

Information Asymmetry in Private-Label Mortgage Securitization: Evidence from Allocations to Affiliated Funds*

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Abstract

Did underwriters capitalize on the information asymmetry embedded in the securitization process by placing mortgage-backed securities with affiliated investors? We expand the debate on incentives embedded in the originate-to-distribute model by presenting novel evidence on the placement of mortgage-backed securities with investors who are affiliated with either the security underwriter or issuer. We do so by capitalizing on a unique testing platform encompassing institutional holdings of mortgage-backed securities (MBS). We find that affiliated funds are associated with deals comprised of loans with lower expected prepayment rates and higher expected default rates. Thus, in contrast to the IPO market where evidence indicates that underwriters give preference to affiliated investors, our results suggest that MBS underwriters used affiliated investors to offload riskier mortgages.

JEL Classifications: R3, R31, R38

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1 Introduction

Over the past decade, financial economists and others have put forward a number of different narratives to explain the causes of the mortgage foreclosure crisis and subsequent Great Recession of 2007-2008. For example, research has identified problems with loan originations stemming from misrepresentation of borrower income and assets, appraisals and collateral valuation, and second liens and piggyback loans (see for example, Ambrose et al., 2016; Griffin and Maturana, 2016a; Jiang et al., 2014; Mian and Sufi, 2015; Garmaise, 2015). In addition, problems associated with securitization and the originate to distribute model as well as fraudulent reporting and skewed incentives by financial intermediaries are routinely mentioned in the popular press as well as in academic studies as being a catalyst for the financial crisis.¹ Furthermore, the conflicts of interest and various incentives associated with financial intermediaries have received particular attention by policy makers and regulators (Agarwal et al., 2012; Ambrose et al., 2005). For example, provisions in the Dodd-Frank act explicitly target the perception that the originate-to-distribute model of mortgage securitization created incentives for MBS issuers and underwriters to collude with mortgage originators to lower underwriting standards during the housing boom prior to 2007. This narrative mirrors the concerns arising from the market for initial public offerings (IPO) where investment banks have been criticized for allocating “hot” IPOs to affiliated and favored investors (Ritter and Zhang, 2007). Thus, this narrative raises the question of whether incentives embedded in the securitization process led to the financial crisis.

We test whether underwriters capitalized on the natural information asymmetry between security originators and investors that is inherent to the process of securitization in the placement of mortgage-backed securities. However, unlike the IPO market, identifying potential conflicts of interest in the MBS market is more difficult due to the competing termination risks (prepayment and default) embedded in the underlying mortgages that comprise the MBS pool.

As architects of the MBS structure, issuers and underwriters possess an informational advantage about the quality of the underlying mortgages in the pool and hence the quality of

¹For example, Michael Lewis’ book and associated movie *The Big Short* point to mortgage securitization as a primary cause for the growth in risk mortgage lending that precipitated the housing crisis. Academic studies such as Agarwal et al. (2012), Agarwal et al. (2011), Griffin and Maturana (2016b) and Keys et al. (2009) provide additional evidence pointing to misaligned incentives in the securitization process.

the resulting securities. Generally, underwriters disclose information on the risks associated with MBS deals by providing investors with the average characteristics of the underlying pool of mortgages securing the MBS. However, underwriters have collateral information and possibly soft information on loan quality since they may have originated or selected the mortgages that went into the deals. Furthermore, they use information about the underlying collateral to structure the deals and cash flow waterfalls.

The presence of asymmetric information in the MBS market creates incentives for vertically and horizontally integrated issuers to utilize that information with respect to the placement of securities with affiliated investors that is similar to the incentives documented in the market of initial public offerings (IPOs). For example, Ritter and Zhang (2007) find evidence that underwriters favor affiliated mutual funds through the allocation of “hot” initial public offering’s (IPO) of equity securities. They argue that this evidence is consistent with a preferential treatment (or nepotism) hypothesis. Similarly, MBS underwriters often play both sides of the deal through affiliated investment funds. Investment banks have financial incentives to support their affiliated funds as better performance attracts additional investment leading to greater management fees. Furthermore, when acting as a MBS deal underwriter, Wall Street firms can promote their funds by allocating a larger proportion of “good” MBS deals to those funds.² We refer to this steering of MBS deals to affiliated funds based on unobservables as the *Preferential Treatment Hypothesis*.³ Under this hypothesis, deals from an integrated issuer-underwriter placed with an affiliated fund should perform better based on observable characteristics.

In contrast, Berzins et al. (2013) find evidence of pervasive conflicts of interests in the asset management business resulting in significantly lower risk-adjusted returns (or alphas) for affiliated funds. This finding is supported by Hao and Yan (2012) who document that bank-affiliated funds perform worse than unaffiliated funds due to their holdings of IPOs from clients of the bank. As a result, Hao and Yan (2012) suggest that the evidence supports the dumping hypothesis whereby investment banks use affiliated funds to support the price of securities being offered by the bank. Furthermore, Henderson and Tookes (2012), in a study

²We define “good” deals to be either low risk or securities with a high risk/return trade-off.

³Investment banks may also receive “commission paybacks” on future trading activity from investors in response to allocations of securities. See Reuter (2006), Ritter and Zhang (2007), Nimalendran et al. (2007), Goldstein et al. (2011) for discussion and evidence of commission paybacks in response to IPO placements. However, such additional compensation should not affect the preferential treatment of affiliated funds.

of pricing in the convertible bond market, show that affiliation between investment banks and investors creates opportunities to improve security pricing. Thus, in contrast to the *Preferential Treatment Hypothesis*, integrated MBS underwriters could use their information advantage to differentially select against affiliated funds in order to preserve their reputation with outside investors. In this case, we would expect that underwriters would place lower quality deals with affiliated funds. We refer to this as the *Dumping Hypothesis*.

Finally, we note that both the *Dumping* and *Preferential Treatment Hypotheses* are predicated on mortgage originators and/or MBS issuers and underwriters taking advantage of asymmetric information in the placement of securities with investors. However, a plausible alternative hypothesis is that asymmetric information either does not exist, or if it does exist, that institutions active in the MBS market erect firewalls within the originate-to-distribute channel to prevent the flow of soft information. We refer to this as the *Reputation Hypothesis*. The rationale behind this hypothesis rests on the models of underwriter reputation whereby market participants rely on the repeated game nature of securitization issuance to limit the natural incentives to take advantage of uninformed investors.⁴ Thus, to the extent that institutions value reputation in the production and placement of mortgage securities then the data should reveal that loans in MBS placed with affiliated funds performed no different than loans in MBS that were placed with non-affiliated investors.

Thus, our paper expands the debate on incentives embedded in the originate-to-distribute model by presenting novel evidence on the placement of MBS with funds that are affiliated with either the security underwriter or issuer. We do so by capitalizing on a unique testing platform encompassing institutional holdings of MBS. Therefore, we add to the literature on the role of mortgage securitization in the period prior to the financial crisis by examining the role of information in the placement of MBS deals.

To identify the role of asymmetric information on collateral quality in the placement of MBS issues, we examine the placement of a sample of 405 non-agency MBS deals containing approximately 1.2 million underlying mortgages. We estimate the ex ante and ex post prepayment and default probabilities for mortgages collateralized across deals that are classified as

⁴See, for example, the model developed in Chemmanur and Fulghieri (1994) and empirical evidence from the junk bond market in Fang (2005).

either affiliated or unaffiliated based on the link between funds and the underwriter-issuers. We define affiliation status as an institutional investor (or fund) that was affiliated or connected to the MBS underwriter or issuer and held a portion of the MBS deal within a year of the securitization date. Based on this criteria, we classified 25 of the MBS deals as affiliated and the remaining 380 as non-affiliated deals.

Univariate comparisons of mortgage performance between deals suggest that deals placed with affiliated funds have higher initial prepayment rates and lower default rates. However, multivariate regression models of *ex ante* and *ex post* prepayment and default probabilities that control for loan, borrower, and property characteristics reveal that affiliated funds are associated with deals comprised of loans with lower expected prepayment rates and higher expected default rates. Our analysis shows that loans originated by fully integrated lenders and placed in MBS deals that were sold to affiliated investors had, in absolute terms, expected default rates in the 12 months following securitization that were 1.8 percent higher and expected prepayment rates that were 4.5 percent lower than the benchmark loans originated by non-integrated lenders and placed in pools to non-affiliated investors. Furthermore, when looking at the 12-months following securitization (an early default indicator) we find that loans originated and securitized by fully integrated firms and placed with affiliated investors had *ex post* default rates that were 1.9 percent higher in absolute terms than similar benchmark loans. Similarly, compared to the benchmark loans we find that *ex post* prepayment rates are 4.5 percent lower for loans originated by fully integrated lenders and placed with affiliated funds.

We further investigate the correlation between affiliation status and pool risk and show that in contrast to the IPO market where evidence indicates that underwriters give preference to affiliated investors MBS underwriters used affiliated investors to absorb riskier mortgages. Our findings are consistent with evidence of conflicts of interest in other areas such as financial analyst opinions (Mola and Guidolin, 2009), IPO allocations (Jenkinson and Jones, 2009), bank lending behavior and affiliated fund investments (Massa and Rehman, 2008). In addition, the results show that pools comprising higher default risk and lower prepayment risk were differentially more likely to be placed with affiliated investors.

We discuss the institutional background that forms the basis of our research hypotheses in the next section, followed by a review of the data and identification strategy in Section 3.

