

**The Hidden Peril:
The Role of the Condo Loan Market in the Recent Financial Crisis***

Sumit Agarwal, Yongheng Deng, Chenxi Luo, and Wenlan Qian[†]

National University of Singapore

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[†] Corresponding author, Department of Finance, NUS Business School, 15 Kent Ridge Drive, Singapore 119245, phone: (65) 65163015, email address: wenlan.qian@nus.edu.sg.

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Abstract

This paper studies a largely overlooked and important market in explaining the recent financial crisis—the condominium loan market, which constitutes 15% of the overall residential mortgage market. Condo loans have distinct characteristics that make the market a natural setting to understand the roles of less financially constrained homebuyers and investors in contributing to the recent financial crisis. Condominium loans appear to be safer by conventional risk metrics, but they are more likely to be associated with investment purchases; their loan terms are much riskier; and condo borrowers tend to exercise the default option more ruthlessly compared to conventional prime or subprime borrowers. Compared with the subprime market, condominium loan defaults increased at a faster pace over the 2003–2009 period; among loans originated in 2006 or 2007, condominium loans are 30% more likely to default within two years of origination. Condo loans default much earlier, and these early defaults, especially by investors in the non-subprime sector, predict future defaults in the single-family subprime market in the same location.

Keywords: Financial Crisis, Condo Market, Default, Mortgages, Household Finance, Investors, Speculators, Subprime mortgages

JEL Classification Codes: G21, G28

1. Introduction

This study is the first to document the unique risk pattern and borrower behavior in the U.S. condominium loan market in the early 2000s, which may have helped precipitate the recent financial crisis. Using privately securitized condominium (condo) loans, we find that condo loan originations increased by 15-fold during the 2001–2007 period (Figure 1). Across this time period, condo loans accounted for 15% of all U.S. residential loan originations, rising from 9% in 2001 to 16% in 2007.¹ Compared with single-family loans, condominium loans have lower interest rates and are much less likely to be subprime loans, but they are far more likely to have unconventional and riskier loan terms, such as interest-only mortgages or mortgages requiring low or no documentation. Condo loan borrowers have significantly higher FICO credit scores than single-family loan borrowers and they are more likely to be investors.

[Insert Figure 1 about Here]

In addition to its significant size, the condo loan market has distinct characteristics that carry implications for the current debate on the factors contributing to the financial crisis. Much of the existing literature focuses on the role of innovation in mortgage products (e.g., subprime mortgages)² or on the role of securitization and the associated agency problems.³ Other recent research (Haughwout, Lee, Tracy, and van der Klaauw, 2011; Case, Shiller and Thompson, 2012) suggests that a less studied but potentially more fundamental factor may have triggered the crisis—homebuyer and especially investor expectations. Based on a survey sample in four U.S. cities, Case et al. (2012) report that home price expectations, which reached abnormal levels

¹ This is the same as the total stock of subprime mortgages at the peak of the subprime boom.

² These products were designed to help borrowers in markets expecting significant price appreciation. However, they were often marketed to borrowers with relatively poor credit histories as well. As a result, these mortgages are often referred to as subprime mortgages, because they did not meet the underwriting criteria set by the government-sponsored enterprises, e.g. Fannie Mae and Freddie Mac (See Agarwal, Ambrose, Chomsisengphet, and Sanders 2012).

³ For a discussion, see Jiang, Nelson, and Vytlačil (2012); Agarwal, Amromin, Ben-David, Chomsisengphet, and Evanoff (2011); Agarwal, Chang, and Yavas (2012); An, Deng, and Gabriel (2011); Keys, Mukherjee, Seru, and Vig (2010a, 2010b); and Piskorski, Seru, and Vig (2010).

relative to the mortgage rate at the peak of the boom and have declined sharply since, were highly correlated to the price movements of the housing market. Haughwout et al. (2011) hypothesize that real estate “investors”—borrowers who use financial leverage in the form of mortgage credit to purchase multiple residential properties—played a previously unrecognized but important role in fueling the housing boom and exacerbating the housing bust. Specifically, when prices turned down, these investors defaulted in large numbers, contributing to the intensity of the housing cycle’s downward leg. Barlevy and Fisher (2011) show that speculators are more likely to choose exotic mortgages and more likely to default. Amromin, Huang, Sialm, and Zhong (2011) find that high credit worth households chose complex mortgage products leading up to the crisis and that they were more likely to default. Garmaise (2012) shows that borrowers who chose unconventional mortgages that had back loaded payment options were more likely to default during the crisis.

Empirical evidence on the roles of homebuyer expectations and investor behavior, however, is scarce and primarily based on survey or macro-level data. A few studies have used microlevel data to show that real estate investors chase price trends, push prices away from the fundamental level, and are sensitive to negative market shocks (Fu and Qian, 2012; Fu, Qian and Yeung, 2012). To date, no studies have explored how the default behavior of the less financially constrained homebuyers and investors contributed to the crisis. The condominium loan market is a natural setting in which to study this question. Compared to the single family loan market, a significantly higher portion of condominium borrowers are investors in our sample. There is more prevalent use of exotic mortgages in the condominium market, and it has been documented that these less conventional mortgage contracts (such as low- or no-documentation loans and option ARMs) are typically associated with higher income self-employed borrowers. Condominium borrowers indeed have higher FICO scores and tend to purchase in more

expensive areas. Therefore, the default pattern in the condominium loan market is likely to reflect the role of expectations in precipitating the crisis.

Using a unique loan-level dataset for loans originated during 2003–2007, we study the behavior of loan defaults within two years of origination. We model the default behavior of the condo market relative to that of the single-family market⁴ using a logistic specification with fixed effects of year of origination and state. In the pooled sample, a condo loan, on average, is as likely to default within two years of origination as a single-family loan, after controlling for other loan and borrower characteristics. However, there is a sharp increase in condo loan defaults relative to single-family loan defaults over the years—with the biggest jump in condo loan default rates in 2006 and 2007. All else being equal, a condo loan originated in 2007 is 11% more likely to default within two years of origination than a single-family loan originated in the same year.

We further study default behavior in the condominium market relative to the single-family subprime market. Previous literature shows a strong vintage effect in the subprime market; such loans originated in the later years of the 2003-2007 period are significantly more likely to default than those originated in the earlier years (Demyanyk and Van Hemert 2011). We find that condo loan default rate grows at a faster rate than subprime loans. Condo loans originated before 2006, relative to single-family subprime loans originated before 2006, are much less likely to default within two years of origination. However, among loans originated in 2007, condo loans are 29% more likely to default than subprime loans in the single-family market, conditioning on all the observed loan and borrower characteristics. Furthermore, among loans originated in 2007, subprime loans in the condo market default at a rate 69% higher than that of subprime loans in the single-family market. These findings imply that condo loans have distinct features that make them inherently riskier than other types of residential mortgages.

⁴ The single-family market in this paper refers to that of the *detached* single family houses.

We find evidence consistent with the hypothesis that the impact of condo loan defaults spills over to the single-family subprime market. Condo loans default much earlier compared with subprime loans in the single-family market; that is, there is a much higher default probability for condo loans within the first year of origination. The earlier defaults in the condo market are driven by the loans in the non-subprime sector, where there are disproportionately more investors and where borrowers take on loan terms that are much riskier than those of the single-family market. At the zip code level, we find that a higher default rate in the first year after origination among condo loans—especially this rate among loans for condo investors in the non-subprime sector—strongly predicts second-year defaults of the same cohort’s single-family loans in the same zip code. Furthermore, we only find this spillover effect of within-one-year condo loan defaults in the non-judicial states. This suggests that foreclosures resulting from condo loan defaults are associated with higher subsequent defaults in the single-family subprime market, likely through the negative effect of foreclosures on neighborhood house prices (Campbell, Gilio, and Pathak, 2011).

Two mutually non-exclusive factors could explain why we observe riskier condo loans in our sample. The underlying borrower pool in the condominium market could be riskier, or the lender could have used a more lax underwriting standard for condo loans. We use Home Mortgage Disclosure Act (HMDA) data to determine if lender dynamics play a significant role in explaining what we observe in the data. The HMDA data shows that across our time period, banks tended to reject more and more applications for condo loans (relative to those for single-family loans), a finding inconsistent with the idea that an increasingly lax screening standard led to more condo loan defaults over time. Thus, an increasingly risky condo borrower profile is a more plausible reason for the rapid increase in condo loan defaults over time.

The overall evidence in this paper points to the much ignored condominium loan market in understanding the recent financial crisis. Several studies have explored various factors in

explaining the mortgage crisis, such as Keys et al. (2010a, 2010b); Mian and Sufi (2009); Campbell et al. (2011); Mayer, Pence, and Sherlund (2009); Agarwal et al. (2011); and An, Deng, Rosenblatt, and Yao (2012). Others have focused on the aftermath of the crisis. For example, Piskorski et al. (2010) compare the start of foreclosures for portfolio loans with that of securitized loans. Finally, some studies have looked at political influences on the mortgage market: Mian, Sufi, and Trebbi (2010a) demonstrate that U.S. House Members whose districts have high defaults were more likely to vote for the Foreclosure Prevention Act. Igan, Mishra, and Tressel (2009) argue the lenders that lobbied more for mortgage expansion subsequently increased their mortgage lending. Duchin and Sosyura (2010) document that if banks are headquartered in the districts of members on the U.S. House Committee on Financial Services, they were more likely to receive Troubled Asset Relief Program (TARP) funds. Mian, Sufi, and Trebbi (2010b) find that campaign contributions by the mortgage industry and the share of the subprime population within a U.S. Representative's district predict his or her voting patterns on mortgage-related legislation.

The rest of the paper proceeds as follows. In the next section, we lay out the empirical methodology. In Section 3, we outline and describe the data used for this study. We present the empirical results in Section 4. Finally, we make concluding remarks in Section 5.

2. Methodology

Our null hypothesis is that the condo and single-family markets are similar. Hence, the default rates (as well as default growth patterns) for condo and single-family loans should be similar. We test this hypothesis to determine if condo loans have higher default rates by focusing on comparable single-family and condo markets.

