DIFFERENCES ACROSS ORIGINATORS IN CMBS LOAN UNDERWRITING*

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Abstract

Differences in the organizational structure of CMBS loan originators may reflect differences in the incentives they face for underwriting risky loans. We treat an originator's type — that is, commercial bank, investment bank, insurance company, finance company, conduit lender, or foreign-owned entity — as a proxy for incentives related to warehousing risk, balance sheet lending, and regulatory constraints. After controlling for observable credit characteristics of over 30,000 loans securitized into CMBS after 1999, we find considerable differences in loan performance across originator types. The results suggest that moral hazard — captured by lack of warehousing risk — negatively affected the quality of loans underwritten by conduit lenders. On the other hand, despite opportunities for adverse selection, balance sheet lenders — commercial banks, insurance companies and finance companies — actually underwrote higher quality loans.

*The views expressed are the authors' and do not necessarily reflect the views of the Federal Reserve System or the Board of Governors.

1 Introduction

While problems in the residential mortgage market are often cited as a principal cause of the financial crisis of 2008, the deteriorating performance of commercial real estate (CRE) loans is viewed by many as a "second wave" that likely extended the crisis. Distortions in the incentives of the originators of mortgages securitized into both residential mortgage-backed securities (RMBS) and commercial mortgage-backed securities (CMBS) have been the focus of considerable attention from the media, Congress, and government regulators.

While originators of securitized loans are all subject to market discipline in some form, differences in organizational structure imply that firms face heterogeneous incentives when originating commercial mortgages for securitization. In particular, differences in originators' warehousing risk, the presence of a balance sheet lending operation, and the extent to which the originator is regulated, may affect the quality of loan underwriting. Indeed, the observed performance of loans securitized in CMBS, as measured by 60-day delinqency rates, differs considerably across originators even after controlling for observable risk characteristics of the loans.

To assess the extent to which these unexplained differences in performance reflect differences in incentives, we study the performance of more than 30,000 commercial mortgages that have been securitized since the year 1999. Specifically, we compare the performance of securitized loans originated by commercial banks, investment banks, insurance companies, finance companies, foreign-owned entities, and domestic conduit lenders. Heterogeneity in the organizational structures across originator types allows us to make general inferences about the effect of differing incentives on underwriting standards.

Our results suggest that both moral hazard and the presence of a CRE balance sheet lending operation are significant factors in CMBS loan performance. Domestic conduit lenders, who face a greater moral hazard due to their lack of exposure to warehousing risk and low capitalization, have significantly greater delinquency rates overall, especially in the later vintage years. By contrast, we find that loans originated by firm types that originate CRE loans for their balance sheets — i.e., commercial banks, insurance companies, and finance companies — had lower delinquency rates on securitized loans compared with loans originated by non–balance-sheet lenders. This finding suggests that balance sheet lending may result in positive spillovers, either through superior underwriting technology or more conservative corporate culture; that is, adverse selection due to balance sheet lending appears to be outweighed by other factors.

The remainder of the paper is organized as follows. Section 2 provides background

on CMBS and related research. Section 3 presents the data and summary statistics. Sections 4 and 5 describe two alternative approaches we use to model commercial mortgage performance, along with our results using each approach. Section 6 concludes.

2 CMBS Background

2.1 The CMBS Market

CMBS has grown rapidly to become a significant source of debt financing for commercial mortgages. The modern CMBS market began in the 1990s when the Resolution Trust Company issued securities backed by commercial mortgages held by insolvent savings and loans. CMBS currently accounts for about a quarter of outstanding CRE loans[1] and accounted for almost 40 percent of the CRE loans originated in 2007. Loans securitized in CMBS are typically backed by established, income-generating properties, with longer terms than CRE loans held on the originator's balance sheet. Up through 2004, the typical CMBS loan had a fixed interest rate with a 30-year amortization schedule and a balloon payment after 10-years. Loans with interest-only periods and shorter terms became more prevalent after 2004.[2]

CMBS securities are issued by large investment banks and commercial banks that have investment banking subsidiaries. To bring a CMBS deal to market, the issuer must accumulate mortgages into a "shelf", which is usually maintained by the investment bank issuing the securities, until there are enough loans to form a CMBS pool of the desired size. Some of the mortgages may have been originated directly by the issuer and some may have been purchased from other originators. The risk that an investment bank may not be able to securitize the loans in a shelf is one type of warehousing risk, though the notion of warehousing risk considered in this paper stems from internal warehousing facilities specific to a particular originator. From 2005 to 2007, shelf lives were very short due to the high volume of CMBS that were being issued.

CMBS pools contain far fewer mortgages – typically between 40 and 250 – than RMBS pools, they also have a simpler capital structure.[3] Furthermore, CMBS pools are backed

[1] Federal Reserve Board's Flow of Funds Table L.220.

[2] Floating rate loans comprised a small portion of the CMBS market and we do not include them in our empirical analysis. These loans were almost exclusively made on properties without established cash flows.

[3] Subordination is the only form of credit support in CMBS, cash flows are paid out in order of seniority, only the most senior tranches receive principal payments at any given time, and the holders of the first loss tranche control the resolutions of any defaulted loans.

by income generating commercial properties as opposed to owner-occupied residential properties. Data on the underlying collateral, including the rental income history for the underlying properties in CMBS pools are widely available in a standard form as specified in the CRE Finance Council Investor Reporting Package (IRP). Indeed, credit rating agencies and CMBS investors with a first loss position (known as B-piece buyers) conduct due diligence upon and re-underwrite the majority of the loans in a given CMBS pool. As a result, CMBS pricing and credit ratings are more sensitive to the perceived credit quality of individual loans rather than model-generated default probabilities derived from distributions of borrower and loan characteristics, which is the case for RMBS. Thus, our focus on the quality of individual loans seems particularly appropriate for the CMBS market.

The period between 2005 and 2007 was characterized by a well-documented loosening of underwriting standards, similar to that seen in the residential market. For example, lenders would base reported DSCRs on estimates of future rents, rather than on current or historical rental income. Loans were also underwritten for properties with much lower capitalization rates than the historical average,[4] which implied larger appraisal values for properties generating a given income stream. Many borrowers also took out second liens and "mezzanine debt" to increase their overall leverage. To the extent that originator types differed over how tight or loose their underwriting standards were, we would expect to see type-specific effects on loan quality, controlling to observable loan characteristics.

2.2 CMBS originators

Differences in CMBS loan underwriting standards may be in response to the existence of differences in incentives across the six *types* of originators: commercial bank, investment bank, insurance company, finance company, foreign entity, domestic conduit lenders. We make the key assumption that organizational structures differ primarily across originator types as opposed to within a given type. While ex-ante, all of the originator types faced the same degree of moral hazard inherent in the originate-to-distribute model, the six originator types differ with respect to warehousing risk, balance sheet lending, and the extent to which they were regulated during the sample period. Warehousing risk and regulation of the originators' on balance sheet activities might this mitigate moral hazard, but the presence of a balance sheet lending operation might result in adverse selection of

[4]The capitalization rate on a property is defined as $\frac{NOI}{Market\ value}$, where the numerator (NOI) is the annual net operating income and the denominator is the property value assigned by the loan underwriter.

those loans that are securitized.

We use data from the National Information Center (NIC) to identify the top-holder of the originators in our sample, which allows us to group the originators into types. The NIC provides charter codes for commercial banks and insurance companies, and we classified the remaining originators by hand using institutional knowledge including discussions with market participants. Foreign entities were classified as commercial (investment) banks if their parent had a domestic subsidiary whose operations were comparable to domestic commerical (investment) banks. For example, subsidiaries of RBS and Nomura were classified as commerical and investment banks, respectively, since both institutions had substantial U.S. operations comparable to domestic commercial and investment banks. Market participants also helped to identify domestic conduits, which are typically smaller firms that with a CRE focus that almost exlusively originate loans for securitization. We now discuss how the specific originator types face differing incentives; the content of this discussion is summarized in Figure 1.