Next, we present our empirical findings in Sections 4, 5, and 6. Section 7 presents a number of robustness and falsification tests designed to confirm our primary findings. Finally, section 8 concludes.

2 Mortgage Securitization

The process of securitizing a mortgage is complex involving a number of different entities including a mortgage originator (or lender), the MBS issuer, an underwriter, and ultimately, a set of investors. Figure 1 shows the various entities involved in the mortgage market. The top part of figure 1 shows the primary market. Traditionally, in the primary market a borrower obtains a mortgage on a single-family residential property via a mortgage broker or retail lender (the “originator”).⁵ Once the mortgage is originated, the lender either holds the loan in its retained portfolio (i.e. a portfolio loan) or sells it in the ‘secondary’ market (the bottom part of Figure 1) through securitization. For non-conforming (i.e. not eligible for purchase by the GSEs) or private-label mortgages, the originator normally assembles a portfolio of loans originated during approximately the same time period and then sells the portfolio to an institution referred to as the issuer. Depending on the size of the portfolio created by the originator, the issuer may combine this portfolio with loans from other lenders/originators to create a pool. Once the issuer has assembled a pool of mortgages for securitization, it works with an underwriter to create the mortgage-backed security. This involves transferring the mortgage pool to a special purpose vehicle (SPV), which is a bankruptcy remote entity specifically created to effectively remove the mortgage pool from the issuer’s balance sheet. The issuer and/or security underwriter (often an investment bank) then create a series of bonds (or tranches) representing prioritized claims to the pool cash flows that are sold to investors.

The series of institutions depicted in Figure 1 may have multiple relationships among themselves. For example, large lenders operating in the primary market may have sufficient scale and scope to fill a securitization pool using loans from their own origination pipeline. In this case, the originator and underwriter are related. We denote this as vertical integration

⁵See Integrated Financial Engineering (2007) for a detailed discussion of the mortgage origination and securitization process.

since the functions occur in the primary and secondary market.⁶ Similarly, many Wall Street investment banks that specialized in underwriting and structuring mortgage-backed securities had the capability of performing the issuer function. We refer to this as horizontal integration since the function takes place in the secondary market. Finally, the investors at the bottom of Figure 1 are often institutions or funds that may be affiliated with the issuer or underwriter.

Based on the relationships among the primary and secondary market participants, the potential exists for soft information obtained during loan origination or pool formation to be passed along to the ultimate investors. The level of information available will depend on the underwriter's relationship with the MBS issuer and mortgage originator. The issuer obtains the loans comprising the MBS deal via two channels: (1) originating loans directly or via a related company, or (2) purchasing loans from other mortgage originators. If the underwriter and issuer are the same entity (horizontally integrated) then there is no information leakage (i.e., no information asymmetry) in the creation of the MBS. Similarly, the MBS underwriter may have an information advantage when the mortgage originator is linked with the issuer/underwriter (vertically integrated). Obviously, soft information from unrelated originators may not be fully transferable to the underwriter given organizational discontinuity (Agarwal and Hauswald (2010), Petersen (2004), Stein (2002)). Thus, by having access to soft information on the quality of the mortgages, the integrated underwriter/issuer is better informed about the quality of a deal than underwriters unrelated to the issuer or originator. Consequently, the level of information asymmetry between the ultimate investors and the underwriter is greater if the underwriter is vertically and/or horizontally integrated.

To empirically test whether underwriters used soft information in the placement of MBS with investors, we look to the performance of the underlying mortgages in the MBS pools. Specifically, we model the correlation between *ex ante* and *ex post* individual mortgage termination (early prepayment and default) as a function of the various links between loan originators, security underwriters, and investors. Within this framework, finding that investor affiliation status is associated with higher likelihoods of early mortgage termination would be consistent with the dumping hypothesis since greater probability of prepayment or default would signifi-

⁶In addition, many investment banks sought additional revenue streams by vertically integrating via the acquisition of primary market lending institutions.

cantly increase the volatility of the corresponding security’s cashflows.⁷ In contrast, a positive link between investor affiliation status and low probabilities of prepayment and default is consistent with the preferential treatment hypothesis since lower likelihood of loan termination leads to greater predictability of the MBS cashflows. Finally, finding no link between investor affiliation status and the underlying mortgage performance would be consistent with either the lack of soft information or underwriters seeking to preserve their reputation with investors.

3 Data

3.1 Data Sources

Our data comprises information on mutual fund holdings of MBS, the characteristics of those MBS deals, and the loan level details for the mortgages in those securities. Our data is unique in that it identifies MBS deals that are held by institutional investors as well as the investors’ affiliation status with the underwriters and issuers of the MBS deals. We combine two datasets to achieve this level of identification.

First, we obtained a representative sample of 500 MBS deals from the Corelogic data library that were originated between 2002 and 2007. These deals are ‘private label’ (non-GSE or FHA/VA) securities composed of non-conforming, subprime and alt-a mortgages. The Corelogic data library includes information on the individual mortgages and the monthly performance for those mortgages securitized in the MBS deals. We exclude loans that were originated outside the United States, that are missing documentation type, purpose, credit score (FICO), or were prepaid or defaulted prior to securitization.

Next, we match the loan level data obtained from the Corelogic data library with the Thomson Reuters eMaxx (eMaxx) holdings data. The eMaxx database provides a quarterly snapshot of MBS holdings across institutional investors such as mutual funds, pension funds and life insurance companies. By matching investor name with the names of the MBS deal issuer and underwriter, we identify whether the investor is affiliated with the deal issuer or underwriter. In this way, we define an affiliated investor as a mutual fund that is publicly

⁷Note, even for investors in the senior (‘AAA-rated’) tranches, higher levels of prepayments and defaults will alter the security cashflows as principal repayments hit the underlying mortgage pool.

listed as a subsidiary or related to the underwriter or issuer.⁸ For example, consider the case of Morgan Stanley and its affiliated asset management company (Morgan Stanley Assets & Investment Trust Management Co. Ltd.). We classify the deals underwritten by Morgan Stanley as affiliated deals if they are bought by Morgan Stanley Assets & Investment Trust Management within one-year of the MBS issuance.

Starting with the initial sample of 500 MBS deals, we exclude deals that do not appear in the holdings data within a year of securitization or that have incomplete data. Our identification methodology rests on the assumption that funds that are affiliated to MBS underwriters and issuers have asymmetric information on the collateral underlying the deal. However, the value of information obtained at loan origination diminishes as mortgages season. Thus, we restrict the holdings snapshot to within a year of securitization as investment decisions after one-year are more likely to result from general economic trends (e.g. changes in house prices or interest rates) rather than unobserved information about the borrower. After cleaning and matching with the Corelogic data, we have a final sample of 405 unique MBS deals that contain approximately 1.2 million securitized mortgages originated between 2000 and 2007. Out of the 405 MBS deals, we identified 25 deals (6%) that were bought by an affiliated investor within one-year of the securitization date. We labeled these as “affiliated” and the remaining 380 deals as “not-affiliated”. Panel A in Table 1 shows the frequency distribution of deals based on year of issue while Panel B reports the frequency distribution of mortgages in these deals by loan origination year cohort. The majority of deals were issued and loans were originated at the peak of the housing market in 2005. We also see a consistent increase in the proportion of affiliated deals over time such that by 2007, 12% of the deals originated that year were classified as affiliated. In contrast, only 1 deal (2% of the total) was affiliated in 2003 at the start of the housing boom. Furthermore, we note a jump in the percentage of affiliated deals between 2006 and 2007, from 7.9% to 12.3%. Panel B shows a similar but more dramatic increase in the distribution of individual loans in affiliated and non-affiliated deals. In 2006, we see that 6.3% of securitized mortgages were placed in affiliated deals whereas in 2007 24% of mortgages were placed in affiliated deals.

The frequency counts by year point to two possible interpretations of the role of affiliated

⁸We term a related fund as falling under the same corporate governance umbrella as the issuer/underwriter.

investors in the MBS market. One possibility is that in early 2007, as housing prices peaked and mortgage delinquencies accelerated, underwriters placed higher concentrations of MBS with affiliated funds because other investors were backing away from the market. In effect, the frequency counts are consistent with the “Dumping” hypothesis narrative that underwriters were using affiliated funds to absorb declining demand for MBS as the housing market peaked. Alternatively, it is possible that unobservable or soft information became increasingly valuable as the housing market deteriorated in early 2007 allowing underwriters to use this information to protect their affiliated funds through selected placement of lower risk deals, the “Preferred Treatment” hypothesis.

3.2 Descriptive Statistics

As a first cut in assessing whether loans contained in deals that were placed with affiliated investors were different, we perform a univariate comparison in Table 2 segmenting the sample based on affiliation status. Of the 1,179,456 loans in the sample, 1,076,181 (or 91%) are in non-affiliated deals and the remaining 103,275 loans (9%) are in affiliated deals. We track the performance of these mortgages from date of origination through December of 2008.⁹ Panels A and B report the cumulative prepayment and default rates for the periods covering 6, 12, 18, and 24 months following deal securitization.¹⁰ We note that differences exist across the loan performance windows. For example, affiliated deals have lower early period (6 and 12 month) prepayment rates and higher early period default rates than unaffiliated deals. However, after the first year, affiliated deals have higher cumulative prepayment rates and lower cumulative default rates. Overall these statistics are consistent with the narrative that underwriters used soft information to place loans with higher credit risk with affiliated investors.