Our main empirical specification is a logistic model of the default decision of loans originated between 2003 and 2007. We define a loan to be in default if it becomes delinquent by

at least 60 days⁵ within two years of origination. The main independent variable, $Condo_{is}$, is a binary variable that is set to one if the loan is a condo mortgage. Other explanatory variables include both loan-level and macro-level variables. We include state fixed effects to control for unobservable factors at the state level, such as the cross-sectional variation in foreclosure laws. Loan i enters the study in month t_{is} , which is the first occurrence of that loan. The same loan exits the study in month T_{is} , which is the earliest occurrence of one of the “exit” events (default or prepay or the end of the sample period). Finally, all the errors reported in this study are corrected for clustering at the origination year level, in addition to being robust to heteroskedasticity.

Loan-level controls are motivated by the literature. They include indicators for FICO credit scores, indicators for fixed-rate and interest-only loans, indicators for low- and no-documentation (low/no doc) loans, an indicator for owner-occupancy status, an indicator for subprime mortgages, and an indicator for home equity lines of credit (HELOC). Following the literature, we also include an indicator variable for LTV at origination of 80% as a proxy for the existence of a second lien on the property. Continuous loan-level variables include (log of) the loan amount, the first interest rate observed, the time elapsed from origination to the end of the sample period or to the first classification as being prepaid or delinquent at least 60 days, and LTV at the time of origination. We also include the current level of the residential home price index, the state-level unemployment rate, the slope of the yield curve, and the credit spread as control variables.

3. Data

3.1 Data sources

⁵ More specifically, we define default as a loan that is delinquent by at least 60 days, or that is in foreclosure, is in bankruptcy, is REO (real estate owned), or is in the liquidation stage.

We use two main sources of data for our study: loan-level data furnished by BlackBox Analytics (BBX) and the database of home loan applications and originations collected under the Home Mortgage Disclosure Act (HMDA).⁶ For the main analysis, we use loan-level data from BBX for loans originated in 2003–2007 (we leave out loans originated earlier due to better data coverage later in the sample period). BBX aggregates data from mortgage servicing companies that participate in their servicing agreement. The most recent BBX data cover about 18 million mortgages throughout the United States.⁷ The data include prime and subprime mortgages in both the condo and single-family markets. In addition to monthly data on loan performance, BBX contains information on key borrower and loan characteristics at origination, including the borrower’s FICO credit score, the loan amount and interest rate, whether the loan is a fixed- or adjustable rate mortgage, LTV, and whether the loan was intended for home purchase or refinancing, among other characteristics. The outcome variable that we focus on is whether the loan becomes 60 days or more past due in the 24 months following origination. We also merge BBX loan-level data with macro variables, including the slope of the yield curve and the credit spread from Federal Reserve Bank of St. Louis, the state-level unemployment rate from Bureau of Labor Statistics, and the MSA-level quarterly housing index from the Office of Federal Housing Enterprise Oversight (OFHEO), which was succeeded by the Federal Housing Finance Agency (FHFA).⁸

HMDA data provide information on prime market share at the MSA level. It records each applicant’s final status (denied/approved/originated), purpose of borrowing (home

⁶ The HMDA was enacted in 1975 and implemented by the Federal Reserve Board. It requires that lending institutions report virtually all mortgage application and loan data. See <http://www.ffiec.gov/hmda/> for details. In this study, we only use HMDA data from 2004 through 2007 because several key loan variables are not available before 2004.

⁷ Based on a comparison of the BBX and HMDA data which include a nearly complete universe of U.S. mortgage applications and originations, we estimate that the BBX data cover about 70% of the prime market during the period.

⁸ Established in 2008, FHFA is a successor agency that resulted from the statutory merger of the Federal Housing Finance Board (FHFB), the Office of Federal Housing Enterprise Oversight (OFHEO), and the U.S. Department of Housing and Urban Development’s government-sponsored enterprise mission team.

purchase/refinancing/home improvement), loan amount, race, sex, income, homeownership status, and also (in the case of originated loans) whether the loan was sold to the secondary market within the year. In addition, the HMDA dataset provides details on the location of the property.

3.2 *Summary statistics: Condo versus Single-family loans*

Table 1, Panel A shows summary statistics of the BBX dataset. We keep those loans originated in 2003–2007 for the purchase of single-family houses and condominiums. We remove refinancing loans and those with original loan balances larger than \$10 million. Panel A reports the statistics of the major variables in the pooled sample for the 2003–2007 period. The full sample contains 6.376 million purchase loans, of which 15% are for condo purchases. The probability of default within two years of the loan origination date is 5% on average. Among all the loans, 41% are fixed-rate mortgages and 28% are subprime mortgages. Borrowers have an average FICO credit score of 679, and take out up to 74% of the property value (LTV).

[Insert Table 1 about here]

Loan and borrower characteristics in the condo and single-family home mortgage market differ. Condo borrowers have higher FICO credit scores than single-family borrowers (by 24 points). The number of subprime loans in the condo market is one-third smaller than in the single-family market. The average condo borrower's interest rate is significantly lower than that of single-family borrowers. That said, the contract terms of condo loans are less conventional than those of single-family loans. Among condo loans, we observe much fewer fixed-rate mortgages and considerably more option ARMs, interest-only loans, and low/no doc loans than in the single-family market. In addition, fewer condo borrowers purchase for owner-occupancy, and they tend to buy in more expensive areas (i.e., those with a higher FHFA/OFHEO House Price Index, or HPI).

Even though condo loans are less likely to be subprime and their borrowers appear to be more creditworthy, these loans are not necessarily less risky given the higher proportion of investment-driven purchases and the greater use of non-conventional risky loan contracts. The condo market's size and fast growth during the boom in the housing market suggests that it could have played a significant role in the financial crisis.

4. Empirical Results

4.1 A first look at the default behavior of the condo market

The summary statistics of the full sample (Table 1, Panel A) reveal some interesting differences between the condo and single-family loan markets. To better examine these differences, we compute summary statistics of both the condo and single-family loans by the origination year in the period 2003–2007 (Table 1, Panel B). The number of both single-family and condo loans peaked in 2005 and then sharply declined in 2007. Over the years, there is a greater number of option ARMs, interest-only rate mortgages, and low/no doc mortgages among condo loans than among single-family loans. A lower percentage of condo loan originations are for owner-occupied purposes.

The default rates within two years of origination in both markets increased over the years in our sample (Figure 2.1). More importantly, the increase in the condo loan default rate is much faster. Among the 2003 cohort loans, the default rate in the single-family market is more than double that of the condo market. However, among loans originated in 2007, the two-year condo default rate is 9.9%, which is comparable with 11.6% in the single-family market.

[Insert Figure 2 about here]

4.2 Condo loans versus subprime loans

We further compare condo loan performance for loans originated between 2003 and 2007 with that of the subprime market. To the extent that subprime mortgages are riskier loans than prime mortgages, the comparison between condo loans and subprime loans is more informative about the characteristics and risk profiles of condo loans.

Panel A of Table 2 shows the summary statistics for all condo loans and all single-family subprime loans in the pooled sample. Condo borrowers are much more creditworthy by the conventional measures. They have significantly higher FICO credit scores than single-family subprime borrowers (by 122 points), and their original LTV is, on average, 6 percentage points lower. However, close to 8% of the condo loans are option ARMs versus only 0.1% among single-family subprime loans. Additionally, 40% of the condo loans are low/no doc loans compared to 13% for single-family subprime loans. And 29% of the condo loans are interest-only loans—21 percentage points higher than the share of interest-only loans in the single-family subprime market. Furthermore, condo borrowers are much less likely to purchase for owner-occupancy than single-family subprime borrowers (69% versus 80%). Condo borrowers also purchase in more expensive areas: the average appraisal value at the time of origination is 51% higher for condo loans than for subprime loans in the single-family market.

[Insert Table 2 about here]

We examine whether the drastic differences between condo loans and single-family subprime loans in their borrower and loan contract characteristics can be explained by a greater concentration of less conventional and riskier subprime loans within the condo market. Panel B of Table 2 displays the borrower and loan characteristics of both condo subprime loans and single-family subprime loans. The comparisons suggest that the subprime market is relatively homogeneous across the condo and single-family markets; the differences in borrower and loan characteristics between these two markets are much smaller than between all condo loans and

single-family subprime loans (Panel A of Table 2). Nevertheless, we still observe a robust pattern of riskier loan terms and borrower characteristics in the condo subprime market.

Figure 2.2 shows a decomposition of the default patterns in the condo and single-family markets, by subprime and non-subprime status. Within the subprime and non-subprime submarkets, condo loan defaults start at a much lower rate than single-family loan defaults, but grow more quickly over the sample period. Specifically, the rate of condo subprime loan defaults exceeds that of the single-family market by 1.9 percentage points among loans originated in 2007. These results, in combination with our previous findings, imply that condo loans have distinct features that make them riskier and more vulnerable to default, especially during times of market distress.

4.3 *Empirical analysis of condo loan default behavior*

Option-based theoretical and empirical models for mortgage default analysis have been well developed during the past two decades (e.g., Kau, Keenan, Muller, and Epperson, 1992; Kau and Keenan, 1999; Deng, Quigley and Van Order, 1996, 2000), and they have increased in realism and sophistication in the past decade (e.g., Ambrose, Capone and Deng, 2001; Deng and Gabriel, 2006). Clapp, Deng, and An (2006) provide a comprehensive review of these modeling frameworks. Following Clapp et al., we perform logistic regressions to formally study the default behavior of the condo market relative to the single-family market. Because condo loans differ substantially from single-family loans in their loan and borrower characteristics, we include observables on loan and borrower characteristics as controls in the logistic analysis. Table 3 reports odds ratios in the full sample analysis: an odds ratio greater (smaller) than one indicates a positive (negative) effect. Consistent with the literature, FICO scores, LTV, FRM loan type, and owner-occupancy status are strong predictors of default. Second lien loans and low/no doc loans are risky, as they are associated with higher default rates within two years of origination.

Although condo loans have a lower average default rate in the summary statistics (Table 1, Panel A), the logistic analysis of Table 3 shows that after controlling for loan and borrower characteristics, condo loans do not differ much from single-family loans in their two-year default probability. Furthermore, separating default behavior by origination year reveals a significant time trend in the condo market defaults. Consistent with the time-series pattern shown in Panel B of Table 1 and Figure 2, while condo loans originated in 2003 are 58% less likely to default, there is a sharp increase in condo loan defaults relative to single-family loan defaults over the years—with the biggest jump in condo loan default rates being seen in 2006 and 2007. For example, condo loans originated in 2007 are 11%⁹ more likely to default within two years of origination than single-family loans in the same cohort.