2.2.1 Warehousing Risk

Originators differ significantly in their degree of exposure to loans during the securitization process. While all lenders must at least initially hold an originated loan on their books, the length of time that each firm is exposed to this risk varies greatly. Originators with larger balance sheets are generally willing to warehouse loans internally for longer periods of time. Industry sources have confirmed that commercial banks, insurance companies, investment banks, and finance companies warehoused loans internally. Indeed, many warehoused CMBS loans, particularly large floating-rate loans that were originated by investment banks on hotel properties, were trapped in internal warehouse facilities when the CMBS market shut down in the fall of 2007, which increased the stress on the balance sheets of the investment banks holding them.

Domestic conduit lenders, who are smaller and hold relatively less capital, are designed to minimize warehousing risk. In practice they may hold loans for a month or so, but they generally close on loans very close to the date at which the CMBS are issued. Sources of funding for warehousing by domestic conduit lenders were generally short-term lines of credit and/or repurchase agreements. Less is known about the warehousing risk of foreign entities, however. Many of these entities, though similar to conduit lenders, are subsidiaries of large European financial firms and thus, may have access to internal sources of funding for purposes of warehousing loans prior to securitization. While we suspect

that many foreign entities incurr some warehousing risk, the ability to do so depends upon the relationship with the parent, which we do not observe.

2.2.2 Balance Sheet Lending.

CMBS originators that also originate CRE loans for their balance sheets may be subject to several factors that affect underwriting loans for securitization. On the one hand, balance sheet lenders have the ability to engage in adverse selection since the originator must choose which loans to securitize. Most of the time, this decision is made when the loan is originated since CMBS loans have different longer terms than CRE held on balance sheet. Characteristics that are unrelated to a loan's performance but that make it more favorable to investors may also affect which loans are securitized.

Notwithstanding the opportunity to engage in adverse selection, balance sheet lenders may have better underwriting due to spillovers from their CRE underwriting technology. That is, the risks associated with balance sheet lending are likely to induce firms to invest in better underwriting technology and have loan officers with more experience. Both of these factors could spill over into underwriting loans for securitization, particularly when loan officers underwrite loans for both the balance sheet and securitization. In addition, balance sheet lenders may have a more conservative lending orientation either due to corporate culture or the fact that they tend to be better capitalized. Several recent papers (see Keys et al., 2009; and Purnanandam, 2009) have found that firms with higher capital (i.e. those with more conservative balance sheets) have also tended to originate less risky securitized residential mortgages.

Commercial banks, insurance companies, and finance companies all engaged in balance sheet lending during our sample period. Conduit lenders, by definition, did not. Investment banks held some CRE on their balance sheets, but these were typically floating rate, and/or syndicated loans with significantly larger balances than typical CMBS loans.[5] As a result, we view investment banks as being non balance-sheet lenders for purposes of this paper.

2.2.3 Regulation of originators

Regulation of a CMBS originators could affect underwriting in at least three ways. First, the institution's regulator may examine the quality of loans destined for securitization,

[5]Investment banks also held a fair amount of mezzanine debt, which is not securitized into CMBS.

particularly if internally warehousing periods are relatively long. Similarly, a regulator might be concerned about a firms' originating loans with risk characteristics and performance that differ markedly from loans held on balance sheet. Finally, regulated firms may have a more conservative corporate culture, which could affect CMBS underwriting. Commercial banks and insurance companies were the only originator types that were subject to regulation during the sample period. While most of the investment banks in the sample are now subject to regulation, they were not during the sample period.

2.3 Related Literature

To our knowledge, our paper is one of the first to focus expressly on the impact of the originate-to-distribute model on the quality of commercial mortgages. Other related papers explore similar issues using data on residential mortgages. For example, Purnanandam (2009) finds evidence that the capital structure of originators of securitized residential loans impacts the subsequent performance of such loans. Keys et al. (2009) find that balance sheet lenders, when compared to less regulated lenders, provide lower quality residential loans to the securitized market. This finding runs counter to our results, although the authors find a positive correlation of higher loan quality with strong internal risk management, better capitalization, and "skin in the game." The conflicting results may be attributable to a higher degree of adverse selection in the residential market. Residential pools are less transparent regarding individual loans and models are often used to analyze the risk exposure of the residential pools rather than the loan level analysis common in the CMBS market.

In general, there has been more work on the residential mortgage market than the commercial side, partly due to the lack of data on historical commercial loan performance. Many early studies were limited to data from one or more life insurance companies (Synderman 1991, Esaki et al. 1999, Vandell et al. 1993, Ciochetti et al. 2003). More recent studies using data from the CMBS market include Ambrose and Sanders (2001) and Deng et al. (2004). These papers, as well as Archer et al. (2002), find evidence that the original loan terms may be correlated with unobserved loan or borrower characteristics. This may result in tighter 'observeable' underwriting (i.e. lower LTVs, higher DSCRs) being correlated with worse loan performance. The lender might demand lower LTVs or higher DSCRs to compensate for some high risk associated with the loan that is unobservable.

We attempt to minimize the severity of the potential bias caused by such unobservable risks by including additional measures that are observable at origination, such as the

occupancy rate of the underlying properties and the coupon rate on the loan. The coupon rate on commercial mortgages is correlated with their observable risk factors, as shown in An et al. (2009). We depart from the approach of several of these papers, including Seslen and Wheaton (2005), by *not* including contemporaneous variables, despite their ability to improve predictions of default risk. Some of the differences in loan performance across originator type may be due to differences in the quality of underwriting as reflected in the accuracy of the reported credit characteristics at origination. If we were to use contemporaneous credit characteristics, we would miss this potential impact.

Our paper is closely related to other recent work on securitized commercial loans that explores correlations between loan quality and characteristics of the originator or the CMBS deal. Titman and Tsyplakov (2010) use data on the financial status of originators to show that companies undergoing serious financial stress often see the quality of their underwriting decline as they push more marginal loans into securitized pools. Using data from the early period in the historical development of CMBS (from 1994 to 2000), An et al. (2010) explore differences in loan pricing between "conduit" and "portfolio" loans. In addition to the earlier time horizon, another key distinction between their paper and ours is the difference in how loans are categorized. Our definition of a *conduit* is based on the type of *originator*. By contrast, the An et al. definition of a *conduit* is based on the type of *pool* into which a loan is placed. Pools for conduit CMBS deals contain loans from multiple lenders, which may be of any type, while pools for portfolio CMBS deals contain loans that all come from a single lender. Based on this alternative categorization, "conduit" transactions over 1994–2000 enjoyed a premium over portfolio transactions.

3 Data and Summary Statistics

Our data come from Realpoint LLC, a CMBS data provider and, since 2008, a subscription-based rating agency. The loans in our sample were originated between 1999 and 2007. For each loan, we observe information on loan terms at origination as well as the date at which a loan first became delinquent from origination through June 2010. Loan and property characteristics at the time of origination include debt-to-service coverage ratio (DSCR), loan-to-value (LTV) ratio, occupancy rate, coupon spread (the contractual interest rate on the loan net of the rate on U.S. Treasuries for the corresponding maturity that were issued in the month of origination[6]), loan amount (the original principal balance), and the name of the originator, which we linked up with our originator-type classifications.

[6]We interpolated rates for maturities not offered by the U.S. Treasury.

We use the observed payment history of each loan to constuct our delinquency measure, which considers a loan to be delinquent at the point at which it either becomes officially reported as being 60 or more days late in payment, or enters special servicing.[7] Commercial mortgages can become delinquent at any point during the course of the loan or at maturity, when there is typically a balloon payment for the final principal balance. To construct our dependent variable, we use the date on which each loan first becomes delinquent, with the reporting date of July 2010 serving as a censoring variable.

