

Are landlords different?

Foreclosure in single-family, duplex, and triple-decker housing in
Massachusetts, 1998-2009

An honors thesis for the Department of Economics

Emily Morgan

Tufts University 2010

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Abstract:

In the state of Massachusetts, foreclosure rates rose ten-fold between 2004 and 2008, rising from 0.03% to 0.60% of the total housing stock¹. Research on the foreclosure crisis has so far focused on single family, owner-occupied dwellings. It has neglected another important segment of the housing stock: small, multi-family rental structures. This research looks at how owners of these properties have been affected by the crisis and, in particular, how an owner's occupancy status influences the probability of foreclosure. To determine these relationships, I track owners' experiences for a sample of homes in Massachusetts from 1998 to 2009, using data from the Massachusetts Registry of Deeds, the Home Mortgage Disclosure Act (HMDA), and the US Census. I find that ownership of a multifamily property is correlated with higher foreclosure rates than ownership of single-family properties; owners of two family properties are nearly twice as likely to experience foreclosure and owners of three family properties are more than 2.5 times more likely. Owner occupants are more likely to experience foreclosure than investor owners, although financial characteristics, such as loan type, have much greater impacts the probability of foreclosure. Moreover, between 1998 and 2009 I find significant changes in the correlation between owner occupancy, property type and foreclosure.

¹ <http://www.bos.frb.org/economic/dynamicdata/module1/bmap.html#app=1dc8&2888-selectedIndex=1>

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I. Introduction

In the state of Massachusetts, foreclosure rates rose twenty-fold between 2004 and 2008, from 0.03% to 0.60% of the total housing stock². According to the Mortgage Bankers Association's National Delinquency Survey, nearly 10% of all residential loans on one-to-four unit properties were delinquent at the end of the third quarter in 2009³. Not surprisingly, research on the causes and effects of foreclosure has grown tremendously since the beginning of the 21st century. In 2000, only 15 scholarly articles related to foreclosure were published, compared to 57 articles in 2008 and 75 in 2009⁴. To date, however, this literature has almost exclusively focused on single-family, owner-occupied homes. Little attention has been paid to an important segment of the housing stock: small multi-family rental properties⁵. These properties are experiencing disproportionately high rates of foreclosure. An article in the New York Times noted that in the city of Boston, triple-decker rental homes comprise 14% of the housing stock and account for 21% of all foreclosures. Similarly, in New Bedford, these structures comprise 16% of the housing stock and 32% of foreclosed properties (Goodnough 2009). This research sets out to address this neglected topic in the literature on small multi-family properties and their owners.

Rental properties account for a substantial portion of the United States housing stock; roughly one-third of all properties are rentals. This research is focused only on the rental properties that still qualify for residential mortgages (i.e. properties with less than 5 family units). The stock of these properties varies by region, though the Northeast has much higher shares of small multi-family properties than the rest of the United States. In Massachusetts, these

² <http://www.bos.frb.org/economic/dynamicdata/module1/bmap.html#app=1dc8&2888-selectedIndex=1>

³ A summary of the survey results can be accessed at: <http://www.mbaa.org/NewsandMedia/PressCenter/71112.htm>

⁴ These numbers are according to an EconLit keyword search for foreclose/foreclosure by year

⁵ In this paper, a small rental property refers to a multi-family property with less than 5 family units.

properties account for almost one-quarter of all properties, compared to 9% of all properties in the United States. In the context of economic downturn, there is worry that owners of these properties will be more vulnerable to default because of the added risk of owning more housing than one consumes. Owners of rental properties may be at greater risk because their income is dependent on the profitability of their rental properties; whether or not an owner is able to find tenants for their unit and whether or not a tenant makes his/her rent payments impact an owner's income and thus his/her ability to make mortgage payments on that property. When unemployment rates are high, it may be difficult for owners of rental properties to find and/or maintain tenants. As a result, we expect these owners to be more likely to experience foreclosure.

Little is known about the owners of small, multi-family properties. The only comprehensive survey of US residential property owners, the Property Owners and Managers Survey was conducted 15 years ago in 1995. From this survey, we know that owners of small, multi-family properties are more likely to occupy the property than owners of larger structures. About one-quarter of the owners of small, multi-family properties reported being owner occupants, compared to 3% of owners of properties with 50+ units⁶.

Owner-occupants are distinctly different from non-owner occupants in both observable and unobservable ways, which could affect their likelihood of foreclosure. Owner-occupants face higher transaction costs associated with foreclosure. An owner-occupant must find a new home if the bank forecloses on the property, whereas owners who do not occupy the property do not face these costs. Some of the risks associated with owning a rental property may then be offset if the owner is also a resident of the property; while owners of rental property experience increased likelihood of foreclosure because of the inherent risks of renting out a property, occupant owners face the same disincentives to default as single family, occupant owners. As a result of these two

⁶ Estimates based on author's calculations using Property Owners and Managers Survey data

opposing forces, it becomes unclear which effect will dominate, and how the foreclosure rates for owner and investor owned small, multi-family properties will differ.

Furthermore, foreclosed rental properties also have important implications with regards to tenants. If an owner chooses to default on their mortgage and the bank forecloses on their property, then the tenants of the property are also affected, which results in a multiplier effect. This raises several public policy issues, particularly how, if at all, the affected renters should be helped.

One way to examine foreclosure rates among owners of small, multi-family properties is to look at ownership experiences and, in particular, their ownership outcomes. An ownership experience tracks all of an owner's transactions during his/her period of ownership for a given property. An ownership experience begins with the purchase of a property, often but not always financed with a purchase mortgage. Some ownership experiences include second and subsequent mortgages or refinancing of the initial mortgage. Each ownership experience ends with either sale or foreclosure of a property⁷.

This study examines the outcomes of ownership experience spells for owners of single-family, two and three family properties, and condominiums. It focuses on how these outcomes differ by structure type and by owner occupancy status. Using data on ownership experiences in Massachusetts initiated between from 1998 to 2006, I find that owners of multifamily properties are significantly more likely to experience foreclosure than are owners of single-family properties⁸; that owners of two family properties nearly twice as likely to face foreclosure and that owners of three family properties are more than 2.5 times more likely. Owner occupants are

⁷ Foreclosure is initiated when the lender files a foreclosure deed on the property.

⁸ Because we cannot control for unobservable owner characteristics that affect foreclosure, the results of this research are interpreted as partial correlations and not causal effects. When phrases such as "more likely to" are used, these are **not** meant to imply a causal relationship.

more likely to default and experience foreclosure than investor owners, but this difference is only significant between 2005 and 2008. Furthermore, financial characteristics, such as loan type, have a much higher correlation with the probability of facing foreclosure. For example, owners who purchase properties with a subprime mortgage were roughly 5.5 times more likely to experience foreclosure. These models are consistent with the contention that more relaxed lending standards for owner-occupiers made “over-consumption” of housing possible. They add the notion that the effects of relaxation in lending standards were even more pronounced for purchasers of small multifamily properties financed with residential mortgages.

The structure of this thesis is as follows. Section II provides background information on rental housing in the United States and its owners, from Census 2000, the American Housing Survey, and the Property Owners and Managers Survey. Section III reviews the current literature on the behavior of owners of multi-family properties and on the current subprime mortgage and foreclosure crises, while Section IV presents the theoretical model for this research. A description of the data used is provided in Section V, followed by the regression model findings in Section VI. Section VII concludes.

II. Background Information

Relatively little is known about the small multi-family housing stock in the United States and, in particular, about the characteristics of the owners of these properties. Most of the data on these structures and their owners is either over a decade old, or is disaggregated only to the level of metropolitan areas. Nevertheless these datasets still provide viable background information. The 2000 Census, the American Housing Survey of 2007, and the Property Owners and Managers Survey of 1995 were all used in background research⁹ to provide information on small, multi-family properties and their owners. The findings and limitations of each dataset are discussed separately below.

Census 2000

The decennial United States Census provides data on population demographics and housing stock characteristics for the nation. Unfortunately, the last Census available at the time of my research was conducted 10 years ago. According to HUD's Components of Inventory Change Survey, there was about a 10% increase in the housing stock from 2000 to 2007, though there was relatively little change in its overall composition by structure type¹⁰. As such, the information provided by the 2000 Census is relatively representative of the current housing stock, particularly in Massachusetts where the housing stock has grown more slowly than in some other regions of the US.

⁹ The American Community Survey also provides information on the rental housing stock. However, the results of this survey are not included in this research.

¹⁰ Data from this survey are publicly available at: <http://www.huduser.org/portal/datasets/cinch.html>. It shows that single family properties account for about 62% and 2-4 family properties for about 8% throughout this time period.

The United States housing stock

The Census provides data on housing tenure, which is important to this research. Housing tenure varies significantly across regions, with greater proportions of renter-occupied housing in the Northeast and the West. Across the United States, approximately one-third of all properties are renter-occupied, while the remaining two-thirds are owner-occupied. In the Northeast and Western regions the proportion of rental housing is slightly higher—38% and 39% respectively. In the Midwest and the South, however, these numbers are almost ten percentage points lower. Within the state of Massachusetts and the Boston Primary Metropolitan Statistical Area (PMSA), there are also relatively higher proportions of renter-occupied housing units. In the state of Massachusetts 38% of all units are renter-occupied, and within the Boston PMSA 41% of all units are renter-occupied¹¹. If rental housing is more vulnerable to experiencing foreclosure, then these areas will be disproportionately affected by the crisis relative to the rest of the United States.

For data reporting purposes, the Census Bureau groups properties into single family, 2 family, 3-4 family, 5-9 family, 10-19 family, 20-49 family, and 50+ family units. Of the total national housing stock, two-thirds of all properties are single family, while 4% are 2 family, 5% are 3-4 family, another 5% are 5-9 family, 4% are 10-19 family, 3% are 20-49 family and the remaining 5% are 50+ family properties. There is definite variation in the composition of a region's housing stock, and the table below illustrates some of these differences. It is important to note the much higher proportion of 2 and 3-4 family structures in both Massachusetts and the Boston PMSA, compared to the rest of the nation.

¹¹ Census 2000, Summary File 3, H7

Table 1: Percentage of Housing Units by Structure Type

<i>Region</i>	<i>Single Family</i>	<i>2 Family</i>	<i>3-4 Family</i>	<i>5-9 Family</i>	<i>10-19 Family</i>	<i>20-49 Family</i>	<i>50+ Family</i>	<i>Other</i>
United States	66	4	5	5	4	3	5	8
Region 1: Northeast	59	9	7	5	4	5	5	9
Region 2: Midwest	71	5	4	4	4	3	4	5
Region 3: South	67	3	4	4	4	2	5	11
Region 4: West	65	3	5	5	5	4	6	7
All metro areas	68	4	5	5	4	3	4	7
New England	61	10	10	6	4	3	4	2
Massachusetts	56	12	11	6	4	4	5	2
Boston PMSA	50	13	12	6	5	5	7	2

Source: Author's calculations using Census 2000, Summary File 3, H30

As shown by this table, the Northeast has a smaller proportion of single-family homes, and much higher percentages of small, multi-family properties. This coincides with the fact that this region also has a relatively higher number of renter occupied structures, since multi-family properties are much more likely than single-family units to be completely or at least partially renter occupied rather than completely owner-occupied.

Rental Properties

As a percentage of total occupied properties, there is a greater proportion of renter occupied, small multi-family properties (i.e. 2, 3, and 4 family structures) in the Northeast Region compared to the rest of the United States. For example, while renter occupied, 3-4 family structures comprise only 3% of the total national housing stock, these types of properties account for 5% of all structures in the Northeast, 7% of all structures in New England, and 9% of all structures in Massachusetts. Renter occupied, two-family structures make up approximately 3%

of the national housing stock, compared to 5% of all properties in the Northeast, 6% of all properties in New England, and 6% of all properties in Massachusetts.

The proportion of owner-occupied versus renter-occupied properties varies across structure types. The table below shows the percentage of owner occupied and renter occupied housing by structure type for all of the United States.

Table 2: Percentage of Household Tenure by Structure Type

Structure Type	Percent Owner Occupied	Percent Renter Occupied	Percent Vacant
Single Family	79	14	7
2 Family	23	66	11
3-4 Family	12	77	11
5-9 Family	9	80	11
10-19 Family	8	81	11
20-49 Family	11	79	10
50+ Family	12	78	10

Source: Author's calculations using Census 2000, Summary File 3, H32

These numbers are relatively similar across different regions. Surprisingly, however, a slightly smaller percentage of 2 and 3-4 family units are renter-occupied in the Northeastern Region, compared to the rest of the United States, despite the fact that this region still has a higher proportion of renter-occupied multifamily units (as a share of total occupied properties). This is most likely accounted for by the fact that this region, overall, has a much higher relative stock of 2 and 3-4 family structures to begin with.

In the United States as a whole, 30% of renters live in single-family structures, 13% live in 50+ family structures and 12% live in 5-9 family structures. This distribution, however, varies across regions. For example, a greater proportion of renters live in small multifamily properties in the Northeast, compared to the rest of the United States. The table below charts these differences.

Table 3: Distribution of Renter Households

<i>Region</i>	<i>Single Family</i>	<i>2 Family</i>	<i>3-4 Family</i>	<i>5-9 Family</i>	<i>10-19 Family</i>	<i>20-49 Family</i>	<i>50+ Family</i>
United States	30	9	11	12	11	9	13
Region 1: Northeast	18	15	16	11	9	11	18
Region 2: Midwest	30	11	12	13	11	9	10
Region 3: South	35	7	10	12	11	6	12
Region 4: West	33	6	11	12	11	10	14
All Metro Areas	35	10	12	12	9	7	13
New England	17	18	23	13	8	8	11
Massachusetts	13	18	24	13	10	9	13
Boston PMSA	11	18	23	13	11	10	15

Source: Author's calculations using Census 2000, Summary File 3, H32

Renter vs. Owner Characteristics

The Census provides the racial composition of different areas, which is also relevant to the current foreclosure crisis, as regions with larger minority populations have observed higher foreclosure rates¹². While it remains questionable as to whether there is a direct causal relationship between the two variables, it still remains a fact that this correlation exists. 75% of the nation's population is white and 12% black, these numbers, however, vary greatly by region. For example, in the western region the population is 68% white and 5% black, while in the South, 19% of the population is black. Within the New England metro areas, the population is 4% black, and within the state of Massachusetts it is 5% black¹³.

In the rental units affected by the crisis, black households are disproportionately affected. White households occupy 85% of all owner-occupied properties and 67% of all rental properties, while black households occupy 8% of owner-occupied dwellings and nearly 18% of all rental

¹² See Gerardi, Shapiro and Willen (2007) and Baxter and Lauria (2000) for more on this relationship.