[Insert Table 3 about here]

4.4 Empirical analysis of loan defaults: condo vs. subprime market

Next, we explore the dynamics of condo loan default behavior relative to subprime loan default behavior. Previous literature has documented dramatic growth in the subprime loan market during the housing boom, which played a significant role in triggering the recent financial crisis (e.g., Demyanyk and Van Hemert 2011). The condo loan market and the subprime market have similar magnitudes of growth leading up to the housing bubble burst (Figure 1), and we find a rapid increase in condo loan defaults in more recent vintages. Therefore, we compare the dynamics of condo market default behavior with that of the subprime market.

First, we perform a subsample analysis of all condo loans and all single-family subprime loans. The results in Panel A of Table 4 show that, on average, condo loans are slightly more

⁹ We multiply the coefficient on condo dummy with the coefficient on condo x origination year 2007 interactive term ($0.421 \times 2.626 = 1.11$) to compute the odds ratio of a 2007-originated condo loan default relative to a 2007-originated single family loan default.

likely to default, but the effect is not statistically significant. In earlier vintages, single-family subprime loans are consistently more likely to default than condo loans of the same vintage. However, condo loan defaults grow at a faster rate and over time condo loans begin to default more than single-family subprime loans. Condo loans originated in 2006 and 2007 are 32% and 29%, respectively, more likely to default within two years of origination than single-family subprime loans originated in those same years, conditioning on all the observed loan and borrower characteristics.

[Insert Table 4 about here]

To investigate whether the greater propensity to default among all condo loans of later origination years is driven largely by the behavior of condo subprime loans, we restrict our sample to only the subprime market (Table 4, Panel B). In our sample, condo subprime loans are riskier than single-family subprime loans—a condo subprime loan is 9% more likely to default than a single-family subprime loan. The higher default probability among condo subprime loans is driven by the later vintages (i.e., loans originated in 2006 and 2007). A condo subprime loan originated in 2007 is 69% more likely to default than a single-family subprime loan originated in the same year. Taken together, these findings imply that condo loans have distinct features that make them riskier than other types of loans, such as single-family loans.

4.5 The spillover effects of condo loan defaults

We document strong evidence that condo loans are inherently riskier than single-family loans. In particular, condo loans default at an astonishing rate, even compared with subprime loans in the single-family market. Does the higher risk have negative externality effects beyond its implications within the condo market? Because more condo borrowers are investors and because condo loan terms are riskier (than those of single-family loans), these borrowers are likely to be more responsive to market conditions and default on their loans earlier than other

borrowers—possibly prompting more defaults in the single-family sector in the same geographic area later on.

We examine this hypothesis using two approaches. First, we directly study whether condo loan defaults are even more prominent within one year of origination. We define the one-year default dummy as one if the loan is at least 60 days delinquent within the first year of loan origination. We compare the one-year default probability of condo loans with that of subprime loans in the single-family market (Table 5, Panel A). Condo loans originated in 2006 (2007) are 48% (42%) more likely to default within the first year of origination than single-family subprime loans of the same cohort. Compared with the two-year default differential between the condo loans and single-family subprime loans of the same cohorts (32% for the 2006 cohort and 29% for the 2007 cohort), this result suggests that not only do condo loans are more likely to default than single-family subprime loans, but they also default much earlier.

[Insert Table 5 about here]

Within the subprime market, condo loans originated in 2007 are 44% more likely to default within one year of origination than single-family loans originated in 2007, and condo loans of the same cohort are 69% more likely to default within two years of origination (Table 4, Panel B). This suggests that the faster rates of default among condo loans are driven more by the *non-subprime* sector. This is consistent with our findings (Table 2) that there are more condo investors in the non-subprime sector and that condo borrowers take on riskier loan terms than single-family borrowers in both the subprime and non-subprime sectors.

Next, we look at spillover effects—whether condo loan defaults impact the single-family subprime loan market in the same zip code. We study whether more single-family subprime loans default in the second year after origination if more of the condo loans originated in the same year and in the same zip code defaulted within the first year of origination. We first regress

the proportion of the second-year defaults of single-family subprime loans originated in year t in zip code j on the proportion of first-year defaults of the same-cohort single-family subprime loans and of the same-cohort condo loans in the same zip code. Other control variables include the state-level unemployment rate, the MSA-level HPI, the slope of the yield curve, and the credit spread. We also include zip code and origination year fixed effects to control for any unobservable factors at the zip code and origination-year levels. The first column of Panel A, Table 6 shows the results. A higher level of within-one-year defaults in the single-family subprime market of the same cohort does *not* predict more defaults in the second year after origination for the same cohort of single-family subprime loans. Although the coefficient is positive, it is statistically insignificant. However, more within-one-year defaults in the condo market of the same cohort positively predicts the second-year defaults of the same-cohort single-family subprime loans, and the effect is statistically significant at the 5% level.

That said, the single-family subprime within-one-year default rate is positively associated with the same-cohort condo market's second-year default rate, but its effect is much smaller than the influence of the within-one-year defaults of the same-cohort condo loans in the same zip code (column (2) of Table 6, Panel A). The latter has a significantly higher coefficient, and the F-test rejects the hypothesis at the 1% level that the coefficient on the single-family subprime market's within-one-year default rate is equal to the coefficient on the condo market's within-one-year default rate. Results in Panel A of Table 6 are consistent with the notion that defaults in the condo market occur earlier and spill over to the single-family subprime market, but not vice versa.

[Insert Table 6 about here]

We then decompose the condo within-one-year default rate at the zip code level into the non-subprime and subprime default rates and repeat the analysis. Panel B of Table 6 shows that

the positive spillover effect into the single-family subprime market arises mainly from the within-one-year defaults in the non-subprime sector of the condo market.

We also study the role of investor defaults in the condo market by decomposing the condo loan default rate at the zip code level into investor and non-investor default rates. Panel C of Table 6 shows that both investor and non-investor defaults in the first year after origination in the condo market positively predict defaults of the same-cohort single-family subprime loans in the second year after origination (column (1)). When we separate the condo within-one-year defaults by investors into the subprime and the non-subprime sectors, we find that condo investor defaults in the *non-subprime* sector most strongly predict second-year defaults of the same-cohort single-family subprime loans (column (2)). By contrast, the coefficient on the condo investor defaults in the subprime sector is negative and statistically insignificant. Furthermore, non-subprime condo investor first-year defaults have an even higher influence than first-year non-investor condo defaults on second-year defaults in the single-family subprime market, as the F-test rejects the hypothesis that the two coefficients are equal.

Lastly, we use the exogenous variation across state laws on judicial foreclosure to better identify the spillover effect of condo market defaults.¹⁰ Panel D of Table 6 shows the results of the single-family subprime loan second-year default regressions (as in Panel A of Table 6) in the judicial foreclosure states and in the non-judicial foreclosure states separately. The within-one-year defaults in the condo market *only* positively and significantly predict second-year defaults among single-family subprime loans of the same origination cohort in the same zip code in the non-judicial foreclosure states. In judicial foreclosure states, foreclosures are processed through courts, which is typically a lengthy and costly process. As a result, condo defaults in these states do not immediately result in foreclosures. Because we find this default spillover only in the non-

¹⁰ Mian, Sufi, and Trebbi (2010) use state judicial foreclosure laws as an instrument to identify the effect of foreclosures on house prices. They show that states with no judicial foreclosure laws have twice as many foreclosures and higher house price declines.

judicial foreclosure states, we infer that foreclosures following condo loan defaults are likely associated with higher subsequent defaults in the single-family subprime market through the downward pressure that condo foreclosures put on neighborhood house prices (Campbell et al., 2011).

Overall, the results in Tables 5 and 6 are consistent with our hypothesis that condo loan defaults have an impact beyond their influence on the condo market. Condo loans in the sample default earlier than single-family subprime loans. Condo loan defaults in the first year after origination predict a higher default rate during the second year after origination of the same-cohort single-family subprime loans in the same zip code. The spillover from condo loan defaults is largely driven by the mortgages of condo investors in the non-subprime market, whose early defaults could have triggered more defaults of the same-cohort single-family subprime loans in the same neighborhood through the channel of depressed local house prices after condo foreclosures.

4.6. *Why do condo loans appear riskier?*

Lastly, we attempt to understand why condo loans appear to be riskier than single-family loans during this period. Condominium loan borrowers might be, on average, riskier in nature than single-family borrowers (e.g., more of the condo borrowers are speculative investors), or banks might have become more lax in screening condo borrowers in the later years of the sample (relative to the single-family borrowers). We investigate these possibilities using data from the HMDA.

Table 7, Panel A presents the summary statistics of the original HMDA data sample. We select only condo and single-family loans originated between 2004 and 2007. We follow the same filtering rule as earlier, removing refinancing loans and those with an original loan balance larger than \$10 million. The summary statistics show striking differences between the condo and

single-family loan applications. Relative to single-family loans, condo loans, on average, are larger and are much less likely to be owner-occupied or second liens. Additionally, a much smaller fraction of condo loan applicants are male, black, or Hispanic.

[Insert Table 7 About Here]

Compared to our earlier BBX dataset, condo loan applications make up a much smaller fraction of the entire sample of loan applications in HMDA (<1%). This is because a potentially sizable fraction of the condo loan applications are classified into the same category as single-family houses in HMDA. Despite the data challenge, we are able to analyze the available condo loan applications to determine differences in the application and rejection patterns between the condo and single-family markets.

Condo loan applicants are systematically different from single-family loan applicants, indicating that we may have a selection of higher (or lower) risk borrowers in the condo market rather than in the single-family market. If the change in bank screening (especially in the later years of the sample) is driving the evolution of condo loan defaults over time, then we should observe that among loan applicants with comparable risk profiles, banks reject fewer condo loans and are *increasingly* less inclined to reject condo loans over time. To test this possibility, we perform one-to-one propensity score matching on the loan applications of both the condo and single-family markets in the HMDA data. The matching variables are loan amount, location (MSA), a male applicant dummy, a Hispanic applicant dummy, an Asian applicant dummy, a black applicant dummy, a second lien dummy, and an owner-occupied status dummy. Panel A of Table 7 shows summary statistics of both the matched sample and the original full sample. In the matched sample, the single-family loan applications are more comparable to the condo loan applications.