To get a sense of cumulative delinquency rates, Table 1 shows the proportion of loans that were ever delinquent for each type of originator. Insurance companies have the lowest incidence of delinquency (4.68 percent), followed by commercial banks (7.68 percent) , and then finance companies (8.76 percent) and investment banks (8.93 percent). Foreign entities and domestic conduits have the highest incidence of delinquency (10.10 percent and 12.89 percent, respectively).[8]

Differences in default rates across orginator types may be due to differences in loans characteristics, both observable and unobservable. Table 2 provides summary statistics for credit risk measures that were observed at the time of origination for each type of originator. Loans underwritten by finance companies, foreign entities and domestic conduits appear riskier on average, based on observed DSCRs, occupancy rates, coupon spreads, and LTVs. Thus, it is possible that the relatively inferior performance of loans originated by foreign entities and domestic conduits can be explained by observable factors, though the relatively superior performance of finance companies suggests that there may also be unobserved factors contributing to loan performance. Unobserved factors affecting loan performance, conditional on observed loan characterstics, include overly agressive underwriting of DSCRs and LTVs, or coupon spreads that do not fully reflect the risk of default based on the other observed loan characteristics.[9]

[7]We also consider an alternative definition that defines a loan to be delinquent at the point in time at which it enters Realpoint's "watchlist," a special category reserved by the rating agency for loans in danger of defaulting. The latter category covers a larger number of loans (15.8 percent as opposed to 3.9 percent), but the two definitions produce qualitatively similar findings, so in our Results section, we only report findings for the definition based on loans being 60 days late or in special servicing.

[8]The incidence of delinquency, as defined in this paper, is different than that of a delinquency rate which is the proportion of delinquent loans at any point in time.

[9]Unobserved loan characteristics could also explain coupon spreads. In addition, loan compositions by originator type and risk premia may have changed over time. Thus, it is not possible to draw a strong conclusion about how risk was priced based solely on the summary statistics.

4 Binary Logit Model

To determine the sources of differences in performance across originators, we estimate the effects of various loan characteristics as of origination on delinquency rates. This allows us to identify differences across originator types that cannot be accounted for by observed loan characteristics; these differences could then be attributed to more agressive or lower quality underwriting. Specifically, we treat each loan as a single observation and model the behavior of the loan as a binary outcome in which the loan either does or does not become delinquent at any point in the sample period prior to July 2010.[10] We assume that the latent function determining delinquency is linear in loan characteristics as of origination, the originator's type, and an error term. logit (Extreme Value Type I) error. In particular, we assume that:

$$y_i^* = x_i\beta + \varepsilon_i$$

where x_i includes the explanatory variables summarized in table 2, as well as vintage dummies interacted with originator type.[11] The outcome variable, whether a loan becomes delinquent during the sample period, is determined by the value of the laten variable y_i^*, which we do not observe.

$$\begin{aligned} y_i &= 1 \text{ if } y_i > 0 \\ y_i &= 0 \text{ if } y_i \leq 0 \end{aligned}$$

Assuming that ε_i is independently distributed Type 1 Extreme Value, the probability of delinquency has the logit form:

$$\Pr\left[y_i = 1\right] = \frac{e^{x_i\beta}}{1 + e^{x_i\beta}}$$

Table 3 summarizes the maximum likelihood estimates from the binary logit model.

[10] As a robustness check, we estimate a multinomial logit specification in which we distinguish between two types of non-delinquent loans: loans that prepay at some point in time and loans that neither become delinquent nor prepay but simply pay on time throughout the sample period. The results using this specification, which are qualitatively similar to those presented below, are presented in Appendix 1.

[11] The vintage dummies will help control for the fact that older loans have more time to become delinquent.

With the exception of the DSCR, whose effect is not statistically significantly different from zero, all of the characteristics as of origination have the expected effect on the probability of delinquency. Namely, higher occupancy ratios are associated with less delinquency, while higher coupon spreads, loan amounts, and loan-to-value ratios are associated with greater delinquency.

The estimated effects of the dummy variables for originator type indicate that, even after controlling for observed loan characteristics, loans originated by commercial banks and insurance companies have a lower propensity to become delinquent. Among all the originator-type categories, loans originated by insurance companies are the least likely to become delinquent, with the model implying a 4.8% probability of becoming delinquent when evaluated at the sample means of the origination characteristics (see right column of Table 3), compared to a 6.3% probability for loans originated by commercial banks. The performance of loans originated by finance companies is not much different from the performance of loans originated by commercial banks, while loans originated by investment banks and foreign entities perform somewhat worse. Loans originated by domestic conduits have the worst performance of all, with the model implying a 10.6% delinquency probability when evaluated at the sample means of the characteristics as of origination.

The vintage dummies show that loans originated in 2005 and 2006 are more likely to have become delinquent at some point before July 2010 than loans originated before 2005, despite the fact that the newer loans have had less time over which to become delinquent. On the other hand, loans originated in 2007 are significantly less likely to have become delinquent. For brevity, in Table 3 we do not report the estimated coefficients for the various interaction effects between vintage and originator type.

Table 4 reports the probability of delinquency conditional on vintage for each originator type; that is, the dummy variables for originator-type are vintage-specific and the other explanatory variables are evaluated at vintage-specific means. Given the cumulative nature of our delinquency measure, one would expect newer vintages to exhibit lower delinquencies than older ones. However, each type exhibits higher delinquencies in either the 2005 or 2006 vintage than loans originated prior to 2005. Domestic conduits stand out and experience the most drastic deterioration, with the conditional probability of delinquency increasing from 10.1% for loans originated prior to 2005, to 14.1% for 2005 loans, to 12.8% for 2006 loans. Moreover, while loans made in 2007 by the other originator types have yet to become delinquent at rates seen for the 2005 and 2006 vintages, the 13.3 percent of the conduit-originated loans from the latest vintage have already experienced a delinquency.

5 Hazard Model

As an alternative to the binary logit specification, we also estimate a model in which we treat the event of a loan becoming delinquent for the first time as a simple hazard process. A key advantage of the hazard approach is that it provides a way to control for censoring by the end of the sample period. The hazard function $h_i(t)$ is the probability of loan i becoming delinquent for the first time at an age of t, conditional on having never before been delinquent.[12] For simplicity, we make the Cox proportional hazards assumption. Namely, at all ages t, the hazard function for each loan i is proportional to a flexible, baseline hazard that varies nonparametrically over time, $h(t)$, with the proportion being determined by observable covariates x_i:

$$h_i(t) = h(t)exp(x_i'\beta)$$

As in the logit model, the covariates x_i are loan characteristics observed at the time of origination and include dummies for vintage and for the originator type. If we wanted to control for contemporaneously determined covariates — that is, loan characteristics that change over time — we could generalize the model by allowing x_i to also vary over time, but we choose not to do so for reasons given in Section 2.3.

Our dependent variable is T_i, the amount of time it takes for loan i to become delinquent. Because our data are truncated at July 2010, there is an additional variable indicating when a loan is censored. Prepaid loans by definition do not fail within the sample period, so we treat the censoring date for prepaid loans as July 2010.[13]

An advantage of the Cox model is that we can estimate the parameters β without estimating the baseline hazard $h(t)$. Our estimation approach, based on maximizing a partial likelihood function, exploits the fact that the probability of a particular loan i failing at age t, *conditional* on the failure of one of the loans that have survived to age t, does not depend upon $h(t)$. Thus, β can be identified by differences in delinquency outcomes at age t across loans that have survived up to age t. Specifically, let T_i^* denote

[12] In theory, we could also model the process of recovery from delinquency as well as subsequent episodes of delinquency following the initial one. However, this is not possible due to data limitations, because we only have information on the timing of the initial delinquency.

