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Mortgage Default in Southern California: Examining Distressed Borrower's Decision Making and Market Contagion

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By

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APPROVAL OF THE REVIEW COMMITTEE

This dissertation has been duly read, reviewed, and critiqued by the Committee listed below, which hereby approves the manuscript of Michael Wilkerson as fulfilling the scope and quality requirements for meriting the degree of Ph.D. in Politics/Economics

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Abstract

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By: Michael Wilkerson

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This dissertation focuses on mortgage defaults in Southern California during the housing bubble of the 2000s. The rapid decline in the housing market that precipitated the current recession has been accompanied by an unprecedented number of loan defaults and foreclosures. Recent studies have identified two major theories of default—the "double trigger" hypothesis, where negative equity and an income shock are necessary conditions for default—and "strategic default" where negative equity is a sufficient condition for default. This paper adds to the default literature by adding short sale as another possible outcome of mortgage default.

The primary goal is to analyze the determinants of mortgage default to assist in understanding the conditions under which strategic behavior of home sales is most likely to occur. Data from Los Angeles County was analyzed from 2007 to 2010 for every closed sale, then coded into three possible sales outcomes: 1) Organic 2) Short Sale 3) Real Estate Owned (REO). A multinomial probit model was used to model homeowner decision-making based on the sale outcome. The model rejected the "double trigger" hypothesis, as it was found that income shocks do no have a significant effect on impacting the predicted probability for distressed sales. Education levels, the sales price of homes, credit card debt, and market price reductions were found to be significant variables in determining distressed sales outcomes, thereby confirming the strategic default hypothesis.

The next section studied spatial association of short sales and REO to see if any contagion effects were present. It was found that both short sales and REO form into clusters of hot and cold spots. Social stigma is believed to impact consumer behavior, the theory was confirmed through the findings of contagion and spatial lag. The final section constructed a hedonic price model to capture the price effects that distressed sales have on neighborhood pricing. Foreclosures were found to have three times the negative impact on neighborhood pricing compared to short sales.

For Jenny

Acknowledgements

I would first like to thank my family for the years of support on this seemingly never-ending journey to complete this dissertation. Specifically my parents, Bill and Elaine, for instilling an intellectual curiosity at a young age and my grandparents Aaron and Stella for stressing the life long importance of a quality education. My entire family has made innumerable sacrifices that have allowed for my continued studies, without their help, I would have surely not had the continued focus required to finish.

I am also greatly indebted to the members of my dissertation committee, Tom Borcherding, Jennifer Merolla, and Mark Abdollahian for allowing me to pursue a subject that interested me, although not directly a focus of their studies. Their efforts, suggestions and guidance allowed me to focus my ideas into a project with an achievable goal. Many thanks also to Yi Feng for encouraging me to continue the pursuit of a doctorate after the completion of my masters.

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Table of Contents

Chapter 1 – Introduction……1

Chapter 2 – Modeling Consumer Behavior: The Choice Between Short Sale and Foreclosure……16

Chapter 3 – Neighborhood Effects: Measuring Contagion and the Impact of Social Stigma on Borrower Decision Making……63

Chapter 4 – Distressed Sales Market Impact: Evaluating Price Contagion of REO vs. Short Sales……92