Panel C of Table 2 shows the descriptive statistics for the borrower and loan level characteristics observable at loan origination. Even though all the t-statistics are significant due to

⁹Following standard industry convention, we define loans as being in default if their status is recorded as real estate owned (REO), in foreclosure, in bankruptcy, or 90 days delinquent.

¹⁰Note, unlike previous studies of mortgage performance, we report loan performance since the date of securitization rather than the date of loan origination. Regardless of an early termination outcome, we exclude loans that do not have a sufficient performance history corresponding to the performance windows under consideration. For example, loans in a deal securitized in November of 2007 are not considered in the 18 or 24 month performance windows given that our performance data is only available through December of 2008. However, loans securitized in November 2007 would be included in the analysis for the 6 and 12 month windows. As of December 2008, about 14% of all loans were in default and 41% had prepaid.

the large sample, we note that little economic difference exists between loans in affiliated and unaffiliated deals on observables. For example, affiliated deals have a slightly lower average credit (FICO) score (701 versus 704) and slightly higher average loan-to-value ratios (78% versus 76%), but these differences are sufficiently small as to be economically insignificant.¹¹ We also note that the proportion that are fixed-rate, owner-occupied, refinance, and first-liens are virtually the same across both groups. As a result, it is not surprising that we find average loan interest rate spreads to be within 3 basis points of each other, suggesting similar pricing based on observable risk characteristics.

Although differences in observable risk characteristics appear to be minor, we do see some interesting differences in variables that proxy for the presence of soft information at origination. For example, we note that the proportion of low or no document loans is higher in the affiliated group (63% versus 58%). Ambrose et al. (2016) show that low or no document loans may contain significant soft information, particularly with respect to income.

Finally, panel D of Table 2 reports the differences in MBS deal characteristics that proxy for soft-information present at deal securitization (issuer-underwriter links, originator-underwriter links, and the securitization lag). As a proxy for the ability to transfer soft information, we create a variable measuring the percentage of loans in a deal that were originated by a firm tied to a particular underwriter through previous business relationships. In order to identify whether the originator and underwriter are linked, we create two data screens. First, we require that the originator have at least 100 loans in our sample. Second, we require that at least 50% (or 75%) of those loans be securitized by a unique underwriter thereby creating an originator-underwriter link. We then identify all loans as belonging to that linked originator-underwriter pair.¹² This indicator captures the possible information pass-through that may occur according to the strength of the relationship between originator and underwriter. We note that affiliated deals have a higher proportion of loans originated by firms that are linked to the deal underwriter (34% versus 30% when evaluated at a 75% threshold). We also capture the

¹¹In untabulated results, we note that the percentage of borrowers with FICO scores below 650 (a standard criteria for identifying a subprime loan) was 20% and 19% for affiliated and non affiliated deals, respectively, further implying that the loan groups were similar risk based on observables.

¹²For our purposes, we define an originator as linked to the lead underwriter if 50% (75%) or more of the originator's loans are passed to the lead underwriter up to and including the month when the MBS deal is issued.

linkage between the MBS deal issuer and underwriter. The deal issuer is the firm that purchases the individual mortgages to create the mortgage-backed security whereas the underwriter is the investment bank that places the securities with investors. Interestingly, we see that 40% of the loans in the non-affiliated category are linked to a deal where the issuer and underwriter are the same firm. In contrast, only 19% of the loans in the affiliated group are in deals having the same issuer-underwriter. Finally, we see that mortgages in affiliated deals were held in the originator's or issuer's portfolio (or warehouse) longer prior to securitization than loans placed in non-affiliated deals. For the affiliated deals, loans were warehoused an average of 4 months before securitization while loans in non-affiliated deals average 3.8 months between origination and securitization. The longer time in the originator or issuer portfolio prior to securitization is consistent with the MBS market slowing down in 2007.

To summarize, the univariate statistics in Table 2 show that little difference exists in observable information about loan pools across affiliated versus unaffiliated deals. However, we do see economically significant differences in affiliated versus unaffiliated MBS deals for the variables that proxy for greater soft information.

3.3 Unconditional Termination Rates

As a further check on whether underwriters placed higher or lower risk loan pools with affiliated investors, we examine the unconditional mortgage prepayment and default rates. Panels A and B in Table 3 show the default and prepayment rates in relation to origination and securitization cohort, respectively. First, consistent with the narrative that underwriters placed lower risk loan pools with affiliated investors, we see in panel A that the average default rates for loans in affiliated deals are significantly lower for origination years 2006 and 2007 than for loans in non-affiliated deals. The largest difference in default rates occurs for loans originated in 2006 (17% for loans in affiliated deals versus 28% for loans in deals that were not affiliated). Again, this period coincides with the housing market peaking and delinquencies rising when the value of soft information would be highest. In contrast, during 2002 and 2003 the default rates are virtually the same across affiliated and non-affiliated deals. Panel B confirms that 2006 was a turning point as loans in affiliated deals issued that year had lower default rates than deals purchased by unaffiliated investors. This sizable difference starting in

2006 is consistent with the hypothesis that underwriters recognized the peak of the housing market and thus started to select against unaffiliated investors prior to the financial crisis by steering affiliated investors toward lower risk deals.

4 Predicted Loan Outcomes and Affiliation Status

We now turn to a formal analysis of whether underwriters placed lower risk loan pools with affiliated investors. Our empirical strategy is similar to that employed by Adelino et al. (2014) and Adelino et al. (2016) in that we use conditional mortgage performance measures (prepayment and default) to examine whether soft information available to loan originators influenced ultimate investment in mortgage securities via the linkage between originators, issuers/underwriters, and investors. Our analysis considers whether an investment by a fund affiliated with the firm that created the security is correlated with the *ex ante* performance of the underlying mortgages. Unlike Adelino et al. (2014) who look at GSE and non-GSE purchases of loans in the same pool thereby rendering all deal-level unobservable characteristics irrelevant, our analysis must explicitly control for differences in issuers, originators, and underwriters across MBS securities. By using a complete set of variables that capture the relationships between deal issuer/underwriters, loan originators, and deal investors, we are able to isolate the linkage between loan production, securitization, and ultimate investment.

We closely follow the methodology outlined in Ashcraft and Vickery (2010) and Adelino et al. (2014) to create the predicted probability of prepayment and default for each loan using only information available at the time of origination and deal securitization. Our approach employs a two-step estimation strategy using two loan samples denoted as the benchmark group and the securitization group. We first create a series of benchmark samples consisting of all loans from deals securitized over a 12 month period prior to the deal securitization quarter identified in the securitization sample where the gap between benchmark and securitized samples matches the performance windows of 6, 12, 18, and 24-months.¹³ Then we estimate the following OLS model of loan performance using the benchmark sample for each performance

¹³Therefore, it is never the case that outcomes considered in the benchmark sample occur after the securitization quarter of the securitization sample. For example, when considering the 6 month performance window the benchmark includes loans securitized 18 months to 6 months prior to the securitization sample quarter.

window and repeat this forward through time using a rolling window methodology:¹⁴

$$Pr(Y_i) = \alpha + \beta_1 X_i + \varepsilon_i \quad (1)$$

where X_i is a vector of mortgage-level control variables including borrower and property specific characteristics. We estimate two versions of equation (1) with the dependent variable (Y_i) being an indicator variable reflecting loan prepayment or default over the various performance windows, respectively. Using the estimated coefficients from these models, we then calculate the predicted probabilities of prepayment and default for the securitization sample loans over the 6, 12, 18, and 24-month windows following securitization.

We use the predicted probabilities as the dependent variables in the following *ex ante* performance regression:

$$\begin{aligned} Pr(\hat{Y}_i) = & \alpha + \beta_1 Affiliated_i + \beta_2 IU_i + \beta_3 OU_i + \beta_4 (Affiliated_i \times IU_i) \\ & + \beta_5 (Affiliated_i \times OU_i) + \beta_6 (IU_i \times OU_i) \\ & + \beta_7 (Affiliated_i \times IU_i \times OU_i) + \varepsilon_i \end{aligned} \quad (2)$$

where $Affiliated_i$ is an indicator variable denoting whether the mortgage is contained in an MBS deal that was purchased by an investor affiliated with the issuer or underwriter, IU_i is an indicator variable equal to one if the MBS issuer is related to the MBS underwriter (horizontal integration), and OU_i is an indicator variable equal to one if the loan originator is linked to the MBS deal underwriter (vertical integration). We estimate the *ex ante* models via OLS where the predicted probabilities from the first stage are conditioned on all information available at deal securitization and the rolling window methodology captures additional unobservable information through time.

The control group are loans in deals that do not have an investor affiliated with the issuer, underwriter, or mortgage originator. Thus, the coefficient for the variable *Affiliated* captures the difference in predicted performance outcomes between loans based on whether the investor was affiliated with the issuer/underwriter. Similarly, the estimated coefficients for *IU* and *OU*

¹⁴Tables I.2 and I.3 in the appendix report the average estimated coefficients from the first-stage regression models.

capture the difference in predicted loan performance based on whether the deal containing the loan was securitized by a horizontally integrated investment bank (same issuer-underwriter) or whether the loan was originated by a lender connected with deal underwriter (vertically integrated). Thus, the coefficients on the interaction terms ($Affiliated*IU$) and ($Affiliated*OU$) represent the *ex ante* differential risk associated with loans in deals where the investor is affiliated with a horizontally integrated issuer-underwriter or a vertically connected originator-underwriter, respectively. Finally, the coefficient on the triple interaction ($Affiliated*IU*OU$) captures the full risk differential between loans based on investor affiliation and the firms that originated the loan and created the mortgage-backed security versus the benchmark set of mortgages that are originated, securitized, and held via separate entities.