¹³ Census 2000, Summary File 1, P6

dwelling¹⁴. Furthermore, black renter households are much more likely to occupy small, multi-family properties. Approximately 13% of black renter households occupy two-family properties, and 27% occupy 3 or 4 family properties¹⁵. Compared to the numbers presented in Table 3 for the entire renter population, these proportions are much greater. From a public policy perspective, these numbers imply that if rental units are being disproportionately affected by this crisis, then black populations will also be more greatly affected.

Census data also presents information on median household income across tenure status. The median income for the entire United States is \$41,581, though the median income for rental households is only \$27,361, compared to \$51,323 for owner-occupied households. In the Northeast, the median income overall is higher, and, while the median income for both groups is higher, there is an increase in the income gap between them. Overall median income in the region is \$45,254--\$57,242 for owner-occupiers and \$28,763 for renters. Median income in Massachusetts is even higher, with an even greater disparity of nearly \$34,000 between owners and renters¹⁶.

These facts are all important to consider when evaluating the external validity of this research. Because this research is limited only to the Massachusetts housing market, it is unclear whether or not the results can be compared to other housing markets with much different housing stock compositions.

American Housing Survey

The American Housing Survey (AHS) is a household survey conducted by the Census Bureau, which gathers information on different housing markets in the United States. It is

¹⁴ Census 2000, Summary File 3, H11

¹⁵ Census 2000, Summary File 4, HCT17

¹⁶ Census 2000, Summary File 3, P53

conducted at both the national and the metropolitan area level, and surveys a sample of households in the selected area. The most recent AHS for the Boston Metropolitan Area was conducted in 2007. The survey results provide an update to the previously collected Census data, as well as additional data on the quality of housing that is available in the metro area. For example, households are asked to rate their overall opinion of a structure, and information on the proximity of public transportation is also reported. The AHS also provides more detailed information on rental properties than the Census.

According to the AHS, 88% of all rental housing in the Boston PMSA is multi-family, with 42% of all rental properties containing between 2 to 4 family units. Properties with 5 or greater family units are rather even distributed, with each comprising approximately 11% of the rental housing stock. These numbers match very closely with the numbers from the Census, presented in Table 3. Single-family, detached units account for an additional 7% of the rental stock, and single family attached units for 5%. The remaining 6% of rental housing stock are condominiums. Additionally, 23% of owners/property managers report living at the property—a number that is comparable to the value attained by the Property Owners and Managers Survey over a decade earlier.

The survey also reports select demographic characteristics for renter households. 75% of rental units house two people or less, and 14% house 3 persons; the remaining 11% house 4 persons or more. Owner-occupied units, on the other hand, are more likely to house a greater number of occupants. Moreover, the median age for rental households is slightly younger than that of owner-occupied households—42 years old vs. 53 years old.

Renters are also more likely to have moved in more recently than owner-occupiers. The median year moved in for renters is 2005, compared to 1995 for owner-occupiers. This supports the theory that rental housing has a much higher turnover rate than owner-occupied housing.

The median income for rental households is \$38,123, which is much higher than the median income reported by the Census in 2000. It is very likely that these values differ as a result of inflation, as the Census values are reported in 1999 dollars. When inflation is adjusted for, the initial value from the Census is equal to approximately \$37,000 (in 2007 dollars), which is much closer to the value reported in the AHS. The reported median income for owner-occupiers is also much higher--\$91,413—though unlike for renter households, some of the growth in median income must be attributed to factors other than simply inflation.

Some of this income gap may be explained by the fact that renters tend to be less educated than owner occupants. Approximately 86% of all renters aged 25 years or older have completed high school or higher, and an additional 37% have completed a bachelor's degree or higher. These rates are much higher for owner-occupiers, of which 95% have completed high school or higher and 56% have completed a bachelor's degree or higher.

There is some variation in the distribution of renter income across different structure types. For example, the median income for renters of single family, detached structures is \$53,285, while the median income for 2-4 family structures is roughly \$15,000 less. Overall, median income decreases with property size, with the lowest median income (\$13,831) for 50+ family units. Median monthly rents also decrease with structure size. Single-family detached units have the highest median income, as well as the highest median rent (\$1500+). Similarly, the second highest median rent of \$1140 per month is for 2-4 family units. Occupants of 50+ family units have the lowest monthly rent (\$522).

Purchasing or renting a home is often likened to the purchase or rental of a bundle of goods and services. That is, when a renter chooses to rent a given property, they are paying not only to occupy the physical unit, but also for the goods and services it provides—for example, access to nearby amenities, use of the local school system, etc. The AHS attempts to capture some of these amenities. This information helps to capture some of the differences between owner-occupied and rental housing that may not be captured in my regression analysis that follows.

With respect to an occupant’s opinion of their structure and neighborhood, the majority of respondents rated their structure and neighborhood to be a 7 or higher, on a scale of 1 to 10 (10 being the highest). While the results are similar for owner-occupied structures, these types of households do report having a slightly higher opinion of their home and neighborhood. The survey also reports that nearly 75% of all rental units are less than 10 minutes travel time away from the nearest bus stop, train, or subway. 40% of units are less than 5 minutes of any of these, while an additional 30% are 5-9 minutes away, and 11% are 10-14 minutes away. With regards to owner-occupied units, properties are slightly further away from public transit stops, with 23% within less than 5 minutes from a stop and 28% within 5-9 minutes.

Property Owners and Managers Survey (POMS)

The Property Owners and Managers Survey (POMS) was conducted by the US Census Bureau, for the Department of Housing and Urban Development, in 1995 to collect information on the nation’s rental housing stock, as well as it’s owners. A sample of approximately 16,300 housing units was selected from across the nation, including single, as well as multi-family rental properties (including two family, 3-4 family, 5-9, 10-19, 20-49, and 50+ family properties). The

overall composition of homes in this survey is 30% single family, 11% two family, 8% 3-4 family, 6% 5-9 family, 5% 10-19 family, 8% 20-49 family, and the remaining 31% 50+ family properties. The results of this survey are publicly available from the Department of Housing and Urban Development¹⁷.

The two greatest problems with this dataset are its timeframe and its large missing data issues. Given the recent changes in the housing market with the introduction of the subprime mortgage market in the early 2000s, it is unclear as to whether the demographic information about owners and their financial decisions, is still applicable. Moreover, there is also a large missing data issue because respondents were not forced to answer all questions. It becomes difficult to compare rates across property types when certain types have a higher non-response rate for a given question, causing the actual values to be underestimated. Despite these drawbacks, this survey contains a variety of interesting questions pertaining to the property characteristics, management policies, motivations for purchasing rental housing, financing decisions and behaviors, and owner characteristics. For this reason, this survey is still worth considering. Selected results from this survey are discussed below.

Owner characteristics

This survey is a unique source of information on the characteristics of owners of rental housing in the United States—information that is not available from any other nationwide (or even statewide) survey. It shows that the vast majority of properties in 1995 were owned by individuals or couples; 86.3% of all owners are either individuals or a husband/wife couple, and

¹⁷ Data are available from the Department of Housing and Urban Development at: <http://www.huduser.org/DATASETS/poms.html>

90% of all properties with 5 units or less are owned by these types of owners. Owner occupancy status varies across structure types, as shown below.

Table 4: Owner Occupancy by Structure Type

<i>Structure Type</i>	<i>Percent Owner Occupied</i>
2-4 Family Units	27
5-49 Family Units	10
50+ Family Units	3
All rental structures	24

Source: Author's calculations using Property Owners and Managers Survey data

Over half of the owners (52%) of small multi-family properties own only one rental property, compared to 30% of owners of properties with 5-49 units and 15% of those who own properties with 50+ units. This suggests that, because landlords of small multi-family properties are less likely to own a large quantity of rental units, then they may be more sensitive to changes in the profitability of an individual property. At the same time, median percentage of income earned by owners from all owned rental units decreases with property size, implying that small landlords' income is less dependent on their rental properties. Overall, there is little variation in profits between these groups, with 41% of all owners making a profit on their property in the last year, 16% breaking even and 27% incurring losses. Owners of small multi-family properties report being slightly less likely to make a profit; only 40% of owners reported making a profit, compared to 46% of owners of 5-49 unit properties, and 45% of owners of 50+ unit properties.

The survey also reports owners' reasons for purchasing a rental property. The top three reasons given are shows below.

Table 5: Main Reason for Purchasing Rental Property

<i>Structure Type</i>	<i>Provide residence</i>	<i>Long-term capital gain</i>	<i>Income from rent</i>
2-4 Family Units	34	9	32
5-49 Family Units	5	18	42
50+ Family Units	0.3	23	42

Source: Author's calculations using Property Owners and Managers Survey data

The owner's responses for why they continue to own the given property are somewhat different, however. One-quarter of small multi-family properties are kept for residence, 31% for income, 6% for long-term gains, and 14% for retirement security. For larger properties, owners were less likely to maintain their ownership as a means of residence and retirement security, and much more likely to continue to own them to provide income and capital gains.

These results imply that owners of small multi-family properties are less likely to be seeking income and capital gains from their properties (i.e. they may be less likely to ruthlessly default if they are not making a profit) and are more likely occupy their home and to continue to own the property as a means of maintaining their residence. In this way, they may be less likely to default and face foreclosure on their properties than owners of larger multi-family units.

The age of owners is relatively evenly distributed across age groups—for entire the United States, 23% were age 45 years or younger, 25% ages 45-54, 23% ages 55-64 and 29% were age 65 or older. With regards to race, 85% of all owners were white, 8% black, 4% Asian or Pacific Islander and 6% Hispanic. For properties with less than 5 units, these numbers were the same. Among properties with 5-49 units and 50+ units there was a higher proportion of white owners, 88% and 94% respectively. This implies that small multi-family units are more likely to have a minority owner than larger multi-family units.

Owners of smaller rental properties report higher concentrations of low to middle income tenants than larger rental properties (Bradley, Cutts and Follain 2001). This means that these landlords may be at higher risk for decreased revenue from a tenant’s inability to make rental payments, since low-income tenants may be more prone to exogenous income shocks such as unemployment.

Financial characteristics

The POMS provides insight into the financial decisions of rental property owners. 39% of single-family rental properties and all 37% of multi-family rental properties are mortgaged. The larger multi-family properties were less likely to be mortgaged than the small multi-family properties, though missing data make it difficult to the same number of mortgages, given the missing data problem. The table below shows the percentage of mortgage properties with fixed rate versus adjustable rate mortgages by structure type.

Table 6: Select Mortgage Types by Structure Type

<i>Structure Type</i>	<i>Mortgaged properties with fixed rate mortgage %</i>	<i>Mortgaged properties with adjustable rate mortgage %</i>
Single Family	61	23
2 Family	53	15
3-4 Family	55	17

Source: Author’s calculations using Property Owners and Managers Survey data

Estimating Owner Occupancy

The POMS microdata allow us to model links between a property’s physical traits and its owners’ characteristics. Since my study addresses characteristics associated with owner versus

non-owner occupants, I developed a probit model of the likelihood that an owner of a multi-family property would be resident in the building as a function of owner and structure characteristics. The model results are shown in the table below.

Table 7: Probit Model for Owner Occupancy

<i>Variable</i>	<i>Coefficient</i>	<i>Marginal Effects</i>
3-4 Family	0.164 (0.151)	2.80
5-9 Family	0.203 (0.191)	3.57
10-19 Family	--	--
20-49 Family	-0.121 (0.226)	-1.81
50+ Family	-0.013 (0.208)	-0.21
Minority	0.448** (0.145)	8.89**
Male	-0.231 (0.133)	-4.08
Individual/Couple	0.657** (0.200)	8.74**
Multiple Mortgages	0.169 (0.159)	2.92
Fixed Rate Mortgage	0.270* (0.126)	4.06*
50% or more of income coming from property	0.309 (0.194)	5.80
Owner hold another job	-0.081 (0.129)	-1.31
Purchased for residence	1.725** (0.209)	48.15**
Purchased for income from rents	0.069 (0.202)	-1.12
Purchased for capital gains	-0.118 (0.241)	-1.78
Purchased for retirement security	-0.060 (0.255)	-0.93
Purchased for future security	0.328 (0.299)	6.34
Constant	-2.198** (0.327)	-
Pseudo R-squared	0.3564	
**statistically significant at the 95% confidence interval		

Source: Author's calculations using Property Owners and Managers Survey data

The first column shows the coefficients from the probit regression; the marginal effect of each independent variable, (taken from the partial derivative of the probit regression), is listed in the second column. These values indicate the percentage point change in the probability that an

owner is an owner-occupier that results from a one unit change in that variable (holding all other variables constant).

The pseudo R-squared value for this regression model is about 36%, but few of the coefficients in this model are statistically significant. Compared to owners of two family homes, owners of 3-4 and 5-9 family properties are more likely to be owner-occupiers, while owners of larger properties are less likely to be owner-occupiers. The coefficients however, are not statistically significant at the 95% confidence interval, and thus we cannot be sure that the effect of owning a larger structure is not different from zero.

Minority owners are nearly 9 percentage points more likely to be occupant owners than are non-minority owners. Not surprisingly, individuals and couples are also more likely to be owner occupants than are 'other' owners, a category that includes companies, trusteeships, and realty companies. Owners in the POMS sample who purchase the structure with a fixed rate mortgage were also slightly more likely to be owner occupants. As could be expected, owners that report either purchasing the property for use as a residence are much more likely to be owner occupants. In fact, those that report purchasing the property originally as a residence are 48 percentage points more likely to be owner occupants.

III. A Review of the Current Literature

As previously mentioned, the scholarly literature on the foreclosure crisis has focused almost solely on single family, owner-occupied homes. Some of this literature, however, provides a useful framework for the development of the theoretical model for this research by applying what is known about the differences between owners of single-family properties and owners of multi-family properties. For example, if it is true that owner-occupiers are less likely to default and to face foreclosure, then we would expect to see higher default rates among rental properties with more units, as their owners are less likely to be owner-occupiers. The following section reviews relevant research on housing finance for small multi-family properties and on the foreclosure process in general.

The Foreclosure Process

The term foreclosure, as used in this paper, refers to when a lender takes possession of a property and auctions it off to the public. There are many steps, however, which lead up to this final sale, and these steps vary from state to state. Chapter 244 of the General Laws of Massachusetts explains the process for the state¹⁸. In Massachusetts, the foreclosure process begins with a missed monthly mortgage payment. At this stage, the property owner is considered to be “in arrears,” and is given a 90-day grace period to make his/her missed payment without any penalties. After 30 days, however, if the payment is not made, the owner is considered to be in “default”.