[13] We also estimated an alternative specification in which we treat the prepayment date as the censoring date. This specification has a somewhat different interpretation, but in practice produces very similar results. Given the similarity of the delinquency parameters in the binary and multinomial logit models (see Appendix 1), we have chosen not to estimate a competing hazard model.

either the time at which loan i becomes delinquent or the age of loan i at the censoring date, and let $A(t)$ denote the set of loans that have not experienced a delinquency through age t. The contribution of loan i to the partial likelihood is:

$$\prod_{t=0}^{T_i^*} \frac{e^{x_i'\beta}}{\sum_{j_t \in A(t)} e^{x_j'\beta}}$$

For further details, see Cox (1972). Table 5 shows the estimation results from our baseline model. The estimates are expressed in terms of hazard ratios, where a hazard ratio greater than one indicates that a covariate increases the probability of delinquency, whereas a coefficient less than one indicates a reduction in the probability of delinquency.

The loan characteristic coefficients, which are all significant at the 5 percent level except for the debt-to-service coverage ratio, have the expected magnitude relative to one. Higher coupon spread, loan amount, and LTV ratio all predict a greater probability of delinquency. In contrast, higher occupancy rate, which has an estimated coefficient of 0.98, predicts a lower probability of delinquency.

The ranking of the coefficients on the originator-type dummies are consistent with the unconditional differences in delinquency rates by originator type, as shown in Table 1, as well as the logit results shown in table 3. Commercial bank loans are the excluded category. Domestic conduits have the largest hazard ratio of 1.60, indicating that conduit loans are associated with a significantly higher probability of delinquency. Loans originated by foreign entities have the next highest hazard ratio of 1.33 and investment banks also have a hazard ratio significantly greater than one. In contrast, insurance firms have a hazard ratio of 0.77, which is significantly less than one. To summarize, after controlling for observable predictors of loan quality, loans originated by domestic conduits appear to perform the worst, followed by loans originated by foreign entities and then by investment banks. Loans originated by insurance companies exhibit the best performance, followed by commercial banks. and finance companies.

The estimation results can be depicted visually by plotting the implied cumulative hazard rates–that is, the probability that a loan becomes delinquent by a particular number of months after origination. Figures 2 and 3 show the cumulative hazard rates over the first 100 months (about 8 years) in the life of each loan starting from the origination date, averaged over all loans originated in 1999 (the earliest vintage in our data). Cumulative hazards are separately plotted for each originator type.

In Figure 2, we plot the average cumulative hazards evaluated at the mean loan char-

acteristics over the entire sample. As shown, loans issued by insurance companies exhibit the slowest increase in delinquencies. Over the first 60 months, this group's cumulative hazard only reaches 0.05. The next highest cumulative hazard rates, in ascending order, are commercial banks, finance companies, investment banks, and foreign entities. Consistent with the other results, conduits have the highest cumulative hazard rate. The rate for conduits increases more rapidly than the other originator types, such that the conduit cumulative hazard rate approaches almost 0.20 over the 100-month window.

Figure 3 shows a similar plot of the cumulative hazards, but evaluated at the mean loan characteristics for each type of originator. The cumulative hazards in this figure reflect the *total* differences in observed and unobserved loan characteristics across originator types. Therefore, differences across the two figures represent differences across originator types that are attributable to factors besides the observed loan characteristics. As can be seen by comparing Figures 2 and 3, controlling for observed loan characteristics only increases the apparent spread among originator types.

As a final comparison using the baseline hazard model, we run the hazard model separately for each originator type. This allows the hazard ratios for loan characteristics to also differ across originators. Figure 4 shows the cumulative hazards from this approach. As can be seen, the results are qualitatively similar to Figures 2 and 3. The ranking of cumulative hazards by originator type is the same, with insurance companies having the lowest cumulative hazard and conduits having the highest. Again, these results are consistent with the apparent differences across originators in their degree of moral hazard.

To show how delinquency rates vary across vintages of loan originations, Table 6 shows the Cox hazard regression results from an alternative specification that controls for vintage-specific effects. To most clearly show the shift in delinquency rates with the rapid growth in the CMBS market, we split our sample into three vintages: pre-2005, 2005–2006, and 2007. Column 1 indicates that the conditional probability of delinquency for the 2005–2006 vintage is more than twice that of loans originated before 2005. The conditional probability of delinquency is higher still for the 2007 vintage. It thus appears that there is heterogeneity across vintages in the riskiness of loans even after controlling for originator type and loan characteristics. Possible explanations of the elevated risk for later vintages include changes in the macroeconomic environment or changes in lending standards, and we do not attempt to identify the exact cause.

The last two columns of Table 6 report estimation results for specifications that include interactions between originator type and vintage. These results indicate that compared to the other groups, conduit-originated loans have a higher conditional probability of default

across all three vintages. Put differently, throughout the entire sample period, conduits continued originating loans that had riskier unobserved characteristics.

The implied cumulative hazards, split by vintage and evaluated at the mean loan characteristics over the entire sample, are shown in Figure 5. The figure indicates that after controlling for observed loan characteristics and originator type, loans originated before 2005 exhibit the slowest increase in cumulative hazard, followed by loans originated in 2005 and 2006. The fastest increase occurs for loans originated in 2007, rising to a cumulative hazard over 0.10 after the first 60 months.

Figure 6 graphs the cumulative hazards by originator type and vintage implied by the previous estimates, evaluated at the mean loan characteristics over the entire sample. As shown, the cumulative hazards are higher for later vintages for all six originator types. However, compared to the loans originated by commercial banks, the loans originated by conduits and foreign entities clearly deteriorate at a faster rate across vintages. The cumulative hazard for 2007-vintage loans originated by conduits rises to approximately 0.20 over the first 60 months. In contrast, the loans issued by insurance companies exhibit the least amount of deterioration across vintages. Even for 2007-vintage loans, the cumulative hazard remains below 0.10 for the first 60 months. These results show that there were differences across originators in the degree of deterioration in underwriting standards. Our results for domestic conduits indicate that the performance of loans made by these originators deteriorated the most, which is consistent with the greater degree of moral hazard for these originators.

5.1 Discussion

Across a variety of specifications, our results consistently rank loans originated by domestic conduits as having the worst performance (before and after conditioning for observed loan characteristics), with loans originated by foreign entities doing somewhat better. Loans originated by insurance companies had the best performance (unconditional and conditional), followed by commercial banks and finance companies. Loans originated by investment banks performed better than loans originated by domestic conduits and foreign entities, but worse than loans originated by insurance companies, commercial banks and finance companies. The ranking of originator types leads us to three main conclusions:

First, moral hazard appears to be somewhat mitigated to the extent that an originator is exposed to warehousing risk. If one takes seriously our characterization of firm types in Figure 1, the difference between the performance of loans originated by investment banks

and those originated by domestic conduits would be solely attributable to differences in warehousing risk. Warehousing risk is a form of risk retention — though not ideal due to its limited term.— and our results suggest that initiatives requiring ABS originators to retain some risk may promote better loan underwriting.

Second, the presence of a CRE balance sheet lending operation significantly increases loan performance. Rather than suffering from adverse selection, loans originated by balance sheet lenders — commercial banks, insurance companies, and finance companies — perform better than loans originated by firms that do not lend on their balance sheets. To be clear, our results do not suggest the absence of adverse selection, only that it is outweighed by other factors associated with balance sheet lending, such as better underwriting technology or institutional conservatism. Documenting specific mechanisms whereby balance sheet lending affects the quality of securitized loans would be a useful avenue for additional research.

Third, the similarity of commercial bank and finance company loan performance suggests that the presence of a bank regulator, the only dimension in which they differ in our characterization, did not increase the quality of securitized loans. On the other hand, the superior performance of loans originated by insurance companies could reflect differences in insurance regulation, though it may also capture greater institutional conservatism on the part of insurance companies.