Table 4 reports the estimation results for the models of *ex ante* predicted prepayment and default (equation (2)). For all models, we report standard errors that are clustered at the deal level. For ease of interpretation of the results, Panel A reports the average *ex ante* predicted probability of default and prepayment for each performance window. Since we require that the benchmark estimation window match the securitization sample performance window, the loans included in the 18- and 24-month benchmark samples are predominately originated during the early years of our dataset. As a result, these loans did not experience the same housing price path as the loans in the 6- and 12-month samples. Thus, we focus our discussion on the 12-month performance window as this corresponds to the typical early default period associated with risky underwriting and it allows us to use loans originated over the entire sample period leading up to the housing and financial crisis.

Affiliation Status

We note that the coefficients for the indicator variable for *Affiliated* are not statistically significant. Therefore, affiliation status by itself is not correlated with predicted default (Panel B) or prepayment (Panel C). This suggests no difference in predicted prepayment or default rates between loans in pools classified as affiliated from those in pools that were not affiliated.

Horizontal Integration

Many MBS originators are horizontally integrated, that is the MBS issuer and underwriter are the same firm (or subsidiary). The indicator for Same Issuer-Underwriter (IU) allows us to test whether loans in pools originated by horizontally integrated institutions have lower ex ante risk characteristics than the baseline case of loans in non-affiliated pools that were created and underwritten by separate firms. The estimated coefficient is not statistically significant. Thus, we find no relation between ex ante default risk (Panel B) or ex ante prepayment risk (Panel C) and horizontal integration in the production of mortgage-backed securities ($IU = 1$).

To examine the impact of horizontal integration on placement of loans to affiliated investors, we interact the integration variable with affiliation status. In the default model, the interaction term is statistically insignificant whereas in the prepayment model the coefficient is negative and statistically significant (at the 10 percent level). Thus, horizontal integration does not appear to be correlated with the default risk on loans placed with affiliated investors but it is aligned with the risk of prepayment. Summing the coefficients for *Affiliated*, IU , and the interaction ($Affiliated * IU$), we see that loans originated by horizontally integrated lenders and placed with affiliated investors had predicted prepayment rates that were 3.8 percentage points lower than loans originated by non-integrated lenders and placed with unaffiliated investors.

Vertical Integration

Vertical integration in the financial industry occurs when institutions that originate MBS also control the production of loans that go into those securities. We see that the coefficient in the default model (Panel B) for the variable denoting loans originated by lenders connected with the deal underwriter (vertical integration) is positive and statistically significant (at the 10% level). The estimated coefficient for vertical integration in the prepayment model (Panel C) is also positive and statistically significant at the 5 percent level. The implication is that loans originated and securitized by vertically integrated ($OU = 1$) firms had higher predicted default and prepayment probabilities relative to the base case of loans that were not part of a vertically integrated firm.

Considering the interaction of affiliation status and vertical integration, we see the coeffi-

cient in the default model is negative but statistically insignificant. In contrast, the interaction of affiliation status and vertical integration is significant in the prepayment model (at 5 percent level). Thus, we note that loans originated by vertically integrated lenders and placed with affiliated funds had early predicted prepayment rates that were 120 basis points lower than the baseline group of loans originated by non-vertically integrated lenders and placed with unaffiliated investors.¹⁵ Thus, on an ex ante basis we find evidence that vertically integrated lenders used their information advantage to help affiliated investors select loan pools with lower expected prepayment risk.

Full Integration

Our model also allows us to test the effects of full integration (vertical and horizontal) with affiliation status. First, in Panel B we see that full integration ($OU * IU = 1$) has a negative and statistically significant coefficient in the default model (at 1 percent level). The coefficient on the triple interaction term showing the link between investor, underwriter, and loan originator is positive and statistically significant (at 5 percent level) in the default model. The magnitude of the coefficient effectively reverses the implications from the single interaction terms. Summing the coefficients, we see that a loan originated by a vertically and horizontally integrated lender that is sold to an affiliated investor ($Affiliated * OU * IU = 1$) has a predicted default probability that is 1.80 percentage points higher than mortgages originated via a non-integrated channel and that are not sold to affiliated investors. Thus, based on an ex ante risk measure of default, we find evidence that underwriters appeared to be selectively sending higher risk securities to affiliated investors. Compared to the average expected default rate across all loans, the coefficients suggest that loans in fully integrated deals placed with affiliated funds had predicted default rates that were over twice as high.

In the prepayment model (Panel C), the parameters imply that loans in deals purchased by funds affiliated with vertically and horizontally integrated banks had lower predicted prepayment probabilities than comparable benchmark loans originated by non-integrated lenders and not purchased by affiliated investors. For example, the predicted prepayment probability for affiliated loans originated and securitized by vertically and horizontally integrated firms

¹⁵-0.012=0.002+0.076-0.090

(*Affiliated* * *OU* * *IU* = 1) had predicted prepayment probabilities that were 4.5 percentage points lower than comparable benchmark loans in non-affiliated deals. These results are consistent with the unconditional results reported earlier and again suggest that lenders with information advantages were using that information to select loans with higher performance expectations (in this case lower expected prepayment) to place with affiliated funds.

Summary

To summarize, the results from the *ex ante* analysis of loan outcome and affiliation status reveal that underwriters placed mortgage pools with affiliated funds that had higher predicted default rates and lower predicted prepayment rates. This evidence is consistent with the presence of asymmetric information in the MBS market.

5 *Ex Post* Loan Outcomes and Affiliation Status

In this section, we repeat the analysis using a variant of equation (2) but with the dependent variable (Y_i) now being an *ex post* indicator of loan performance. Specifically, we estimate two versions with Y_i taking the value of 1 if the loan defaulted or prepaid, respectively, for each performance horizon window and 0 otherwise. We include the predicted probabilities of default and prepayment in the ex post models where the predicted probabilities are determined in the first-step estimation discussed in section 4 to control for borrower and loan risk characteristics. In this specification, we estimate the model in a logistic framework.

Table 5 presents the average marginal effects (AME) for the ex post likelihood of default (Panel A) and prepayment (Panel B).¹⁶ We note that the reported marginal effects are monotonically increasing in magnitude across the performance windows. The average marginal effects for predicted default and prepayment probabilities tend to be statistically significant in the performance windows for both prepayment and default models. In the default model for the 12-month performance window, predicted prepayment and default are significant at the 1

¹⁶Calculating the AMEs is a multi-step process. For example, the AME for the *Affiliated* variable are calculated by first computing the probability of default (prepayment) for each loan assuming that it is contained in an affiliated deal while holding all other variables constant. Next, the process is repeated assuming that the loan is not in an affiliated deal (*Affiliation* = 0). Finally, we take the difference in the two probabilities as the marginal effect and then average across all loans.

percent level. In contrast, only predicted default is statistically significant (at the 1 percent level) in the prepayment model (Panel B). Consistent with the ability of the first-stage loan underwriting model to assess the odds of ex post default (Panel A), we note that an increase in the ex ante probability of default is associated with a higher ex post probability of default. We also see that higher predicted default probabilities are associated with lower actual prepayment probabilities (Panel B).

Affiliation

We see that the marginal effect for *Affiliated* is positive and statistically significant (at the 5 percent level) in the default model over the 12-month performance window. The average marginal effect indicates that loans in affiliated deals have a probability of default that is 110 basis points higher on average than loans of non-affiliated deals. To place this in perspective, the marginal effects indicate that after controlling for observable differences and deal characteristics, the affect of affiliated status increases the 12-month unconditional default rate reported in Table 2 by approximately 26.2% (from 4.2% to 5.3%). In the prepayment model (Panel B), the marginal effect is not statistically significant.

Horizontal Integration

The marginal effect for the variable denoting deals where the issuer and underwriter is the same (horizontally integrated) are positive and significant (at the 5 percent level) in the default model (Panel A) for the 12-month performance window. Thus, we see that the probability of default is 1.6 percentage points higher for loans in securitized deals issued by horizontally integrated issuer/underwriters than loans in deals where the securities issuer is not the underwriter. However, the marginal effects for horizontal integration are not statistically significant in the prepayment model.

We do find significantly negative marginal effects for the interaction of *Affiliation* with *same Issuer/Underwriter* (at the 5 percent level) in the prepayment and default models. By summing across the coefficients, the marginal effects indicate that loans in deals issued by horizontally integrated firms and purchased by an affiliated investor have a 4.2 percentage points lower probability of prepayment than loans in the control group. We also note that

these loans are associated with a 40 basis point higher default rate.

Vertical Integration

We also control for vertical integration in the loan production and securitization process by including the indicator variable OU that identifies originators that disproportionately channel their loans to be securitized by the same firm. In the default model, the marginal effect is positive and significant (at the 1 percent level) for the 12-month performance window. We see loans originated by vertically integrated lenders have ex post default rates that are 1.2 percentage points higher than loans originated by non-integrated lenders. When loans originated by vertically integrated firms are placed with affiliated investors the summed marginal average effects reveal probabilities of default that are on average 1.2 percentage points higher than loans originated by non-integrated lenders and placed with unaffiliated investors.

In the prepayment model, we note that the marginal effect for linked originator-underwriter (OU) is weaker than in the default model and is not statistically significant. In addition, the affect for the interaction of affiliation status with the indicator for vertically linked originator-underwriter is insignificant and close to zero. Thus, for the 12-month performance window, the marginal effects suggest that loans originated by vertically integrated firms and placed with affiliated investors had prepayment probabilities that were 0.8 percentage points higher than benchmark loans in non-affiliated deals.