Chapter 5 – Conclusion……104

References……109

Chapter 1-

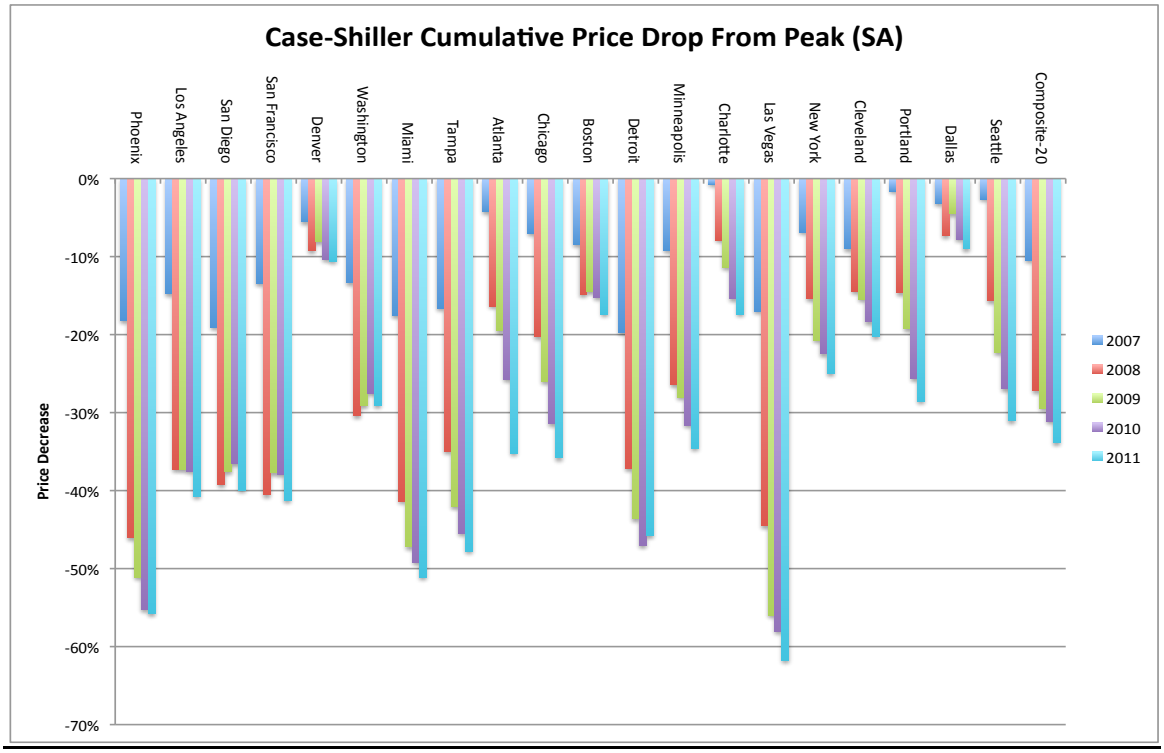
Introduction

"When in October 2006 I participated in a panel sponsored by the Yale Investment Club, I shared the dais with Frank Nothaft, chief economist at Freddie Mac. As I recall the event now, I asked him if Freddie Mac had stress-tested the impact on itself of a possible housing price decline. He answered that they had, and they had even considered the possibility of a 13.4% national drop in home prices. I protested: "what about the possibility of a drop that is bigger than that?" He answered that such a drop had never happened, at least not since the Great Depression." Shiller (2008)

This quote is chilling because it epitomizes the consensus view on the housing market prior to the crash in 2008. Robert Shiller was apt to point out that our standard economic models might be missing something; predicting a housing crash of up to 50% (Barron's 2005). Smith and Smith (2006) created a model focusing on calculating the present value of a home and the future expected cash flow the asset will produce. They found that "buying a house at current market prices appears to be an attractive long-term investment." During an economic bubble, there is rarely consensus as to when the bubble will pop. As we now know, Shiller was correct—a major housing market correction occurred, with prices falling by more than 50% in certain markets (see figure 1). The recent "attention cascade"[1] regarding the financial market meltdown has come to focus on foreclosures and strategic default. Using Los Angeles County in Southern California as the area of analysis, this study will closely examine the distressed housing market and the resultant mortgage defaults.

[1] Attention cascades occur when economic events or problems become the subject of more and more talk and of stories in the media, until the come to dominate public thinking, Shiller (2008)

Figure 1 – Price Decline from Peak Market Price by City 2007-2011[2]