6 Conclusion

The financial crisis has highlighted several ways in which the incentives of participants in securitization markets may have been misaligned with incentives one would expect to find in a well-functioning market. This paper considers the incentives of originators of commercial mortgages subsequently securitized into CMBS. Our results strongly suggest that poor performance was, at least in part, attributable to differences across types of originators that are correlated with potential incentive distortions.

Our results may be useful in informing current policy debates about securitization reform. Complete risk transfer appears to encourage moral hazard, perhaps due to the inability of market participants to overcome informational frictions. To the extent that the effect of informational frictions can be accurately priced into the securities, risk retention by originators may not be required. On the other hand, if pricing this risk is too difficult to make the securities economical, requiring originators to maintain skin-in-game by retaining some risk could be approriate. Such a measure would require a significant

overhaul of the originate-to-distribute business model, particularly for conduit lenders. Our results also suggest that there are significant complementarities associated with balance sheet lending and lending for securitization. In addition, risk retention requirements would be significantly less onerous, at least in terms of adjustments to the overall business model, for balance sheet lenders.

Finally, our results are subject to a number of caveats discussed throughout the paper. An important caveat is that we document relative differences in loan performance. We have no way to quantify how incentive distortions common to all types of originators affected loan performance. A second caveat is our assumption that differences across types of orginators reflect differences in incentives related to loan underwriting. To the extent that this assumption is not the case, the interpreation of our results would change. Nonetheless, the findings should be of independent interest. Given the differences across types of originator, exploring differences in business models would inform the debate on securitization reform.

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Figure 1: Institutional Features Affecting Underwriting

	Warehouse loans	Balance sheet lender	Regulated
Commercial Bank	X	X	X
Insurance Company	X	X	X
Investment Bank	X		
Finance Company	X	X	
Foreign Entity	Depends		
Domestic Conduit			

Figure depicts which institutional features of CMBS loan underwriting apply to each of the originator types. An "X" indicates that the originator type is characterized by the feature in the column heading. For example, commercial banks warehouse loans but domestic conduits do not.

Figure 2: Cumulative Hazards Evaluated at Sample Means

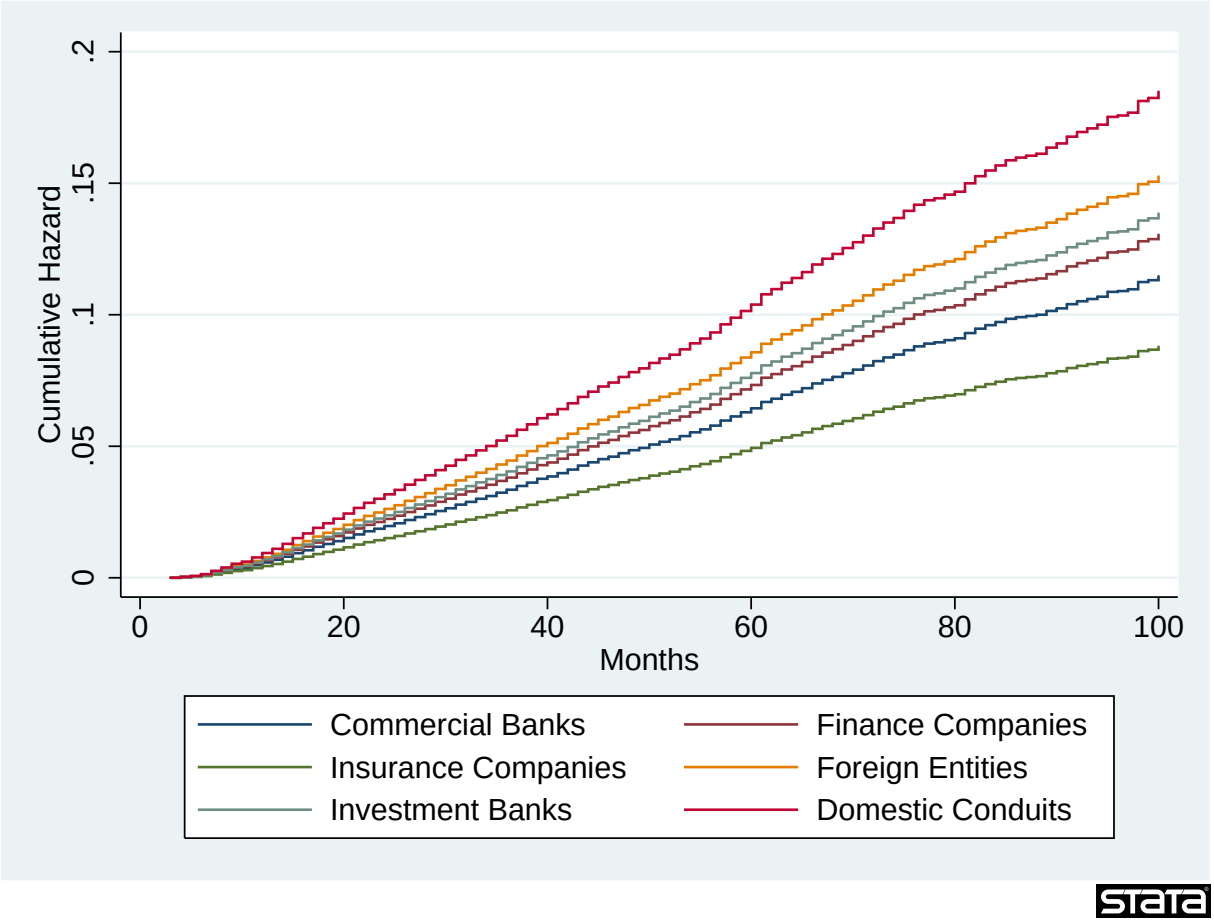

Figure depicts estimated cumulative hazard of default for loans originated by each lender type, evaluated with all other explanatory variables set to the overall sample mean.

