RESEARCH REPORT

Default and Loss Experience for Two- to Four-Unit Properties

Laurie Goodman   *Jun Zhu*

May 2016

URBAN INSTITUTE · ELEVATE · THE · DEBATE

ABOUT THE URBAN INSTITUTE

The nonprofit Urban Institute is dedicated to elevating the debate on social and economic policy. For nearly five decades, Urban scholars have conducted research and offered evidence-based solutions that improve lives and strengthen communities across a rapidly urbanizing world. Their objective research helps expand opportunities for all, reduce hardship among the most vulnerable, and strengthen the effectiveness of the public sector.

Contents

Acknowledgments

Default and Loss Experience for Two- to Four-Unit Properties

As a relatively small part of the US mortgage market, two- to four-family properties are usually lumped in with the much larger single-family market and receive almost no separate attention. But such structures make up 19 percent of all rental housing. They make up an even larger share of affordable rental housing because two- to four-unit properties have much lower rents than either single-family investment properties or properties with five or more units. Two- to four-unit structures tend to be older than most one-unit structures; the average two- to four-unit structure was built in 1965, compared with 1981 for one-unit attached and 1973 for one-unit detached structures. These two- to four-family units play a significant role in the US housing market, yet they have been hit even harder than one-family units by the postrecession tightening of credit. Indeed, it has become significantly harder to obtain financing for these structures.

In this paper, we examine the characteristics of two- to four-family properties, both owner-occupied and investment properties. We find that two- to four-unit properties are more likely than one-unit properties to be in lower income census tracts and to be owned by minorities. We also determine the likely losses to lenders from loans on these properties by calculating the default rate, the liquidation rate, and the severity if liquidated for each type of property.

We find that total losses on two- to four-unit properties have been higher than losses on one-unit owner-occupied properties and comparable to those on one-unit investment properties. Recently, the differences between one-unit owner-occupied units and other housing groups (two- to four-unit properties and one-unit investment properties) have substantially converged because of the disproportionate tightening of financing requirements for the other groups.

The remainder of the paper is organized as follows: We provide background on two- to four- unit properties, then discuss the raw data. Next we present the empirical specification and main results of the default analysis. After that, we discuss the empirical specification and the results of the liquidation analysis. Then we describe the empirical specification and results of the severity analysis. Finally, we summarize the analysis and discuss the policy implications. We make the case that though predicted losses on two- to four-unit production are now on par with one-unit owner-occupied properties, the low volume suggests that many borrowers (who are disproportionately likely to be low and moderate income and minority) are getting squeezed out. In the interest of expanding credit to these underserved

populations and expanding, or at least preserving, the supply of affordable rental housing, the government-sponsored enterprises (GSEs) could relax the current loan-to-value requirements. If this relaxing were coupled with counseling for landlords, we believe it would make financing more available for this critical part of the market, with little additional risk to the GSEs.

Background

Lending for two- to four-unit properties accounts for approximately 5 percent of all single-family (one to four units) lending volume. For this discussion, we refer to properties where the owner lives on one side or one floor of the building and rents out the remaining space to tenants as *owner-occupied* dwellings. We refer to properties where the owner does not live in the building as *investment* dwellings. Financing for these units has become increasingly difficult since the financial crises. Lending for two- to four-unit properties was 5–6 percent of all single-family lending before 2009 but has fallen since to 2–3 percent (figure 1).

Two- to Four-Unit Volume Origination Share by Agency, 2000–15
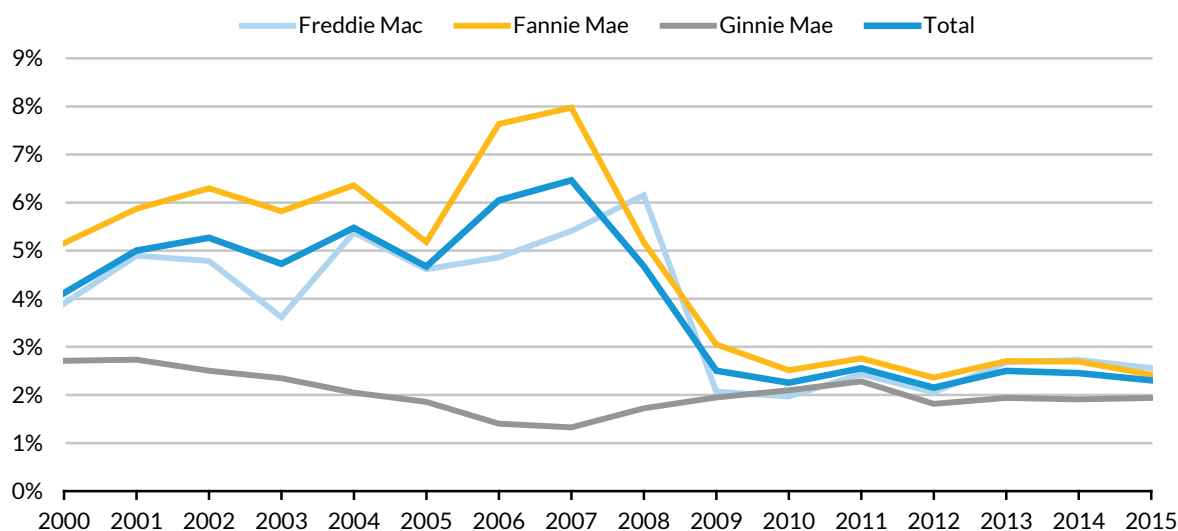
Source: eMBS pool level as of August 2015.

In the Ginnie Mae program (which we use as a proxy for government lending), two- to four-unit properties make up roughly 2 percent of all one- to four-unit originations, slightly higher than the 1.5 percent share at the peak of the housing bubble in 2007.[1] In contrast, the share of two- to four-unit

originations by Fannie Mae and Freddie Mac (the government-sponsored enterprises, or GSEs) has *declined* from 6–8 percent in 2007 to under 3 percent today. This pattern likely reflects tighter underwriting of GSE loans for two- to four-unit properties; the requirements were tightened substantially after the crisis and have since eased marginally. In December 2009, the GSEs reduced the maximum loan-to-value ratio (LTV) from 95 to 80 on all two-unit properties and from 80 to 75 on three- to four-unit properties, depressing origination volumes. The maximum LTV for two-unit properties was raised to 85 in October 2012; it remains at 75 for three- to four-unit properties.

Approximately 19 percent of all rental units are in two- to four-unit structures, and a disproportionately large number have affordable rents. Properties with two to four units are generally found in low-income neighborhoods in older, large cities, particularly in the northeast. The property owners are disproportionately lower income and minority. Table 1 uses the 2013 Fannie Mae and Freddie Mac public use database and shows the characteristics of two- to four-unit properties financed by the GSEs.

TABLE 1

Characteristics of Borrowers in the One- to Four-Unit Housing Market (percent of loans)

Category	1 unit	2 units	3–4 units	Total
Tract median income ≤80% of local area median income	12.07	40.53	50.02	13.82
Minority borrower	26.50	38.86	41.56	27.23
Borrower annual income ≤80% of area median family income	23.43	34.16	29.91	23.53
Rent affordable for very low or low-income family	44.10	64.12	67.63	51.29
Rent affordable for very low income family in a low-income area	1.87	5.98	9.67	2.17

Source: Authors' calculations based on 2013 FHFA public use database for Fannie Mae and Freddie Mac.
Note: Rental affordability category is based on the ratio of annualized rent to area median family income.

Two- to four-unit properties are more likely to be owned by lower-income households: 34.2 percent of borrowers taking out loans on two-unit properties and 29.9 percent of borrowers taking out loans on three- to four-unit properties have incomes at or below 80 percent of area median income. Only 23.4 percent of borrowers on one-unit properties have incomes that low.

Two- to four-unit properties are also more likely to be minority owned: 26.5 percent of one-unit homes have minority borrowers versus 38.9 percent of two-unit properties and 41.6 percent of three- to four-unit properties. This disparity reflects the higher percentage of minority borrowers with two- to four-unit owner-occupied properties. Looking at the numbers in greater detail (not shown), minority borrowers own 45.3 percent of two-unit owner-occupied versus 33.7 percent of two-unit investment

properties. Minority borrowers also own 50.4 percent of three- to four-unit owner-occupied properties but only 39.1 percent of three- to four-unit investment properties.