Full Integration

Similar to the results for the ex ante analysis, we note that the interaction for vertical and horizontal integration ($OU * IU = 1$) in the default model (Panel A) is negative and statistically significant (at the 1 percent level) for the 12-month performance window but is insignificant in the prepayment model (Panel B). According to the 12-month performance window, loans originated by fully integrated lenders had default rates that were 1.7 percent higher than loans originated by non-integrated lenders. Finally, we see that the marginal effect for the triple interaction ($Affiliated * IU * OU = 1$) is positive and statistically significant for the default likelihood model (at 5 percent level) but not for prepayment. Summing the coefficients in the 12-month model, we note that loans originated and securitized by integrated firms

(*Affiliated* * *OU* * *IU* = 1) and placed with affiliated funds have predicted ex post probabilities of default 1.9 percentage points higher and ex post prepayment probabilities 4.5 percentage points lower than similar benchmark loans.

Summary

Overall, the results reported in Table 5 are consistent with the ex ante results and suggests that the ex post performance of loans in MBS deals differ based on whether the investor that purchased the security is affiliated with the deal issuer or underwriter. As a result, we find evidence supporting the hypothesis that MBS sponsors may have used private (or soft) information gained during the securitization process to place securities with higher default risk and lower prepayment risk with affiliated investors.

6 Dumping versus Preferential Treatment

In sections 4 and 5, we demonstrated that mortgages in MBS deals that were ultimately placed with funds affiliated with the underwriter or issuer had a higher probability of default and a lower probability of prepayment. However, investors are not selecting individual loans but instead invest at the deal level. Thus, in this section we explore the direct link between deal characteristics and investment by affiliated funds. Our goal is to determine whether MBS issuers and underwriters pursued a preferential treatment or a dumping strategy with respect to affiliated investors. To do so, we estimate the following model of affiliated status by securitization year at the deal level:

$$Pr(Deal = Affiliated_i) = \alpha + \beta_1 \overline{Prepay}_i + \beta_2 \overline{Default}_i + \beta_3 OU_i + \beta_4 \overline{Season}_i + \epsilon \quad (3)$$

The dependent variable is an indicator of whether the MBS deal i is identified as an affiliated deal, \overline{Prepay}_i is the average predicted prepayment probability (over the 12-month performance window) for the loans in deal i , $\overline{Default}_i$ is the average predicted default probability (over the 12-month performance window) for the loans in deal i , OU_i indicates the percentage of deal i where the loan originator is linked to the deal underwriter at the 75% threshold, and \overline{Season}_i is the average loan seasoning in deal i as of securitization. Essentially, equation (3) allows us

to test whether issuers/underwriters steered affiliated funds into higher or lower risk deals.

Table 6 reports the results. We note the overall percentage of loans in the pool that are originated by lenders linked to the underwriter is negative and statistically significant (at 10 percent level). We also see that the estimated coefficient for the average expected probability of default is positive and statistically significant (at the 10 percent level) whereas the expected probability of prepayment is negative and statistically significant (at the 5 percent level). Finally, we note that the control for average loan seasoning is not statistically significant. Consistent with the 4 and 5 results, the negative coefficient on the prepayment probability implies that the probability of a pool being placed with affiliated investors declined as the probability of prepayments on the loans in the pool increased. Similarly, the positive coefficient on the default probability indicates that the probability of a pool being placed with an affiliated fund increases as the underlying mortgage pool default risk increased. These results are consistent with the dumping hypothesis.

7 Robustness and Falsification Tests

We recognize that our results may be subject to unobserved heterogeneity. Thus, we conduct a series of falsification tests to confirm that unobserved factors are not driving our findings of differential prepayment and default across affiliated and unaffiliated portfolios. In the first test reported in Table 7, the variable *affiliation* is constructed through a randomization process. That is, MBS deals are categorized as having an affiliated link between the investor, underwriter or issuer through a random algorithm. Intuitively, this random measure should not have a significant effect on the likelihood of prepayment or default. The results in Table 7 show no statistical significance, as expected, thus lending credence to our primary results in section 5 that affiliated status is correlated with higher risk. We also perform similar falsification tests with randomized trials of issuer-underwriter links and originator-underwriter links. The results consistently show no statistical associations of the random variables for issuer-underwriter and originator-underwriter. Finally, we also conducted a complete randomization test with random assignment of affiliation status, issuer-underwriter link, and originator-underwriter link. Again,

the regression results reveal no statistical significance.¹⁷

8 Conclusion

This study investigates the perception that the originate-to-distribute model created incentives for MBS issuers and underwriters to collude with mortgage originators in the placement of mortgage-backed securities. We present novel evidence on the placement of mortgage-backed securities with investors who are affiliated with the security underwriter or issuer. As a result, we add to the literature examining the role of securitization in the run-up to the financial crisis.

Our empirical analysis reveals that affiliated funds are associated with deals that have lower expected prepayment rates and higher expected default rates. In addition, the results show that pools comprising higher default risk and lower prepayment risk were differentially more likely to be placed with affiliated investors. This result is consistent with a dumping hypothesis.

¹⁷Tabulated tables reporting these results are available upon request.

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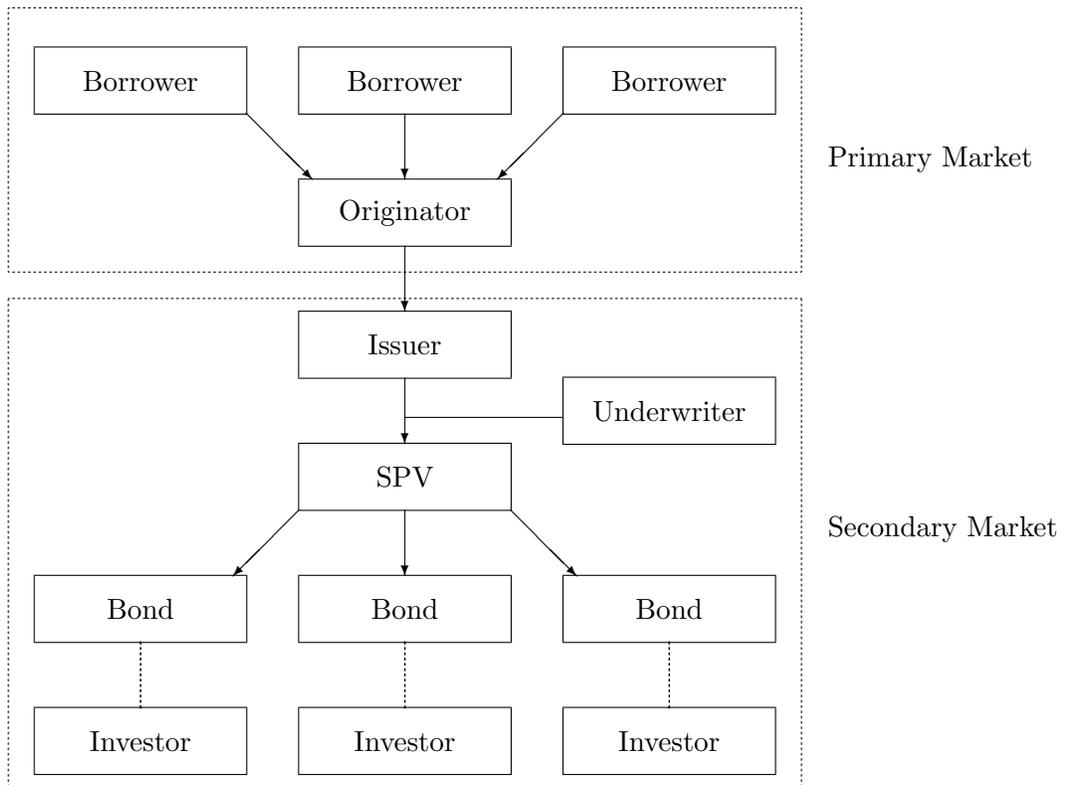


Figure 1. Private Label Securitization Process

Table 1. Frequency Distribution of MBS Deals and Individual Mortgages by Deal Securitization Year and Loan Origination Year

Year	Not Affiliated		Affiliated		Total
	Number	Percent	Number	Percent	
Panel A: MBS Deals by Year of Issuance					
2002	8	100%	0	0%	8
2003	46	98%	1	2%	47
2004	85	96%	4	4%	89
2005	109	95%	6	5%	115
2006	82	92%	7	8%	89
2007	50	88%	7	12%	57
Total	380	94%	25	6%	405
Panel B: Mortgage Counts by Origination Year					
2000	599	73%	219	27%	818
2001	2,556	79%	678	21%	3,234
2002	37,418	98%	785	2%	38,203
2003	119,772	95%	5,710	5%	125,482
2004	249,854	96%	11,551	4%	261,405
2005	377,689	88%	49,558	12%	427,247
2006	225,694	94%	15,058	6%	240,752
2007	62,599	76%	19,716	24%	82,315
Total	1,076,181	91%	103,275	9%	1,179,456

Affiliation status identifies deals where investors are linked to either the underwriter or the issuer of the invested MBS deal within 1 year of the deal being securitized.