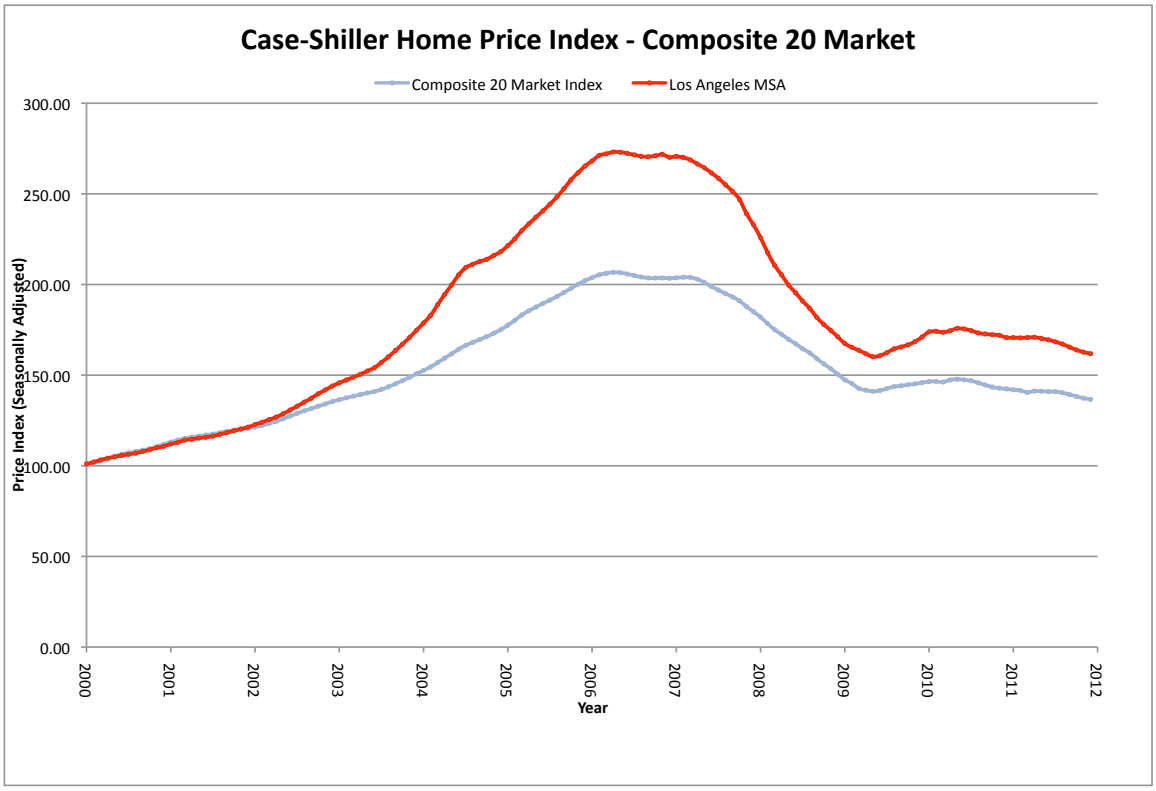


Prior to the housing bubble bursting, economic models focused primarily on income shocks as the main determinant for foreclosures. An oft-cited study authored by Foote, Gerardi and Willen (2008), focuses on the Massachusetts housing market in the 1990s. Their findings were that negative equity is a necessary but not a sufficient condition for foreclosure; estimating that less than 10% of homeowners with negative equity would face foreclosure. Analysts have struggled to predict the timing of the eventual bottom of the current market depression; as a result forecasts have varied in their estimates of the number

[2] Data obtained from S & P Case Shiller Home Price Index ; peak price was determined for each individual market, then used to calculate the percentage price drop for each year using the price level from December for the years 2007-2011

homeowners that are underwater[3]. In a 2009 study, Weaver and Shen estimated that 26% of homeowners with mortgages were underwater — at the time, they estimated the market would bottom out in the first quarter of 2011, with the number growing to 48% expected to have negative equity at the predicted market bottom.