Neighborhoods differ for one-unit and two- to four-unit properties. Following the measure used in the Fannie and Freddie public use database, we define an underserved neighborhood as one where census tracts reveal that the median income is 80 percent or less of the local median income. Only 12.1 percent of one-unit properties are in underserved neighborhoods, compared with 40.5 percent of two-unit properties and 50.0 percent of three- to four-unit properties (table 1).

Rental affordability is also much better within two- to four-unit properties than with one-unit properties. Only 44.1 percent of single-family structures are affordable to low- and very low income renters, versus 64.1 percent of two-family and 67.6 percent of three- to four-family structures. A similar pattern is observed for very low income renters: 5.5 percent of one-family units are affordable versus 11.6 percent of two-family units and 16.6 percent of three- to four-family units.[2]

Data and Summary Statistics

Few studies have examined the default experience of two- to four-unit properties. Those that exist are based heavily on subprime data and rely on small geographic areas.[3] Moreover, none of these studies have been able to translate default behavior into total losses, as they have lacked two pieces of crucial data: the probability of liquidation after default and the loss severity given liquidation.

To calculate total losses, we multiply the *probability of default* by *the probability of liquidation after the default* by *the percentage of the loan that will be lost with a liquidation.* For example, if we know that a group of loans has a 2.5 percent default rate, 70 percent of the defaulted loans will go on to liquidation, and, on average, 50 percent of the original value of a liquidated loan is lost, we have a total loss rate of (.025 × 0.70 × 0.5) or .00875. In this example, the lender would assume that just under 1 percent (0.875 percent) of the total value of the original loans will be lost. If the value of the original loans was $1,000,000, the lender should assume losses of about $8,750.

Using the Fannie Mae and Freddie Mac single-family loan performance databases, we are able to calculate nationwide defaults as well as the likelihood of liquidation and the loss severity.[4] Accordingly, we are able to calculate total losses for these loans. These Fannie Mae and Freddie Mac databases, first released in 2013 and updated quarterly, encompass only fixed-rate, fully amortizing, full-documentation mortgages; Fannie's includes only 30-year mortgages. The data include a rich array

of loan characteristics: FICO scores, original LTV ratios, debt-to-income (DTI) ratios, property type (owner-occupied versus investment), and three-digit zip code. To fully control for loan characteristics, we also assemble house price appreciation data from CoreLogic, allowing us to estimate the contemporaneous LTV ratio by updating the house value using the zip code–level price index. We refer to this as the mark-to-market LTV (MTMLTV), which enables us to capture the continuing changes in house prices during our sample period.

We combine Freddie Mac and Fannie Mae loan-level databases and restrict our sample to 30-year purchase loans originated between 2000 and 2014. We exclude loans with an origination term less than 240 months or greater than 420 months;[5] loans that have been repurchased by the lenders; loans with missing FICO, LTV, or other key characteristics; and refinance loans (because of less useful origination LTVs). The resulting sample is comparable between Fannie and Freddie and allows us to look at the impact of loan characteristics.

The sample contains 8 million Fannie Mae and 6 million Freddie Mac one- to four-unit mortgages, for a total of 14 million loans. Most are for one-unit properties. About 250,000 are loans on two-unit properties, and about 76,000 are loans on three- to four-unit structures.

The top section of table 2 presents summary loan-level characteristics for one-unit, two-unit, and three- to four-unit owner-occupied and investment properties from 2000 to 2014. A few points to note:

- FICO scores for owner-occupied structures are lower than for investment properties. Moreover, borrowers for two-unit structures have lower FICO scores than borrowers for either one-unit or three- to four-unit structures.

- DTI ratios are about the same for all investment properties regardless of the number of units. It is higher for two-unit and three- to four-unit owner-occupied properties than for one-unit owner-occupied properties. When calculating the DTI ratio of two- to four-unit owner-occupied properties, 75 percent of the market rent (or actual rent if there is a tenant in place) on the rental units is added to the borrower's income; the remaining 25 percent is assumed to absorb vacancy and maintenance costs.

- Over the entire period, loans on two-unit properties have similar average initial LTV ratios to one-unit properties while three- to four-unit properties have lower LTVs.

TABLE 2

Loan Characteristics Comparison

	1-unit owner-occupied	1-unit invest-ment	2-unit owner-occupied	2-unit invest-ment	3–4-unit owner-occupied	3–4-unit invest-ment	Total
Loan characteristics							
FICO	738.34	752.75	731.19	747.33	736.19	752.53	739.37
DTI	35.25	34.19	38.46	35.04	38.39	34.42	35.21
Orig. UPB	191,029	129,141	233,917	147,504	311,729	229,053	187,201
LTV	79.76	77.18	80.36	77.84	76.03	72.66	79.54
% LTV>80	35.2%	17.4%	34.6%	22.5%	9.7%	0.6%	33.7%
Default rate	3.2%	2.9%	5.3%	4.2%	4.1%	2.3%	3.2%
Loan count	13,299,542	987,415	132,012	118,305	21,394	54,826	14,613,494
Termination events (%)							
Current	15.85	7.12	26.95	9.19	23.87	10.60	15.39
Per del	10.27	6.82	9.95	6.64	12.81	7.25	10.03
Prepayment	14.40	10.14	22.63	14.41	24.45	18.97	14.24
Liquidation	59.48	75.92	40.47	69.77	38.86	63.18	60.34
Loss severity (%)							
Loss severity	37.27	59.32	57.46	67.52	63.09	73.07	39.46
Loan characteristics in 2014							
FICO	752.20	767.36	752.28	764.30	752.61	764.65	753.45
DTI	34.25	33.87	38.04	34.29	38.54	33.81	34.24
Orig. UPB	231,249.51	161,708.49	330,294.27	236,244.81	419,957.02	328,127.98	226,964.62
LTV	83.14	74.96	75.39	71.70	72.88	71.27	82.38

Source: Authors' calculations based on Fannie Mae and Freddie Mac's single-family loan performance data..

Note: DTI = debt-to-income ratio, LTV = loan-to-value ratio, per del = persistently delinquent, UPB = unpaid principal balance.

While the average loan-to-value ratio is very similar for loans on one- and two-unit owner-occupied structures, it has shifted over time. The LTV ratio for one-unit owner-occupied structures has risen since the housing crisis while it has fallen for all other structure types (figure 2).

The top rows of table 2 also show the share of loans that have defaulted. For this paper, a loan is said to have defaulted if has ever been 180 days delinquent (or liquidated before 180 days of delinquency through a short sale, deed-in-lieu, or REO sale).[6] The default rate is the defaulted loans divided by the total loans in our sample. The historical data illustrate that the default rate is higher for owner-occupied properties than for investment properties and higher for two-unit properties than either one-unit properties or three- to four-unit properties. Among owner-occupied properties, two-unit structures have a cumulative default rate of 5.3 percent, versus 4.1 percent for three- to four-unit properties and 3.2 percent for one-unit properties

