistent with these findings, the paper also reports results showing that affiliated deals have lower yields and subordination for the AAA-rated securities, but again only for the low documentation deals.

Begley and Purnanandam (2012) study private-label residential mortgage-backed securities using information from U.S. Securities and Exchange Commission filings, coupled with loan-level data from CoreLogic, for 2001, 2002, and 2005. They find that, after controlling for observable borrower and loan characteristics, loan pools with a higher proportion of low documentation mortgages require larger equity tranches to absorb losses. This is consistent with investors understanding the greater potential for private information and adverse selection with low documentations loans. The paper also finds that observable risk characteristics (e.g, credit scores and loan-to-value ratios) have no effect on the size of the equity tranche, but do explain the size of the AAA-rated tranches (relative to mezzanine and equity tranches). The authors also study the relation between the size of the equity tranche and unexpected performance of the deal (i.e., foreclosure rate after controlling for observable risk factors and macro outcomes) and find a positive relation.

Adelino, Frame, and Gerardi (2014) examine subprime mortgage-backed security deals in which Fannie Mae or Freddie Mac participated as an investor (by exploiting the conforming loan limit for identification) and using the CoreLogic data for deals issued during 2003-2007. The authors find that pools

bought by the GSEs had similar *ex ante* risk characteristics but performed significantly better *ex post* -- relative to other mortgage pools in the same deals (after controlling for deal-level fixed effects). These findings are concentrated in low documentation loans; and for security issuers that were highly dependent on Fannie Mae and Freddie Mac and where originator and sponsor were affiliated. Because Fannie Mae and Freddie Mac financed about 30 percent of all securitized subprime mortgage debt, the authors argue that their findings are consistent with market discipline imposed by large investors.

The results for each of these papers are concentrated among low documentation mortgages that have the greatest potential for private information. Key findings are that: (1) The proportion of low documentation mortgages in a deal was positively correlated with the size of the equity tranche; (2) Low documentation loans tended to perform better when the lender is affiliated with the sponsor and/or servicer and this is priced into the securities; and (3) Low documentation loans performed better when purchased by Fannie Mae/Freddie Mac -- particularly in cases where the issuer was historically dependent on the GSEs for placement and where the originator and sponsor were affiliated. Hence it appears that investors were wary of private information embedded in low documentation mortgages backing privately issued MBS, but that agency cost-reducing mechanisms on the issuer-side reduced these concerns and were compensated.

Conclusions

This paper reviewed recent empirical research for the U.S. home mortgage market that suggests that securitization itself may not have been a problem, but rather the origination and distribution of *observably* riskier loans. Low documentation mortgages, for which asymmetric information problems are acute, performed especially poorly during the crisis. Securitized low documentation mortgages performed better when included in deals where security issuers were affiliated with lenders or had

significant reputational capital at-stake; and investors priced the risk of low documentation loans via larger required equity tranches and/or higher security yields.

The findings and interpretation of this literature are important for public policy. It is widely believed by policymakers and pundits that securitization itself is problematic; and this has resulted in an international consensus that lenders or securitizers retain risk as part of securitization deals. (But as shown by Willen (2014), the largest financial intermediaries of U.S. mortgage credit risk during the recent housing boom arguably retained too much of this exposure.) To better inform policy going forward, additional research is needed to understand more completely whether certain specific contracting frictions, market practices, and/or mortgage products were central to the collapse of the U.S. private mortgage securitization market.

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Table 1
Holders of U.S. Residential Mortgage Credit Risk
Annual Data from the Federal Reserve's Flow of Funds

Year	Total Mortgages		Depository Institutions		Agency MBS & Loans		Privately Issued MBS		Residual	
	(\$ Billions)		(\$Billions)	Percent	(\$Billions)	Percent	(\$Billions)	Percent	(\$Billions)	Percent
2000	\$ 5,122.1	\$	\$ 1,684.6	32.9%	\$ 2,635.2	51.4%	\$ 384.8	7.5%	\$ 417.4	8.1%
2001	\$ 5,675.1	\$	\$ 1,784.9	31.5%	\$ 2,979.8	52.5%	\$ 463.9	8.2%	\$ 446.6	7.9%
2002	\$ 6,431.3	\$	\$ 2,010.7	31.3%	\$ 3,340.5	51.9%	\$ 545.5	8.5%	\$ 534.6	8.3%
2003	\$ 7,255.3	\$	\$ 2,236.0	30.8%	\$ 3,752.6	51.7%	\$ 669.0	9.2%	\$ 597.5	8.2%
2004	\$ 8,292.3	\$	\$ 2,655.0	32.0%	\$ 3,786.0	45.7%	\$ 1,059.2	12.8%	\$ 792.1	9.6%
2005	\$ 9,420.6	\$	\$ 2,972.6	31.6%	\$ 3,900.2	41.4%	\$ 1,649.4	17.5%	\$ 898.4	9.5%
2006	\$ 10,500.6	\$	\$ 3,203.2	30.5%	\$ 4,206.7	40.1%	\$ 2,173.0	20.7%	\$ 917.7	8.7%
2007	\$ 11,240.3	\$	\$ 3,370.6	30.0%	\$ 4,819.6	42.9%	\$ 2,214.3	19.7%	\$ 835.7	7.4%
2008	\$ 11,153.6	\$	\$ 3,226.6	28.9%	\$ 5,320.6	47.7%	\$ 1,902.6	17.1%	\$ 703.8	6.3%
2009	\$ 10,939.0	\$	\$ 3,033.9	27.7%	\$ 5,699.9	52.1%	\$ 1,578.7	14.4%	\$ 626.5	5.7%
2010	\$ 10,452.7	\$	\$ 2,953.8	28.3%	\$ 5,765.7	55.2%	\$ 1,303.0	12.5%	\$ 430.2	4.1%
2011	\$ 10,206.9	\$	\$ 2,877.6	28.2%	\$ 5,810.6	56.9%	\$ 1,109.5	10.9%	\$ 409.2	4.0%
2012	\$ 9,976.5	\$	\$ 2,853.3	28.6%	\$ 5,802.2	58.2%	\$ 928.3	9.3%	\$ 392.8	3.9%
2013	\$ 9,882.4	\$	\$ 2,751.9	27.8%	\$ 5,970.3	60.4%	\$ 787.3	8.0%	\$ 372.9	3.8%
2014	\$ 9,887.4	\$	\$ 2,794.5	28.3%	\$ 6,012.6	60.8%	\$ 701.6	7.1%	\$ 378.7	3.8%
2015	\$ 9,989.3	\$	\$ 2,871.5	28.7%	\$ 6,137.5	61.4%	\$ 602.1	6.0%	\$ 378.3	3.8%