Figure 3: Cumulative Hazards Evaluated at Means Conditional on Originator Type

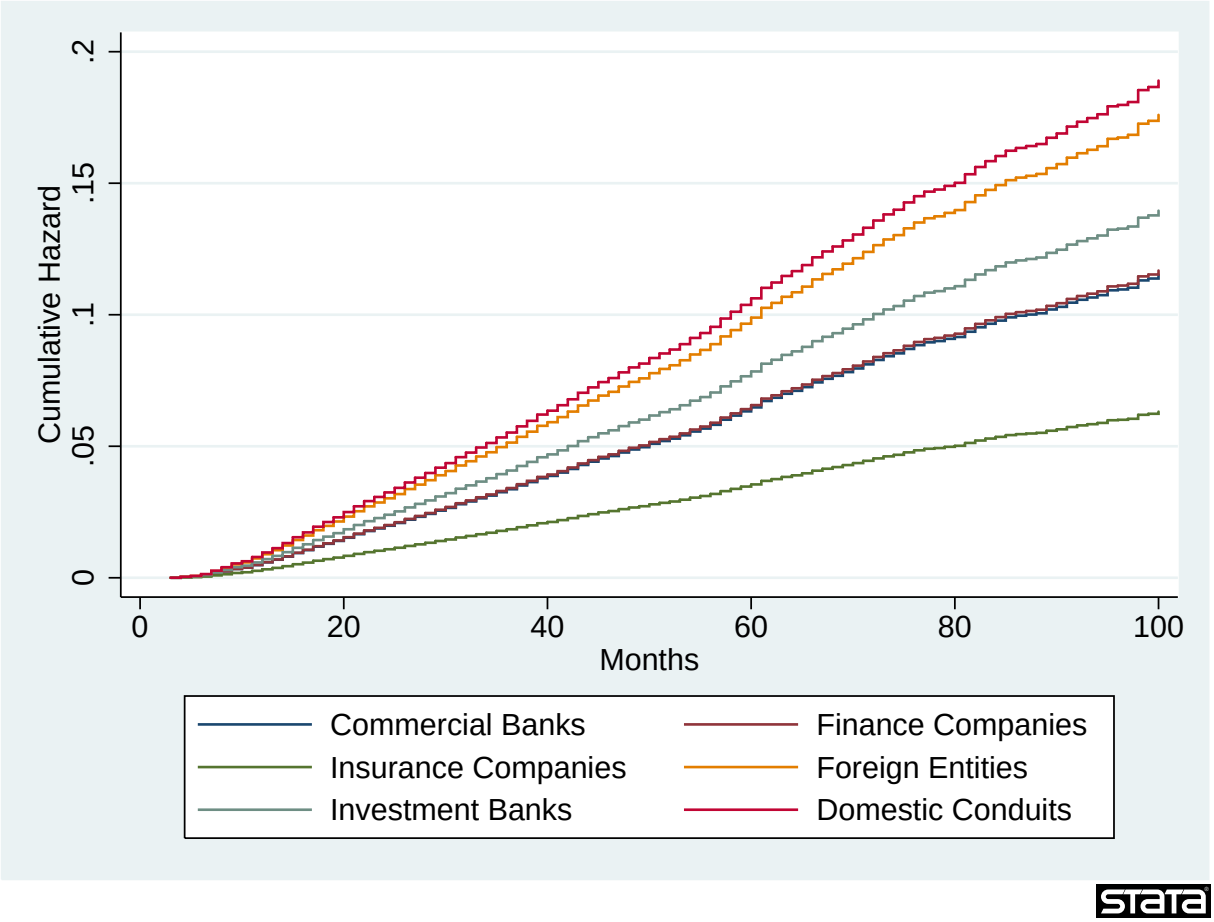

Figure depicts estimated cumulative hazard of default for loans originated by each lender type, evaluated with all other explanatory variables set to the means conditional on the lender type.

Figure 4: Cumulative Hazards Estimated Separately by Originator Type

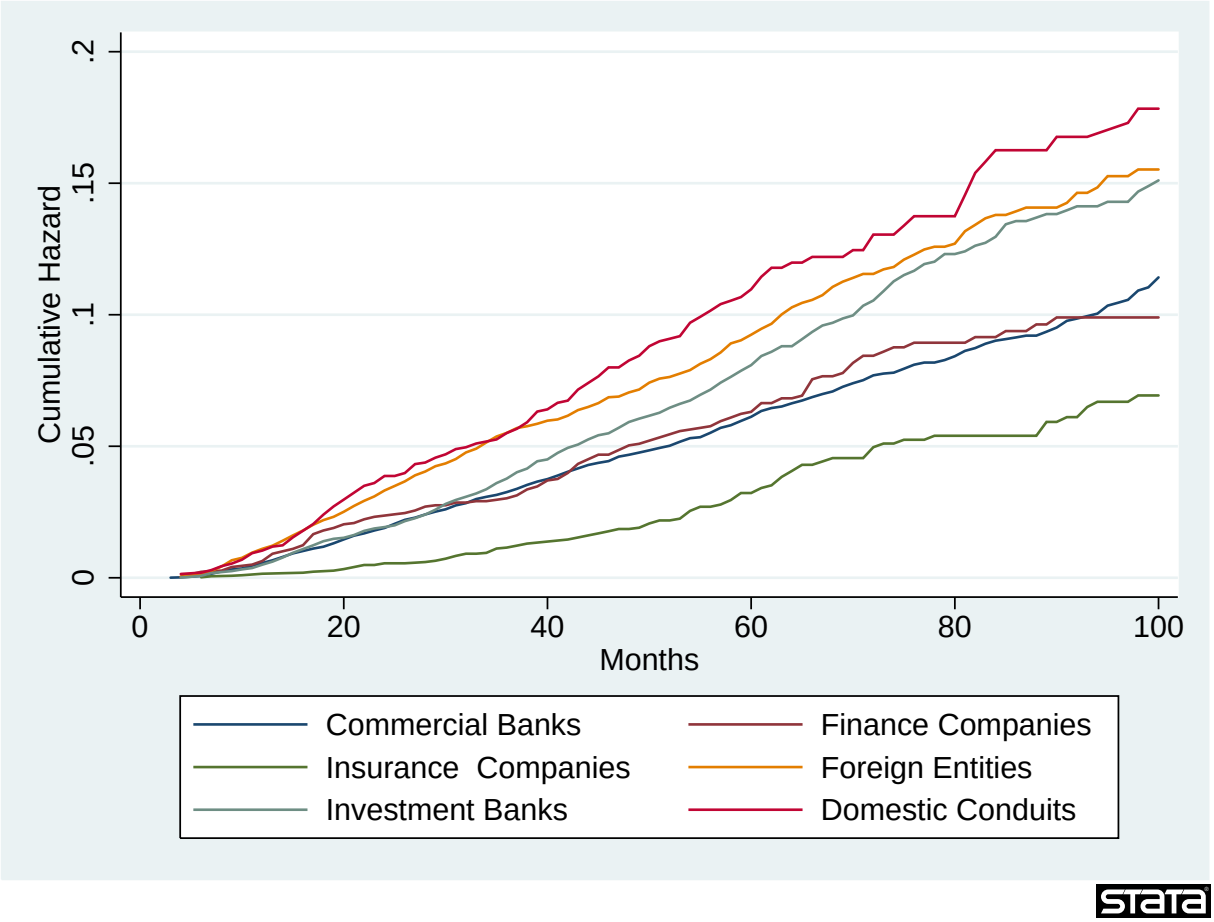

Figure depicts estimated cumulative hazard of default for loans originated by each lender type, estimated separately on subsamples based on lender type.