FIGURE 2

Average Loan-to-Value Ratio by Property and Borrower Type and by Origination Year, 1999–2014
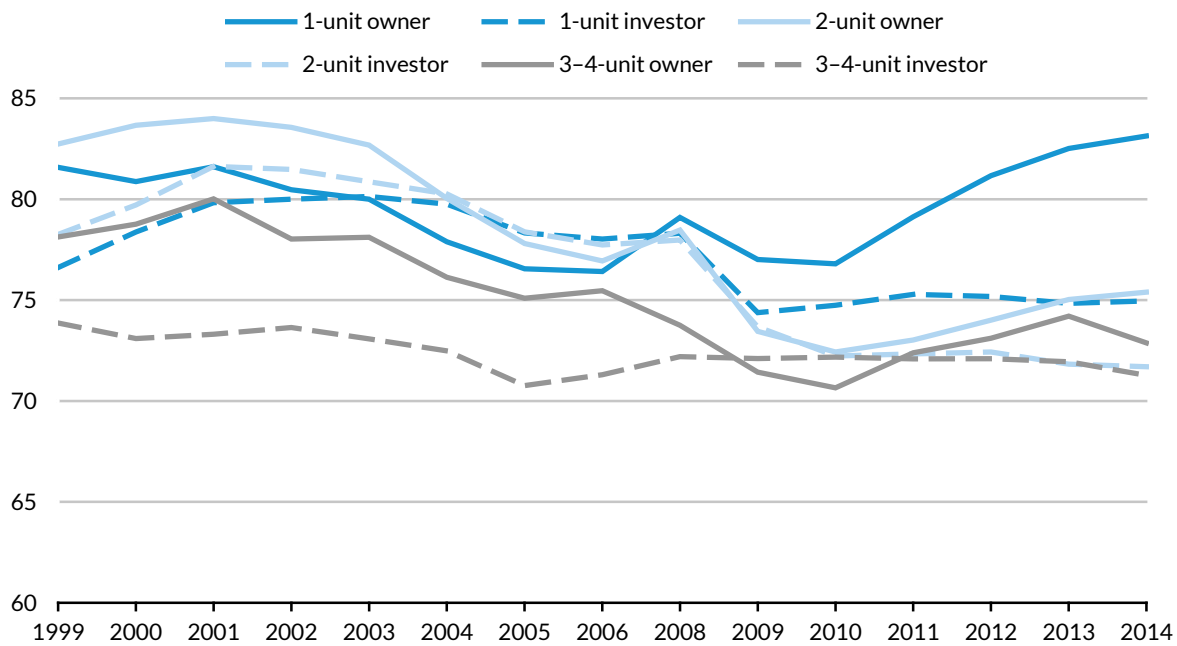
Source: Author's calculations based on Fannie Mae and Freddie Mac single-family loan performance data.

The "termination events" section of table 2 details the last known fate of the loan after default. Possible outcomes include becoming current, prepaying, liquidating (through short sale or REO) or remaining persistently delinquent (per del). Per del refers to loans that are not current or prepaid but have not liquidated. Loans on two- to four-unit owner-occupied properties are less likely to liquidate, conditional on default, than their one-unit counterparts and more likely to regain current status. Investment loans are more likely to liquidate, conditional on default, than are owner-occupied loans, The share of per del loans is relatively similar regardless of the number of units in the structure, but persistent delinquency is more common for owner-occupants than investors.

Table 2 also shows loss severity, conditional on liquidation. One-unit owner-occupied structures have the lowest severities. Plus, investment properties have higher severities than owner-occupied ones, regardless of unit number. We use this information later to calculate loss rates.

The geographic concentration of two- to four-unit properties also differs greatly from the concentration of one-unit properties. Table 3 shows the top 10 states by property types. California has the largest number of mortgages backed by one-unit properties, by a large margin, followed by Florida and Illinois. New York, Massachusetts, and New Jersey contain a disproportionate amount of two- to

four-unit structures, and New York has more two-unit properties than California. Even within a given state, the distribution is uneven. In New York, two- to four-unit properties are most concentrated in Albany and Buffalo zip codes. In Massachusetts, such properties are most concentrated in Worchester.

Top 10 States by Property Type

Rank	1 unit	2 units	3–4 units	Total
1	CA	NY	CA	CA
2	FL	CA	MA	FL
3	IL	MA	NY	IL
4	TX	IL	IL	TX
5	MI	NJ	NJ	MI
6	OH	WI	WA	OH
7	PA	OH	PA	NY
8	VA	PA	OH	PA
9	NC	FL	FL	VA
10	NY	TX	CT	NC

Source: Urban calculations from Fannie Mae and Freddie Mac single-family loan performance data.

We will now specify one set of models for default, a second set for termination, and a third set for loss severity. We discuss the implications of each set of results after the model specifications and combine them all with a loss analysis in the last section.

The Default Model and Results

In the previous section, we looked at default rates without controlling for loan-level characteristics. In this section, we focus on default rates for different property types and investor types, controlling for loan-level characteristics. In the first set of regressions, we test whether loans on properties with two units and three to four units have same default risk as loans on properties with one unit. Equation 1 (page 22) is our baseline empirical specification: it is a hazard model of a loan going 180 days delinquent for the first time in month t, during the period from loan origination through December 2015. (All equations are spelled out in the appendix.)

Regression C1 includes both loan-level origination characteristics (FICO score, LTV, DTI, origination channel [retail broker, correspondent, unknown], loan balance, geographic fixed effects, origination year fixed effects), and time-varying parameters such as MTMLTV and loan age. The loan age variable is captured via a third-degree polynomial expressed as months since origination. We did

not include interest rates in the regression as this is captured by the origination year fixed effects and the loan-level origination characteristics.

For these regressions, the baseline is measured for one-unit owner-occupied properties. The first set of regression results clearly shows that, all other things being equal, in every month the loan is outstanding, loans on two-unit and three- to four-unit properties are more likely to default than loans on one-unit properties (table 4). Specifically, two-unit properties are 29 percent more likely to default than their one-unit counterparts, and three- to four-unit properties are 23 percent more likely to default than their one-unit counterparts. The coefficients from this baseline specification are intuitive: loans with lower FICO and higher LTV are more likely to default. Loans with mortgage insurance, as proxied by the LTV>80% indicator, are less likely to default (after controlling for LTV). And, broker loans and those missing the origination channel are significantly more likely to default than loans originated through the correspondent channel.

TABLE 4

Hazard Regression for Default

Variables	Regression C1		Regression C2		Regression C3	
	Estimate	*T*-value	Estimate	*T*-value	Estimate	*T*-value
Intercept	-8.04	-23.72	-8.01	-38.3	-8.00	-23.61
2 units	0.29	22.39			0.29	17.74
3–4 units	0.23	7.92			0.26	6.1
Investor			0.15	22.82	0.14	22.01
2 units * investor					-0.12	-4.53
3–4 units* investor					-0.19	-3.3
FICO 10E-4	-71.00	-143.94	-71.37	-144.7	-71.44	-144.87
FICO ≤700	0.31	41.47	0.31	41.61	0.31	41.55
FICO 700–750	0.20	38.24	0.20	38.26	0.20	38.11
DTI	0.02	110.41	0.02	110.7	0.01	110.49
Orig. UPB 10E-7	-1.75	-8.08	-0.44	-1.99	-0.70	-3.15
LTV	0.02	45.58	0.02	45.13	0.02	45.19
LTV ≤70	-0.06	-3.18	-0.07	-3.91	-0.07	-3.92
LTV 70–80	-0.05	-5.98	-0.07	-7.58	-0.07	-7.62
LTV 80–90	-0.03	-4.84	-0.05	-8.43	-0.05	-8.49
MTM_LTV	0.01	120	0.01	131	0.01	139
Channel: broker	0.20	39.53	0.20	39	0.20	38.8
Channel: correspondent	0.02	5.4	0.02	5.22	0.02	5.34
Channel: unknown	0.28	71.6	0.28	71.94	0.28	71.99
Loan age	8.82	179.43	8.83	179.59	8.81	179.2
Year fixed effect		Yes		Yes		Yes
State fixed effect		Yes		Yes		Yes
2 log likelihood ratio		6,236,380		6,235,972		6,235,746
Loan-month observations		511,059,280		511,059,280		511,059,280

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data.
Notes: Equations for the regressions are spelled out in the appendix. DTI = debt-to-income ratio, LTV = loan-to-value ratio, MTM = mark-to-market, UPB = unpaid principal balance.