If the 90-day grace period expires and the owner still has yet to make any payments, the mortgage lender sends a notice of intent to foreclose to the owner, officially placing the home in

¹⁸ These laws can be accessed online at <http://www.mass.gov/legis/laws/mgl/gl-244-toc.htm>

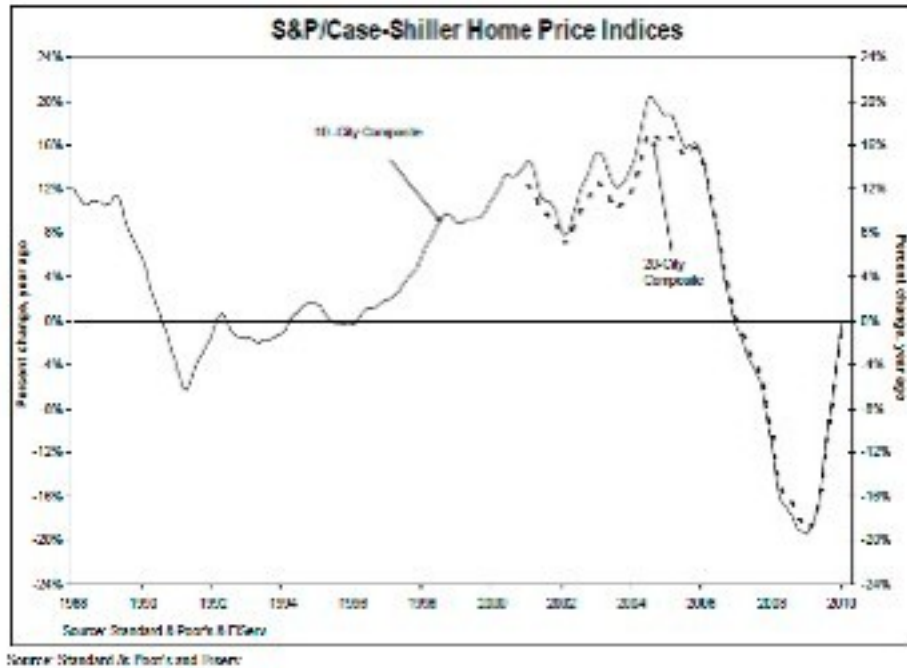
“foreclosure” status. This letter is sent three weeks before the lender plans to auction the home. Lenders must also initiate a court action with the Massachusetts Land Court at this time, to obtain approval for the repossession of the property and the subsequent auction. Once the Land Court gives approval, lenders send the owner a notice of sale, indicating the date of the foreclosure auction. Notice of the auction must also be given in the newspaper for three weeks prior. At any point before this notice of sale, if the owner chooses to repay the bank for his/her missed payments (and any additional fees), then the foreclosure process will end.

The foreclosure process generally takes about six months from the first missed payment to the final auction of the home. Following the auction, if the bank is unable to make enough money from the sale to payoff the remaining balance on the loan that was defaulted on, then the owner is liable for this difference. Conversely, if the bank makes more money than was originally owed on the mortgage, then the owner is entitled to that surplus.

Negative Equity Theory of Default

Prior to the early 2000s, default and foreclosure were considered to be a result of income shocks, such as divorce, illness, or unemployment, which affect an owner’s ability to make their mortgage payments. In the absence of an economic downturn, these events are usually random occurrences, and thus, foreclosures were much more randomly distributed. This theory, however, has not hold in the event of volatile house prices and economic downturn.

Beginning in 2004, the housing prices in the United States began rapidly declining. The graph below captures the changes in the Case-Shiller house price indices.



Graphic taken from http://www.standardandpoors.com/spf/docs/case-shiller/CSHomePrice_Release.pdf

Shortly after house prices began to decline, foreclosure rates also started rising. Economists then began to explore a new theory of default, developed almost a decade earlier—the negative equity theory. Negative equity occurs when the present value of all future mortgage payments on a property minus the transaction costs (ex. legal costs, the value of the option to prepay, moving costs, etc) of default is less than the current market value of that property. This implies that if house prices were to begin to fall at a faster rate than owners were paying back their mortgages, there would be a rise in foreclosure rates (Kau, Keenan, Kim, 1994).

Further empirical work presented by Foote, Gerardi and Willen (2008) suggests that negative equity is a necessary, but not the only sufficient, condition for default. By examining data from Massachusetts during the house price decline in the early 1990s, they find that fewer than 10% of borrowers who were likely to have been in negative equity actually experienced

foreclosure. This suggests that exogenous income shocks still play an important role in the decision to default.

At the same time, however, Guiso, Sapienza and Zingales (2009) also use a survey of US households to show that approximately 26% of existing defaults are strategic. Strategic default occurs when a household can afford to make mortgage payments, but chooses to default, as a result of negative equity. Furthermore, their results also show that households do not strategically default when the equity shortfall on their mortgage is less than 10% of the value of the home.

Financing Small Multi-Family Housing

One reason that foreclosure rates among single family properties can be compared to foreclosure rates among small, multi-family properties is that multi-family properties with less than 5 family units qualify for the same residential mortgages as single-family properties. Depending on the living situation of the landlord his/herself, however, owner-occupied and investor loans are available. The main differences between investor loans and owner-occupied loans are that investor loans tend to have a higher maximum loan-to-value ratio, a higher upfront basis-point fee, and higher reserve requirements (Joint Center for Housing Studies of Harvard University 2004).

Though landlords are eligible for residential mortgages, non-occupant owners may be riskier borrowers because of their increased vulnerability to negative equity. This increase results from lower transaction costs of default for non-occupant owners versus occupant owners. Owners who purchase structures for investment purposes do not rely on these structures for shelter and amenities. As such, foreclosure does not require non-occupant owners to vacate their

home and to relocate to a different one, meaning that landlords face lower transaction costs to default.

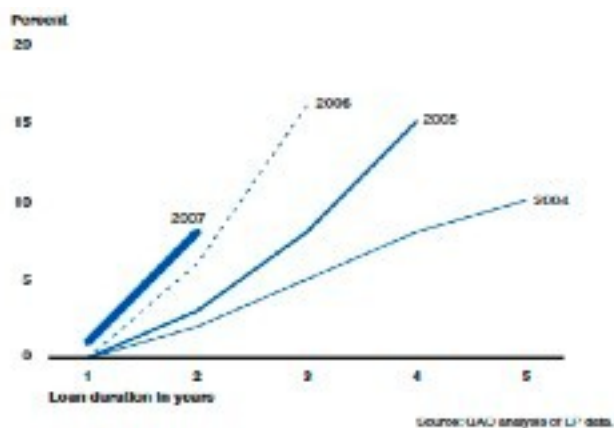
At the same time, lenders may choose to sue owners who chose to strategically default (i.e. they default when they could still afford to be making their mortgage payments). In certain states (including Massachusetts), lenders are also allowed to repossess other forms of wealth that an owner holds, in the event of foreclosure—for example, investor owners facing foreclosure on their rental properties are at risk of having the bank also seize their primary residence. As a result, the threat of losing their primary residence may outweigh the original reduction in transaction costs of default for non-occupant owners. Ghent and Kudlyak (2009) use data from across the United States to show that in states with recourse laws, there is a 20% in the probability of default for households in negative equity.

Subprime Mortgages and Foreclosure

Subprime mortgages were first introduced in 1995, as a means of increasing homeownership in the United States. There are various different definitions of subprime loans, though they are generally characterized as residential loans with higher, adjustable interest rates, higher fees, and lower down payment requirements. These loans are typically given to riskier borrowers who do not qualify for conventional fixed rate mortgages (i.e. prime loans)—for example, borrowers with lower FICO scores or borrowers wishing to purchase a home that would normally be out of their price range. Given the higher interest rates and higher maximum loan-to-value ratio, subprime loans leave borrowers much more vulnerable to negative equity than prime loans. At the Jackson Hole symposium in 2007, Gramlich predicted that the subprime foreclosure rate would reach 20% for the newest vintage loans.

According to the Government Accountability Office (GAO), nonprime mortgages rose in overall market share from 12% in 2000 to 34% in 2006. Furthermore, the annual value of subprime mortgages went from \$100 billion to \$600 billion from 2000 to 2006. In the first quarter of 2009, the GAO found that 1 in 8 nonprime mortgages were in the foreclosure process, and that 1.6 million of the 14.4 million nonprime loans originated between 2000 and 2006 were completely foreclosed on. The table below, taken from their paper, captures the cumulative percentage of subprime mortgages that completed the foreclosure process by cohort year. As shown, the later the cohort, the steeper the line (i.e. the higher the cumulative percentage).

Cumulative Foreclosure Rates of Subprime Loans by Origination Year



Additionally at this time, of the remaining 5.2 million active nonprime loans, 1/4 of these loans were in default or in the foreclosure process. No distinctions were made by the GAO between rental and non-rental properties.

A new strand of scholarly literature began to develop in the mid-2000s surrounding the potential correlation between subprime mortgage originations and foreclosure rates. For example, Gerardi, Shapiro and Willen (2007) used non-parametric hazard models to show that the rise in subprime loan originations, in conjunction with the decline in real house prices, contributed to the rising number of foreclosures in Massachusetts in 2006 and 2007. This is

because subprime mortgages with higher LTV ratios combined with declining real house prices cause more households to experience negative equity and/or to have problems making mortgage payments as a result of liquidity issues.

Immergluck and Smith (2005) examine the relationship between subprime origination rates and foreclosure in the Chicago Metropolitan Area from 1995 to 2002. They find that subprime lending tends to be concentrated in certain areas and that those certain neighborhoods also tend to have a disproportionately high number of foreclosures. It remains unclear, however, as to whether a causal effect can be assigned to subprime mortgages for the crisis or whether subprime mortgage originations is picking up the effect of other unobservable neighborhood characteristics.

Another strand of literature has sought to identify which groups are more likely to take out subprime loans. Calem, Hershaff, and Wachter (2004) hypothesize that minority population is positively correlated with subprime lending, whereas education level is negatively correlated, at the neighborhood level. They support this hypothesis with a model for 7 cities of prime vs. subprime loan originations based on individual and neighborhood characteristics. Meyer and Pence (2008) conducted a similar analysis using national data on subprime mortgages from LoanPerformance, HMDA and HUD. They find that high minority population, as well as moderate (aggregate) credit scores, lower median income, and higher unemployment rates as predictors of increased subprime lending for different zip codes. High shares of minority populations are often linked to subprime mortgages because of the existing differences in incomes and credit scores among minority households versus white households.

Furthermore, Courchane, Surette and Zorn (2004) use Freddie Mac survey data from 2001 to show that most borrowers in the subprime market do possess higher risk characteristics,

but that there are also some people who are forced into the market as a result of household “shocks” or liquidity problems, or because of a lack of financial knowledge.

The difference in origination rates of subprime mortgages for single family versus multi-family properties however, has yet to be determined and will be examined in this research.

The Spillover Effects of Foreclosure

As policy options to mitigate the crisis are being sought out, the spillover and proximity effects of foreclosure have received a growing amount of attention. The generally accepted hypothesis is the foreclosed properties sell for lower prices, for two main reasons. The first is that, after receiving notification that their home will be seized, owners have less incentive to continue to maintain the property’s quality, and also that lenders auctioning off these homes are rushed—they do not have time to wait for potential buyers willing to pay their asking price. The deteriorated values of these foreclosed properties then reduce the values of other properties in the area. This is important in the context of multi-family properties, as they tend to be more clustered in denser, urban areas.

Using data from New York City from 2000 to 2005, Schuetz, Been and Ellen (2008) show that deteriorated values for foreclosed properties are a result of several different factors. First, owners may feel less inclined to upkeep their properties after receiving a foreclosure notice, because they know they are going to lose their property, and after the owners vacate, the property may be subjected to vandalism and crime. Additionally, foreclosed properties are more likely to be sold to investors wishing to turn the units into renter-occupied housing, which is often not maintained as well as owner-occupied housing. They also present evidence that these deteriorated property values have a proximity effect on nearby units (provided there are a certain

number of foreclosures in the neighborhood) and that the magnitude of the price discounts on nearby properties is increases (in a non-linear fashion) with the number of foreclosures in the area.

Further research has attempted to quantify these spillover effects. Using a sample of properties in approximately 300 different zip codes across the United States, Lin, Rosenblatt and Yao (2009) find significant spillover effects on properties within a 10-block radius of a foreclosed property for up to 5 years after liquidation. They find that these effects are maximized when properties are closest, and that the property values of nearby properties can be depressed by up 8.7% per neighboring foreclosure. These effects diminish over time and in space. Campbell, Giglio and Pathak (2009) also find that properties in Massachusetts, from 1987 to 2008, within a 0.05 mile radius of a foreclosed property experienced a decrease in home value of approximately 1%.

Once again, however, none of this research is specific to multi-family properties or to non-occupant owned properties. It remains unclear as to whether the findings of these articles can be applied to these segments of the housing stock. This research is an attempt at beginning to fill this gap in the literature.

IV. Model

The model used in this research integrates a housing tenure choice model which determines how much housing a consumer should purchase, and the negative theory of equity which determines when an owner will chose to foreclose on their home. The housing tenure model explains why some individuals chose to become landlords, as well as why choosing to rent out property can be riskier than occupying it. This additional risk could translate into a higher probability of default among owners of rental properties compared to single-family owner-occupiers. Furthermore, the theory of negative equity provides insight into why owner-occupiers may be less likely to default than non-owner occupiers.

Henderson and Ioannides's (1983) model of tenure choice provides insight into the way in which consumers decide how much housing to consume and in what form. There are three types of consumers in a housing market: owners who own and occupy only their home, owners who own and occupy their own home, while also renting out additional properties, and renters. Each of type of consumer possesses both a demand for housing consumption and a demand for housing investment, which together drive their tenure decisions. Owner occupants with no additional rental properties are those whose demand for housing consumption and demand for housing investment are equal. Those who do own additional properties have a demand for housing investment greater than their demand for housing consumption (i.e. they purchase more housing than they plan to occupy). Renters are those whose demand for investment is lower than their demand for consumption. In a market with all three types of consumers, the interest that owners forego on equity in housing must be at least equal to their net rental profits.

Their work also discusses what is called “the renter externality”, which captures some of the added risk of being a landlord. Because renters are not directly responsible for maintaining the property they occupy, they have less incentive to take proper care of a property—particularly if they know they will not be occupying that property for an extended period of time. As such, rental properties generally either deteriorate at a faster rate than owner-occupied properties or are much more costly to owners.

This housing tenure model helps to explain why a large proportion of owners were sensitive to the recent decline in housing prices. According to Henderson and Ioannides, a consumer is assumed to maximize the following in a two period scenario:

$$U(Y_1 - S - (P - L - R)h_I - Rh_c, h_c f(u)) + E\{V(Y_2 + S(1+r) + (P(1+\theta) - L(1+r) - (T(\hat{u}) - \tau(\hat{u})))h_I - \tau(u)h_c)\}$$

Where Y_1 is the income in period 1, S is the savings, P is the price of housing, L is the value of a mortgage loan, R is the rental price of housing Rh_c , $h_c f(u)$ is the user cost of housing consumption, Y_2 is the income in period 2, r is the interest rate, θ is the unknown return on housing earned by selling, $(T(\hat{u}) - \tau(\hat{u}))$ is the non collectable maintenance costs of rental housing and $\tau(u)h_c$ is the rental utility function.