Figure 5: Cumulative Hazards by Vintage

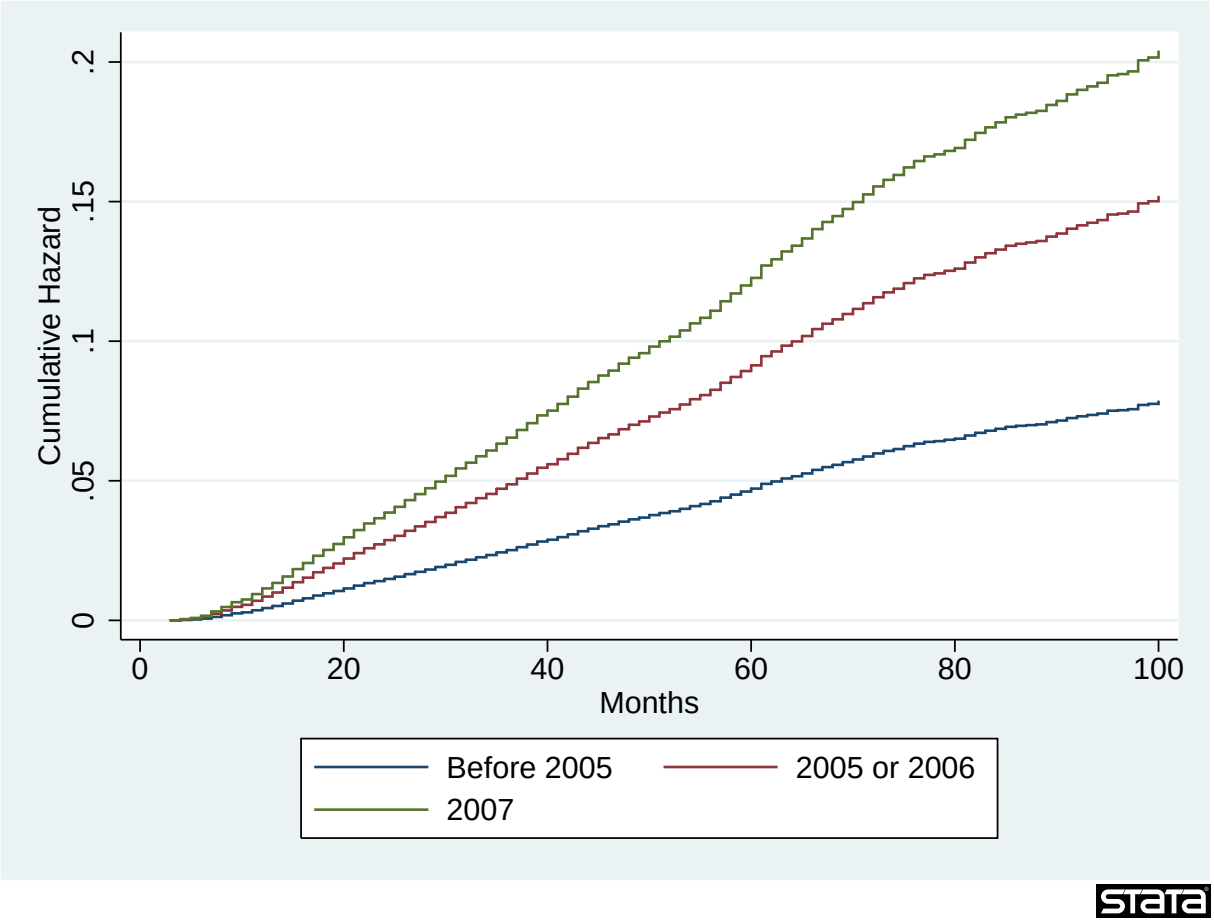

Figure depicts estimated cumulative hazard of default for various loan vintages (< 2005, 2005–2006, or 2007) evaluated with all other explanatory variables set to the overall sample mean.

Figure 6: Cumulative Hazards by Originator Type and Vintage

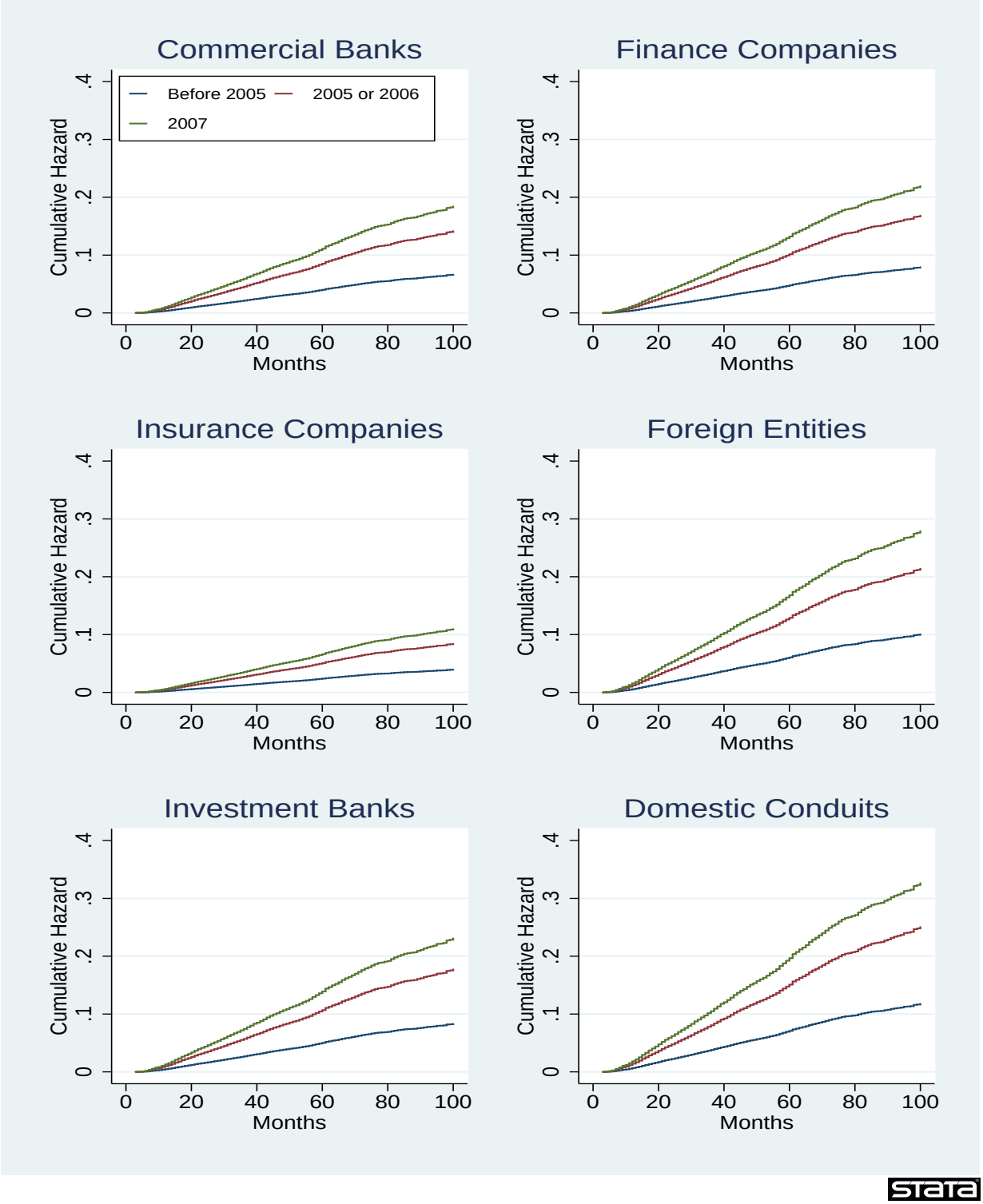

Figure depicts estimated cumulative hazard of default for various loan vintages (< 2005, 2005–2006, or 2007) evaluated with all other explanatory variables set to the means conditional on the lender type.

Table 1: Delinquency by Originator Type

	Mean (Standard Error)
Commercial Banks	7.38% (0.22)
Insurance Companies	4.68% (0.42)
Investment Banks	8.93% (0.36)
Finance Companies	8.76% (0.68)
Foreign Entities	10.10% (0.40)
Domestic Conduits	12.89% (0.87)
Total	8.30% (0.16)

Table 2: Summary Statistics of Loan Characteristics at Origination, by Originator Type

Mean (Std. Dev.)	DSCR	Occupancy	Coupon Spread	Loan Amount	LTV Ratio	N
Commercial Banks	1.49	94.59	1.47	9.71	68.15	13701
	(0.46)	(7.37)	(0.65)	(14.87)	(12.46)	
Insurance Companies	1.49	96.02	1.55	8.15	64.45	2565
	(0.39)	(6.32)	(0.70)	(11.34)	(11.92)	
Investment Banks	1.50	94.73	1.46	10.87	69.02	6441
	(0.40)	(7.54)	(0.65)	(16.93)	(10.37)	
Finance Companies	1.45	93.33	1.57	8.68	70.16	1724
	(0.34)	(7.37)	(0.70)	(11.01)	(10.08)	
Foreign Entities	1.41	94.86	1.55	8.58	70.82	5752
	(0.26)	(6.98)	(0.76)	(12.99)	(9.19)	
Domestic Conduits	1.39	94.13	1.63	10.36	70.56	1474
	(0.30)	(7.53)	(0.71)	(15.75)	(9.45)	
Total	1.47	94.69	1.50	9.59	68.73	31657
	(0.40)	(7.28)	(0.68)	(14.63)	(11.33)	

Table 3: Logit Estimates and Implied Probabilities

Loan Charactistics at Origination	Coefficients (Standard Error)	Marginal Effect on Pr(Delinquency) Evaluated at Sample Means
Debt-Service Coverage Ratio	0.044	0.003
	(0.104)	(0.007)
Occupancy	-0.025***	-0.0016***
	(0.003)	(0.00017)
Coupon Spread	0.324***	0.021***
	(0.039)	(0.0025)
Loan Amount	0.011***	0.00068***
	(0.0012)	(0.000074)
Loan-to-Value Ratio	0.052***	0.0033***
	(0.0033)	(0.0002)
Originator-Type and Vintage Effects	**Coefficients (Standard Error)**	**Predicted Pr(Delinquency) Evaluated at Sample Means**
Commercial Banks		0.063***
		(0.0021)
Insurance Companies	-0.287**	0.048***
	(0.144)	(0.0046)
Investment Banks	0.202**	0.074***
	(0.082)	(0.0033)
Finance Companies	0.077	0.065***
	(0.123)	(0.0075)
Foreign Entities	0.163*	0.083***
	(0.086)	(0.0036)
Domestic Conduits	0.230*	0.106***
	(0.131)	(0.0077)
Vintage $\leq$ 2004		.067***
		(.0025)
Vintage = 2005	0.153*	0.079***
	(0.091)	(0.0036)
Vintage = 2006	0.225**	0.087***
	(0.090)	(0.0042)
Vintage = 2007	-0.534***	0.045***
	(0.124)	(0.0032)

(N = 31,657)
Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Interactions between type and vintage are not reported.