We are not the first researchers to find that two- to four-unit properties are more likely to default than their one-unit counterparts, but we are the first to do so on the national level. Most previous studies were limited to a single market, single lender, or narrow geographic areas; they also used primarily subprime data. Okah and Orr (2010) found that loans on two- to four-unit properties are more likely to default than loans on one-unit properties. However, the paper was restricted to subprime lending in New York City, where more than half the units were in two- to four-unit properties, compared with a single-digit national average. Shilling (2010) found similar results examining the property price declines and foreclosure experience on multifamily mortgages in Cook County, Chicago. Using the loan history file of a large subprime lender, Cowan and Cowan (2004) showed that between 1995 and 2001, loans on two- to four-unit properties defaulted more than loans on one-unit properties and condos. Gerardi, Shapiro, and Willen (2008) and Gerardi and Willen (2009), looking at Massachusetts mortgages with a heavy subprime component, showed that multifamily properties defaulted at a higher rate than single-family properties between 1989 and 2007. As Okah and Orr (2010) pointed out, rental income is a key cash inflow for all two- to four-unit property owners, both owner-occupied and investment, and variability in rent collection will increase income volatility.

Regression C2 looks at investment properties and shows that, all other characteristics being equal, investors are more likely to default on their mortgage than owner-occupants. In particular, investment properties are 15 percent more likely to default, controlling for loan and property characteristics. Again, the higher default rate, with all else held constant, is consistent with the literature. Investors have fewer personal ties to the properties and neighborhoods and are not subject to costs associated with eviction, making them more likely to default than owner-occupants (Belsky and Richardson 2010; Fisher and Lambie-Hanson 2012; Gerardi, Shapiro, and Willen 2008; Haughwout, Peach, and Tracy 2008). Focusing on Chelsea, Massachusetts, Fisher and Lambie-Hanson (2012) found that local investors had 1.8 times the foreclosure risk of owner-occupants. Haughwout, Peach, and Tracy (2008) found that investors were significantly more likely than owner-occupants to default when confronted with a downward movement in house prices or negative equity. Greenberg, Essene, and Lee (2009) reminded us that it is important to look at loan characteristics. Their data for southern New England showed that investors experience lower default rates than owner-occupants because investors had stronger loan characteristics. This is consistent with our historical results in table 2 that show a lower default rate, reflecting the stronger loan characteristics of borrowers of investment properties versus their owner-occupied counterparts.

The third set of regressions (C3) is intended to explore whether two- to four-unit owner-occupied properties have the same default risk as two- to four-unit investment properties. Thus, this regression

includes the interaction between occupancy and property types. It shows that both two-unit and three- to four-unit owner-occupied properties are more likely to default than their one-unit owner-occupied properties and that two-unit owner-occupied properties are more likely to default than their three- to four-unit counterparts. This makes sense: in a two-unit owner-occupied property, the owner lives in one unit and the other unit is the only rental income source. Thus, any income shock to that rental unit would put substantial financial pressure on the owner. The shock would be less severe for three- to four-unit owner-occupied properties as there would be more than one source of rental income.

The results for investment properties are consistent with the literature: Controlling for characteristics, one-unit investment properties default more than their owner-occupied counterparts. Two-unit and three- to four-unit investment properties have default rates very similar to two-unit and three- to four-unit owner-occupied counterparts. The stronger historical results in the upper rows of table 2 can be explained by the stronger loan characteristics of the investment properties.

Table 5 shows the predicted cumulative default rates based on different property type/investor type combinations using the average loan characteristics from 2000 to 2014, and the parameters estimated in the final regression in table 4. To calculate the cumulative default rate, we need to account for prepayments: we apply a rate of 1.25 percent a month, the average prepayment rate over our sample period. This table allows us to predict default rates by separating property-type characteristics and loan characteristics. We can then substitute more recent loan characteristics and recalculate default rates for each property/investor type. We find that, when loan characteristics are equal, two- and three- to four-unit properties have a higher likelihood of defaulting than one-unit properties. The recent credit tightening has improved loan characteristics in two- to four-unit properties; therefore default probabilities (the combination effect from both property type and loan characteristics) are very similar.

In table 5, the diagonals in the top section show the default rate for each property type/investor type based on its own average loan characteristics, as given in table 2. Consequently, these numbers have the same ordinal ranking as the results in the top section of table 2. The predicted cumulative default rate for one-unit owner-occupied properties is 1.85 percent. Two-unit owner-occupied properties have a much higher default rate (2.60 percent) than their three- to four-unit owner-occupied counterparts (1.95 percent). Two-unit and three- to four-unit investment properties have considerably lower default rates than their owner-occupied counterparts.

TABLE 5

Predicted Default Rates Based on Property Types

Loan characteristics/ scenario	Loan count	1-unit owner- occupied	1-unit invest- ment	2-unit owner- occupied	2-unit invest- ment	3–4-unit owner- occupied	3–4-unit invest- ment
Predicted default rates							
1-unit owner-occupied	12,709,479	1.85%	2.10%	2.44%	2.40%	2.33%	2.23%
1-unit investment	958,953	1.58%	1.80%	2.11%	2.06%	2.00%	1.92%
2-unit owner-occupied	96,023	1.96%	2.23%	2.60%	2.55%	2.48%	2.38%
2-unit investment	66,220	1.61%	1.83%	2.14%	2.10%	2.04%	1.95%
3–4-unit owner- occupied	17,062	1.53%	1.75%	2.05%	2.01%	1.95%	1.86%
3–4-unit investment	35,736	0.93%	1.07%	1.25%	1.22%	1.19%	1.14%
Predicted default rates, 2014 scenario							
1-unit owner-occupied	12,709,479	0.53%	0.61%	0.71%	0.69%	0.67%	0.64%
1-unit investment	958,953	0.39%	0.45%	0.52%	0.51%	0.50%	0.48%
2-unit owner-occupied	96,023	0.50%	0.57%	0.67%	0.65%	0.63%	0.61%
2-unit investment	66,220	0.40%	0.46%	0.54%	0.53%	0.51%	0.49%
3–4-unit owner- occupied	17,062	0.45%	0.52%	0.61%	0.60%	0.58%	0.50%
3–4-unit investment	35,736	0.29%	0.34%	0.40%	0.39%	0.38%	0.36%

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data.

To consider the effects of occupancy/property type alone, holding loan characteristics constant, we can look across the rows. The first row takes the average one-unit owner-occupied loan characteristics, and asks, when all else is constant, what the cumulative default rate would be if the property were a two- or three- to four-unit or an investment type. We see the one-unit owner-occupied model has the lowest default rate, at 1.85 percent. There is not a huge difference between the other groups (one-unit investor properties and two- and three- to four-unit owner-occupied or investment properties); although two-unit properties perform marginally worse than the other groups.

Finally, by looking down the columns, we see the impact of historical loan characteristics on default, holding the model constant. Looking at the first column of percentages, two-unit owner-occupied borrowers have marginally weaker characteristics over 2000–14 than one-unit owner-occupied borrowers, as their default rate, using the one-unit owner-occupied model, is 1.96 percent rather than 1.85 percent. By contrast, one- and two-unit investment properties and three- to four-unit owner-occupied and investment properties have characteristics that, on net, produce a default rate lower than one-unit owner-occupied properties.

The bottom section of table 5 shows the results using 2014 loan characteristics for all property type/occupancy groups. As can be seen here, the differences along the diagonals are quite small. This

reflects the fact that loan characteristics have improved substantially more for all other property type/occupancy groups than for one-unit owner-occupied properties. The bottom section of table 2 shows that for all other property types, FICO is up 12–21 points, DTI is down marginally, and LTVs are much lower. By contrast, for one-unit owner-occupied properties, FICO is up 14 points and DTI is down marginally, but LTV is considerably higher.

It is clear from this decomposition that two- to four- unit properties (as well as one-unit investment properties) have been more likely to default than their one-unit owner-occupied counterparts. And the behavior of two-unit owner-occupied properties has been the weakest of all. However, given recent origination characteristics, the predicted default behavior is very similar for all groups.

The Liquidation Model and Results

When mortgage borrowers default (go 180+ days delinquent), there are a number of different possible outcomes for the loan: (1) the lender may allow a pre-foreclosure short sale by the borrower; (2) the lender may sell the property as REO; (3) the borrower may fully repay the loan (prepay); (4) the loan may become current again (we define current as current for the past three months), either through a modification or the borrower paying off the delinquent mortgage balance; or (5) the loan may remain in the foreclosure pipeline, which we label per del. The per del path is more prevalent in states with long foreclosure timelines. Short sale and REO are liquidation paths with a loss; current and prepaid are deemed termination paths without a loss.