This model, however, assumes that $P(1+\theta) - L(1+r) - (T(\hat{u}) - \tau(\hat{u}))$ is also greater than zero, meaning that it does not account for the costs of default. This assumption implies that the sale value of a home will not fall below its original purchase price and that owners choosing to sell their home will be able to at least break even and pay off their remaining mortgage balance. Unfortunately, this does not seem appropriate in the context of the recent decline in housing prices, which caused θ to dip below the original purchase price of the home. Investors who purchased during the housing bubble of the early 2000s, with the expectation that house prices would continue to rise, did not foresee this decline in housing prices. As a result, those who

overestimated the expected value of their housing investments in the future chose to purchase more housing than was optimal.

The theory of negative equity provides a more precise model of how those owners discussed in the previous section, who over estimated the future values of his/her property, found themselves in negative equity as a result of their over-investment. Negative equity is defined by the equation below:

$$PV(i, v/hv, t) - C > HV(hpa)$$

Where PV is the present value of the remaining mortgage payments, and is a function of the interest rate (i), the value of the loan compared to the value of the home (v/hv), and the type of loan (t), and C represents the transaction costs associated with default. Furthermore, HV represents the current market value of the home, and is a function of local housing market appreciation (hpa).

The theory is that when a household enters into negative equity (and if the transaction costs are low enough), the household will be more likely to default on their mortgage, and face foreclosure. Negative equity, though a necessary condition for default, is not the only sufficient condition. It has been shown that less than 10% of owners experiencing negative equity actually default on their mortgage (Foote, Gerardi and Willen 2007).

There are three major monetary components of negative equity: the market value of a home, the present value of all future mortgage payments on that home, and the transaction costs associated with defaulting (and experiencing foreclosure). Each of these different components is sensitive to several factors, which in turn affect how vulnerable a household is to negative equity.

The present value of all future mortgage payments is dependent on the terms and type of mortgage that a household has purchased. It is a function of the interest rate and the original loan to value ratio of the mortgage. A higher interest rate will incur higher monthly mortgage payments holding the amortization period constant, and a higher LTV ratio makes it easier to fall

into negative equity because a smaller depreciation in the market value of the home is needed for the value of the loan to exceed the market value. The type of mortgage purchased (i.e. subprime versus prime mortgages) influences both of these factors. Subprime mortgages, by definition, are riskier loans. They have higher and adjustable interest rates and allow for higher LTV ratios, and therefore put households at a higher risk for negative equity. Hence, the model predicts that owners who purchase with a subprime mortgage will be more likely to fall into negative equity and foreclose.

The transaction costs of default and foreclosure are influenced by a household's preferences and the value that they place on being able to remain in the same household, on maintaining their credit score, and expectations of future house price changes. Thus, households that do not value these things would be more likely to default. We would expect that homes that are not owner-occupied would be more vulnerable to foreclosure because the owners face lower transaction costs, since the owners themselves would not have to worry about finding a new home.

The last component, the market value of the home is, by definition, be sensitive to local changes in the housing market; the greater the local house price appreciation, the higher the probability that a home's market value will increase, and the lower the probability that households will in that area will experience negative equity.

Gerardi, Shapiro and Willen (2008) find that, while negative equity is a necessary condition for foreclosure, it is not a sufficient condition. They posit that exogenous shocks to household income, which affect a household's ability to make mortgage payments, are also a factor. For example, shocks could include unemployment, a medical problem, divorce, etc. In the

case of multi-family homes, these homes may be more vulnerable to exogenous shocks, because their income is dependent also on the income of their tenants.

Based on these assumptions, the theoretical model is then that the probability that an owner faces foreclosure is correlated with the type of mortgage they purchase a property with, their ability to make payments on that mortgage (which in the case of multifamily is also correlated with the rental income of property), recent house price appreciation/depreciation, and exogenous income shocks.

The models discussed in this section provide the foundation for the actual empirical model presented in the Results section of this thesis, by helping to determine what independent variables should be included. Henderson and Ioannides's housing tenure model suggests that distinctions should be made for rental versus non-rental properties, while the theory of negative equity suggest that information on owners' mortgages should be included, as well as data in house price changes. Furthermore, the model also implies that occupant owners may need to be examined separate from non-occupant owners, as they two groups face different transaction costs.

V. Data

The data for this paper come from two sources—the Warren Group and the Home Mortgage Disclosure Act. These sources include a set of all purchase/sale deeds, residential mortgage originations, and foreclosure deeds for single, two, and three family properties and condominiums in Massachusetts from 1990 to 2009, compiled by the Warren Group, and lender and borrower characteristics collected under the Home Mortgage Disclosure Act (HMDA). These two datasets were merged together by researchers at the Federal Reserve Bank of Boston to create the final data set used in the regression analysis. The characteristics and limitations of these sources are described below.

The Warren Group

The Warren Group electronically archives records from the Registry of Deeds, and sells this information to the public. Because of inconsistencies in recording across records (for example, misspelling street names, using “Rd” instead of “St” or reversing the order of owners names), the Registry of Deeds database can often to be difficult or problematic to use when attempting to track individual owners and/or properties. The Warren Group eliminates many of these inconsistencies to facilitate the creation of time series datasets.

The Warren Group dataset used in this research records all purchase and sale deeds, residential mortgage originations, and foreclosure deeds from 1990 to the beginning of 2009 in Massachusetts, for all single, two, and three family properties, and for condominiums. Each record provides information about the property itself (i.e. location, structure type, assessed value,

lot size, number of rooms, etc), as well as information pertaining to the transaction (for example, information on sale or purchase prices, mortgage loan-to-value ratios).

The Warren Group records do not contain reliable information on owner/borrower characteristics, which are particularly pertinent to this research¹⁹. This data was obtained from a different source.

Other researchers at the Federal Reserve Bank of Boston also extended the Warren Group dataset to include several other variables of interest. The first important variable tracks individual properties and the different owners of that property. For each individual property, the variables track the “ownership experience” of each owner by grouping together all of their transactions for that property. The typical “ownership experience” begins with the purchase deed for the property, followed by any mortgage deeds, and, if applicable, either a sale or foreclosure deed. While an owner’s actions can be tracked across an ownership experience, owners cannot be tracked across several different properties (i.e. if an owner decides to sell property A and purchase property B, they will have two different ownership experience numbers).

Another important variable created by researchers at the Federal Reserve Bank of Boston uses the list of subprime lenders, released by the US Department of Housing and Urban Development (HUD), to identify whether an owner purchased a home with a mortgage from a lender on this list. HUD’s definition of a subprime lender is based on several different indicators. Subprime lenders generally have lower origination rates, a higher proportion of refinancing loans, and tend not to sell a large percentage of their portfolios to government sponsored enterprises. HUD also conducts surveys with lenders to determine their subprime mortgage

¹⁹ While these records do include a resident owner variable, it is unclear how this variable was been determined. When compared to the owner occupancy status provided by the HMDA, the two variables are not consistent. Because the HMDA data are considered more reliable, the Warren Group resident owner variable was discarded.

origination rates. Mortgages obtained from HUD's subprime lenders are assumed to be subprime mortgages in this dataset.

Home Mortgage Disclosure Act (HMDA)

The Home Mortgage Disclosure Act, which was enacted in 1975, requires lending institutions to report public loan data. This practice was designed to allow the federal government to determine whether financial institutions serving the needs of their surrounding communities, to help identify areas in need of public or private sector investments, and to identify any discriminatory lending patterns²⁰. The data are available through the Federal Financial Institutions Examinations Council (FFIEC).

The HMDA dataset used spans loan originations from 1998 to 2006 in Massachusetts. It contains information on loan, lender, and borrower characteristics, such as owner occupancy/tenure, race, and income.

In the HMDA data, the owner occupancy variable is biased in the direction of a Type I error for owner occupants. When lenders record the information, the default assumption is that a property will be owner-occupied, unless otherwise stated²¹. This does mean, however, that we can be fairly sure that all units that are classified as non-owner occupied are actually non-owner occupied.

HMDA data cover the great majority of mortgage transaction in the United States, though the entire mortgage market is not accounted for. In 2006, it was estimated that HMDA coverage was about 80% of the mortgage market²². Institutions with no branch office in any Metropolitan

²⁰ For a further description of the survey, its history, and its uses, see <http://www.ffiec.gov/hmda/history.htm>

²¹ Refer to HMDA reporting guide, Appendix A

²² <http://www.federalreserve.gov/pubs/bulletin/2007/articles/hmda/default.htm>

Area, and institutions with financial assets/loan originations totaling less than a given threshold are no covered under HMDA.

Merged Dataset

A match sample was created by researchers at the Boston Federal Reserve Bank using the Warren Group and HMDA data, based on the dollar amount of the mortgage, the Census tract where the borrower lives, the identify of the mortgage lender, whether the mortgage was for a refinance or a purchase, and the date of the mortgage²³. The initial data matching paired approximately 3.4 million of the 12 million records in the database, for a match rate of about 28%. This number drastically understates the number of matches made, however, because the HMDA data does not include information for mortgage originations before 1998 or after 2006. When this is accounted for, the match rate is approximately 50%.

Because the variables of interest within the HMDA dataset were static variables relating to borrower characteristics, additional records could be matched. As long as one transaction for a given ownership experience could be matched to a HMDA record, then all of the records for that owner could be matched as well. With this in mind, the match rate for owners increased to about 70%.

Unfortunately, the HMDA data was not the only cause for missing data. Within the Warren Group dataset, some information is also missing. For example, not all observations include the purchase price or LTV ratio for properties. As a result, observations with missing values were dropped from the regression models. The resulting sample contains roughly 560,000 ownership experiences—about one quarter of original Warren Group dataset that spanned from

²³ For more information on how this data was merged, consult Willen and Gerardi, *Subprime Mortgages, Foreclosures and Urban Neighborhoods* (2009).

1990 to 2009. For each year included in the final dataset, the match rate was around 60%. Exact match rates are listed in the table below.

Table 8: Percent of Records Used in Final Regression Models

Year	Percent of Records Matched	Year	Percent of Records Matched
1998	68%	2003	62%
1999	66%	2004	55%
2000	64%	2005	56%
2001	63%	2006	57%
2002	64%		

Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

In order to account for any sample selection biases in merging the two datasets, an inverse mills ratio was created and included in the regression models. To create this ratio, a probit model was first run, using the purchase price for the home, the loan-to-value ratio on the home's mortgage, and dummy variables for the different property types, years and counties as the independent variables²⁴. The predicted xb values from this regression model were then estimated, and the normal probability density functions and normal cumulative distribution functions for these values were then generated. The final value of the inverse mills ratio used as an independent variable in the final regression models was set equal to the normal PDF values divided by the normal CDF values.

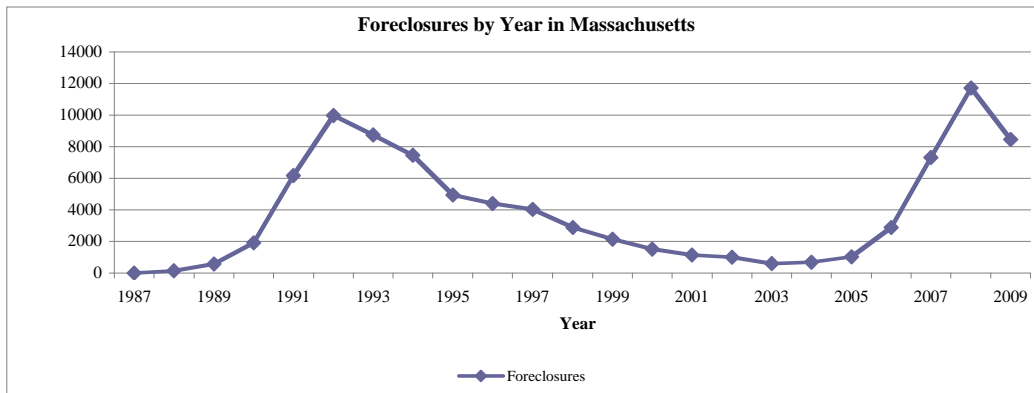
For each of the subsequent sets of regression models that break up the datasets by owner occupancy, year of ownership termination and structure type, additional inverse mills ratios were created based on the records that were included. The significant of the inverse mills ratio variables are discussed in the Results section.

²⁴ The county variables are not included in the later regression model of foreclosure.

Summary Statistics

The descriptive statistics for each of the variables included in the regression models can be found in Tables A1, A2 and A3 in the Appendix. This data provides us with some initial facts about the Massachusetts housing market since 1998. During this time period, roughly 988,000 of the 2.6 million total properties were either sold, purchased, foreclosed upon, or received mortgages. Furthermore, over 1.7 million ownership experiences were initiated, 1.8% of which ended in foreclosure²⁵.

The number of foreclosed properties has varied greatly by year. In more recent years, the share of foreclosed properties has increased. The proportion of foreclosures in recent years has surpassed those seen during the previous housing decline in Massachusetts in the early 1990s. The graph below charts the number of ownership experiences terminated in a given year that ended in foreclosure from 1989 to 2009.



Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

Furthermore, in the state of Massachusetts, the percentage of properties with residential mortgages that went into foreclosure in 1998 was 0.14%. These percentages were decreasing until 2006, when the number of foreclosed properties more than doubled from the previous year.

²⁵ This number is slightly overestimated within the final matched dataset used for the regression models.

Almost 3,000 properties went into foreclosure—about 0.14% of the total housing stock. This rapid increase continued through to 2009, peaking at 0.56% of all housing structures in 2008. The table below shows these changes over time.

Table 9: Foreclosures by Year

Year	Number of Foreclosures	Percent of total housing stock
1998	2,895	0.14
1999	2,129	0.10
2000	1,511	0.07
2001	1,136	0.05
2002	1,000	0.05
2003	607	0.03
2004	681	0.03
2005	1,030	0.05
2006	2,887	0.14
2007	7,302	0.35
2008	11,703	0.56
2009	8,451	0.41

Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

These numbers vary with respect to structure type. Single-family properties comprise approximately two-thirds of the dataset, while two family properties account for about 8% and three family properties account for roughly 4%. The remaining quarter is condominiums. Foreclosure patterns in recent years, however, are not proportional to these percentages. The data here shows a considerable increase in the share of multi-family experiencing foreclosure compared to single-family units in recent years. Prior to 2006, two and three family properties accounted for roughly one-quarter of all foreclosed properties in a given year—more than double their share of the overall housing stock. Roughly two-thirds of the foreclosed properties were single family, and the remaining 10% were condominiums. Beginning in 2006, however, the share of single-family properties relative to multi-family properties and condominiums began to

decline. During this time, there were increases in the share of three family properties and of condominiums. Table 10 shows a more detailed breakdown of these percentages by year.