Figure 2 – Case Shiller Home Price Index Time Series 2000-2012

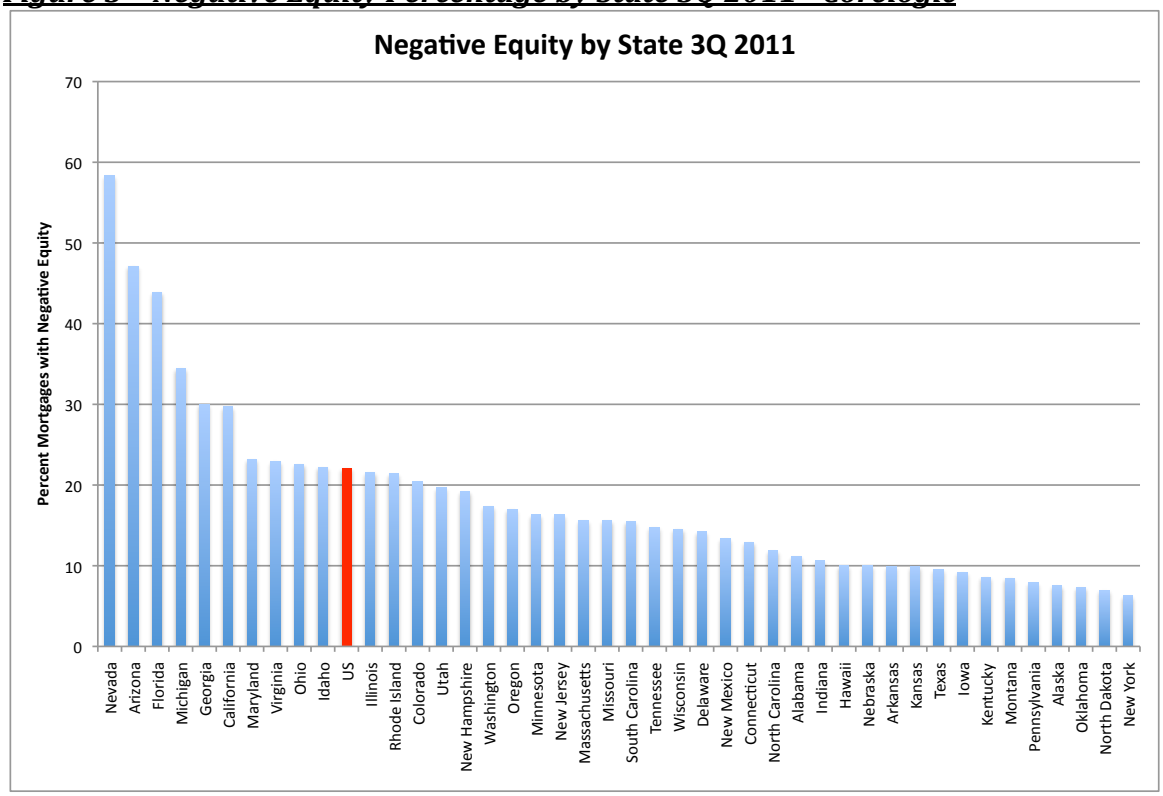


To date, home prices have continued to decline in most markets across the United States, as a result previous studies have underestimated the duration of the crash. The most recent S & P Case Shiller data as of Oct 2011, show that 19 of 20 markets declined in the most recent month (September 2011), and 18 of 20 markets declined in the past year (October 2010). The 20 major market index decreased

[3] Underwater is another term to describe negative equity – occurs when a homeowner owes more on their mortgage than the fair market value of their home

1.2% from September to October 2011, while declining 3.4% from October 2010 to 2011. Prices have currently dropped back to 2003 levels (see figure 2), although the rate of decline has decreased in 14 of 20 markets from October 2010 to 2011[4]. As prices continue to decline, the amount of borrowers with negative equity increases. Corelogic (2011) estimates that as of the 3rd quarter 2011, 10.7 million or 22.1% of residential properties with mortgages were underwater. This number varies greatly by state—Nevada is the highest with 58% of borrowers underwater, New York is the lowest at 6.3%, while California is at 29.7% (see figure 3).