Using a multinomial choice model, we investigate factors affecting the outcomes for loans that have defaulted. Based on the results, we further predict the short sale probability and REO probability for particular property and occupancy types. The transition rate from per del to short-sale and from per del to REO is calculated based on the hazard rate of short sale and REO each month for loans in the persistently delinquent path.

Table 6 shows the results of the liquidation models. Given that we are looking at liquidation after a default, which reduces the number of observations, we combine two-unit and three- to four-unit owner-occupied and investment properties. The first model looks at two to four units only, the second looks at investment properties only. The third regression includes two- to four-unit properties, investment properties, and an interaction term for property type and investor type.

Two- to four-unit owner-occupied properties are less likely to liquidate or to prepay than one-unit owner-occupied properties and more likely to become current. Investment properties are more likely to liquidate, either through short sale or REO. The results are consistent with the argument that investors are not subject to costs associated with eviction, moving, and purchasing a new house, thus are more likely to foreclose.[7] And two- to four-unit investment properties look similar to their one-unit investment counterparts when it comes to prepayments and liquidations.

TABLE 6

Multinomial Logit Regression for Termination

Variables	Cat	Regression C1		Regression C2		Regression C3	
		Estimate	T-value	Estimate	T-value	Estimate	T-value
Intercept	Prepay	2.35	19.33	2.43	20.08	2.39	19.75
Intercept	Per del	-0.24	-2.06	-0.20	-1.68	-0.22	-1.84
Intercept	Short sale	-4.04	-33.56	-3.95	-32.90	-3.97	-33.06
Intercept	REO	-2.31	-21.52	-2.24	-20.86	-2.26	-21.02
2–4 units	Prepay	-0.35	-6.95			-0.54	-9.16
2–4 units	Per del	-0.04	-0.91			-0.18	-4.05
2–4 units	Short sale	-0.02	-0.54			-0.27	-5.29
2–4 units	REO	0.22	5.75			-0.04	-0.76
Investment	Prepay			0.52	15.6	0.55	15.58
Investment	Per del			0.39	13.42	0.38	12.19
Investment	Short sale			0.69	25.51	0.70	24.23
Investment	REO			0.96	38.20	0.97	36.22
2–4 units * investment	Prepay					0.22	1.91
2–4 units * investment	Per del					0.23	2.57
2–4 units * investment	Short sale					0.19	1.99
2–4 units * investment	REO					-0.03	-0.35
Control variables		Yes		Yes		Yes	
Servicer fixed effect		Yes		Yes		Yes	
Year fixed effect		Yes		Yes		Yes	
Zip code fixed effect		Yes		Yes		Yes	
2 log likelihood ratio		1,083,516		1,082,211		1,082,079	
Loan observation		441,628		441,628		441,628	

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data.
Note: This table shows the multinomial logit regression results for five termination events: current, prepay, persistently delinquent (per del), short sale, and real estate owned (REO) sales. Current is the reference category.

Table 7 shows the predicted liquidation rates. Looking along the diagonal of the top section, note that the short sale rate is not very different across three of the four groups: one-unit owner-occupied, one-unit investment, and two- to four-unit investment (20.71 percent, 20.47 percent, and 21.39 percent). Two- to four unit owner-occupied properties are somewhat less likely to go to short sale (15.11 percent). However, controlling for loan characteristics (including geography and servicer), two- to four-unit owner-occupied properties behave much more like the other investor/property types.

TABLE 7

Predicted Liquidation Rates

Loan characteristics/ scenario	Loan count	1-unit owner-occupied	1-unit investment	2–4-unit owner-occupied	2–4-unit investment
Short-sale rate					
1-unit owner-occupied	405,504	20.71%	20.66%	18.35%	20.45%
1-unit investment	27,995	21.22%	20.47%	18.63%	20.22%
2–4-unit owner-occupied	5,703	16.75%	18.31%	15.11%	18.13%
2–4-unit investment	3,188	21.60%	21.65%	19.16%	21.39%
REO rate					
1-unit owner-occupied	405,504	38.75%	48.65%	42.56%	48.99%
1-unit investment	27,995	45.43%	55.43%	49.42%	55.69%
2–4-unit owner-occupied	5,703	22.73%	29.55%	25.15%	29.73%
2–4-unit investment	3,188	37.29%	46.67%	40.89%	46.89%
Persistently delinquent rate					
1-unit owner-occupied	405,504	14.42%	12.30%	13.80%	13.55%
1-unit investment	27,995	12.44%	10.15%	11.80%	11.18%
2–4-unit owner-occupied	5,703	23.52%	22.56%	22.90%	24.72%
2–4-unit investment	3,188	16.20%	14.11%	15.59%	15.46%
Short sale or REO given per del					
	Per del to short-sale probability			Per del to REO probability	
Hazard type	12.19%			34.18%	

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data.

In contrast, the diagonal of the REO rates section shows rates differ significantly, with two- to four-unit owner-occupied borrowers much less likely to go to REO than the other three property types. Investment properties are much more likely to go REO than owner-occupied. Even when we control for loan characteristics, we find that owner-occupied properties are less likely to go to REO than their investment counterparts, although the differences between the one- and two- to four-unit properties disappears. This makes sense since foreclosure and REO are less disruptive for investors than it is for owner-occupants.

The next section of the table shows the predicted percentage of per del borrowers using the average characteristics over the period. The diagonal shows that two- to four-family properties have a higher percentage of per del borrowers than one-unit properties (two- to four-unit owner-occupied is higher than one-unit owner-occupied, two- to four-unit investment is higher than one-unit investment). Many two- to four-unit properties are in older northeastern states, which are more likely to have a judicial foreclosure process than states in other parts of the country. Controlling for loan characteristics, the differences between one-and two- to four-unit properties disappears, but owner-occupants remain more likely to be per del than investors.

The bottom rows of table 7 show the proportions of borrowers expected to go to short sale or REO from the per del path, based on the average transition rate to short sales and REO in our sample. In the final section of this paper, those transition rates will be applied to per del loans to calculate the losses.

In summary, borrowers on two- to four-unit owner-occupied properties have been less likely to liquidate than one-unit owner-occupied borrowers. Most of this disparity is accounted for by loan characteristics, principally LTV and geography. With the LTVs on recent originations of two- to four-unit loans so much lower than in the past, this is even more likely to be the case going forward.

Loss Given Liquidation Model and Results

Our goal in this section is to estimate the loss after liquidation—or loss severity.[8] We first calculate the loss for each loan in our sample by adding up all the loss components. Loss components differ slightly between Fannie Mae and Freddie Mac, but the total numbers are comparable. We translate the loss numbers for each liquidated loan in our sample into loss severity, which we define as total losses divided by the defaulted unpaid principal balance. The severity regressions, given in the appendix, are estimated for short sale and REO separately using an ordinary least squares regression framework, which controls for loan characteristics.

The loss given liquidation model estimates the loss severities as a function of the origination characteristics, servicer, year, and zip code fixed effects. Given the relatively small number of observations, we have combined two- and three- to four-unit owner-occupied investment properties. Table 8 shows that after controlling for occupancy/property characteristics, on short sales and REO sales, the loss severity on owner-occupied properties with two to four units is about 16 to 18 percent higher than on one-unit owner-occupied properties. One-unit investment properties have severities about 12–13 percent higher than one-unit owner-occupied properties, and two- to four-unit investment properties have severities about 22 percent higher than one-unit owner-occupied properties. The relative percentage differences are virtually identical for short sales and REO sales.