Table 2. Summary Statistics

	Total		Affiliated		Not Affiliated		T-Stat Diff.
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Number of Loans	1,179,456		103,275		1,076,181		
Panel A: Prepayment Rates							
6 Months	9.4%	0.29	8.7%	0.28	9.4%	0.29	7.24
12 Months	19.4%	0.40	18.6%	0.39	19.4%	0.40	6.54
18 Months	27.4%	0.45	28.1%	0.45	27.4%	0.45	-4.33
24 Months	35.8%	0.48	38.7%	0.49	35.5%	0.48	-18.19
Panel B: Default Rates							
6 Months	1.8%	0.13	1.9%	0.14	1.8%	0.13	-2.50
12 Months	4.2%	0.20	4.4%	0.21	4.2%	0.20	-4.26
18 Months	6.9%	0.25	5.4%	0.23	7.0%	0.26	19.07
24 Months	8.5%	0.28	8.1%	0.27	8.5%	0.28	4.35
Panel C: Borrower and Loan Characteristics							
Initial Interest Rate minus Treasury Rate	2.04	2.00	2.07	1.60	2.04	2.04	-4.05
Loan Balance at Securitization	12.34	0.90	12.40	0.88	12.33	0.90	-22.38
Months To Maturity from Securitization	340.77	55.49	352.55	41.69	339.64	56.51	-71.53
FICO	703.62	61.02	701.25	60.09	703.85	61.11	13.06
Fixed Rate Mortgage	0.33	0.47	0.32	0.47	0.33	0.47	4.85
Single Family	0.67	0.47	0.69	0.46	0.67	0.47	-9.90
Condo	0.10	0.30	0.12	0.32	0.10	0.30	-15.89
Town homes	0.00	0.06	0.00	0.04	0.00	0.06	8.01
PUD	0.17	0.38	0.13	0.34	0.17	0.38	31.40
Property Type Other	0.05	0.23	0.06	0.24	0.05	0.22	-12.30
Owner-Occupied	0.82	0.39	0.81	0.39	0.82	0.39	8.46
Refinance	0.48	0.50	0.48	0.50	0.48	0.50	-2.24
Low Document	0.55	0.50	0.56	0.50	0.54	0.50	-12.55
No Document	0.04	0.19	0.06	0.25	0.03	0.18	-52.44
1st Lien	0.91	0.28	0.95	0.23	0.91	0.29	-39.49
CLTV for Second Liens and First LTV for First Liens	76.49	14.73	77.94	13.37	76.35	14.85	-33.22
$CLTV_{orLTV} < 50$	0.06	0.24	0.04	0.20	0.06	0.24	26.84
$50 \leq CLTV_{orLTV} < 60$	0.06	0.23	0.04	0.20	0.06	0.24	21.36
$60 \leq CLTV_{orLTV} < 70$	0.10	0.31	0.09	0.29	0.10	0.31	12.12
$70 \leq CLTV_{orLTV} < 80$	0.22	0.41	0.23	0.42	0.22	0.41	-8.80
$80 \leq CLTV_{orLTV} < 90$	0.38	0.49	0.38	0.48	0.38	0.49	2.02
$90 \leq CLTV_{orLTV} < 100$	0.10	0.30	0.16	0.37	0.09	0.29	-71.52
$CLTV_{orLTV} \geq 100$	0.08	0.27	0.05	0.22	0.08	0.27	31.89
Panel D: MBS Deal Characteristics							
Seasoning (Securitization date - Origination Date)	3.79	5.62	3.97	5.63	3.77	5.62	-11.08
Same Issuer-Underwriter	0.38	0.49	0.19	0.39	0.40	0.49	136.14
Linked Originator-UW at 50%	0.40	0.49	0.41	0.49	0.40	0.49	-3.09
Linked Originator-UW at 75%	0.31	0.46	0.34	0.47	0.30	0.46	-23.08

In Panels A and B, early termination is defined as the first incident of prepayment or default, which includes: being 90 days delinquent, REO, foreclosure, bankruptcy, or bankruptcy and foreclosure as of December 2008 where the performance horizon in months is defined from securitization. In Panel D, MBS deal characteristics are given at the loan level.

Table 3. Summary of Early Termination by Affiliation Status as of December 2008

Year	Affiliated					Not Affiliated				
	Default Count	Rate	Prepaid Count	Rate	Total Count	Default Count	Rate	Prepaid Count	Rate	Total Count
Panel A: Origination Year										
2000	13	6%	131	60%	219	43	7%	339	57%	599
2001	41	6%	457	67%	678	83	3%	1,656	65%	2,556
2002	9	1%	644	82%	785	1,212	3%	31,543	84%	37,418
2003	218	4%	4,246	74%	5,710	3,532	3%	74,982	63%	119,772
2004	1,243	11%	7,229	63%	11,551	14,011	6%	141,547	57%	249,854
2005	7,817	16%	23,789	48%	49,558	59,884	16%	142,220	38%	377,689
2006	2,508	17%	3,183	21%	15,058	63,395	28%	48,459	21%	225,694
2007	2,384	12%	1,571	8%	19,716	9,703	16%	6,804	11%	62,599
Panel B: Securitization Year										
2002	0	.	0	.	0	1,035	6%	14,063	87%	16,077
2003	4	1%	520	90%	580	1,617	2%	55,357	70%	78,990
2004	1,371	10%	10,187	74%	13,763	7,546	4%	108,446	60%	180,990
2005	7,046	15%	24,217	50%	48,315	35,900	10%	166,287	46%	362,934
2006	3,278	16%	4,647	23%	19,914	76,761	27%	82,049	29%	287,037
2007	2,534	12%	1,679	8%	20,703	29,004	19%	21,348	14%	150,153

Origination year identifies the year the loan was originated whereas securitization year identifies loans by the year their MBS was securitized.

Table 4. Ex-Ante Linear Probabilities of Early Termination

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Panel A: Average Predicted Early Termination Likelihoods				
Predicted Default Rate	1.0%	1.7%	1.6%	1.2%
Predicted Prepayment Rate	11.4%	25.3%	37.9%	55.7%
Panel B: Default Likelihood				
Affiliated	0.003 (0.005)	0.007 (0.009)	0.011 (0.009)	0.025* (0.014)
Same Issuer - Underwriter	0.003 (0.002)	0.005 (0.004)	0.008 (0.005)	0.018*** (0.007)
Linked Originator-UW at 75%	0.009** (0.004)	0.012* (0.006)	0.012* (0.007)	0.041*** (0.015)
Affiliated*Same(Issuer/UW)	-0.003 (0.006)	-0.004 (0.011)	-0.007 (0.012)	-0.019 (0.015)
Affiliated*Originator-UW (75%)	-0.012** (0.006)	-0.020 (0.013)	-0.023 (0.014)	-0.049** (0.020)
Same(Issuer/UW)*Originator-UW (75%)	-0.013*** (0.004)	-0.020*** (0.007)	-0.013 (0.009)	-0.033* (0.018)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	0.020** (0.008)	0.038** (0.016)	0.020 (0.019)	0.055** (0.023)
Constant	0.010*** (0.002)	0.017*** (0.003)	0.016*** (0.003)	0.012*** (0.004)
# Loans	1,140,572	1,100,584	1,032,103	931,570
# Deals	387	366	332	289
Panel C: Prepayment Likelihood				
Affiliated	0.001 (0.014)	0.002 (0.032)	0.019 (0.041)	-0.065 (0.040)
Same Issuer - Underwriter	-0.000 (0.007)	0.024 (0.016)	0.041** (0.018)	-0.004 (0.025)
Linked Originator-UW at 75%	0.023 (0.014)	0.076** (0.034)	0.100*** (0.029)	0.064** (0.028)
Affiliated*Same(Issuer/UW)	-0.031* (0.016)	-0.064* (0.035)	-0.052 (0.062)	-0.041 (0.044)
Affiliated*Originator-UW (75%)	-0.031 (0.020)	-0.090** (0.045)	-0.154*** (0.048)	-0.101** (0.043)
Same(Issuer/UW)*Originator-UW (75%)	-0.012 (0.016)	-0.053 (0.038)	-0.078** (0.034)	-0.027 (0.038)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	0.035 (0.022)	0.060 (0.048)	0.140** (0.058)	0.078 (0.051)
Constant	0.114*** (0.005)	0.253*** (0.012)	0.379*** (0.013)	0.557*** (0.020)
# Loans	1,140,572	1,100,584	1,032,103	931,570
# Deals	387	366	332	289

Dependent variables are predicted default and predicted prepayment likelihoods generated from rolling window estimates of benchmark samples of loans securitized prior to the securitization quarter sample to give an ex ante likelihood of default and prepayment risk where the gap between benchmark and securitized samples matches the performance window being considered. The first-stage control variables include: Interest Rate Spread, ln(Loan Balance at Securitization), Months to Maturity from Securitization, Fico, LTV Waterfall, Fixed Rate Indicator, Property type, Owner-Occupied Indicator, Refinance Indicator, Documentation Type, and 1st Lien Indicator. The second-stage controls are currently displayed with the figures in parentheses reporting standard errors of the coefficient estimates that are clustered at the deal level where 1, 2, and 3 stars indicate statistical significance at 10%, 5%, and 1%, respectively.