Panel B of Table 7 shows the results of the logistic analysis of loan rejections on the matched sample. Column (1) shows that, conditioning on the other loan application characteristics and fixed effects, condo loan applications in HMDA, on average, are less rejected by the banks than single-family loan applications during the full sample period (2004–2007). However, the growing tendency among banks to reject condo loan applications (relative to single-family loan applications) over time in HMDA appears inconsistent with the idea that an increasingly lax screening standard led to more condo loan defaults over time. In column (2) of Table 7, Panel B, we observe that rejections of condo loan applications increase rather than decrease from 2004 through 2007. At the same time that condo loan defaults were rising rapidly (2004–2007, see Table 3), the increase in the rejection rate for condo loan applications is significantly larger than the increase in the rejection rate among single-family loan applications. These findings suggest that an increasingly risky condo borrower profile is a more plausible reason behind the rapid increase in condo loan defaults over time.

4.7 Robustness Checks

Condo loans are systematically different from single-family loans in loan size and other observables (see Figure A1 in the Appendix). In addition, they make up a smaller portion of the mortgage market (14%) than single-family loans, resulting in an unbalanced sample in our default analysis. Therefore, we perform a propensity score match in the first stage to obtain a more homogeneous (control) sample of single-family loans. Specifically, we perform a one-to-one match of the single-family and condo loans in the subprime and non-subprime markets, respectively, based on the original loan balance, location of the loan (MSA), and origination year, as well as other loan and borrower characteristics. The resulting matched sample is homogeneous in terms of loan and borrower characteristics between the condo and single-family loans, both in the full sample and in the subprime sample (see Table A1 and A2, respectively, in

the Appendix). The logistic analysis both in the full sample and in the subprime sample show results broadly consistent with those in Table 3 and Table 4.

It is well known that the subprime crisis exhibits cross-sectional heterogeneity, with a more striking default pattern in several “sand states” (i.e., California, Florida, Nevada, and Arizona). We test whether similar heterogeneity exists for condo loan defaults. In unreported analyses, we confirm that the condo loan default level and growth patterns are qualitatively the same among sand states as in the full sample. They do not appear to be stronger in these sand states, likely because there are other important determinants of condo loan presence and growth (e.g., supply constraints and demographic distribution) that make the four states a crude and noisy identification (of cross-sectional heterogeneity). Another potential sample selection bias could arise from a few super star cities whose condo markets have unique characteristics that could confound our interpretation. We perform robustness tests of our key default analysis (Table 3 and 4) by removing New York and Los Angeles from our sample. The results remain qualitatively the same. These results are available upon request.

5 Conclusion

Condominium loan originations grew dramatically from 2001 to 2007. We document strong evidence that condo loans are inherently riskier than single-family loans, despite many observables that make condo loans appear to be safer. More condo borrowers are investors, and their chosen loan terms are riskier than those of the average single-family borrower. Perhaps more strikingly, we find that the default rate for condo loans grows at an exponential rate over the sample period, and condo loans originated in 2006 and 2007 are considerably more likely to default, even compared to the subprime mortgages in the single-family market in the same cohort. Furthermore, we show evidence consistent with the hypothesis that condo loans default earlier and that they potentially impact single-family subprime defaults in the same geographic

area. The spillover effects of condo defaults are driven by investor defaults in the non-subprime condo market, and they exist only in the non-judicial foreclosure states. This implies that condo borrowers default early, and the associated foreclosures put downward pressure on neighborhood house prices, triggering more defaults in the single-family subprime market.

Our findings have important implications for understanding the recent mortgage crisis. The prior literature has focused on the roles of securitization and the subprime mortgage market in explaining the crisis. Undoubtedly, both of these factors played significant roles in triggering the crisis, but more fundamental factors identified by recent research, such as the role of homebuyer expectations and investor behaviors, has been largely ignored by the literature, due to lack of direct observation of such factors.

The condominium market is a natural setting to study homebuyer and investor behavior. Condominium borrowers are more likely to be investors; they tend to be less financially constrained and have higher FICO scores (and thus higher income on average); and they tend to buy in more expensive areas. In addition, condo borrowers use much more unconventional and risky loan terms—the mortgage vehicles of choice among ruthless and strategic defaulters, according to previous studies. The average default pattern in this market is a strong indicator of the contribution of homebuyer expectations and investor behaviors to the financial crisis. Our evidence suggests that less financially constrained home buyers and investors defaulted at a greater speed when the housing market slowed down and that the large number of early condo defaults subsequently influenced default behavior in the single-family subprime market in the same zip code.

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Figure 1 Frequency Distribution of Condo Loans Originated in 2001–2007

This figure shows the frequency distribution of condo loan originations for all U.S. states. We include purchase loans and loans smaller than \$10 million. All the loans are originated during the period 2001–2007. Fig. 1.1 shows the number of condo loan originations in 2001–2007 (in thousands), and Fig. 1.2 presents the percentage of condo loan originations as the share of single-family loan originations plus condo loan originations in 2001–2007.

Fig. 1.1 Number of condo loans originated in 2001-2007 (in thousands)

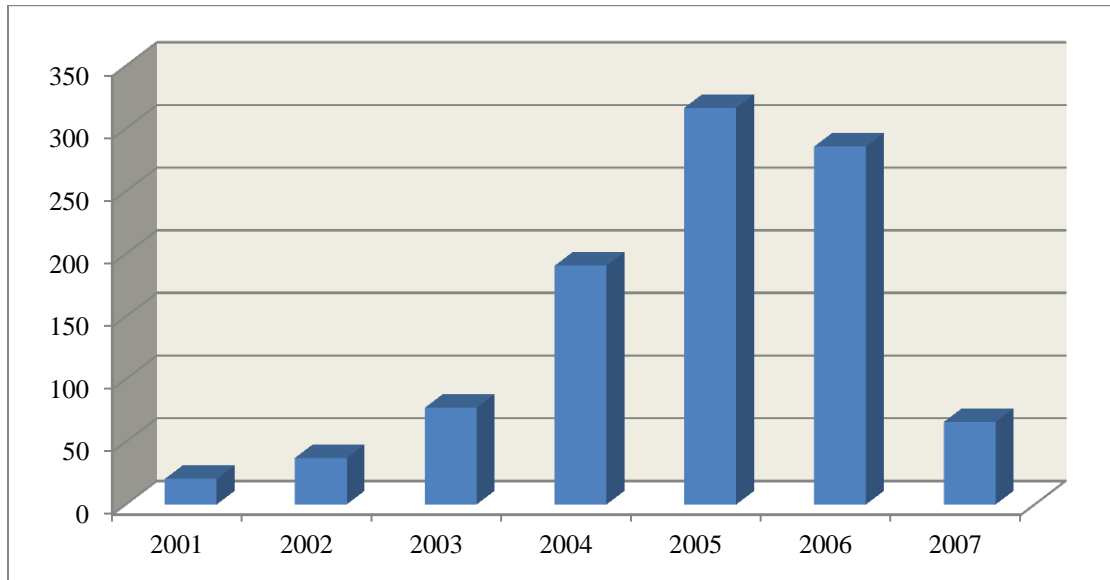


Fig. 1.2 Percentage of condo loans originated in 2001–2007

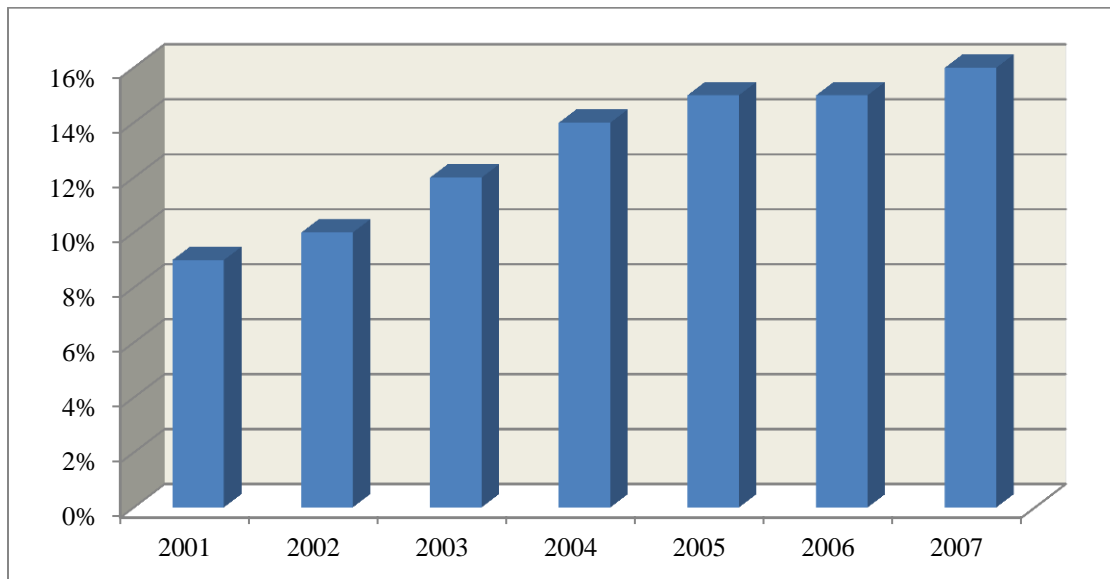


Figure 2 Frequency Distribution of Defaults within Two Years of Origination: Condo vs. Single-Family

This figure shows the frequency distribution of loan defaults within two years of origination (in percentages). All the loans are originated during the period 2003–2007 and are separated by property type: condo and single-family. Fig. 2.1 shows the frequency distribution of within-two-year default rates for the full sample; Fig. 2.1 presents the distribution by comparing subprime and non-subprime loans. The Y-axis indicates the percentage of default probability within two years of origination, and the X-axis indicates the origination year of the loan.