TABLE 8

OLS Estimation for Loss Severity

Category	Regression C1		Regression C2		Regression C3	
	Estimate	T-value	Estimate	T-value	Estimate	T-value
Short sale						
Intercept	0.06	2.01	0.05	1.78	0.06	2.09
2–4 units			0.18	16.41	0.16	10.71
Investment	0.13	25.06			0.12	22.26
2–4 units * investment					-0.06	-2.95
FICO(10E-4)	-1.08	-4.32	-0.60	-2.42	-1.12	-4.48
DTI(10E-4))	-2.13	-1.76	-2.59	-2.13	-2.19	-1.81
Orig_UPB(10E-8)	-4.72	-3.33	-4.01	-4.74	-4.88	-3.45
LTV(10E-3)	4.83	22.11	4.66	21.32	4.85	22.23
LTV_80	-0.18	-39.89	-0.18	-39.67	-0.18	-39.93
Servicer fixed effect		Yes		Yes		Yes
Year fixed effect		Yes		Yes		Yes
Zip code fixed effect		Yes		Yes		Yes
R-square		0.15		0.15		0.15
Loan observations		91,186		91,186		91,186
REO						
Intercept	0.46	29.87	0.49	31.50	0.46	29.93
2–4 units			0.18	33.10	0.17	22.94
Investment	0.13	55.75			0.14	56.38
2–4 units * investment					-0.09	-8.95
FICO(10E-4)	-1.68	-13.78	-0.84	-6.87	-1.70	-13.92
DTI(10E-4))	-7.74	-13.21	-8.65	-14.63	-7.72	-13.18
Orig_UPB(10E-6)	-1.48	-16.31	-1.75	-19.11	-1.47	-16.26
LTV(10E-3)	2.48	17.60	1.55	10.96	2.49	17.65
LTV_80	-0.18	-69.63	-0.17	-64.30	0.00	-69.74
Servicer fixed effect	Yes		Yes		Yes	
Year fixed effect	Yes		Yes		Yes	
Zip code fixed effect	Yes		Yes		Yes	
R-square		0.35		0.34		0.35
Loan observations		175,743		175,743		175,743

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data .
Note: DTI = debt to income, LTV = loan to value, UPB = unpaid principal balance.

Table 9 shows the loss severity predictions for short sales and REO sales. The diagonals show the predicted results for each type of property, using the average characteristics of that property type over the period. The one-unit owner-occupied properties have the lowest severities, 40.8 percent for an REO sale, while two- to four-unit properties have an REO severity of 66.8 percent. The REO severity of investment properties is higher than their owner-occupied counterparts, with REO severities of 63.3 percent for one unit and 74.5 percent for two to four units. Short sale severities are 10–22 percent lower than REO severities. These patterns persist even when we control for borrower characteristics.

TABLE 9

Loss Severity Predictions

Loan characteristics/ scenario	Loan count	1-unit owner-occupied	1-unit investment	2–4-unit owner-occupied	2–4-unit investment
Short sale					
1-unit owner-occupied	83,919	30.84%	43.31%	46.47%	52.65%
1-unit investment	5,727	36.56%	49.02%	52.19%	58.36%
2–4-unit owner-occupied	859	28.75%	41.22%	44.38%	50.55%
2–4-unit investment	681	34.39%	46.85%	50.02%	56.19%
REO					
1-unit owner-occupied	157,282	40.80%	54.72%	58.09%	62.62%
1-unit investment	15,527	49.25%	63.17%	66.54%	71.06%
2–4-unit owner-occupied	1,438	49.47%	63.39%	66.76%	71.29%
2–4-unit investment	1,496	52.67%	66.59%	69.96%	74.49%

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data.

A Summary of Empirical Results and Policy Implications

To determine whether loans on properties with two to four units ultimately generate more losses than loans on one-unit properties, we first need to calculate total losses by multiplying the three factors discussed above: the default rate, the probability of liquidation (through short sale or REO sale) given default, and the loss severity in the event of liquidation.

Table 10 summarizes these factors, with the top section showing the predicted default rates (from table 5), the next two sections showing the short sale and REO rates (counting per del loans using the transition rate from per del to liquidation), and the following showing the predicted loss severity in the event of a short sale or REO sale, respectively. The final two sections—Predicted loss, 2000–14 and Predicted loss, 2014 characteristics—show the most important number: the total actual losses, calculating by multiplying the previous factors together. The highlighted diagonals on these sections show the predicted losses for each property and occupancy type, given historical behavior and characteristics of that property type.

TABLE 10

Summary Table for Loss

Loan characteristics/ scenario	1-unit owner- occupied	1-unit investment	2-unit owner- occupied	2-unit investment	3–4-unit owner- occupied	3–4-unit invest- ment
Predicted default rates (%)						
1-unit owner-occupied	1.85	2.10	2.44	2.40	2.33	2.23
1-unit investment	1.58	1.80	2.11	2.06	2.00	1.92
2-unit owner-occupied	1.96	2.23	2.60	2.55	2.48	2.38
2-unit investment	1.61	1.83	2.14	2.10	2.04	1.95
3–4-unit-owner-occupied	1.53	1.75	2.05	2.01	1.95	1.86
3–4-unit-investment	0.93	1.07	1.25	1.22	1.19	1.14
Predicted short sale rate (%)						
1-unit owner-occupied	22.5	22.2	20.0	22.1	20.0	22.1
1-unit investment	22.7	21.7	20.1	21.6	20.1	21.6
2-unit owner-occupied	19.6	21.1	17.9	21.1	17.9	21.1
2-unit investment	23.6	23.4	21.1	23.3	21.1	23.3
3–4-unit owner-occupied	19.6	21.1	17.9	21.1	17.9	21.1
3–4-unit investment	23.6	23.4	21.1	23.3	21.1	23.3
Predicted REO rate (%)						
1-unit owner-occupied	43.7	52.9	47.3	53.6	47.3	53.6
1-unit investment	49.7	58.9	53.5	59.5	53.5	59.5
2-unit owner-occupied	30.8	37.3	33.0	38.2	33.0	38.2
2-unit investment	42.8	51.5	46.2	52.2	46.2	52.2
3–4-unit owner-occupied	30.8	37.3	33.0	38.2	33.0	38.2
3–4-unit investment	42.8	51.5	46.2	52.2	46.2	52.2
Predicted short sale severity (%)						
1-unit owner-occupied	30.8	43.3	46.5	52.6	46.5	52.6
1-unit investment	36.6	49.0	52.2	58.4	52.2	58.4
2-unit owner-occupied	28.8	41.2	44.4	50.6	44.4	50.6
2-unit investment	34.4	46.9	50.0	56.2	50.0	56.2
3–4-unit owner-occupied	28.8	41.2	44.4	50.6	44.4	50.6
3–4-unit investment	34.4	46.9	50.0	56.2	50.0	56.2
Predicted REO severity (%)						
1-unit owner-occupied	40.8	54.7	58.1	62.6	58.1	62.6
1-unit investment	49.2	63.2	66.5	71.1	66.5	71.1
2-unit owner-occupied	49.5	63.4	66.8	71.3	66.8	71.3
2-unit investment	52.7	66.6	70.0	74.5	70.0	74.5
3–4-unit owner-occupied	49.5	63.4	66.8	71.3	66.8	71.3
3–4-unit investment	52.7	66.6	70.0	74.5	70.0	74.5
Predicted loss, 2000–14 (bps)						
1-unit owner-occupied	45.79	80.95	89.90	108.30	85.64	101.01
1-unit investment	51.80	86.22	96.97	113.22	92.24	105.36
2-unit owner-occupied	40.90	72.10	78.01	96.67	74.25	90.04
2-unit investment	49.24	82.87	91.87	109.00	87.36	101.38
3–4-unit owner-occupied	31.93	56.49	61.41	76.05	58.36	70.68
3–4-unit investment	28.54	48.20	53.66	63.62	50.95	59.06

Loan characteristics/ scenario	1-unit owner- occupied	1-unit investment	2-unit owner- occupied	2-unit investment	3–4-unit owner- occupied	3–4-unit invest- ment
Predicted loss, 2014 characteristics (bps)						
1-unit owner-occupied	10.39	14.28	12.38	15.7	10.89	14.89
1-unit investment	13.04	16.86	16.02	18.8	14.09	17.54
2-unit owner-occupied	11.86	14.82	14.63	16.94	12.87	15.93
2-unit investment	12.48	15.78	15.56	18.21	13.68	17.24
3–4-unit owner-occupied	11.27	13.73	14.43	15.9	12.71	14.51
3–4-unit investment	9.6	11.64	12.69	13.71	11.18	12.36

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data .