Table 5. Ex Post Average Marginal Effects Associated with the Logistic Estimation of Early Loan Termination including Ex Ante Predicted Early Termination

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Panel A: Default Likelihood				
Pr(Prepay)	0.013*	0.036***	0.073***	0.098***
	(0.008)	(0.009)	(0.012)	(0.013)
Pr(Default)	0.531***	0.619***	0.642***	0.357***
	(0.044)	(0.052)	(0.056)	(0.038)
Affiliated	0.005	0.011**	0.008	0.024*
	(0.004)	(0.006)	(0.008)	(0.013)
Same Issuer - Underwriter	0.010**	0.016**	0.021	-0.002
	(0.004)	(0.007)	(0.014)	(0.029)
Linked Originator-UW at 75%	0.005***	0.012***	0.007	0.007
	(0.001)	(0.003)	(0.004)	(0.007)
Affiliated*Same(Issuer/UW)	-0.013*	-0.023**	-0.035*	-0.013
	(0.007)	(0.010)	(0.019)	(0.016)
Affiliated*Originator-UW (75%)	-0.002	-0.011	0.008	-0.019
	(0.005)	(0.007)	(0.013)	(0.015)
Same(Issuer/UW)*Originator-UW (75%)	-0.005***	-0.011***	-0.002	0.003
	(0.002)	(0.004)	(0.006)	(0.009)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	0.015**	0.025**	0.028	0.008
	(0.007)	(0.010)	(0.027)	(0.016)
# Loans	1,100,369	1,064,273	968,865	751,813
# Deals	375	354	310	224
Pseudo R-sqr	0.343	0.320	0.290	0.238
Panel B: Prepayment Likelihood				
Pr(Prepay)	0.048***	-0.011	-0.078***	-0.128***
	(0.008)	(0.009)	(0.012)	(0.013)
Pr(Default)	-0.324***	-0.409***	-0.556***	-0.279***
	(0.064)	(0.075)	(0.073)	(0.058)
Affiliated	0.005	0.015	0.021	0.047***
	(0.005)	(0.010)	(0.013)	(0.017)
Same Issuer - Underwriter	0.004	-0.009	-0.022**	-0.044***
	(0.004)	(0.009)	(0.011)	(0.012)
Linked Originator-UW at 75%	-0.001	-0.007	-0.004	0.013
	(0.003)	(0.007)	(0.008)	(0.014)
Affiliated*Same(Issuer/UW)	-0.009	-0.048**	-0.023	-0.087**
	(0.009)	(0.019)	(0.027)	(0.034)
Affiliated*Originator-UW (75%)	0.004	0.000	-0.007	-0.077***
	(0.006)	(0.013)	(0.016)	(0.024)
Same(Issuer/UW)*Originator-UW (75%)	-0.005	-0.001	-0.000	-0.026
	(0.004)	(0.009)	(0.012)	(0.018)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	-0.010	0.005	0.002	0.077***
	(0.008)	(0.021)	(0.022)	(0.029)
# Loans	1,104,294	1,064,306	968,924	751,844
# Deals	375	354	310	224
Pseudo R-sqr	0.522	0.491	0.495	0.466

Additional variables not currently displayed include: Number of Months between Origination and Securitization (Seasoning) and Performance Months. The predicted default and predicted prepayment likelihoods are generated from rolling window estimates of benchmark samples of loans securitized prior to the securitization quarter sample to give an ex ante likelihood of default and prepayment risk where the gap between benchmark and securitized samples matches the performance window being considered. The first-stage control variables include: Interest Rate Spread, ln(Loan Balance at Securitization), Months to Maturity from Securitization, Fico, LTV Waterfall, Fixed Rate Indicator, Property type, Owner-Occupied Indicator, Refinance Indicator, Documentation Type, and 1st Lien Indicator. The figures in parentheses report standard errors of the coefficient estimates that are clustered at the deal level where 1, 2, and 3 stars indicate statistical significance at 10%, 5%, and 1%, respectively.

Table 6. Estimation of Affiliation Status using Ex Ante Predictions of Early Termination by Deal Securitization Year

Explanatory Variable	
Pr(Prepayment)	-0.142** (0.066)
Pr(Default)	1.193* (0.658)
Deal Pct. Linked Originator-UW at 75%	-0.044* (0.024)
Deal Avg. Seasoning	0.003 (0.004)
Constant	0.088*** (0.030)
R-Squared	0.032
# Deals	366

The first-stage control variables used to generate the out-of-sample predicted early termination probabilities for a 12 month performance window include: Interest Rate Spread, $\ln(\text{Loan Balance at Securitization})$, Months to Maturity from Securitization, Fico, LTV Waterfall, Fixed Rate Indicator, Property type, Owner-Occupied Indicator, Refinance Indicator, Documentation Type, and 1st Lien Indicator. The second-stage controls are currently displayed with the figures in parentheses reporting robust standard errors of the coefficient estimates where, 1, 2, and 3 stars indicate statistical significance at 10%, 5%, and 1%, respectively.

Table 7. Marginal Effects Associated with the Logistic Estimation of Early Loan Termination when Affiliation is Randomly Assigned

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Panel A: Default Likelihood				
Affiliated	-0.003 (0.006)	-0.006 (0.009)	-0.007 (0.011)	-0.004 (0.017)
Same Issuer - Underwriter	0.007 (0.000)	0.016 (0.000)	0.021 (0.000)	0.017 (0.001)
Linked Originator-UW at 75%	0.003 (0.000)	0.005 (0.001)	0.008 (0.001)	0.008 (0.001)
Affiliated*Same(Issuer/UW)	0.001 (0.006)	0.005 (0.011)	0.008 (0.016)	0.008 (0.023)
Affiliated*Originator-UW (75%)	0.006 (0.020)	0.011 (0.028)	0.015 (0.036)	0.015 (0.040)
Same(Issuer/UW)*Originator-UW (75%)	-0.002 (0.001)	-0.003 (0.001)	-0.002 (0.002)	0.001 (0.001)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	-0.010 (0.023)	-0.017 (0.032)	-0.025 (0.044)	-0.024 (0.053)
Panel B: Prepayment Likelihood				
Affiliated	-0.002 (0.005)	0.002 (0.012)	0.004 (0.015)	0.006 (0.020)
Same Issuer - Underwriter	0.003 (0.001)	-0.002 (0.001)	-0.006 (0.002)	0.003 (0.002)
Linked Originator-UW at 75%	0.002 (0.001)	0.004 (0.002)	0.008 (0.002)	0.009 (0.003)
Affiliated*Same(Issuer/UW)	0.008 (0.008)	0.008 (0.018)	0.009 (0.032)	0.003 (0.028)
Affiliated*Originator-UW (75%)	-0.004 (0.014)	-0.005 (0.029)	-0.014 (0.041)	-0.018 (0.045)
Same(Issuer/UW)*Originator-UW (75%)	-0.011 (0.001)	-0.013 (0.002)	-0.016 (0.003)	-0.015 (0.003)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	0.000 (0.018)	-0.001 (0.034)	0.010 (0.056)	0.011 (0.055)

Additional variables not currently displayed include: Number of Months between Origination and Securitization, Performance Months, Interest Rate Spread, ln(Loan Balance at Securitization), Months to Maturity from Securitization, Fico, LTV Waterfall, Fixed Rate Indicator, Property type, Owner-Occupied Indicator, Refinance Indicator, Documentation Type, 1st Lien Indicator, and Issuer FE, State FE, Origination Year Month FE. The figures in parentheses report the standard deviations of the sample of estimates from 10 test iterations.

9 Appendix

Table I.1. Summary of Tranche Subordination for Affiliated Tranches

Rating	Count
AAA	69
AA+	0
AA	2
AA-	0
A+	0
A	2
A-	0
BBB+	0
BBB	1
BBB-	0
BB+	1
BB	0
B	0
B-	0
CCC	0
CC	0
D	0
NA	0

Displaying the counts of the highest ratings Affiliated tranches receive across S&P, Fitch, and Moody's ratings. Differences in counts between Affiliated deals and Affiliated tranches is explained by the fact that investors are investing in more than one tranche within a deal.

Table I.2. Ex Ante First Stage Summary Estimation of Prepayment

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Interest Rate Spread	0.034	0.050	0.048	0.045
	2.9%	3.8%	4.4%	4.1%
Loan Balance	0.053	0.080	0.084	0.079
	4.2%	6.2%	6.9%	6.8%
Months to Maturity*	0.000	0.177	0.247	0.276
	0.0%	0.0%	0.0%	0.0%
FICO*	0.261	0.210	0.073	-0.105
	0.0%	0.1%	0.1%	0.1%
LTV Waterfall*	-0.418	0.042	0.743	1.334
	0.1%	0.1%	0.1%	0.1%
Fixed Rate	-0.052	-0.073	-0.088	-0.112
	7.6%	5.3%	5.6%	5.9%
Single Family Property	0.018	0.009	0.014	0.020
	5.8%	7.4%	7.4%	6.5%
Condo	0.011	0.013	0.028	0.036
	6.3%	7.3%	6.7%	6.0%
Townhome	0.002	0.008	0.011	0.015
	1.1%	2.9%	4.3%	6.0%
PUD	0.022	0.019	0.027	0.034
	6.5%	7.7%	7.8%	7.1%
Property Type Other	-0.018	-0.025	-0.004	0.004
	8.6%	10.9%	7.7%	7.9%
Owner Occupied	0.016	0.038	0.048	0.058
	4.9%	6.5%	5.8%	4.3%
Purpose Refi	0.022	0.024	0.020	0.009
	3.0%	2.6%	2.1%	1.4%
Low Documentation	0.001	0.011	0.019	0.016
	1.7%	2.5%	2.5%	2.3%
No Documentation	0.002	-0.012	-0.022	0.035
	10.1%	12.3%	13.7%	4.9%
1st Lien	-0.029	-0.079	-0.090	-0.068
	4.9%	8.1%	11.1%	11.1%
Average Adjusted R-sqr	0.040	0.059	0.067	0.072
# Quarters	19	17	15	13

Displaying the average coefficients from the first-stage benchmark sample estimates from the ex ante rolling window analysis. The benchmark samples include loans securitized prior to the securitization quarter sample where the gap between benchmark and securitized samples matches the performance window being considered. The percentages report the share of coefficients from the rolling window estimates that are significant at the 5% level. (*) These estimates have been multiplied by 1,000 for displaying.