Table 10: Foreclosures by year by structure type

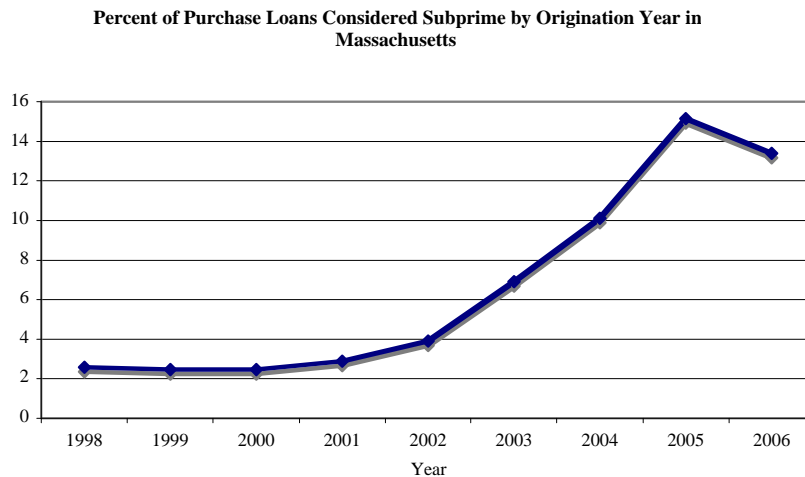
Year	<i>Percent of Foreclosed Properties:</i>			
	Single-Family	2-Family	3-Family	Condominiums
1998	0.64	0.15	0.08	0.28
1999	0.57	0.13	0.11	0.20
2000	0.62	0.17	0.07	0.14
2001	0.66	0.18	0.06	0.10
2002	0.66	0.18	0.07	0.10
2003	0.67	0.19	0.07	0.06
2004	0.70	0.16	0.06	0.08
2005	0.62	0.16	0.08	0.13
2006	0.60	0.16	0.12	0.12
2007	0.53	0.19	0.13	0.15
2008	0.51	0.19	0.12	0.18
2009	0.54	0.18	0.10	0.17

Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

An initial summary of the data tells us that the initial LTV ratios for properties range from less than one one-thousandth of the purchase price to over 1.5 million times the price. These numbers suggest that there are some outliers within the dataset, most likely caused by the inclusion of non-arms length transactions wherein properties are sold for less than market value. As such, it does not seem appropriate to include these values in the data and values for properties that were sold for less than \$100 were dropped. The resulting new upper bound for this ratio is 900, while the average household's LTV is 0.9, with a standard deviation of about 3.

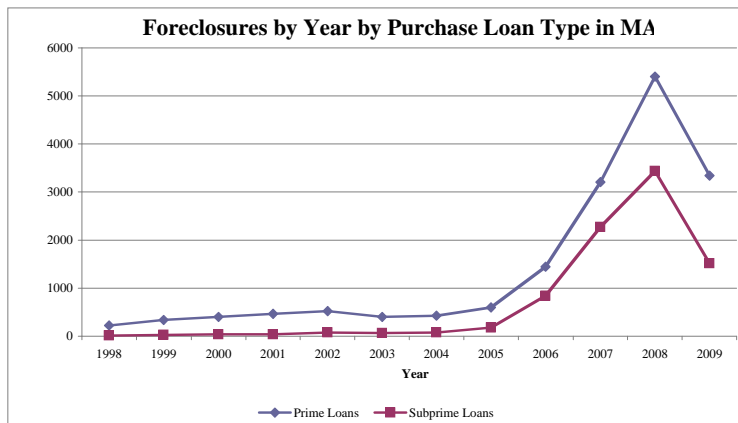
Approximately 91% of all owners in the dataset are classified as owner occupants. Moreover, 77% of owners were white and 3.6% of all owners were both black and owner occupants. With respect to financial behaviors, 7.8% of all properties were purchased with a

subprime loan. This number, however, underestimates the more recent levels of subprime lending because it averages it over years in which subprime mortgages were not widely available to consumers. Prior to 2003, less than 5% of purchase loans per year were considered to be subprime loans. The share of subprime loans increased to 7% in 2003 and 12% in 2004. Subprime loans reached a peak of 17% in 2005, and then fell slightly in 2006 to 13%. The graph below shows subprime loans as a percentage of all purchase loans made, by year between 1998 and 2006, in Massachusetts.



Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

From the descriptive statistics, it is also apparent that the majority of these loans are made to owner occupants; 7.1% of all owners in the dataset are owner occupants with subprime purchase loans. The remaining 0.7% of subprime purchase loans was issued to non-owner occupants. With respect to the behaviors of owners purchasing with subprime loans vs. prime loans, there is similar trends in foreclosure rates. Amongst both groups, there was a sharp increase in the number of mortgages that ended in foreclosure from 2005 to 2008, and a decrease from 2008 to 2009. The graph below shows these patterns.



Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

There is substantial of variation in the type of institution issuing the original mortgage. Commercial banks and other independent lenders make up the two greatest shares of the market, with 30% and 24% respectively. There is also a relatively strong correlation between loans originating from independent lenders and subprime purchase loans. The correlation coefficient for these two variables is 0.357, which is much stronger than the correlations between subprime purchase loans and the other types of lenders. Mortgage companies owned by a depository institution account for the third largest fraction of the market with 23%, followed by thrifts with 13%, and mortgage companies owned by banks or thrifts with 7%. Credit unions make up the smallest share of the market, accounting for less than 4% of all observations.

This research is focused on comparing the behaviors of owners of multi-family properties vs. single-family properties and owner-occupiers vs. non-owner occupiers. To evaluate any initial differences between groups, a difference of means test was conducted for each of the dependent and independent variables later used in the regression analysis. The table below shows the means for single-family properties and multifamily properties (i.e. two and three family properties). For all the variables, we reject the null hypothesis that the difference in means is equal to zero. The most important difference that is shown above is the difference in foreclosure

rates—roughly 4 times as many multi-family homes faced foreclosure than single-family homes. It is plausible that some of this difference may be attributed to the lower owner occupant rates or to the three-fold increase in the number of subprime purchases for multi-family properties.

Table 11: Difference in Means Testing for Single Family vs. 2-3 Family Properties

<i>Variable</i>	<i>Means</i>		<i>T-statistic</i>
	<i>Single Family</i>	<i>2-3 Family</i>	
Foreclosure Rate	0.02	0.08	-80.05
White Owner	0.79	0.62	102.89
Owner Occupancy	0.93	0.81	103.55
Natural log of Purchase Price	12.41	12.34	27.78
Natural log of Income	11.29	11.15	56.02
LTV ratio	0.89	1.01	-9.36
Subprime Purchase Loan	0.06	0.18	-1.00E+02
Loan from Commercial Bank	0.3	0.27	14.68
Loan from Thrift	0.13	0.11	11.53
Loan from Credit Union	0.04	0.02	21.08
Loan from Mortgage Co 1	0.22	0.25	-12.9
Loan from Mortgage Co 2	0.07	0.07	2.28
Loan from Independent	0.24	0.28	-22.57
Sample size	492246	67135	

Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

A test for the difference in means between occupant owners and non-occupant owners also shows statistical significance in means for almost all variables, though the difference between the two groups is not substantial.

While the difference in foreclosure rates between the two types of owners is much smaller than the difference in rates across structure types, owner occupants are actually significantly more likely to experience foreclosure. The only substantive difference between the two groups is what types of properties they chose to occupy; non-owner occupants tend towards two and three family homes, while owner-occupants tend towards single-family homes. There is no statistical difference in subprime origination rates, the natural log of the purchase price of

property, the percentage of owners that are white, and the percentage of mortgage originating from mortgage companies.

Table 12: Difference in Means Testing for Owner Occupants vs. Non-owner Occupants

<i>Variable</i>	<i>Means</i>		<i>T-statistic</i>
	<i>Non-owner occupants</i>	<i>Owner occupants</i>	
Foreclosure Rate	0.02	0.03	-7.32
White Owner	0.77	0.77	0.4164
Natural log of Purchase Price	12.4	12.4	-0.5
Natural log of Income	11.74	11.23	175.84
LTV ratio	0.85	0.91	-4.47
Single Family Unit	0.47	0.66	-81.16
Two Family Unit	0.14	0.08	51.28
Three Family Unit	0.12	0.03	101.96
Condo	0.26	0.23	12.52
Subprime Purchase Loan	0.08	0.08	-0.75
Loan from Commercial Bank	0.33	0.29	17.33
Loan from Thrift	0.15	0.12	18.04
Loan from Credit Union	0.01	0.04	-28.32
Loan from Mortgage Co 1	0.23	0.23	1.34
Loan from Mortgage Co 2	0.07	0.07	-0.41
Loan from Independent	0.2	0.25	-21.3
Sample size	48126	511255	

Source: Author's Calculations using Warren Group and HMDA match sample for Massachusetts

VI. Results

The regression model used in this research is a linear probability model with town fixed-effects. The dependent variable (whether or not an owner experiences foreclosure) is a binary variable. Town fixed-effects are used to account for time invariant, unobservable, town-level characteristic, particularly those that are correlated with explanatory variables. For example, these characteristics may be correlated with changes in housing prices²⁶. A linear probability was chosen because fixed effect logit models significantly reduces the sample size, and thus, potentially the accuracy of the model. In this particular dataset, the sample size for the base model is reduced from roughly 559,000 records to 557,000. The proportion of dropped observations is relatively greater, however, when the data are divided up by year of ownership termination, structure type and owner occupancy. Furthermore, the results of a linear probability model are much more directly interpretable than the results of a logit model.

The model used is shown below.

$$Y_{\text{town, owner}} = \beta_1 W_{\text{to}} + \beta_2 X_{\text{to}} + \beta_3 Z_{\text{to}} + \alpha_t + u_{\text{to}}$$

Where Y is the whether or not a home forecloses, W is a vector of owner characteristics, X is a vector of housing finance characteristics, Z is a vector of property characteristics, Z is the year of purchase for the property, and α are the town level fixed effects.

The vector of owner characteristics includes owner occupancy status and race, as recorded by HMDA. Owner occupancy is included as a proxy for measuring the transaction costs of default, as discussed in the negative equity model. The hypothesis is that owner occupants will be less likely to experience foreclosure. This variable may however be endogenous, because an owner's decision to occupy a property is determined by a wide range of factors. For example, an

²⁶ Case and Shiller's (1989) findings that housing prices generally move at the town level.

owner's income may play a role in whether or not they occupy the property. Owner occupants have lower incomes than non-owner occupants, as shown by Table 15, which may mean they cannot afford to purchase an additional residence. As a result, the coefficients on owner occupancy can be interpreted only as correlations and not causal effects. The race variable is included because there has been a noted correlation between foreclosure and minority households²⁷.

Financial characteristics include whether or not the home was purchased with a subprime mortgage, what type of institution originated the loan, the LTV ratio of the purchase loan, and the income of the owner at the time of purchase. These variables control for the differences in financial behaviors of owners; loans with higher LTV ratios and adjustable interest rates are riskier and thus will be more sensitive to negative equity.

The dummy variables indicating a property's structure type are a way to control for some of the unobservable owner characteristics that may be present and the additional layer of risk that is added when an owner chooses to rent out a property.

A final set of variables indicates the year in which the property was purchased to capture the effects of the boom and bust of the housing market in Massachusetts. Homes purchased during the rapid increase in housing prices should be much more vulnerable to the house price decline that followed. Furthermore, if a property was purchased more recently, then owners will have had less time to build equity in their mortgage. In the event of house price depreciation, these owners will be more likely to experience negative equity and thus, to defaulting on their mortgage. However, because this data includes no information on refinancing loans, it is possible

²⁷ See Gerardi, Shapiro and Willen (2007) and Baxter and Lauria (2000) for more on this relationship.

that even owners who purchased their properties many years ago may still have low equity if they have recently taken out new loans.

Tables A4, A5, A6, and A7 show the results of the regression models. Table A4 shows the base model and the subsequent tables show how these results change when the dataset is divided into different subgroups. One of the main findings of these models is that owners of multifamily properties are significantly more likely to foreclose than those of single-family properties; owners of two family properties nearly twice as likely to foreclosure and owners of three family properties are more than 2.5 times more likely. Furthermore, while owner occupants are more likely to foreclose than investor owners, financial characteristics, such as loan type, and purchase year have much greater impacts the probability of foreclosure. For example, purchasing a home with a subprime mortgage makes owners roughly 5.5 times more likely to experience foreclosure. Moreover, the correlation between being an owner occupant and experiencing foreclosure is not robust over time. The results of these models suggest that owner-occupants were, overall, more vulnerable to “over-consumption” of housing during the mid-2000s than non-occupant owners via more relaxed lending standards and/or overestimation of future house prices.

One important note is that among nearly all regression models, the inverse mills ratio variable, discussed in the data section, is statistically significant. While this does not affect the how these numbers should be interpreted, it does signify that the dataset was subject to sample selection bias.

Base Model

Four different regressions are included in this section—the original base model, as discussed above, and the remaining three models include interaction variables. Most of the independent variables in these models are statistically significant at the 95% confidence level and are consistent with the originally hypothesized signs.

In the first model, race is both significant and negative, as hypothesized. White owners are 0.9 percentage points less likely to face foreclosure, all other things held equal.

The coefficient on owner occupants, however, is not as hypothesized. The number is positive and statistically significant, implying that those owners who occupy their properties are more likely to experience foreclosure than those who do not occupy their properties. There are several possible explanations for this unexpected result. The first is measurement error in the HMDA data, which tends to overstate the number of owner occupants. The misclassification of some investor owners as owner occupants could be upwardly biasing these coefficients.

A second explanation is that the owner occupancy variable is capturing other unobservable characteristics of owners. For example, if owner occupants are more susceptible to exogenous income shocks, such as unemployment, then they may be more prone to experience foreclosure. Or, if changes in the credit market made lending standards much looser for owner occupants than for non-owner occupants, then owner occupants may have been more vulnerable to “over-consumption” of housing.

A final explanation is also that Massachusetts is a recourse state. In recourse states, if lenders are unable to sell the foreclosed property for at least the balance outstanding on the defaulted mortgage, then the borrower who defaulted is responsible for paying this difference. In the case of non-occupant owners of rental properties who experience foreclosure on their rental

property, there is risk that the lender may seize their primary residence as a means of making up this difference. This may mean that non-occupant owners have less of an incentive to default if they believe the bank might seize their primary residence.