Table 11, which consolidates the diagonals from the bottom two sections of table 10, clearly illustrates two important trends:

- The 2014 numbers are much lower than the 15-year average, indicating that credit is dramatically tighter now that it has been on average over the past 15 years; and

- The differences between loan types substantially collapse for 2014 loans; losses range from 10 to 18 basis points compared with averaged losses of 46 to 109 basis points between 2000 and 2014.

TABLE 11

Total Predicted Losses (basis points)

	1-unit owner- occupied	1-unit investment	2-unit owner- occupied	2-unit investment	3–4-unit owner- occupied	3–4-unit investment
2000–14	46	86	78	109	58	59
2014 only	10	17	15	18	13	12

Source: Authors' calculations based on Fannie Mae and Freddie Mac single-family loan performance data .

Ranking property types in order from lowest to highest predicted losses in 2000–14:

1. one-unit owner-occupied
2. three- to four-unit owner-occupied
3. three- to four-unit investment
4. two-unit owner-occupied
5. one-unit investment
6. two-unit investment

The 2014 ranking is very similar to the 2000–14 ranking. In both, one-unit owner-occupied properties have lower losses than any other property/investor type. And while two-unit owner-occupied properties have higher default rates than any other group, their total loss rates are actually lower than either one- or two-unit investment properties. Why? Because two- to four-unit owner-occupied properties liquidate far less often (they are more apt to prepay or cure) and have similar severities to one-unit investment properties (and lower severities than two- to four-unit investment properties).

Two policy conclusions emerge from this analysis. First, controlling for loan characteristics, two-unit owner-occupied properties default more often than any other group, followed closely by two-unit investment properties. The greater income volatility that comes from having only one or two tenants, combined with a borrower who is more likely to have below-average income and an inability to sustain a prolonged vacancy, clearly contributes to the default statistics. The outcomes for three- to four-unit owner-occupied and investment properties, holding loan characteristics constant, are also worse than outcomes for one-unit investment properties. This pattern suggests that many purchasers of two- to four-unit properties, especially owner-occupants, would benefit from counseling on how to minimize and manage income variability, as well as how to be a landlord in a small building. A number of state housing finance agencies recognize the importance of this and require landlord counseling for all buyers of two- to four-unit properties.

Second, when the GSEs tightened LTV requirements, they did so because of concern about the higher default rates on two- to four-unit properties. Our analysis suggests that the GSEs may have overcorrected. The characteristics of recent loans for two- and three- to four-unit owner-occupied properties are much higher quality than the characteristics of their one-unit owner-occupied counterparts; the LTV for one-unit owner-occupied properties has crept up to 83.1 while the LTVs for two- to four-family homes have not followed (they are in the 75–76 range). The pristine characteristics of recent vintages suggest very low future losses, similar to losses on one-unit owner-occupied properties.

Conclusion

Compared with one-unit properties, two- to four-family properties are older and have a higher proportion of lower-income borrowers and renters. Since the housing crisis, finding financing for these structures has become difficult. Using a unique dataset from Freddie Mac and Fannie Mae, we study default, liquidation given default and loss severity experience, comparing loans on two- to four-unit and

one-unit properties, for both owner-occupied and investor types. We show that, for any given set of loan characteristics and compared with one-unit properties, two- to four-unit properties are more likely to default, two- to four-unit owner-occupied properties are less likely to liquidate, two- to four-unit investment properties are more likely to liquidate, and all two- to four-unit properties are more likely to have a higher loss severity upon liquidation.

Historically, these patterns have led to higher losses on two- to four-unit loans. In recent years, however, these higher losses have been mostly mitigated by the very low LTVs on these structures, resulting in loss rates much closer to those on one-unit owner-occupied properties.

These results have important policy implications: the low volume of two- to four-unit origination suggests that many borrowers, who are disproportionately likely to be low and moderate income and minority, are getting squeezed out. In the interest of expanding credit to underserved populations and increasing, or at least preserving, the supply of affordable rental housing, the GSEs could relax the current LTV requirements. If this relaxation were coupled with counseling for landlords, for both owner-occupants and investors, it could mitigate the marginally higher default rate.

Appendix A. Regressions Used in the Analysis

Default Regressions

A. Regression to test difference in default rates between two- to four- unit properties and one-unit properties

$$h(t) = f\left(\beta_1{}' \ X_{it} + \gamma_1{}' \ P\_Type_i + \varepsilon_{1it}\right), t = 1, \dots. T \tag{1}$$

where *P_type* is a vector of property types (one unit, two unit, three to four units), and *X* is a vector of explanatory variables for loan *i* in month *t*, which includes origination characteristics, mark-to-market LTV, and geography.

B. Regression to test for a difference in default rates between investment and owner-occupied properties

$$h(t) = f(\beta'_2 X_{it} + \rho_2{}' I\_Type_i + \varepsilon_{2it}), t = 1, \dots. T \tag{2}$$

where *I_type* is a binary indicator that equals 1 if the property type is investment and 0 if it is owner-occupied.

C. Regression to test for a difference in default rates between two- and three- to four-unit owner-occupied and investment properties

$$h(t) = f\left(\beta'_3 X_{it} + \gamma_3{}' P\_Type_i + \rho_3{}' I_{Type_i} + \mu_3{}' P\_Type_i * I\_Type_i + \varepsilon_{i3t}\right), t = 1, \dots. T \tag{3}$$

Based on equation 3, we can compute hazard default rate for month *1* to *T* for each loan in our sample and calculate the cumulative default rates for each loan *i*.[9]

$$\widehat{S}_i(t) = 1 - \widehat{Y}_i(t-1), t = 1, \dots. T \tag{4}$$

$$\hat{y}_i(t) = \left[1 - \hat{S}_i(t-1)\right] * \hat{h}(t) * prepay(t), t = 1, \dots. T \tag{5}$$

$$\widehat{Y}_i(t) = \sum_{s=1}^{t} \hat{y}_i(s) \tag{6}$$

$\widehat{S}_i(t)$ is the predicted survivor rate for loan i in month t. $\hat{y}_i(t)$ is the predicted conditional default rate in month t. $\widehat{Y}_i(t)$ is the predicted cumulative default rate for loan i in month t, and $prepay(t)$ is the prepayment rate in t. In the paper, we calculated an average prepayment rate and applied it to each month.

Using equations (4) to (6), we can further infer the default rate difference between one-unit and two- to four-unit owner-occupied and investment properties by asking what is the hypothetical default rate if a mortgage on a particular unit type was originated with the characteristics of another unit type or/and if a mortgage with loan characteristics belonging to a one-unit type was applied to another unit type.

For example, we can predict the hypothetical default rates for a one-unit owner-occupied property under two- to four-unit owner-occupied circumstance or two- to four-unit investment circumstance by the following equations based on estimation results of equation (3).

$$HY_{00} = \{E(Y_i|PType_i^* = 1,\ IType_i^* = 1|PType_i = 0,\ IType_i = 0)\} \qquad (7)$$

Liquidation Model Specification

We estimate the following multinomial logistic estimation models:

$$Z_i(z) = f\left(\beta'{}_8 K_i + \gamma_8{}'\ P\_Type_i + \varepsilon_{8i}\right), \qquad (8)$$

$$Z_i(z) = f\left(\beta'{}_9 K_i + \rho_9{}'\ I_{Type_i} + \varepsilon_{8i}\right), \qquad (9)$$

$$Z_i(z) = f\left(\beta'{}_{10} K_i + \gamma_{10}{}'\ P\_Type_i + \rho_{10}{}'\ I_{Type_i} + \mu_{10}{}'\ P\_Type_i * I\_Type_i + \varepsilon_{8i}\right) \qquad (10)$$

where z = short sale, REO, prepay, current, and persistently delinquent.