Fig. 2.1 Frequency distribution of defaults within two years: Full sample

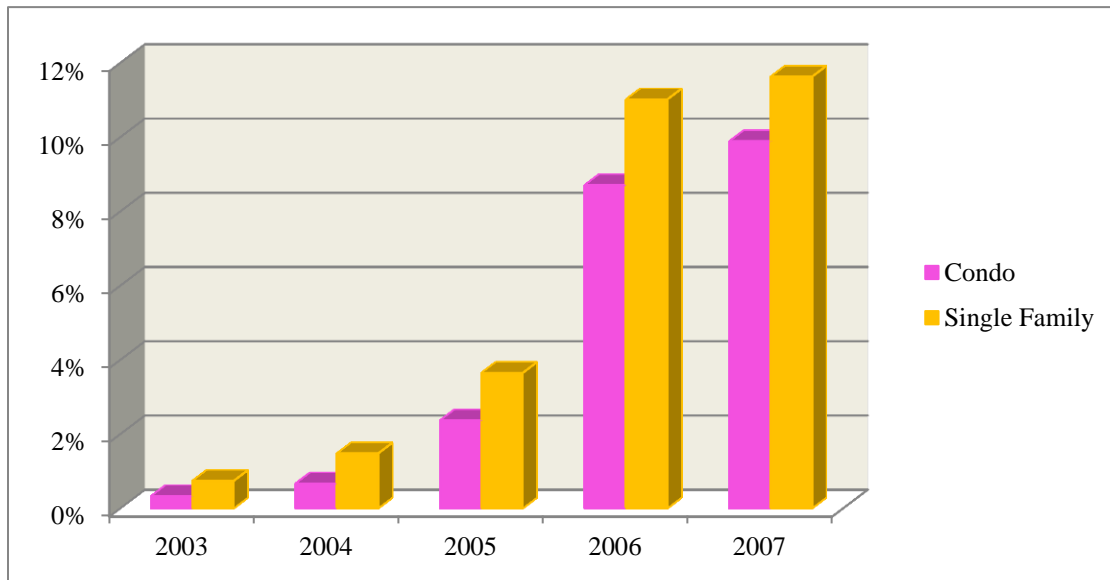


Fig. 2.2 Frequency distributions of defaults within two years: Subprime and non-subprime

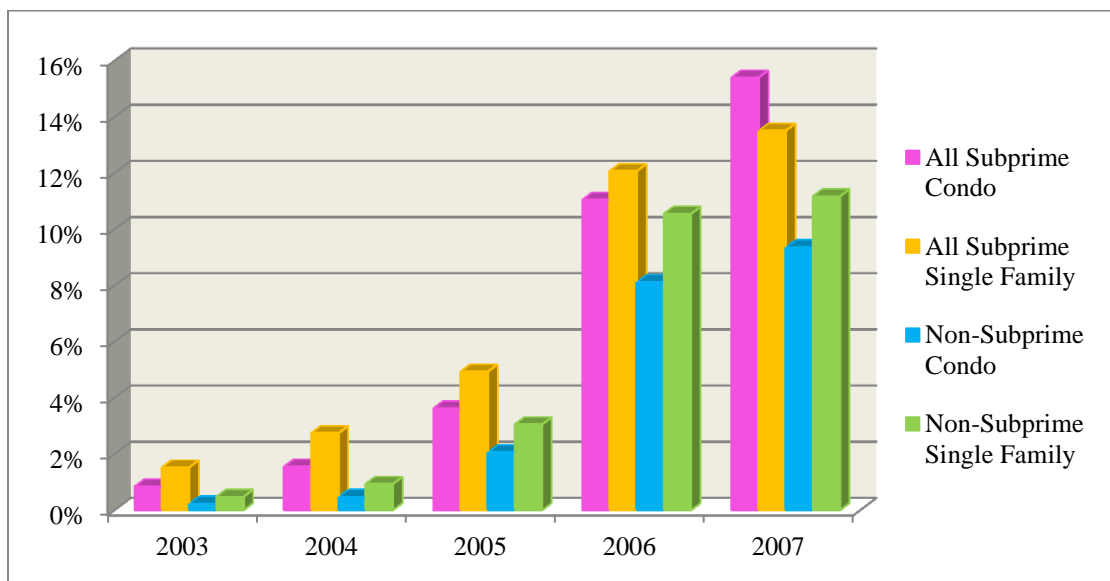


Table 1 Summary Statistics of BlackBox Full Sample

This table presents the summary statistics of the BlackBox Analytics (BBX) dataset. This dataset includes only single-family and condominium (condo) loans originated during the period 2003–2007. Panel A reports the results from aggregate-level summary statistics of the loans and compares the average values of the variables by full sample, single-family loans, and condo loans, respectively. Panel B shows the full sample summary statistics results by origination year. The variables with “D_” represent dummies. *D_default within 2 yrs* is equal to one for defaulting within two years of the loan origination date. *Current interest rate* refers to the coupon rate charged to the borrower for the most recent remittance period. *Original loan balance* is defined as the amount of principal on the closing date of the mortgage. *FICO score* refers to the FICO (formerly the Fair Isaac Corporation) borrower credit score at the time of the loan closing. *Original LTV* means the ratio of the original loan amount to the property value at loan origination. *D_FRM* is equal to one for fixed-rate mortgages. *D_Owner occupied* takes one if the property is owner occupied. *D_Second lien* is equivalent to one for a second lien loan that is subservient to the main or first mortgage on a piece of real estate. *D_Option ARM* is equal to one if it is an adjustable rate mortgage with added flexibility of making one of several possible payments on your mortgage every month. *D_Interest only loan* is one if it is a loan in which, for a set term, the borrower pays only the interest on the principal balance with the principal balance unchanged. *D_Heloc* is equivalent to one if it is a loan in which the lender agrees to lend a maximum amount within an agreed term, where the collateral is the borrower's equity in his/her house (HELOC is short for home equity line of credit). *D_Low/No doc* takes one if the borrower is required to provide low or no documentation. *D_Subprime* equals one if it is a subprime loan. *Margin* is the difference between the interest rate charged to the borrower and the applicable ARM index, as measured in number of percentage points. *Original appraisal value* refers to the estimate of the property value at the time of loan origination, as supplied by the data provider. *Log_HPI* is log of the quarterly FHFA/OFHEO House Price Index. Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Summary statistics for BlackBox (BBX): from 2003 to 2007

	Total	Condo	Single-Family (SF)	Diff. (Condo-SF)
D_default within 2 yrs	5%	4%	6%	-2%**
Current interest rate	7.53	7.11	7.61	-0.50**
Original loan balance (*1000)	215	219	215	4**
FICO score	679	699	675	24**
Original LTV	74%	73%	74%	-1**
D_FRM	41%	36%	42%	-6%**
D_Owner occupied	73%	69%	74%	-5%**
D_Second lien	19%	18%	19%	-1%**
D_Option ARM	4%	8%	4%	4%**
D_Interest only loan	20%	29%	19%	10%**
D_Heloc	1%	2%	1%	1%**
D_Low/No doc	33%	40%	32%	8%**
D_Subprime	28%	19%	30%	-11%**
Margin	2.31	2.20	2.33	-0.13**
Original appraisal value (*1000)	321	321	321	0
Log_HPI	5.31	5.36	5.30	0.06**
Sample Size (*1000)	6,376	936	5,440	

Panel B Summary statistics for BlackBox (BBX) by loan origination year (2003–2007)

Original Year	2003			2004			2005			2006			2007		
	Single-Family	Condo	Diff.	Single-Family	Condo	Diff.	Single-Family	Condo	Diff.	Single-Family	Condo	Diff.	Single-Family	Condo	Diff.
D_default within 2 yrs	1%	0%	1%**	1%	1%	0%**	4%	2%	2%**	11%	9%	2%**	12%	10%	2%**
Current interest rate	7.35	6.94	0.41**	7.30	6.69	0.61**	7.54	6.93	0.61**	8.01	7.58	0.43**	7.56	7.32	0.24**
Original loan balance (*1000)	218	211	7**	206	210	-4**	208	213	-5**	209	212	-3**	298	323	-25**
FICO score	679	697	-18**	676	701	-25**	676	700	-24**	671	694	-23**	685	710	-25**
Original LTV	74%	73%	1%**	76%	74%	2%**	73%	73%	0%**	72%	70%	2%**	79%	76%	3%**
D_FRM	47%	38%	9%**	35%	27%	8%**	39%	32%	7%**	46%	41%	5%**	52%	47%	5%**
D_Owner occupied	82%	78%	4%**	79%	75%	4%**	74%	68%	6%**	70%	65%	5%**	60%	60%	0%*
D_Second lien	13%	13%	0%**	14%	13%	1%**	20%	18%	2%**	25%	24%	1%**	16%	16%	0%
D_Option ARM	0%	1%	-1%**	3%	5%	-2%**	5%	9%	-4%**	4%	9%	-5%**	5%	10%	-5%**
D_Interest only loan	5%	11%	-6%**	15%	24%	-9%**	23%	34%	-11%**	21%	31%	-10%**	23%	33%	-10%**
D_Heloc	0%	0%	0%	1%	1%	0%**	2%	3%	-1%**	2%	2%	0%**	0%	0%	0%*
D_Low/No doc	23%	24%	-1%**	24%	28%	-4%**	34%	42%	-8%**	38%	48%	-10%**	41%	53%	-12%**
D_Subprime	26%	17%	9%**	30%	19%	11%**	32%	20%	12%**	31%	20%	11%**	20%	9%	11%**
Margin	1.80	1.58	0.22**	2.32	2.21	0.11**	2.58	2.45	0.13**	2.43	2.24	0.19**	1.59	1.57	0.02
Original appraisal value (*1000)	306	297	9**	302	304	-2**	320	316	4**	321	316	5**	419	449	-30**
Log_HPI	5.32	5.40	-0.08**	5.35	5.43	-0.08**	5.31	5.37	-0.06**	5.26	5.31	-0.05**	5.24	5.30	-0.06**
Sample Size (*1000)	581	77		1,182	191		1,758	317		1,563	286		356	66	