Table 4: Implied Probabilities of Delinquency from Logit Model, by Vintage

	Predicted Pr(Delinquency) Evaluated at Means Conditional on Vintage $\leq$2004	Predicted Pr(Delinquency) Evaluated at Means Conditional on Vintage 2005	Predicted Pr(Delinquency) Evaluated at Means Conditional on Vintage 2006	Predicted Pr(Delinquency) Evaluated at Means Conditional on Vintage 2007
Commercial Banks	0.069***	0.069***	0.071***	0.036***
	(0.003)	(0.004)	(0.004)	(0.004)
Insurance Companies	0.052***	0.041***	0.065***	0.031***
	(0.007)	(0.010)	(0.011)	(0.009)
Investment Banks	0.083***	0.088***	0.086***	0.033***
	(0.005)	(0.007)	(0.007)	(0.006)
Finance Companies	0.074***	0.082***	0.068**	0.031**
	(0.008)	(0.011)	(0.028)	(0.013)
Foreign Entities	0.080***	0.083***	0.094***	0.081***
	(0.005)	(0.007)	(0.009)	(0.008)
Domestic Conduits	0.085***	0.121***	0.126***	0.130***
	(0.009)	(0.016)	(0.023)	(0.024)

(N = 31,657)
Note: ** and *** indicate significance at the 5% and 1% levels, respectively.

Table 5: Hazard Model Estimates

Variable	Hazard Ratio (Standard Error)
Debt-Service Coverage Ratio	1.09 (0.11)
Occupancy	0.98*** (0.00)
Coupon Spread	1.52*** (0.06)
Loan Amount	1.01*** (0.00)
Loan-to-Value Ratio	1.05*** (0.00)
Insurance Companies	0.77*** (0.08)
Investment Banks	1.21*** (0.06)
Finance Companies	1.14 (0.10)
Foreign Entities	1.33*** (0.07)
Domestic Conduits	1.61*** (0.13)

(N = 31,657)
Note: *** indicates significance at the 1% level.
Commercial banks are the reference category.

Table 6: Estimated Hazard Ratios (and Standard Errors) of Originator and Vintage Effects in Extended Hazard Model

	Uninteracted Effects	Interaction of Originator Type with 2005-06 Vintage	Interaction of Originator Type with 2007 Vintage
Insurance Companies	0.664***	1.191	1.367
	(0.094)	(0.245)	(0.463)
Investment Banks	1.188**	1.038	0.740
	(0.092)	(0.113)	(0.161)
Finance Companies	1.033	0.979	0.806
	(0.121)	(0.179)	(0.353)
Foreign Entities	1.177**	1.069	1.868***
	(0.095)	(0.122)	0.310
Domestic Conduits	1.117	1.453**	3.219***
	(0.138)	(0.248)	(0.813)
Vintage = 2005 or 2006	2.033***		
	(0.155)		
Vintage = 2007	2.203***		
	(0.275)		

(N = 31,657)
Note: ** and *** indicate significance at the 5% and 1% levels, respectively.
Commercial banks are the reference category.

APPENDIX

Table A1: Multinomial Logit Estimates and Implied Probabilities, Prepayment Eqn.

Loan Characteristics at Origination	Coefficients (Standard Error)	Marginal Effect on Pr(Prepayment) Evaluated at Sample Means	
Debt-Service Coverage Ratio	0.151**	0.003*	
	(0.075)	(0.002)	
Occupancy	-.009***	-0.000**	
	(0.003)	(0.000)	
Coupon Spread	0.481***	0.009***	
	(0.038)	(0.001)	
Loan Amount	0.007***	0.000***	
	(0.002)	(0.000)	
Loan-to-Value Ratio	0.000	-0.000	
	(0.003)	(0.000)	
Originator-type and Vintage Effects	**Coefficients (Standard Error)**	**Predicted Pr(Prepayment) Evaluated at Sample Means**	**Predicted Pr(Prepayment) Evaluated at Means Conditional on Originator Type**
Commercial Banks		.018***	.049***
		(.0021)	(.0019)
Insurance Companies	-0.523***	0.011***	0.035***
	(0.110)	(0.002)	(0.003)
Investment Banks	0.308***	0.024***	0.068***
	(0.063)	(0.003)	(0.003)
Finance Companies	0.709***	0.036***	0.128***
	(0.083)	(0.005)	(0.008)
Foreign Entities	0.352***	0.025***	0.066***
	(0.065)	(0.003)	(0.003)
Domestic Conduits	0.840***	0.039***	0.119***
	(0.091)	(0.005)	(0.008)
Vintage $\leq$ 2004		.114***	
		(.0034)	
Vintage = 2005	-1.007***	0.045***	
	(0.074)	(0.003)	
Vintage = 2006	-3.627***	0.003***	
	(0.240)	(0.001)	
Vintage = 2007	-5.689***	0.000	
	(0.708)	(0.000)	

(N = 31,657)
Note: ** and *** indicate significance at the 5% and 1% levels, respectively.

Table A1, cont'd: Multinomial Logit Estimates and Implied Probabilities, Delinquency Eqn.

Loan Characteristics at Origination	Coefficients (Standard Error)	Marginal Effect on Pr(Delinquency) Evaluated at Sample Means	
Debt-Service Coverage Ratio	0.065	0.004	
	(0.105)	(0.007)	
Occupancy	-0.026***	-0.002***	
	(0.003)	(0.000)	
Coupon Spread	0.366***	0.024***	
	(0.039)	(0.003)	
Loan Amount	0.011***	0.001***	
	(0.001)	(0.000)	
Loan-to-Value Ratio	0.052***	0.004***	
	(0.003)	(0.000)	
Originator-type and Vintage Effects	**Coefficients (Standard Error)**	**Predicted Pr(Delinquency) Evaluated at Sample Means**	**Predicted Pr(Delinquency) Evaluated at Means Conditional on Originator Type**
Commercial Banks		.066***	.063***
		(.0022)	(.0021)
Insurance Companies	-0.292***	0.051***	0.040***
	(0.101)	(0.005)	(0.004)
Investment Banks	0.228***	0.081***	0.080***
	(0.056)	(0.003)	(0.003)
Finance Companies	0.199**	0.078***	0.080***
	(0.094)	(0.006)	(0.006)
Foreign Entities	0.334***	0.090***	0.094***
	(0.056)	(0.004)	(0.004)
Domestic Conduits	0.627***	0.115***	0.122***
	(0.087)	(0.008)	(0.008)
Vintage $\leq$ 2004		.068***	
		(.0025)	
Vintage = 2005	0.097	0.080***	
	(0.064)	(0.003)	
Vintage = 2006	0.153**	0.088***	
	(0.066)	(0.004)	
Vintage = 2007	-0.453***	0.050***	
	(0.078)	(0.003)	

(N = 31,657)
Note: ** and *** indicate significance at the 5% and 1% levels, respectively.