Based on the estimation results, we further predict the short sale probability and REO probability for particular property and occupancy types, using equation (10). For example, we calculate the average hypothetical liquidation rates for a one-unit owner-occupied property under two- to four- unit investment circumstance by the following equations based on estimation results of equation (10).

$$HZ_{00}(z = Short\ Sale) = \{E(Z_i|PType_i^* = 1,\ IType_i^* = 1|PType_i = 0,\ IType_i = 0)\} \qquad (11)$$

$$HZ_{00}(z = REO) = \{E(Z_i|PType_i^* = 1,\ IType_i^* = 1|PType_i = 0,\ IType_i = 0)\} \qquad (12)$$

Loss Severity Given Liquidation Model Specification

We then calculate loss severity for each liquidated loan in our sample using the following equation:

$$S_i = \frac{Loss_i}{D\_UPB_i} \tag{13}$$

Where *S* denotes loss severity and *D_UPB* indicates the defaulted unpaid principal balance.

Specifically, we estimate the following equations:

$$S_i(z = SS) = f\left(\beta'_{\;14}W_i + \gamma_{14}'\;P\_Type_i + \rho_{14}'\;I_{Type_i} + \mu_{14}'\;P\_Type_i * I\_Type_i + \varepsilon_{14i}\right) \tag{14}$$

$$S_i(z = REO) = f\left(\beta'_{\;15}W_i + \gamma_{15}'\;P\_Type_i + \rho_{15}'\;I_{Type_i} + \mu_{14}'\;P\_Type_i * I\_Type_i + \varepsilon_{14i}\right) \tag{15}$$

Loss Estimation

Finally, we calculate losses as the product of the default rates, liquidation given default, and loss severity given liquidation, as shown in equation (16).

$$Loss_i = \widehat{Y}_i * \widehat{Z_\iota}\,(z = SS) * \widehat{S}_\iota(z = SS) + \widehat{Y}_i * \widehat{Z_\iota}\,(z = REO) * \widehat{S}_\iota(z = REO) \tag{16}$$

Notes

1. The Ginnie Mae program includes Federal Housing Authority, Veterans Administration, and US Department of Agriculture–insured loans.

2. While we show only 2013 data, the latest available, this pattern in which borrowers for two- to four-family units are disproportionately minority, disproportionately lower income, and in lower-income census tracts has been consistent through time.

3. See, for example, Okah and Orr (2010); Shilling (2010); Cowan and Cowan (2004); Gerardi, Shapiro, and Willen (2008); and Gerardi and Willen (2009).

4. The GSEs began releasing delinquency information in 2013 to support Fannie Mae's Connecticut Avenue Securities and Freddie Mac's Structured Agency Credit Risk risk-sharing transactions. Loss information was added later. All data are updated quarterly. The data do not contain the GSEs' full book of business.

5. Fannie Mae loan-level data only include loans they consider 30-year mortgages. . Thus, we delete loans with less than 20 years and more than 35 years from Freddie Mac so the combined data are comparable between the GSEs.

6. This is the definition of "credit event" in the Fannie Mae and Freddie Mac risk-sharing transactions.

7. See for example, Gerardi, Shapiro, and Willen (2008); Haughwout, Peach, and Tracy (2008); Belsky and Richardson (2010); and Fisher and Lambie-Hanson (2012) for more details.

8. Loss given default (LGD) is a longstanding topic of interest in the fixed income literature. Altman, Resti, and Sironi (2006) review the literature of default recovery rates in credit-risk modeling. Calem and LaCour-Little (2004) examine the relationship between LGD and the economic environment. Qi and Yang (2009) tests the effect of housing market downturns on LGD.

9. In the paper, we treat prepayment as censored for simplicity.

References

Altman, Edward I., Andrea Resti and Andrea Sironi. 2006. "Default Recovery Rates: A Review of the Literature and Recent Empirical Evidence." *Journal of Finance Literature* (Winter): 21–45.

Belsky, Eric S., and Nela Richardson. 2010. "Understanding the Boom and Bust in Nonprime Mortgage Lending." Cambridge, MA: Joint Center for Housing Studies of Harvard University. http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/ubb10-1.pdf.

Calem, Paul S., and Michael LaCour-Little. 2004. "Risk Based Capital Requirements for Mortgage Loans." *Journal of Banking and Finance* 28 (3): 647–72.

Cowan, A. M., and C. D. Cowan. 2004. "Default Correlation: An Empirical Investigation of a Subprime Lender." *Journal of Banking & Finance* 28 (4): 753–71.

Fisher, Lynn M., and Lauren Lambie-Hanson. 2012. "Are Investors the Bad Guys? Tenure and Neighborhood Stability in Chelsea, Massachusetts." *Real Estate Economics* 40 (2): 351–86.

Gerardi, Kristopher, Adam Hale Shapiro, and Paul S. Willen. 2008. "Subprime Outcomes: Risky Mortgages, Homeownership Experiences and Foreclosures." Working Paper 07-15. Boston: Federal Reserve Bank of Boston.

Gerardi, Kristopher, and Paul Willen. 2009. "Subprime Mortgages, Foreclosures, and Urban Neighborhoods." *B.E. Journal of Economic Analysis & Policy* 9 (3).

Greenberg, Jeffrey, Ren Essene, and Kai-yan Lee. 2009. "The Myth of the Irresponsible Investor: Analysis of Southern New England's Small Multifamily Properties." Boston: Federal Reserve Bank of Boston.

Haughwout, Andrew, Richard Peach, and Joseph Tracy. 2008. "Juvenile Delinquent Mortgages: Bad Credit or Bad Economy?" *Journal of Urban Economics* 64 (2): 246–57.

Okah, Ebiere, and James Orr. 2010. "Subprime Mortgage Lending in New York City: Prevalence and Performance." Staff Report 432. New York: Federal Reserve Bank of New York.

Qi, Min, and Xiaolong Yang. 2009. "Loss Given Default of High Loan-to-Value Residential Mortgages." *Journal of Banking and Finance* 33 (5): 788–99.

Shilling, James D. 2010. "The Multifamily Housing Market and Value-at-Risk Implications for Multifamily Lending." Working paper. Chicago: DePaul University.

About the Authors

Laurie Goodman is the director of the Housing Finance Policy Center at the Urban Institute. The center is dedicated to providing policymakers with data-driven analysis of housing finance policy issues that they can depend on for relevance, accuracy, and independence. Before joining Urban in 2013, Goodman spent 30 years as an analyst and research department manager at a number of Wall Street firms. From 2008 to 2013, she was a senior managing director at Amherst Securities Group, LP, where her strategy effort became known for its analysis of housing policy issues. From 1993 to 2008, Goodman was head of global fixed income research and manager of US securitized products research at UBS and predecessor firms, which were ranked number one by *Institutional Investor* for 11 straight years. Before that, she was a senior fixed income analyst, a mortgage portfolio manager, and a senior economist at the Federal Reserve Bank of New York. Goodman was inducted into the Fixed Income Analysts Hall of Fame in 2009.

Goodman is on the board of directors of MFA Financial, is an advisor to Amherst Capital Management, and is a member of the Bipartisan Policy Center's Housing Commission, the Federal Reserve Bank of New York's Financial Advisory Roundtable, and the New York State Mortgage Relief Incentive Fund Advisory Committee. She has published more than 200 journal articles and has coauthored and coedited five books.

Goodman has a BA in mathematics from the University of Pennsylvania and an MA and PhD in economics from Stanford University.

Jun Zhu is a senior research associate in the Housing Finance Policy Center at the Urban Institute. She designs and conducts quantitative studies of housing finance trends, challenges, and policy issues.

Before joining Urban, Zhu worked as a senior economist in the Office of the Chief Economist at Freddie Mac, where she conducted research on the mortgage and housing markets, including default and prepayment modeling. She was also a consultant to the Treasury Department on housing and mortgage modification issues.

Zhu received her PhD in real estate from the University of Wisconsin–Madison in 2011.

URBAN INSTITUTE · ELEVATE · THE · DEBATE

2100 M Street NW
Washington, DC 20037

www.urban.org