Table 2 Summary Statistics: Condo Loans vs. Subprime Loans

This table compares the summary statistics of condo loans with those of the subprime market. The dataset includes only single-family and condominium (condo) loans originated during the period 2003–2007. Panel A presents the comparison between all condo loans and single-family subprime loans, and Panel B presents statistics of condo subprime loans vs. those of single-family subprime loans. The variables with “D_” represent dummies. *D_default within 2 yrs* is equal to one for defaulting within two years of the loan origination date. *Current interest rate* refers to the coupon rate charged to the borrower for the most recent remittance period. *Original loan balance* is defined as the amount of principal on the closing date of the mortgage. *FICO score* refers to the FICO (formerly the Fair Isaac Corporation) borrower credit score at the time of the loan closing. *Original LTV* means the ratio of the original loan amount to the property value at loan origination. *D_FRM* is equal to one for fixed-rate mortgages. *D_Owner occupied* takes one if the property is owner occupied. *D_Second lien* is equivalent to one for a second lien loan that is subservient to the main or first mortgage on a piece of real estate. *D_Option ARM* is equal to one if it is an adjustable rate mortgage with added flexibility of making one of several possible payments on your mortgage every month. *D_Interest only loan* is one if it is a loan in which, for a set term, the borrower pays only the interest on the principal balance with the principal balance unchanged. *D_Heloc* is equivalent to one if it is a loan in which the lender agrees to lend a maximum amount within an agreed term, where the collateral is the borrower's equity in his/her house (HELOC is short for home equity line of credit). *D_Low/No doc* takes one if the borrower is required to provide low or no documentation. *Margin* is the difference between the interest rate charged to the borrower and the applicable ARM index, as measured in number of percentage points. *Original appraisal value* refers to the estimate of the property value at the time of loan origination, as supplied by the data provider. *Log_HPI* is log of the quarterly FHFA/OFHEO House Price Index. Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Summary statistics for BlackBox (BBX) from 2003 to 2007: condo loans vs. single-family subprime loans

	Condo	SF Subprime	Diff. (Condo-SF Subprime)
D_default within 2 yrs	4%	7%	-3%**
Current interest rate	7.11	8.30	-1.19**
Original loan balance (*1000)	219	151	68**
FICO score	699	577	122**
Original LTV	73%	79%	-6%**
D_FRM	36%	30%	6%**
D_Owner occupied	69%	80%	-11%**
D_Second lien	18%	11%	7%**
D_Option ARM	8%	0%	8%**
D_Interest only loan	29%	8%	21%**
D_Heloc	2%	1%	1%**
D_Low/No doc	40%	13%	27%**
Margin	2.20	3.79	-1.59**
Original appraisal value (*1000)	321	212	109**
Log_HPI	5.36	5.27	0.09**
Sample Size (*1000)	936	1,617	

Panel B Summary statistics for BlackBox (BBX) from 2003 to 2007: condo subprime vs. single-family subprime

	Subprime Condo	Subprime Single-family	Diff. (Subprime Condo- Subprime SF)
D_default within 2 yrs	6%	7%	-1% **
Current interest rate	8.19	8.30	-0.11 **
Original loan balance (*1000)	160	151	9 **
FICO score	579	577	2 **
Original LTV	77%	79%	-2% **
D_FRM	28%	30%	-2% **
D_Owner occupied	80%	80%	0% *
D_Second lien	10%	11%	-1% **
D_Option ARM	0%	0%	0% **
D_Interest only loan	12%	8%	4% **
D_Heloc	3%	1%	2% **
D_Low/No doc	17%	13%	4% **
Margin	3.87	3.79	0.08 **
Original appraisal value (*1000)	226	212	14 **
Log_HPI	5.36	5.27	0.09 **
Sample Size (*1000)	175	1,617	

Table 3 Logistic Analysis of Borrower within-two-year Default: Condo vs. Single-Family

This table presents the result of logistic regression analysis for the BlackBox dataset. This dataset includes only single-family and condominium (condo) purchase loans from all states originated during the period 2003–2007. The dependent variable *D_default within 2 yrs* takes the value of one for defaulting within two years of the loan origination date. The definitions of the independent variables are shown in Table 1. *Log_Duration* is the log of the elapsed time from origination to the end of the sample period or to the first classification as being prepaid or delinquent at least 60 days. The standard errors are clustered at the origination year level. State and origination year fixed effects are included in the regressions but not reported. Odds ratios are reported, and robust z-statistics are included in the parentheses. Note that ** and * indicate 1% and 5% significance, respectively.

	(1) D_default within 2yrs	(2) D_default within 2yrs
D_Condo	0.946 (-1.63)	0.421** (-7.33)
D_Condo * D_OrigYear2004		1.165** (2.91)
D_Condo * D_OrigYear2005		1.853** (23.58)
D_Condo * D_OrigYear2006		2.458** (13.83)
D_Condo * D_OrigYear2007		2.626** (16.73)
D_Owner occupied	0.561** (-7.82)	0.561** (-7.80)
D_Second lien	7.136** (26.40)	7.117** (26.54)
D_FRM	0.794** (-2.69)	0.793** (-2.70)
D_Option ARM	0.503** (-4.37)	0.500** (-4.37)
D_Interest only loan	1.057 (0.60)	1.056 (0.59)
D_Heloc	0.672 (-1.64)	0.671 (-1.65)
D_Low/No Doc	1.341** (3.55)	1.337** (3.53)
D_Subprime	0.790* (-2.56)	0.789** (-2.59)
Original LTV	1.003** (6.33)	1.003** (6.33)
Log_FICO score	0.005** (-26.90)	0.005** (-26.77)
Log_Original loan balance	1.258** (8.11)	1.257** (7.92)
Log_HPI	0.373** (-2.94)	0.372** (-2.94)
Log_Duration	0.261** (-4.20)	0.261** (-4.18)
Unemployment Rate	0.627 (-1.90)	0.626 (-1.91)
Yield Slope	2.092 (1.32)	2.096 (1.32)
Credit Spread	2.867** (6.35)	2.867** (6.35)
Observations	4,267,799	4,267,799
Pseudo R-squared	0.397	0.397

Table 4 Logistic Analysis of within-two-year Default: Condo Loans vs. Subprime Loans

This table presents the results of logistic regression analysis that includes all condo loans and subprime loans from all states originated during the period 2003–2007. Panel A presents the logistic regression results of all condo loans and single-family subprime loans, and Panel B presents results of condo subprime loans and single-family subprime loans. The dependent variable *D_default within 2 yrs* takes a value of one for defaulting within two years of the loan origination date. The definitions of the independent variables are shown in Table 1 and Table 3. State and origination year fixed effects are included in the regressions but not reported. Odds ratios are reported, and robust z-statistics are included in parentheses. Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Logistic analysis of all condo loans and single-family subprime loans		
	(1)	(2)
	D_default within 2yrs	D_default within 2yrs
D_Condo	1.018 (0.63)	0.254** (-3.70)
D_Condo * D_OrigYear2004		1.391** (41.01)
D_Condo * D_OrigYear2005		2.932** (7.53)
D_Condo * D_OrigYear2006		5.183** (7.15)
D_Condo * D_OrigYear2007		5.081** (9.93)
D_Owner occupied	0.671** (-4.46)	0.678** (-4.15)
D_Second lien	5.415** (48.17)	5.254** (54.07)
D_FRM	0.886 (-1.51)	0.873 (-1.69)
D_Option ARM	0.375** (-6.72)	0.357** (-6.79)
D_Interest only loan	1.071 (0.65)	1.038 (0.38)
D_Heloc	0.880 (-0.46)	0.854 (-0.64)
D_Low/No Doc	1.219* (2.12)	1.187 (1.93)
D_Subprime	1.289** (2.69)	1.300* (2.55)
Original LTV	1.004** (3.85)	1.004** (3.71)
Log_FICO score	0.080** (-8.00)	0.077** (-7.53)
Log_Original loan balance	1.109** (2.95)	1.106* (2.47)
Log_HPI	0.464** (-2.91)	0.463** (-3.03)
Log_Duration	0.224** (-4.89)	0.222** (-4.70)
Unemployment Rate	0.684 (-1.58)	0.681 (-1.62)
Yield Slope	1.713 (0.96)	1.742 (0.99)
Credit Spread	2.722** (5.63)	2.715** (5.61)
Observations	1,391,884	1,391,884
Pseudo R-squared	0.353	0.356

Panel B Logistic analysis of all condo subprime loans and single-family subprime loans		
	(1)	(2)
	D_default within 2yrs	D_default within 2yrs
D_Condo	1.093**	0.584**
	(3.37)	(-3.06)
D_Condo * D_OrigYear2004		1.046
		(1.94)
D_Condo * D_OrigYear2005		1.446**
		(6.71)
D_Condo * D_OrigYear2006		2.158**
		(6.35)
D_Condo * D_OrigYear2007		2.893**
		(6.07)
D_Owner occupied	0.701**	0.701**
	(-3.18)	(-3.18)
D_Second lien	3.800**	3.784**
	(103.39)	(117.64)
D_FRM	1.049	1.049
	(0.87)	(0.85)
D_Option ARM	0.407**	0.405**
	(-2.79)	(-2.80)
D_Interest only loan	1.206	1.203
	(1.95)	(1.95)
D_Heloc	0.516	0.521
	(-0.52)	(-0.50)
D_Low/No Doc	1.324**	1.320**
	(3.39)	(3.40)
Original LTV	1.003*	1.003*
	(2.46)	(2.48)
Log_FICO score	0.812	0.820
	(-0.41)	(-0.39)
Log_Original loan balance	1.088	1.085
	(1.34)	(1.28)
Log_HPI	0.396**	0.398**
	(-4.35)	(-4.31)
Log_Duration	0.182**	0.181**
	(-5.21)	(-5.19)
Unemployment rate	0.731	0.730
	(-1.39)	(-1.40)
Yield Slope	1.471	1.475
	(0.68)	(0.69)
Credit Spread	2.614**	2.617**
	(5.44)	(5.46)
Observations	813,329	813,329
Pseudo R-squared	0.312	0.313

Table 5 Logistic Analysis of Within-One-Year Default: Condo Loans vs. Subprime Loans

This table presents the result of the logistic regression analysis that includes all condo loans and subprime loans from all states originated during the period 2003–2007. Panel A presents the logistic regression results of all condo loans and single-family subprime loans, and Panel B presents results of condo subprime loans and single-family subprime loans. The dependent variable *D_default within 1 yr* takes a value of one for defaulting within one year of the loan origination date. We do not include the entire list of control variables; refer to Table 3 for the full list. Standard errors are clustered at the origination year level. Odds ratios are reported, and robust z-statistics are included in parentheses. Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Logistic analysis of all condo loans and single-family subprime loans		
	(1)	(2)
	D_default within 1yr	D_default within 1yr
D_Condo	1.025	0.617
	(0.54)	(-1.84)
D_Condo * D_OrigYear2004		0.801**
		(-3.78)
D_Condo * D_OrigYear2005		0.957
		(-0.71)
D_Condo * D_OrigYear2006		2.403**
		(11.45)
D_Condo * D_OrigYear2007		2.304**
		(10.28)
Observations	1,391,884	1,391,884
Pseudo R-squared	0.428	0.430