It is also important to note that the magnitude of this coefficient, compared to several of the other variables is relatively small—only 1.4 percentage points in the first model. This number is less than half of the coefficient on 3 family properties and almost 1/10th of the coefficient on subprime purchase loans.

The coefficients on structure types are all statistically significant and as hypothesized. Owners of two family homes are 2.6 percentage points more likely and owners of three family homes are 4.1 percentage points more likely than owners of single-family homes to face foreclosure. Owners of condominiums, on the hand, are 0.5 percentage points less likely to experience foreclosure. The values for two and three family properties are quite large when compared to the predicted probability of foreclosure in this model. For this model, the predicted probability is 2.4%, meaning that a household with all independent variables equal to their means had a 0.024 chance of experiencing foreclosure between 1998 and 2009. In this case, owning a two family home more than doubles this probability and owning a three family home almost triples it.

The financial characteristics included in the model are the loan to value (LTV) ratio, the natural log of income, the natural log of the purchase price, the type of institution issuing a mortgage on the home, and whether or not the purchase loan was subprime. The sign on the subprime purchase loan was as hypothesized, though the log of income and LTV ratio variables are generally not significant.

The subprime mortgage variable has the strongest partial correlation with the probability of foreclosure in this model. The marginal effect of purchasing a home with a subprime mortgage makes an owner 11.2 percentage points more likely to face foreclosure. This means that owners purchasing with a subprime mortgage are nearly 5.5 times more likely to default on their mortgage. The addition of the interaction term for owner occupants who purchase with a subprime loan shows that this relationship is different for owner occupants than it is for non-owner occupants.

There is some variation across the different types of mortgage lenders. Compared to loans originated by commercial banks (the omitted dummy variable), those from thrifts, mortgage companies and independent companies are all more likely to be foreclosed upon, while those from credit unions are less likely. These effects are all significant, though varying in magnitude. These coefficients are an attempt to capture the lending standards used by the different types of institutions. For example, loans from mortgage companies that are owned by banks and thrifts have a 1.4 percentage point greater chance of ending in default. It is likely that this is a result of more relaxed lending standards, with respect to other variables that are not being captured in this model—for example, FICO scores and credit history. Loans originating from credit unions, on the other hand, are 1.2 percentage points less likely to end up in default, indicating that these institutions may have stricter lending standards.

The insignificance of income is most likely due to the fact that income is highly correlated with the natural log of the purchase price of the home; the correlation coefficient of these two variables is 0.651. It also may be attributable to measurement error in the income variable, because income is being measured at the time the mortgage was originated, not at the time of foreclosure.

The coefficient on the log of purchase price is negative and significant, which seems logical, because being able to afford a more expensive home generally implies that an owner possesses greater wealth. The magnitude of the coefficient, however, is relatively small—a one percent increase in the purchase price of a home is associated with a 0.3 percentage point decrease in the probability of experiencing foreclosure.

The coefficient on LTV ratio is also insignificant. It is once again possible that this is a result of collinearity, given that LTV ratio is with the natural log of the purchase price; the correlation coefficient of these two variables is -0.137. Another explanation for the insignificance of LTV ratio is that there is again measurement error. Because this value is recorded as the total loan to value ratio of all purchase loans, it does not account for additional refinancing loans.

In the base regressions, the purchase year dummy variables were used to capture the aggregate effects of the boom and bust of housing prices in the state. The coefficients, however, are significant only for 1999 and 2005. One possible explanation for the insignificance of other purchase year variables is that the current foreclosure crisis is affecting new and old owners alike. For example, while new owners were purchasing properties with riskier loans, older owners could have also been refinancing with the same types of loans, which is not being captured in the model. In 1999, the coefficient is negative and implies that homes purchased in 1999 are 1 percentage point less likely to experience foreclosure than properties purchased in 1998 (because 1998 is the omitted purchase year). Properties purchased in 2005 are 1.6 percentage points more likely to face foreclosure.

Models 2 through 4 in Table A4 introduce two interaction variables: white owner occupants and owner occupants who purchase with a subprime mortgage. Model 2 introduces the

white owner occupant variable only. The intuition behind this variable comes from the probit model in Table 1, based the POMS microdata, which regresses whether or not an owner is an occupant owner on different owner characteristics. In the POMS model, being of a minority race increased the probability that an owner was an occupant owner. Including an interaction variable between being white and being an occupant owner negates any biases that may be captured by the white owner and/or occupant owner variables. When the variable is added to the model, the effects on the majority of the regression coefficients are relatively small, with the exception of the coefficient for the white owner variable. Including the white owner occupant variable changes the coefficient on white owners from -0.009 to -0.013. This means that white owners who are not owner occupants are 1.3 percentage points less likely to experience foreclosure. The estimated effect of the white occupant owner variable itself is both positive and significant, with a value of 0.005. This coefficient is half of the value of the coefficient for owner-occupants, suggesting that non-white occupant owners are more likely to experience foreclosure than white occupant owners.

The subprime owner occupant variable is introduced in model 3, which interacts whether or not an owner purchased the home with a subprime loan with whether or not an owner is an occupant owner. Adding this variable also has relatively small effects on all variables except the subprime purchase variable, which is to be expected. Including this interaction variable decreases coefficient on purchasing a property with a subprime loan from 0.112 to 0.087. The coefficient the interaction variable in this model is both positive and significant. Owner occupants who purchase their own with a subprime mortgage are 2.7 percentage points more likely to experience foreclose than owner occupants who do not purchase with a subprime loan.

The final model that includes both interaction variables remains relatively similar to the models 2 and 3.

Year of Ownership Termination

The models in Table A5 explore the impacts of the year of ownership termination on whether or not an ownership experienced ended in foreclosure. Examining the differences in coefficients over time provides insight into how credit markets have changed since 1998. Beginning in 1998, the models have relatively low R-squared values, with very few significant coefficients. For example, in the 1998 regression model, the only variables that are significant at the 95% level are the 3-family property and the mortgage company owned by a commercial bank or thrift indicator variables. This is consistent with the hypothesis that the causes of foreclosure prior to the currently crisis were much different. As portrayed by early theoretical models, foreclosures were typically a result of “trigger events” experienced by borrowers, such as divorce, illness, or unemployment, which are randomly distributed throughout the population. Because the independent variables are not correlated with these types of events, the majority of the variables are not significant for the first eight years. It is not until the 2006 model that the majority of the variables become significant.

The owner occupant variable changes over time. The coefficients are insignificant from 1998 through 2003, and then again in 2009. It is tempting to speculate that there was something happening during this specific time period that was affecting foreclosure rates among owner occupants—most likely changes in lending standards and the economic downturn. If owner occupants were more susceptible to exogenous income shocks during the downturn or were more able to refinance properties with subprime loans than non-owner occupants, then we would

expect a higher proportion of owner occupants to experience negative equity and to default. Between 2004 and 2008, the correlation between being an owner occupant and the probability of experiencing foreclosure varies. In 2004, the coefficient is 0.005, though this increases almost ten-fold by 2006, and eight-fold by 2007. In 2008 the coefficient decreases again to 0.036, perhaps reflecting a re-tightening of lending standards.

The magnitude of the coefficient for white owners increases over time. These changes seem to coincide also with the changes in lending standards. Because people of minority races tend to be lower income and have lower credit scores, the relaxation of lending standards allowed more minorities to become homeowners. Unfortunately, if these new minority owners could not actually afford the homes that these loans allowed them to purchase, then this would explain why white owners were decreasingly likely to experience foreclosure in recent years. Moreover, as inexperienced, new homeowners, it is also possible that minority households may have been unknowingly steered towards riskier loans. In 2006, being a white owner is associated with a 1.8 percentage point decrease in the probability of experiencing foreclosure. This effect nearly triples in 2007, with a coefficient of -5.8 percentage points, and -7.5 percentage points in 2008. This means that, controlling for all other variables in the regression model, among tenure spells ending in 2008, white owners were 7.5 percentage points more likely than minority owners to conclude with a sale (as opposed to a foreclosure).

The impact of owning a 2 or 3 family property also changes over time. In earlier years, these two variables vary in significance and in magnitude. Beginning in 2007, however, both have significant, positive coefficients that are also quite large relative to the other coefficients. For example, in 2008, two family homes were almost 15 percentage points more likely to experience foreclosure and three family homes were 21 percentage points more likely.

The financial characteristics are perhaps the most interesting to observe over time. Purchasing a property with a subprime loan is correlated with a 33 percentage point increase in the probability of experiencing foreclosure in 2007, compared to about 4 percentage points in 2005 and 19 in 2007. This makes sense because the subprime mortgage market began to take off only several years before. Furthermore, the effects of borrowing from different types of lenders also increase over time. These two patterns together suggest the story of a decline in lending standards, particularly for specific types of institutions. While credit unions have kept their underwriting standards relatively strict, even compared to commercial banks, it seems as though mortgage companies and other independent lenders relaxed their standards during the housing bubble, to allow more households to take out loans. Relaxing standards pushed up homeownership rates, but the downside was that providing loans to these households was also much riskier and a greater proportion fell into default and/or foreclosure.

Structure Type

Breaking the original model down by structure type (i.e. single family, two family and three family properties) yields several interesting results. Overall, these models confirm the notion that different structure types inherently attract different types of owners, given the differences in coefficients. The overall probability that a single family home will experience foreclosure, according to this model, is about 2.5%, while for two family properties the probability is 7.4% and for three family properties, 8.9%.

Across structure type, the more units a property has, the more likely an occupant owner is to face foreclosure. Moreover, white owners are less likely to experience foreclosure, the more units the property has.

The relationships between foreclosure and purchase price, income and LTV ratio are not robust across the different structure types; purchase price is negative and significant for single family properties but positive and significant for multi-family properties, while income and LTV ratio are each significant for only two of the three properties. Income is significant for both single and two family properties, though there is a negative effect for single-family properties and positive effect for two family properties. LTV ratio, on the other hand is positive and significant for only two and three family properties. These coefficients are not as hypothesized, and it seems once again as though multi-collinearity may be skewing the results.

For owners purchasing with a subprime loan, there are some differences across structure type. While purchasing with a subprime loan is correlated with a 10 percentage point increase in the probability of default for single-family homes, this effect is even greater for two family properties (12.6 percentage points). Though there are also some differences across the different structure types by loan originators, the coefficients generally increase with size.

For two and three family units, the coefficients for the purchase year dummy variables for are all negative and significant though 2003. This implies that compared to homes purchased in 1998, two and three family properties purchased from 1999 to 2003 are less likely to foreclose. Beginning in 2004, the purchase year variables become less significant for two and three family homes, whereas the coefficients for single-family properties are positive and significant throughout. Single-family properties purchased in 2005 were 3.6 percentage points more likely to experience foreclosure than single-family properties purchased in 1998.

Owner Occupancy

The final set of regression models show how the effects of the independent variables change when the data are divided into owner occupants versus non-owner occupants. As would be expected, the coefficients on owner occupants are similar to the coefficients in the original base models because owner occupants are almost 90% of the dataset. Furthermore, for almost all of the variables, the absolute values of the coefficients for owner occupants are greater than those for non-owner occupants. This is also not surprising because the original models showed that owner occupants have a greater probability of experiencing foreclosure.

For white owners, those who are owner occupants are 0.9 percentage points less likely to experience foreclosure than owners of any other race, while those who are not owner occupants are 1.5 percentage points less likely. In this case, the correlation is almost twice as large. The differences across structure types are also notable. For two and three-family properties, owner occupants are two times more likely to face foreclosure than non-owner occupants.

There is also a significant difference between non-owner occupants and owner occupants with respect to subprime loans; purchasing with a subprime loan is associated with an 11.3 percentage point increase in the likelihood of default for occupant owners, compared to only 8.5 percentage points for non-occupant owners. Some variation also occurs between the two types of owners across different loan originators, though the differences are less than one full percentage point.

There are also some notable differences between the two types of owners with respect to their year of purchase. For non-owner occupants, the effect of purchasing before 2003 is not significant, except in 2000. Purchasing in 2004 is correlated with a 5.7 percentage point increase in the likelihood of default, at the 95% confidence interval. For owners purchasing in 2005 and

2006, this relation is even stronger—6.9 and 8.3 percentage points, respectively. For owner occupants, on the other hand, the coefficients on the purchase year dummy variables were negative and significant throughout. This is perhaps picking up on the fact that owner occupied housing has a much lower turnover rate than rental housing, so a higher proportion of the foreclosed owner occupied properties were purchased much earlier.

VII. Conclusion

The main purpose of this research was to understand how small multi-family properties are different from single-family properties. It also focused on the role that owner occupancy plays in determining foreclosure. This is an important area of research, given that there is little scholarly literature on small, multi-family properties and their owners, particularly in the context of the foreclosure crisis of the mid-2000s. More specifically, this research is critical for the New England Area, where small, multi-family properties comprise one-fifth of all properties (compared to 9% of all properties nationwide).

The findings are consistent with our hypothesis that owners of two and three family properties are significantly more likely to experience foreclosure than owners of single-family properties. Even when we control for owner, loan, and property characteristics, owners of two family properties are nearly twice as likely as owners of single-family properties to experience foreclosure, and owners of three family properties are about 2.5 times more likely.

These findings do not, however, support the hypothesis that owner occupants are less likely to experience foreclosure. We had hypothesized that this would be the case because they would incur higher transaction costs associated with foreclosure. One possible explanation is that reflects greater than optimal housing consumption by occupant owners. In the early to mid-2000s, owner occupants tended to over-consumption of housing more frequently than non-owner occupants. This could be explained by more relaxed lending standards for owner occupants than for non-owner occupants during this time period. Furthermore, owner-occupants may be more susceptible to exogenous income shocks (mainly unemployment) during economics downturns. These shocks would cause them to be more sensitive to negative equity, and thus to experiencing

foreclosure. Alternatively, could also be a result of the recourse laws in Massachusetts. As such, it is unclear whether this finding can be extended to non-recourse states.

This research has several important policy implications. First, because small, multi-family properties have been significantly more vulnerable to foreclosure during this crisis, policies targeting this subset of the housing market should be enacted. The results also confirm that owners of small, multi-family properties who purchase properties with subprime mortgages have been more likely to face foreclosure. Purchasing a two or three family property with a subprime loan is correlated with more than a 10-percentage point increase in the probability of experiencing foreclosure. Hence, it seems relaxed lending standards are attributable to at least some of the current crisis; loose lending standards encouraged owner occupants to purchase sub-optimal amounts of housing. Re-tightening lending standards may prevent this from happening in the future.