Table I.3. Ex Ante First Stage Summary Estimation of Default

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Interest Rate Spread	0.006	0.011	0.013	0.015
	0.3%	0.6%	0.8%	0.9%
Loan Balance	0.001	-0.001	-0.005	-0.008
	0.4%	0.5%	0.5%	0.5%
Months to Maturity*	-0.010	-0.009	-0.018	-0.026
	0.0%	0.0%	0.0%	0.0%
FICO*	-0.136	-0.220	-0.243	-0.244
	0.0%	0.0%	0.0%	0.0%
LTV Waterfall*	0.110	0.203	0.260	0.290
	0.0%	0.0%	0.0%	0.0%
Fixed Rate	-0.007	-0.014	-0.018	-0.020
	0.3%	0.5%	0.7%	0.8%
Single Family Property	0.002	0.002	0.005	0.005
	0.6%	0.9%	0.7%	0.7%
Condo	-0.001	-0.003	-0.001	-0.003
	0.6%	1.0%	0.7%	0.7%
Townhome	-0.003	-0.007	-0.004	-0.003
	0.6%	1.2%	0.6%	0.6%
PUD	0.000	-0.001	0.003	0.002
	0.7%	1.0%	0.6%	0.6%
Property Type Other	0.005	0.007	0.008	0.007
	0.8%	0.8%	1.0%	0.9%
Owner Occupied	0.003	0.003	0.003	0.004
	0.2%	0.3%	0.3%	0.5%
Purpose Refi	-0.004	-0.004	-0.003	-0.001
	0.6%	0.7%	0.4%	0.3%
Low Documentation	0.003	0.006	0.006	0.005
	0.3%	0.5%	0.5%	0.4%
No Documentation	0.006	0.011	0.015	0.016
	0.6%	0.9%	1.0%	1.2%
1st Lien	0.009	0.020	0.028	0.039
	1.4%	3.0%	4.2%	5.3%
Average Adjusted R-sqr	0.025	0.045	0.056	0.064
# Quarters	19	17	15	13

Displaying the average coefficients from the first-stage benchmark sample estimates from the ex ante rolling window analysis. The benchmark samples include loans securitized prior to the securitization quarter sample where the gap between benchmark and securitized samples matches the performance window being considered. The percentages report the share of coefficients from the rolling window estimates that are significant at the 5% level. (*) These estimates have been multiplied by 1,000 for displaying.

Table I.4. Ex Post Marginal Effects Associated with the Logistic Estimation of Prepayment

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Affiliated	0.002 (0.005)	0.014 (0.011)	0.017 (0.014)	0.038*** (0.014)
Same Issuer - Underwriter	0.003 (0.005)	-0.001 (0.011)	-0.006 (0.014)	0.003 (0.016)
Linked Originator-UW at 75%	-0.001 (0.003)	0.001 (0.006)	0.004 (0.007)	0.009 (0.009)
Affiliated*Same(Issuer/UW)	-0.006 (0.010)	-0.055*** (0.021)	-0.030* (0.018)	-0.057*** (0.018)
Affiliated*Originator-UW (75%)	0.008 (0.006)	-0.003 (0.013)	-0.003 (0.015)	-0.033* (0.017)
Same(Issuer/UW)*Originator-UW (75%)	-0.008* (0.005)	-0.012 (0.008)	-0.012 (0.011)	-0.016 (0.012)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	-0.015 (0.010)	0.004 (0.024)	0.009 (0.019)	0.055*** (0.020)
Lag (Securitization - Origination)	-0.000*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.003*** (0.000)
Performance Months	-0.072*** (0.001)	-0.052*** (0.001)	-0.039*** (0.000)	-0.031*** (0.000)
Interest Rate Spread	0.001* (0.001)	-0.004*** (0.001)	-0.012*** (0.001)	-0.015*** (0.001)
Loan Balance	0.002** (0.001)	-0.005*** (0.002)	-0.013*** (0.002)	-0.020*** (0.003)
Months to Maturity*	0.000* (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
FICO*	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
LTV Waterfall*	-0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Fixed Rate	-0.007*** (0.002)	-0.014*** (0.004)	-0.014*** (0.005)	-0.027*** (0.006)
Single Family Property	0.008*** (0.001)	0.005*** (0.002)	0.005** (0.002)	0.005** (0.002)
Condo	0.005*** (0.001)	-0.001 (0.002)	0.001 (0.002)	0.002 (0.002)
Townhome	0.009** (0.004)	0.014** (0.006)	0.017** (0.007)	0.025** (0.012)
PUD	0.011*** (0.001)	0.007*** (0.002)	0.006*** (0.002)	0.005** (0.003)
Owner Occupied	-0.002** (0.001)	0.005*** (0.002)	0.006*** (0.002)	0.015*** (0.002)
Purpose Refi	0.008*** (0.001)	0.010*** (0.002)	0.013*** (0.002)	0.013*** (0.002)
Low Documentation	0.002** (0.001)	-0.001 (0.001)	-0.006*** (0.002)	-0.011*** (0.002)
No Documentation	0.011*** (0.002)	0.010*** (0.003)	0.008** (0.004)	0.005 (0.004)
1st Lien	-0.007 (0.006)	-0.011 (0.010)	-0.020 (0.015)	-0.022* (0.012)
Issuer, State, Origination Year/Month FE	Y	Y	Y	Y
# Loans	1,143,175	1,143,175	1,116,274	999,729
# Deals	393	393	383	340
Pseudo R-sqr	0.526	0.511	0.519	0.505

The figures in parentheses report standard errors of the coefficient estimates clustered at the deal level where 1, 2, and 3 stars indicate statistical significance at 10%, 5%, and 1%, respectively.

Table I.5. Ex Post Marginal Effects Associated with the Logistic Estimation of Default

Explanatory Variable	Performance Window			
	6 Months	12 Months	18 Months	24 Months
Affiliated	0.003 (0.003)	0.007 (0.005)	0.009 (0.008)	0.022** (0.010)
Same Issuer - Underwriter	0.007*** (0.002)	0.016*** (0.005)	0.020** (0.008)	0.017 (0.016)
Linked Originator-UW at 75%	0.003*** (0.001)	0.005*** (0.002)	0.009*** (0.002)	0.009*** (0.003)
Affiliated*Same(Issuer/UW)	-0.008 (0.006)	-0.014 (0.010)	-0.040*** (0.013)	-0.053*** (0.017)
Affiliated*Originator-UW (75%)	-0.001 (0.004)	-0.005 (0.006)	-0.003 (0.009)	-0.017 (0.011)
Same(Issuer/UW)*Originator-UW (75%)	-0.003* (0.002)	-0.004* (0.003)	-0.003 (0.004)	-0.001 (0.005)
Affiliated*Same(Issuer/UW)*Originator-UW (75%)	0.013** (0.006)	0.019** (0.008)	0.024 (0.015)	0.038** (0.017)
Lag (Securitization - Origination)	0.000** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Performance Months	-0.011*** (0.000)	-0.009*** (0.000)	-0.007*** (0.000)	-0.004*** (0.000)
Interest Rate Spread	0.002*** (0.000)	0.004*** (0.000)	0.004*** (0.001)	0.004*** (0.001)
Loan Balance	0.004*** (0.001)	0.006*** (0.001)	0.008*** (0.001)	0.009*** (0.002)
Months to Maturity*	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
FICO*	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)
LTV Waterfall*	0.000*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Fixed Rate	-0.003*** (0.001)	-0.005*** (0.001)	-0.009*** (0.002)	-0.013*** (0.003)
Single Family Property	-0.004*** (0.001)	-0.008*** (0.001)	-0.011*** (0.001)	-0.011*** (0.001)
Condo	-0.006*** (0.001)	-0.011*** (0.001)	-0.016*** (0.001)	-0.016*** (0.002)
Townhome	-0.011*** (0.002)	-0.018*** (0.003)	-0.021*** (0.004)	-0.022*** (0.006)
PUD	-0.007*** (0.001)	-0.012*** (0.001)	-0.014*** (0.002)	-0.013*** (0.002)
Owner Occupied	0.002*** (0.001)	0.000 (0.001)	-0.005*** (0.002)	-0.009*** (0.002)
Purpose Refi	-0.007*** (0.001)	-0.010*** (0.001)	-0.012*** (0.002)	-0.017*** (0.002)
Low Documentation	0.007*** (0.001)	0.016*** (0.001)	0.027*** (0.002)	0.033*** (0.002)
No Documentation	0.008*** (0.001)	0.017*** (0.002)	0.025*** (0.003)	0.031*** (0.004)
1st Lien	0.001 (0.002)	0.004 (0.003)	0.005 (0.004)	0.002 (0.006)
Issuer, State, Origination Year/Month FE	Y	Y	Y	Y
# Loans	1,138,560	1,143,140	1,116,241	999,708
# Deals	393	393	383	340
Pseudo R-sqr	0.364	0.347	0.325	0.294

The figures in parentheses report standard errors of the coefficient estimates clustered at the deal level where 1, 2, and 3 stars indicate statistical significance at 10%, 5%, and 1%, respectively.