Panel B Logistic analysis of all condo subprime loans and single-family subprime loans		
	(1)	(2)
	D_default within 1yr	D_default within 1yr
D_Condo	1.066	0.808
	(1.31)	(-1.69)
D_Condo * D_OrigYear2004		0.847**
		(-3.05)
D_Condo * D_OrigYear2005		1.014
		(0.88)
D_Condo * D_OrigYear2006		1.645**
		(13.02)
D_Condo * D_OrigYear2007		1.784**
		(7.65)
Observations	811,504	811,504
Pseudo R-squared	0.424	0.424

Table 6 Zip Code Level Analysis of the Single-Family Subprime Market Defaults

This table reports the zip code level analysis of the single-family subprime market defaults from loans by their origination cohort years (2003–2007). From the loan-level sample with all the condo and single-family subprime loans, we compute *SF Subprime 2nd Year Default (%)_{j,t}* (*Condo 2nd Year Default (%)_{j,t}*) as the proportion of single-family subprime loans (condo loans) in the zip code *j* originated in year *t* that default during the second year after origination. *SF Subprime Within 1 Year Default (%)_{j,t}* (*Condo Within 1 Year Default (%)_{j,t}*) is defined as the proportion of single-family subprime loans (condo loans) in zip code *j* originated in year *t* that default in the first year after origination. % *Condo Loans_{j,t}* is the number of condo loans divided by the total number of single-family subprime and condo loans originated in year *t* in zip code *j*. *Condo Subprime Within 1 Year Default (%)_{j,t}* (*Condo Non – Subprime Within 1 Year Default (%)_{j,t}*) is the number of condo within-one-year defaults in the subprime (non-subprime) market divided by the total number of condo loans originated in year *t* in zip code *j*. *Condo Within 1 Year Non – Investor Default (%)_{j,t}* (*Condo Within 1 Year Investor Default (%)_{j,t}*) is the number of all condo owner-occupied (non-owner-occupied) loans that default in the first year after origination divided by the total number of condo loans originated in year *t* in zip code *j*. *Condo Non – Subprime Within 1 Year Investor Default (%)_{j,t}* (*Condo Subprime Within 1 Year Investor Default (%)_{j,t}*) is the number of within-one-year condo defaults of non-owner-occupied loans in the non-subprime (subprime) market divided by the total number of condo loans originated in year *t* in zip code *j*. *SF Subprime Within 1 Year Investor Default (%)_{j,t}* (*SF Subprime Within 1 Year Non – Investor Default (%)_{j,t}*) is the number of within-one-year single-family subprime defaults of non-owner-occupied (owner-occupied) loans divided by the total single-family subprime loans originated in year *t* in zip code *j*. Other unreported control variables include the state-level unemployment rate, the MSA-level HPI, the slope of the yield curve, and the credit spread. We also include zip code and origination year fixed effects in all three panels and cluster the standard errors at the origination year level. T-statistics are included in parentheses, and ** and * indicate 1% and 5% significance, respectively.

Panel A Spillover effect of condo defaults		
	(1)	(2)
	SF 2nd Year Default (%)_{j,t}	Condo 2nd Year Default (%)_{j,t}
SF Subprime Within 1 Year Default (%)_{j,t}	0.027 (1.18)	0.022* (3.87)
Condo Within 1 Year Default (%)_{j,t}	0.071* (2.92)	0.176** (5.33)
% Condo Loans_{j,t}	-0.014 (-2.59)	0.038* (3.02)
Constant	0.271* (4.47)	0.176* (2.89)
Observations	76686	76686
R-squared	0.40	0.32

Panel B Spillover effect of condo defaults: subprime vs. non-subprime

	(1)
	SF 2nd Year Default (%) _{j,t}
SF Subprime Within 1 Year Default (%) _{j,t}	0.027 (1.18)
Condo Subprime Within 1 Year Default (%) _{j,t}	0.029 (0.56)
Condo Non – Subprime Within 1 Year Default (%) _{j,t}	0.085* (4.25)
% Condo Loans _{j,t}	-0.014 (-2.60)
Constant	0.271* (4.46)
Observations	76686
R-squared	0.40

Panel C Spillover effect of condo defaults: investor vs. non-investor

	(1)	(2)
	SF 2nd Year Default (%) _{j,t}	SF 2nd Year Default (%) _{j,t}
Condo Within 1 Year Non – Investor Default (%) _{j,t}	0.068* (3.21)	0.068* (3.18)
Condo Within 1 Year Investor Default (%) _{j,t}	0.073 (2.19)	
Condo Non – –Subprime Within 1 Year Investor Default (%) _{j,t}		0.099* (3.02)
Condo Subprime Within 1 Year Investor Default (%) _{j,t}		-0.029 (-0.51)
SF Subprime Within 1 Year Non – Investor Default (%) _{j,t}	0.018 (1.61)	0.018 (1.62)
SF Subprime Within 1 Year Investor Default (%) _{j,t}	0.034 (1.12)	0.034 (1.12)
% Condo Loans _{j,t}	-0.014 (-2.61)	-0.014 (-2.64)
Constant	0.270** (4.47)	0.270** (4.47)
Observations	76686	76686
R-squared	0.40	0.40

Panel D Spillover effect of condo defaults: Judicial vs. Non-judicial foreclosure states

	(1)	(2)
	SF 2nd Year Default (%) _{j,t}	SF 2nd Year Default (%) _{j,t}
	Judicial Foreclosure States	Non-Judicial Foreclosure States
SF Subprime Within 1 Year Default (%)_{j,t}	0.004 (0.19)	0.036** (2.19)
Condo Within 1 Year Default (%)_{j,t}	-0.004 (-0.11)	0.088*** (3.08)
% Condo Loans_{j,t}	-0.014*** (-2.81)	-0.021*** (-3.75)
Constant	0.011*** (9.43)	0.012*** (9.45)
Observations	44839	54813
R-squared	0.39	0.39

Table 7 HMDA Analysis: Summary Statistics and Logistic Analysis

This table presents summary statistics and the result of logistic regression using the HMDA data sample (2004–2007). Panel A presents the summary statistics of the HMDA dataset (2004–2007) by single-family and condo loans separately, before and after propensity score matching. We perform a one-to-one matching based on location (MSA), origination year, and borrower characteristics. The variables with “D_” represent dummies. *D_rejection* is equal to one if the loan is denied by the financial institution. *Loan amount* is defined as the amount of principal on the closing date of the mortgage. *D_Owner occupied* takes a value of one if the property is owner occupied. *D_Hispanic* is equal to one if the main applicant’s ethnicity is Hispanic or Latino. *D_Male* takes a value of one if the main applicant is male. *D_Asian* equals one for Asian applicants, and *D_Black* equals one for black or African American applicants. *D_Second lien* is equal to one for a second lien loan that is subservient to the main or first mortgage on a piece of real estate. *D_HOEPA loan* takes a value of one for a HOEPA loan, which qualifies protection under the Home Ownership and Equity Protection Act (HOEPA) either because it carries a high rate of interest or because it entails high fees for the borrower. Note that ** and * indicate 1% and 5% significance, respectively. Panel B presents the result of the logistic regression analysis of loan rejections in the HMDA matched sample of condo and single-family loans originated in 2004–2007. Standard errors are clustered at the origination MSA level. The MSA fixed effect (392 MSA dummies) and origination year fixed effects are included in the regressions but not reported. Odds ratios are reported, and robust z-statistics are included in parentheses, Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Summary statistics of the HMDA dataset (2004–2007): before and after propensity score matching						
	Original Sample			Matched Sample		
	Single-Family	Condo	Diff.	Single-Family	Condo	Diff.
D_Rejection	15.1%	9.2%	5.9%**	15.1%	11%	4.1%**
Loan amount (in thousands)	177	903	-726**	429	459	-30**
D_Owner occupied	87.4%	8.1%	79.3%**	15.1%	13.3%	1.8%**
D_Hispanic	13.3%	6.3%	7%**	9.2%	8.2%	1%**
D_Male	56.7%	35.3%	21.4%**	42.7%	45.1%	-2.4%**
D_Asian	4.6%	5.1%	-0.5%**	6.6%	6%	0.6%**
D_Black	9.57%	4.1%	5.4%**	5.9%	6%	-0.1%
D_Second lien	19.2%	5.5%	13.8%**	7.2%	7.3%	-0.1%
D_HOEPA loan	0.04%	0.01%	0.03%**	0.008%	0.016%	-0.8%
Sample Size	52,599,505	116,487		61,114	61,114	

Panel B Logistic analysis for matched HMDA sample (2004-2007)

	(1) D_rejection	(2) D_rejection
D_Condo	0.688** (-12.49)	0.674** (-5.97)
D_Condo * D_Year2005		0.910** (-16.95)
D_Condo * D_Year2006		1.029** (2.61)
D_Condo * D_Year2007		1.174** (10.74)
Log_loan amount	1.000 (-0.53)	1.000 (-0.41)
D_Owner occupied	1.396** (3.18)	1.386** (3.31)
D_Hispanic	1.992** (38.24)	1.987** (34.94)
D_Male	1.249** (3.09)	1.240** (3.00)
D_Asian	1.520** (4.77)	1.510** (4.73)
D_Black	2.743** (18.45)	2.745** (18.71)
D_Second lien	1.921** (30.46)	1.922** (29.58)
Constant	0.081** (-4.22)	0.090** (-4.39)
Observations	122,228	122,228
Pseudo R-squared	0.05	0.05

Appendix

Figure A1 Kernel Density Plots of the BBX Sample 2003-2007

This figure shows the kernel density plots of three key variables: FICO score, original LTV ratio, and original loan amount (in thousands of dollars) in the BlackBox dataset. This dataset includes only single-family and condominium (condo) loans originated over 2003–2007; only purchasing loans and those with an original loan amount of less than \$10 million are included in the sample. The Y-axis indicates the probability of density, and the X-axis indicates the value distribution of the variables.