It is clear from this data, that foreclosure rates for single-family properties were significantly different from those for multi-family properties in Massachusetts between 1998 and 2009. Moreover, those differences are not explained by the owner characteristics and financial characteristics available. Many aspects of this research warrant further study. With regards to the owner occupancy variable, an attempt to verify HMDA

One aspect of the data deserves particular attention: the accuracy of the owner-occupancy variable in the HMDA dataset. This could be done in several ways. One approach would be to consult tax assessors' records in order to compare the zip code of a given property with the zip code on the mailing address for the owner's tax forms. Another more tedious approach would be to examine the original purchase mortgage deeds for each property.

Massachusetts is a recourse state with a large fraction of small multi-family properties and caution should be taken in applying these findings to other regions. As a result, future research should also be focused on expanding this research to the broader Northeast Region of the United States, or even to the to entire United States. Expanding the research to larger regions will determine how robust these findings are, and whether it might be appropriate to create region-specific policies.

More research is needed on the impacts on owner occupants and non-resident owners. This study provides evidence that changes in lending standards were greater for owner occupants than for non-resident owners. Similarly, this research raises important questions about how lending standard changed across races, and whether minorities were unknowingly convinced to take out much riskier loans.

Another set of research should focus on different specification models. Given the complexity of the dataset, with owners initiating and terminating their ownership experiences at different points in time, it is unclear if a linear probability model is the best model to use. Repeating this work using a hazard model could be a next step.

A final strand of future research should address the externalities imposed by foreclosed multi-family properties on a neighborhood, and what happens to the tenants of these properties. These issues are important for determining appropriate public policy options for owners of small, rental properties, as well as their tenants.

Table A1: Variables Summary--matched and unmatched observations

Variable	Definition	Observations	Mean	Std Error	Min	Max
forecl2	=1 if property foreclosed on, 0 otherwise	1644783	.0179316	.1327028	0	1
cltv_init3	Loan-to-value ratio of initial loan on property	936969	1.037759	36.44374	4.76e-07	34000
lnprice	The natural log of the purchase price of property	1136754	12.31961	.8320031	0	19.57822
owner_occup	=1 if owner lives at the property, 0 otherwise	1040941	.9035402	.295221	0	1
white_own	=1 if the owner is white, 0 otherwise	1040941	.7737489	.4184037	0	1
lnincome	The natural log of the owner's income	791781	11.25818	.6294915	6.907755	16.118
dummy_98	=1 if property enters the database in 1998, 0 otherwise	1644783	.1080428	.3104346	0	1
dummy_99	=1 if property enters the database in 1999, 0 otherwise	1644783	.1034136	.3044985	0	1
dummy_00	=1 if property enters the database in 2000, 0 otherwise	1644783	.0927581	.2900933	0	1
dummy_01	=1 if property enters the database in 2001, 0 otherwise	1644783	.090981	.2875822	0	1
dummy_02	=1 if property enters the database in 2002, 0 otherwise	1644783	.0963203	.2950301	0	1
dummy_03	=1 if property enters the database in 2003, 0 otherwise	1644783	.0983978	.2978518	0	1
dummy_04	=1 if property enters the database in 2004, 0 otherwise	1644783	.1057945	.3075745	0	1
dummy_05	=1 if property enters the database in 2005, 0 otherwise	1644783	.1042679	.3056078	0	1
dummy_06	=1 if property enters the database in 2006, 0 otherwise	1644783	.0883211	.2837614	0	1
singlefam_d	=1 if the property is single family, 0 otherwise	1618329	.6416495	.479516	0	1
twofam_d	=1 if the property is two family, 0 otherwise	1618329	.075358	.2639682	0	1
threefam_d	=1 if the property is three family, 0 otherwise	1618329	.0328839	.1783328	0	1
condo_d	=1 if the property is a condominium, 0 otherwise	1618329	.2500987	.4330698	0	1
commercial	=1 if the loan was taken out from a commercial bank, 0 otherwise	1034871	.3081746	.4617394	0	1
independ	=1 if the loan was taken out from an independent institution, 0 otherwise	1034871	.2327488	.4225837	0	1
thrift	=1 if the loan was taken out from a thrift, 0 otherwise	1034871	.13332	.3399204	0	1
creditunion	=1 if the loan was taken out from a credit union, 0 otherwise	1034871	.0396871	.1952231	0	1
mortgageco1	=1 if the loan was taken out from a mortgage company owned by a deposit institution, 0 otherwise	1034871	.2187838	.4134218	0	1
mortgageco2	=1 if the loan was taken out from a mortgage company owned by a bank or thrift holding institution, 0 otherwise	1034871	.0672857	.2505162	0	1
subprime_purch	=1 if the property was purchased with a lender classified by HUD as a subprime lender, 0 otherwise	894489	.0632372	.2433893	0	1

Table A2: Variables Summary--matched observations only

Variable	Definition	Observations	Mean	Std Error	Min	Max
forecl2	=1 if property foreclosed on, 0 otherwise	559381	.0284958	.1663846	0	1
cltv_init3	Loan-to-value ratio of initial loan on property	559381	.9056514	3.014118	.0094853	900
lnprice	The natural log of the purchase price of property	559381	12.40181	.6507494	6.763885	16.73328
owner_occup	=1 if owner lives at the property, 0 otherwise	559381	.9139656	.2804151	0	1
white_own	=1 if the owner is white, 0 otherwise	559381	.7721267	.4194608	0	1
lnincome	The natural log of the owner's income	559381	11.27409	.6200346	6.907755	16.118
dummy_98	=1 if property enters the database in 1998, 0 otherwise	559381	.1020092	.3026607	0	1
dummy_99	=1 if property enters the database in 1999, 0 otherwise	559381	.1044029	.3057828	0	1
dummy_00	=1 if property enters the database in 2000, 0 otherwise	559381	.0983516	.2977897	0	1
dummy_01	=1 if property enters the database in 2001, 0 otherwise	559381	.0981049	.2974567	0	1
dummy_02	=1 if property enters the database in 2002, 0 otherwise	559381	.1029227	.3038582	0	1
dummy_03	=1 if property enters the database in 2003, 0 otherwise	559381	.1091778	.3118625	0	1
dummy_04	=1 if property enters the database in 2004, 0 otherwise	559381	.1393093	.3462694	0	1
dummy_05	=1 if property enters the database in 2005, 0 otherwise	559381	.1342091	.3408771	0	1
dummy_06	=1 if property enters the database in 2006, 0 otherwise	559381	.1115125	.3147661	0	1
singlefam_d	=1 if the property is single family, 0 otherwise	559381	.6430036	.4791142	0	1
twofam_d	=1 if the property is two family, 0 otherwise	559381	.0821372	.2745739	0	1
threefam_d	=1 if the property is three family, 0 otherwise	559381	.0378794	.1909047	0	1
condo_d	=1 if the property is a condominium, 0 otherwise	559381	.2369798	.4252302	0	1
commercial	=1 if the loan was taken out from a commercial bank, 0 otherwise	559381	.2979257	.4573471	0	1
independ	=1 if the loan was taken out from an independent institution, 0 otherwise	559381	.2418227	.4281878	0	1
thrift	=1 if the loan was taken out from a thrift, 0 otherwise	559381	.1273533	.3333686	0	1
creditunion	=1 if the loan was taken out from a credit union, 0 otherwise	559381	.0360398	.1863895	0	1
mortgageco1	=1 if the loan was taken out from a mortgage company owned by a deposit institution, 0 otherwise	559381	.2267095	.4187035	0	1
mortgageco2	=1 if the loan was taken out from a mortgage company owned by a bank or thrift holding institution, 0 otherwise	559381	.070149	.2553981	0	1
subprime_purch	=1 if the property was purchased with a lender classified by HUD as a subprime lender, 0 otherwise	559381	.0777413	.2677643	0	1

Table A3: Correlation Matrix

	Foreclosure Rate	White Owner	Occupant Owner	Occupant Owner with Subprime Purchase Loan	Two Family Property	Three Family Property	Condominium	Natural Log of Income	Natural Log of Purchase Price	LTV Ratio	Subprime Purchase Loan	Mtg from Thrift Co
Foreclosure Rate	1											
White Owner	-0.0555	1										
Occupant Owner	0.0098	-0.0006	1									
Occupant Owner with Subprime Purchase Loan	0.2141	-0.0603	0.0849	1								
Two Family Property	0.0752	-0.0853	-0.0684	0.0976	1							
Three Family Property	0.073	-0.1093	-0.1351	0.0484	-0.0594	1						
Condominium	-0.0337	-0.0039	-0.0167	-0.0379	-0.1667	-0.1106	1					
Natural Log of Income	-0.0364	0.0122	-0.2289	-0.0254	-0.064	-0.0351	-0.0638	1				
Natural Log of Purchase Price	-0.023	-0.0192	0.0007	0.0035	-0.0388	-0.0074	-0.1248	0.651	1			
LTV Ratio	0.0054	-0.0012	0.006	0.0077	0.0096	0.0075	-0.0112	-0.0017	-0.1375	1		
Subprime Purchase Loan	0.2206	-0.0649	0.001	0.9531	0.1095	0.0768	-0.0412	-0.0134	-0.0021	0.0081	1	
Mtg from Thrift Co	-0.0336	0.0297	-0.0241	-0.0877	-0.0101	-0.0116	0.0307	0.0435	0.049	-0.0047	-0.0928	1
Mtg from Credit Union	-0.0263	0.0328	0.0378	-0.0534	-0.018	-0.0221	-0.0188	-0.0452	-0.0709	0.0018	-0.056	-0.0739
Mtg from Mortgage Co	-0.0191	-0.018	-0.0018	-0.1044	0.0025	0.0257	-0.026	-0.0248	-0.0332	-0.0001	-0.1116	-0.2068
Mtg from Mortgage Co2	0.011	-0.0439	0.0005	-0.056	-0.0018	-0.0025	0.0112	0.0092	0.0137	0.0022	-0.0592	-0.1049
Mtg from Independent Co	0.0901	-0.0668	0.0285	0.3352	0.0202	0.0224	-0.0004	0.0029	0.041	-0.0004	0.3567	-0.2157
Purchase Year 1999	-0.0324	0.024	0.0138	-0.0643	0.0024	0.0009	-0.0242	-0.0946	-0.1849	0.0003	-0.0651	0.0092
Purchase Year 2000	-0.0261	-0.0009	0.0092	-0.057	0.0002	0.0065	-0.0127	-0.0484	-0.1191	-0.0045	-0.0598	0.0089
Purchase Year 2001	-0.0239	-0.0246	0.0104	-0.0501	0.0009	0.0078	-0.0149	-0.0201	-0.0613	0.0005	-0.053	-0.0102
Purchase Year 2002	-0.0201	-0.0412	-0.0098	-0.0361	0.0003	0.0084	-0.0067	0.0052	0.0062	0.0011	-0.0367	0.0375
Purchase Year 2003	-0.0128	-0.0252	-0.0079	-0.0111	-0.0029	-0.0011	-0.0092	0.0112	0.0636	0.0049	-0.0111	0.0338
Purchase Year 2004	0.0304	-0.0004	-0.0107	0.0625	0.0071	-0.0009	0.0051	0.0497	0.1418	-0.0017	0.0653	-0.0035
Purchase Year 2005	0.0667	0.0116	-0.0189	0.1316	0.0022	0.0003	0.0406	0.0876	0.1768	-0.0007	0.1342	-0.0285
Purchase Year 2006	0.0389	0.0045	-0.009	0.0628	-0.0072	-0.0137	0.0508	0.1	0.1506	0.0002	0.0649	-0.0434

	Mtg from Credit Union	Mtg from Mortgage Co	Mtg from Mortgage Co2	Mtg from Independent Co	Purchase Year 1999	Purchase Year 2000	Purchase Year 2001	Purchase Year 2002	Purchase Year 2003	Purchase Year 2004	Purchase Year 2005	Purchase Year 2006
Mtg from Credit Union	1											
Mtg from Mortgage Co	-0.1047	1										
Mtg from Mortgage Co2	-0.0531	-0.1487	1									
Mtg from Independent Co	-0.1092	-0.3058	-0.1551	1								
Purchase Year 1999	-0.0024	0.0337	-0.0022	-0.0294	1							
Purchase Year 2000	0.0048	0.0523	-0.0652	-0.0341	-0.1128	1						
Purchase Year 2001	0.0027	0.0814	-0.0514	-0.0091	-0.1126	-0.1089	1					
Purchase Year 2002	-0.0016	0.0436	0.0279	-0.0432	-0.1156	-0.1119	-0.1117	1				
Purchase Year 2003	0.0007	0.0736	0.025	-0.0784	-0.1195	-0.1156	-0.1155	-0.1186	1			
Purchase Year 2004	0	-0.071	0.0135	0.0369	-0.1374	-0.1329	-0.1327	-0.1363	-0.1408	1		
Purchase Year 2005	-0.0027	-0.1094	0.0255	0.0918	-0.1344	-0.13	-0.1299	-0.1334	-0.1378	-0.1584	1	
Purchase Year 2006	-0.0006	-0.092	0.0148	0.0796	-0.121	-0.117	-0.1168	-0.12	-0.124	-0.1425	-0.1395	1

Table A4: Base Models

	<i>Base Model I</i>	<i>Base Model II</i>	<i>Base Model III</i>	<i>Base Model IV</i>
White Owner	-0.009** [0.001]	-0.013** [0.002]	-0.009** [0.001]	-0.015** [0.002]
Occupant owner	0.014** [0.001]	0.010** [0.002]	0.011** [0.001]	0.007** [0.002]
White Owner Occupants		0.005** [0.002]		0.006** [0.002]
Owner Occupants with Subprime Loans			0.027** [0.003]	0.028** [0.001]
2 Family prop	0.026** [0.001]	0.026** [0.001]	0.026** [0.001]	0.026** [0.001]
3 Family prop	0.041** [0.001]	0.040** [0.001]	0.041** [0.001]	0.041** [0.001]
Condominium	-0.005** [0.001]	-0.005** [0.000]	-0.005** [0.001]	-0.005** [0.001]
Log of income	-0.001 [0.000]	-0.001 [0.000]	-0.001 [0.000]	-0.001 [0.000]
Log of purchase price	-0.003** [0.001]	-0.003** [0.001]	-0.003** [0.001]	-0.003** [0.001]
LTV ratio	0.000 [0.000]	0.000 [0.000]	0.000 [0.000]	0.000 [0.000]
Subprime loan	0.112** [0.001]	0.112** [0.001]	0.087** [0.003]	0.086** [0.003]
Mtg from thrift co	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]
Mtg from credit union	-0.012** [0.001]	-0.012** [0.001]	-0.012** [0.001]	-0.012** [0.001]
Mtg from mtg co	0.007** [0.001]	0.007** [0.001]	0.007** [0.001]	0.007** [0.001]
Mtg from mtg co2	0.014** [0.001]	0.014** [0.001]	0.014** [0.001]	0.014** [0.001]
Mtg from independent co	0.007** [0.001]	0.007** [0.001]	0.007** [0.001]	0.007** [0.001]
Purchased 1999	-0.010* [0.005]	-0.010* [0.005]	-0.010* [0.005]	-0.010* [0.005]
Purchased 2000	-0.008 [0.005]	-0.009 [0.005]	-0.008 [0.005]	-0.008 [0.005]
Purchased 2001	-0.009 [0.005]	-0.008 [0.005]	-0.009 [0.005]	-0.009 [0.005]
Purchased 2002	-0.008 [0.005]	-0.008 [0.005]	-0.008 [0.005]	-0.008 [0.005]
Purchased 2003	-0.005 [0.005]	-0.005 [0.005]	-0.005 [0.005]	-0.006 [0.005]