Fig. A1.1 Kernel density plot of FICO score: condo vs. single-family

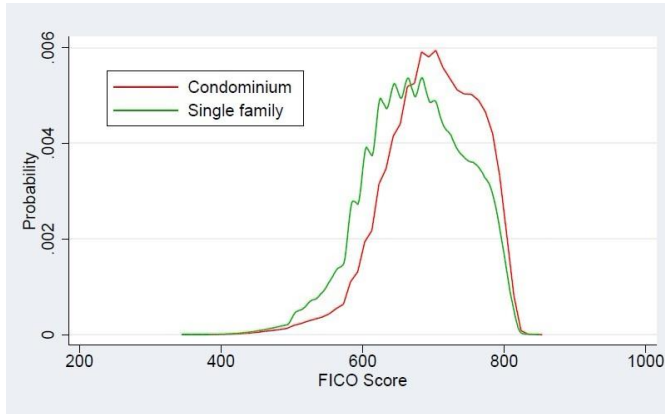


Fig. A1.2 Kernel density plot of LTV: condo vs. single-family

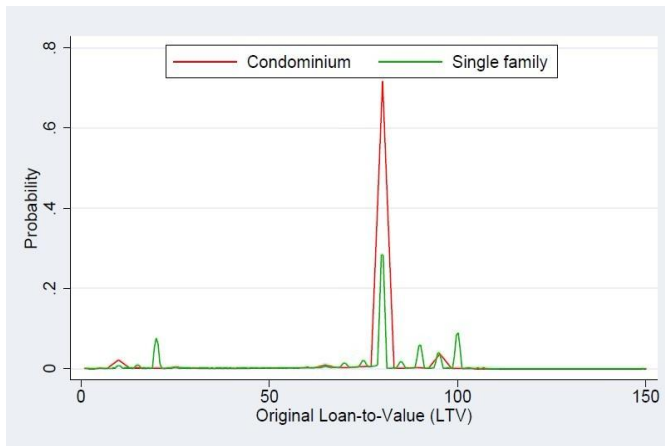


Fig. A1.3 Kernel density plot of original loan balance: condo vs. single-family

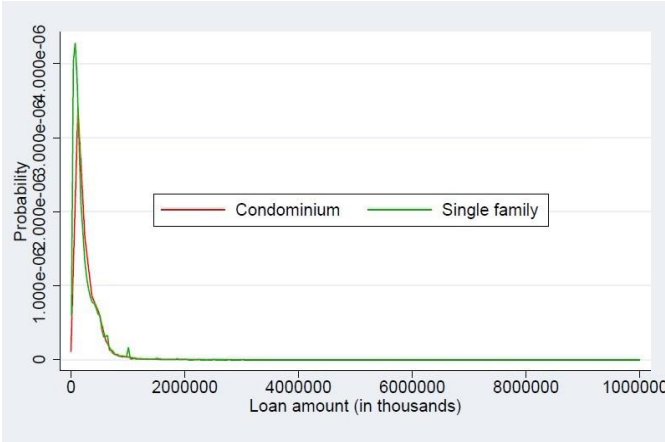


Table A1 Logistic Analysis of Borrower Default for Full Sample: Propensity Score Matching

This table presents summary statistics and the results of a logistic regression in the full matched sample of all condo loans and all single-family loans originated during the period 2003–2007. We perform a one-to-one propensity score matching based on location and origination year, as well as borrower (e.g., FICO) and loan (e.g., LTV, loan amount, FRM, etc.) characteristics. Panel A shows the summary statistics results comparing all condo and all single-family loans in the matched sample. Panel B displays the logistic results for the matched full sample. The dependent variable *D_default within 2 yrs* takes a value of one for defaulting within two years of the loan origination date. The definitions of the independent variables are shown in Table 1. *Log_Duration* is the log of the elapsed time from origination to the end of the sample period or to the first classification as being prepaid or delinquent at least 60 days. Standard errors are clustered at the origination-year level. State and origination-year fixed effects are included in the regressions but not reported. Odds ratios are reported, and robust z-statistics are included in parentheses. Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Summary statistics for matched sample from 2003 to 2007: condo loans vs. single-family loans			
	Condo	Single-Family	Diff. (Condo-SF)
D_default within 2 yrs	4%	5%	-1%**
Current interest rate	7.12	7.37	-0.25**
Original loan balance (*1000)	234	233	1*
FICO score	693	693	0
Original LTV	72.57	72.66	-0.09
D_FRM	37%	37%	0%
D_Owner occupied	70%	70%	0%**
D_Second lien	21%	21%	0%
D_Option ARM	6%	6%	0%**
D_Interest only loan	30%	30%	0%
D_Heloc	1%	1%	0%
D_Low/No doc	42%	42%	0%*
Subprime	12%	12%	0%
Margin	2.02	2.12	-0.10**
Original appraisal value (*1000)	336	341	-5**
Log_HPI	5.35	5.35	0.00**
Sample Size (*1000)	430	430	

Panel B Logistic results of matched sample from 2003 to 2007: condo loans vs. single-family loans		
	(1)	(2)
	D_default within 2yrs	D_default within 2yrs
D_Condo	0.922*	0.669**
	(-2.00)	(-7.27)
D_Condo * D_OrigYear2004		1.182**
		(29.17)
D_Condo * D_OrigYear2005		1.381**
		(9.59)
D_Condo * D_OrigYear2006		1.388**
		(5.71)
D_Condo * D_OrigYear2007		1.415**
		(5.41)
D_Owner occupied	0.580**	0.580**
	(-6.86)	(-6.85)
D_Second lien	8.180**	8.181**
	(24.50)	(24.39)
D_FRM	0.779	0.778
	(-1.94)	(-1.94)
D_Option ARM	0.510**	0.510**
	(-5.36)	(-5.34)
D_Interest only loan	1.023	1.024
	(0.25)	(0.25)
D_Heloc	0.674	0.674
	(-1.77)	(-1.78)
D_Low/No Doc	1.290**	1.290**
	(3.03)	(3.02)
D_Subprime	0.690**	0.690**
	(-4.52)	(-4.52)
Original LTV	1.003**	1.003**
	(3.91)	(3.90)
Log_FICO score	0.003**	0.003**
	(-21.36)	(-21.35)
Log_Original loan balance	1.314**	1.314**
	(7.74)	(7.67)
Log_HPI	0.519	0.517
	(-1.62)	(-1.62)
Log_Duration	0.284**	0.283**
	(-3.69)	(-3.69)
Unemployment rate	0.573*	0.573*
	(-2.19)	(-2.19)
Yield Slope	2.661	2.662
	(1.82)	(1.82)
Credit Spread	2.979**	2.979**
	(6.50)	(6.50)
Observations	855,242	855,242
Pseudo R-squared	0.433	0.433

Table A2 Logistic Analysis of Borrower Default for the Subprime Sample: Propensity Score Matching

This table presents summary statistics and the result of the logistic regression in the subprime matched sample of all condo loans and all single-family loans originated during the period 2003–2007. We perform a one-to-one propensity score matching based on location and origination year, as well as borrower (e.g., FICO) and loan (e.g., LTV, loan amount, FRM, etc.) characteristics. Panel A presents the summary statistics results comparing condo subprime and single-family subprime loans of the matched sample. Panel B shows the logistic results for the matched subprime sample. The dependent variable *D_default within 2 yrs* takes a value of one for defaulting within two years of the loan origination date. The definitions of the independent variables are shown in Table 1. *Log_Duration* is the log of the elapsed time from origination to the end of the sample period or to the first classification as being prepaid or delinquent at least 60 days. Standard errors are clustered at the origination-year level. State and origination-year fixed effects are included in the regressions but not reported. Odds ratios are reported, and robust z-statistics are included in parentheses. Note that ** and * indicate 1% and 5% significance, respectively.

Panel A Summary statistics for matched sample from 2003 to 2007: condo subprime loans vs. single-family subprime loans

	Subprime Condo	Subprime Single-family	Diff. (Subprime Condo-Subprime SF)
D_default within 2 yrs	6%	7%	-1% **
Current interest rate	8.44	8.53	-0.09**
Original loan balance (*1000)	155	156	-1
FICO score	579	579	0
Original LTV	76.19	76.00	0.19
D_FRM	28%	28%	0%
D_Owner occupied	74%	74%	0%
D_Second lien	20%	20%	0%
D_Option ARM	0%	1%	-1%
D_Interest only loan	15%	15%	0%
D_Heloc	0%	0%	0%
D_Low/No doc	21%	22%	-1%
Margin	3.47	3.47	0.00
Original appraisal value (*1000)	203	210	-7**
Log_HPI	5.32	5.32	0.00
Sample Size (*1000)	53	53	

Panel B Logistic results of matched sample from 2003 to 2007: condo subprime loans vs. single-family subprime loans

	(1)	(2)
	D_default within 2yrs	D_default within 2yrs
D_Condo	1.049 (1.73)	0.924 (-1.20)
D_Condo * D_OrigYear2004		0.926** (-8.19)
D_Condo * D_OrigYear2005		1.029 (1.17)
D_Condo * D_OrigYear2006		1.178** (2.80)
D_Condo * D_OrigYear2007		1.380** (3.37)
D_Owner occupied	0.745* (-2.35)	0.744* (-2.36)
D_Second lien	4.263** (18.20)	4.259** (18.41)
D_FRM	1.249 (1.61)	1.249 (1.60)
D_Option ARM	0.291** (-5.41)	0.290** (-5.38)
D_Interest only loan	1.176 (1.38)	1.175 (1.38)
D_Heloc	0.382 (-0.67)	0.369 (-0.69)
D_Low/No Doc	1.200 (1.73)	1.199 (1.73)
Original LTV	1.003 (1.38)	1.003 (1.36)
Log_FICO score	1.278 (0.46)	1.275 (0.45)
Log_Original loan balance	1.250** (3.23)	1.251** (3.24)
Log_HPI	0.521* (-2.45)	0.517* (-2.48)
Log_Duration	0.195** (-4.71)	0.195** (-4.70)
Unemployment rate	0.664 (-1.75)	0.663 (-1.76)
Yield Slope	1.813 (0.98)	1.816 (0.98)
Credit Spread	2.685** (5.61)	2.689** (5.63)
Observations	104,988	104,988
Pseudo R-squared	0.272	0.272