Table A4: Base Models—Continued

	<i>Base Model I</i>	<i>Base Model II</i>	<i>Base Model III</i>	<i>Base Model IV</i>
Purchased 2004	[0.005] 0.005	[0.005] 0.005	[0.005] 0.005	[0.005] 0.005
Purchased 2005	[0.007] 0.016*	[0.007] 0.016*	[0.007] 0.016*	[0.007] 0.016*
Purchased 2006	[0.006] 0.012	[0.006] 0.012	[0.006] 0.012	[0.006] 0.012
Inverse Mills Ratio	[0.007] -0.020*	[0.007] -0.019*	[0.007] -0.020*	[0.007] -0.020*
Constant	[0.009] 0.063**	[0.009] 0.066**	[0.009] 0.065**	[0.008] 0.070**
Observations	[0.008] 559381	[0.008] 559381	[0.008] 559381	[0.008] 559381
Number of towns	349	349	349	349
R-squared	0.049	0.051	0.05	0.051
Predicted Probability	0.024	0.028	0.023	0.029
<i>Actual</i>	<i>0.028</i>	<i>0.028</i>	<i>0.028</i>	<i>0.028</i>

Standard errors in brackets

* significant at 5%; ** significant at 1%

Table A5: Year of Ownership Termination Models

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
White Owner	-0.001 [0.009]	-0.008 [0.006]	-0.012** [0.003]	-0.010** [0.003]	-0.006* [0.002]	-0.005** [0.002]	-0.004** [0.001]	-0.006** [0.002]	-0.018** [0.004]	-0.058** [0.005]	-0.075** [0.007]	-0.057** [0.008]
Occupant owner	0.007 [0.010]	0.005 [0.007]	0.009 [0.004]	0.007 [0.004]	0.006 [0.003]	0.003 [0.003]	0.005* [0.002]	0.014** [0.003]	0.047** [0.005]	0.076** [0.009]	0.036** [0.012]	0.023 [0.013]
2 Family prop	0.035 [0.026]	0.023* [0.010]	0.027** [0.006]	0.008 [0.005]	0.009* [0.004]	0.002 [0.003]	-0.005* [0.002]	-0.008** [0.003]	0.001 [0.006]	0.137** [0.009]	0.147** [0.011]	0.175** [0.012]
3 Family prop	0.087* [0.041]	0.048** [0.011]	0.015* [0.007]	-0.006 [0.006]	-0.004 [0.005]	-0.004 [0.004]	-0.006 [0.003]	-0.008* [0.004]	0.058** [0.008]	0.234** [0.012]	0.207** [0.014]	0.217** [0.016]
Condominium	0.067 [0.037]	-0.019* [0.009]	-0.007 [0.004]	-0.012** [0.003]	-0.010** [0.003]	-0.007** [0.002]	-0.005** [0.002]	-0.013** [0.002]	-0.033** [0.005]	-0.048** [0.006]	-0.088** [0.008]	-0.053** [0.009]
Log of income	0.004 [0.007]	-0.015** [0.004]	-0.003 [0.003]	-0.009** [0.003]	-0.007** [0.002]	-0.005** [0.001]	-0.006** [0.001]	-0.003 [0.002]	-0.009* [0.003]	-0.022** [0.005]	-0.023** [0.007]	-0.017* [0.008]
Log of purchase price	0.017 [0.014]	0.007 [0.005]	0 [0.003]	-0.001 [0.003]	0.001 [0.003]	-0.002 [0.002]	0.002 [0.001]	-0.004 [0.002]	0.008* [0.004]	0.012* [0.006]	-0.075** [0.008]	-0.055** [0.009]
LTV ratio	-0.041 [0.028]	0.017** [0.006]	0 [0.000]	0.004* [0.002]	0.007** [0.002]	0.001 [0.001]	0 [0.000]	0.001* [0.000]	0.005** [0.001]	0.007** [0.002]	0 [0.001]	0.009* [0.004]
Subprime loan	-0.002 [0.018]	0.035** [0.011]	0.023** [0.007]	0.039** [0.006]	0.048** [0.005]	0.027** [0.003]	0.024** [0.003]	0.044** [0.003]	0.188** [0.005]	0.327** [0.007]	0.294** [0.009]	0.228** [0.010]
Mtg from thrift co	0.001 [0.011]	-0.005 [0.007]	0.012** [0.004]	0.006 [0.004]	0.004 [0.003]	0.004 [0.002]	0.003 [0.002]	0.003 [0.002]	-0.001 [0.005]	-0.004 [0.008]	0.005 [0.011]	0 [0.011]
Mtg from credit union	0.001 [0.022]	-0.011 [0.013]	0 [0.009]	-0.009 [0.007]	-0.004 [0.006]	-0.006 [0.004]	-0.001 [0.003]	-0.001 [0.004]	-0.026** [0.009]	-0.080** [0.014]	-0.131** [0.020]	-0.082** [0.020]
Mtg from mtg co	0.001 [0.009]	0.003 [0.006]	0.008* [0.004]	0.011** [0.003]	0.005* [0.002]	0.006** [0.002]	0.006** [0.002]	0.007** [0.002]	0.008 [0.004]	0.020** [0.006]	0.035** [0.009]	0.019* [0.009]
Mtg from mtg co2	0.043** [0.014]	0.005 [0.008]	0.018** [0.005]	0.020** [0.005]	0.007 [0.004]	0.009** [0.003]	0.008** [0.002]	0.013** [0.003]	0.026** [0.006]	0.097** [0.009]	0.082** [0.012]	0.095** [0.013]

Table A5: Year of Ownership Termination Models—Continued

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mtg from independent co	-0.007 [0.010]	-0.006 [0.006]	0.004 [0.004]	0.008* [0.003]	0.008** [0.003]	0.006** [0.002]	0.004* [0.002]	0.004* [0.002]	0.013** [0.005]	0.032** [0.006]	0.054** [0.008]	0.036** [0.009]
Inverse Mills Ratio	0.154 [0.099]	-0.068** [0.024]	-0.040** [0.012]	-0.037** [0.012]	-0.052** [0.013]	-0.029** [0.009]	-0.029** [0.011]	-0.065** [0.017]	-0.115** [0.023]	-0.222** [0.035]	-0.423** [0.027]	-0.192** [0.019]
Constant	-0.379 [0.234]	0.138* [0.061]	0.071* [0.035]	0.149** [0.033]	0.099** [0.026]	0.097** [0.019]	0.064** [0.016]	0.115** [0.021]	0.067 [0.045]	0.288** [0.068]	1.668** [0.096]	1.155** [0.103]
Observations	673	3047	6732	10603	15148	19449	24483	25407	22443	22188	18447	14668
R-squared	0.043	0.028	0.017	0.014	0.015	0.009	0.007	0.015	0.085	0.184	0.163	0.106
Predicted Probabilty	0.005301	0.011493	0.015644	0.020372	0.011863	0.002731	0.008226	0.006888	0.056084	0.179565	0.330539	0.22787
Actual Percent	0.0044577	0.0127995	0.0115865	0.0144299	0.012807	0.0088951	0.0079647	0.0133821	0.0613109	0.174689	0.3331707	0.2295473

Standard errors in brackets

* significant at 5%; ** significant at 1%

Table A6: Structure Models

	<i>Single Family Property</i>	<i>Two Family Property</i>	<i>Three Family Property</i>	<i>Single Family Property</i>	<i>Two Family Property</i>	<i>Three Family Property</i>
White Owner	-0.007** [0.001]	-0.019** [0.003]	-0.027** [0.004]	-0.008** [0.003]	-0.012 [0.007]	-0.039** [0.008]
Occupant owner	0.009** [0.001]	0.028** [0.003]	0.031** [0.005]	0.006** [0.003]	0.028** [0.007]	0.015* [0.007]
White Owner Occupants				0.001 [0.002]	-0.007 [0.005]	0.016 [0.009]
Owner Occupants with Subprime Loans				0.032** [0.004]	0.043** [0.009]	0.037** [0.011]
Log of income	-0.003** [0.001]	0.009** [0.003]	0.002 [0.004]	-0.003** [0.001]	0.009** [0.003]	0.002 [0.004]
Log of purchase price	-0.007** [0.001]	0.021** [0.004]	0.042** [0.008]	-0.007** [0.001]	0.021** [0.004]	0.042** [0.008]
LTV ratio	0 [0.000]	0.002** [0.001]	0.001* [0.000]	0 [0.000]	0.002** [0.001]	0.001* [0.000]
Subprime loan	0.099** [0.001]	0.126** [0.004]	0.100** [0.006]	0.068** [0.004]	0.088** [0.009]	0.073** [0.010]
Mtg from thrift co	0.001 [0.001]	0 [0.004]	0 [0.007]	0.001 [0.001]	0.001 [0.004]	0.001 [0.007]
Mtg from credit union	-0.011** [0.001]	-0.032** [0.008]	-0.011 [0.016]	-0.011** [0.001]	-0.031** [0.008]	-0.011 [0.016]
Mtg from mtg co	0.006** [0.001]	0.005 [0.003]	0.031** [0.005]	0.006** [0.001]	0.005 [0.003]	0.030** [0.005]
Mtg from mtg co2	0.015** [0.001]	0.018** [0.005]	0.022** [0.008]	0.015** [0.001]	0.018** [0.004]	0.021* [0.008]
Mtg from independent co	0.006** [0.001]	0.007* [0.003]	0.036** [0.006]	0.006** [0.001]	0.008** [0.003]	0.036** [0.006]
Purchased 1999	0.008 [0.006]	-0.077** [0.026]	-0.112** [0.039]	0.008 [0.006]	-0.077** [0.026]	-0.114** [0.039]
Purchased 2000	0.012 [0.006]	-0.082** [0.026]	-0.123** [0.042]	0.011 [0.006]	-0.081** [0.026]	-0.126** [0.042]
Purchased 2001	0.012* [0.006]	-0.086** [0.026]	-0.137** [0.044]	0.012* [0.006]	-0.085** [0.026]	-0.140** [0.044]
Purchased 2002	0.012* [0.006]	-0.093** [0.027]	-0.135** [0.045]	0.012* [0.006]	-0.093** [0.027]	-0.139** [0.045]

Table A6: Structure Models—Continued

	<i>Single Family Property</i>	<i>Two Family Property</i>	<i>Three Family Property</i>	<i>Single Family Property</i>	<i>Two Family Property</i>	<i>Three Family Property</i>
Purchased 2003	0.016* [0.007]	-0.086** [0.026]	-0.114** [0.043]	0.016* [0.007]	-0.086** [0.026]	-0.118** [0.043]
Purchased 2004	0.029** [0.008]	-0.084* [0.034]	-0.088 [0.051]	0.029** [0.008]	-0.083* [0.034]	-0.092 [0.051]
Purchased 2005	0.036** [0.008]	-0.034 [0.032]	-0.036 [0.049]	0.036** [0.008]	-0.034 [0.032]	-0.041 [0.049]
Purchased 2006	0.029** [0.008]	-0.049 [0.032]	-0.047 [0.047]	0.029** [0.008]	-0.049 [0.032]	-0.052 [0.047]
Inverse Mills Ratio	0.014 [0.011]	-0.144** [0.046]	-0.189** [0.071]	0.014 [0.011]	-0.143** [0.046]	-0.194** [0.071]
Constant	0.107** [0.010]	-0.180** [0.044]	-0.306** [0.076]	0.110** [0.010]	-0.176** [0.044]	-0.288** [0.076]
Observations	359684	45946	21189	359684	45946	21189
R-squared	0.035	0.071	0.075	0.036	0.073	0.078
Predicted Probability	0.024659	0.073968	0.088625	0.022979	0.074759	0.088206
Actual	0.0232593	0.0703434	0.0896692	0.0232593	0.0703434	0.0896692
Standard errors in brackets						
* significant at 5%; ** significant at 1%						

Table A7: Owner Occupancy Models

	<i>Non-owner Occupants</i>	<i>Owner Occupants</i>
White Owner	-0.015** [0.002]	-0.009** [0.001]
2 Family prop	0.015** [0.003]	0.037** [0.001]
3 Family prop	0.034** [0.003]	0.067** [0.002]
Condominium	0.019** [0.004]	-0.027** [0.002]
Log of income	-0.006** [0.001]	-0.001 [0.001]
Log of purchase price	0.010** [0.002]	-0.006** [0.001]
LTV ratio	-0.001** [0.000]	0.003** [0.000]
Subprime loan	0.085** [0.003]	0.113** [0.001]
Mtg from thrift co	0 [0.002]	0.001 [0.001]
Mtg from credit union	-0.004 [0.006]	-0.012** [0.001]
Mtg from mtg co	0.009** [0.002]	0.007** [0.001]
Mtg from mtg co2	0.004 [0.003]	0.015** [0.001]
Mtg from independent co	0.010** [0.002]	0.007** [0.001]
Purchased 1999	-0.004 [0.003]	-0.006** [0.001]
Purchased 2000	-0.007* [0.003]	-0.017** [0.002]
Purchased 2001	-0.004 [0.003]	-0.027** [0.003]
Purchased 2002	-0.005 [0.003]	-0.032** [0.004]
Purchased 2003	0.015** [0.005]	-0.041** [0.005]
Purchased 2004	0.057** [0.010]	-0.064** [0.008]
Purchased 2005	0.069**	-0.034**

Table A7: Owner Occupancy Models—Continued

	<i>Non-owner Occupants</i>	<i>Owner Occupants</i>
	[0.010]	[0.006]
Purchased 2006	0.083**	-0.047**
	[0.013]	[0.007]
Inverse Mills Ratio	0.249**	-0.347**
	[0.051]	[0.032]
Constant	-0.159**	0.270**
	[0.036]	[0.019]
Observations	48126	511255
R-squared	0.042	0.05
Predicted Probability	0.02080027	0.022860858
Actual	0.0231891	0.0289953

Standard errors in brackets

* significant at 5%; ** significant at 1%

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