Figure 3 – Negative Equity Percentage by State 3Q 2011 - Corelogic



Until this most recent housing crash, there have never been instances of such severe market corrections—accordingly, previous studies focusing on market shocks are likely to have underestimated the effect negative equity has on a

[4] Phoenix increased at an annual rate of .3% from September to October 2011, while Detroit increased 2.5% and Washington D.C 1.3% from October 2010 to 2011.

borrowers decisions to default. An example of this would be Smith and Smith's assertion that in the residential real estate market, "homebuyers generally do not calculate present values" (2006). Studies incorporating data from the past few years, however, show that negative equity does play a significant role in a homeowner's decision to default on their mortgage. Butta, Dokko and Shan (2010) focus on borrowers with mortgages originating in 2006 in Florida, California and Nevada and estimate that 20% of defaults are strategic.

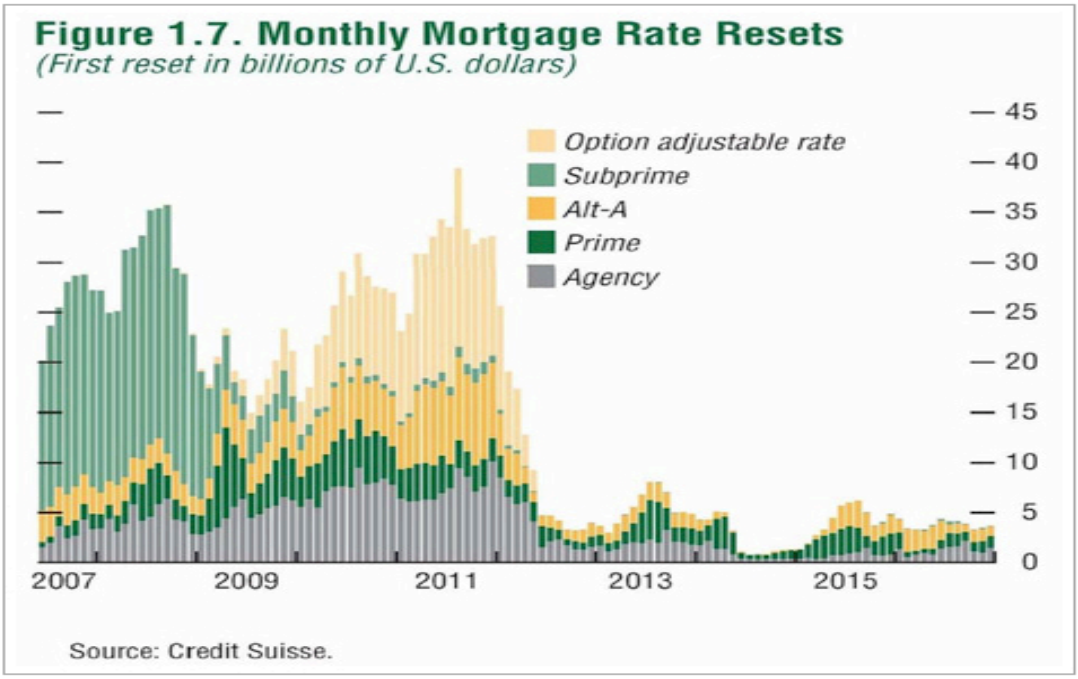
Homeowners generally walk away from their homes due to present valuations and affordability issues, however negative equity also impacts the homeowner's efforts to refinance, thereby effecting affordability if the mortgage has adjustable rates. Mortgage rates have lowered significantly during the housing crash and if homeowners were able to refinance their mortgage it would create more affordable monthly payments. Negative equity prevents most borrowers from refinancing as "they do not have the means or willingness to bring potentially substantial personal funds to the transaction," unless they are able to qualify for a government loan modification program[5] (Fed 2012).

Borrowers with adjustable rate mortgages have greatly impacted the mortgage landscape. Borrowers with adjustable rates are unable to reduce their payments and incur increasing payments as their initial rates expire. Figure 4 shows a time series of adjustable rate mortgage resets from 2007 through 2015. The number of resets does not begin to reduce significantly until the middle of 2012, including the last remaining option adjustable rate reset. These types of loans allow

[5] see http://www.makinghomeaffordable.gov/programs/lower-payments/Pages/hamp.aspx for information on the HAMP and HARP modification programs

the borrower to ability to choose their payment, including the ability to pay less than the interest-only payment, thereby adding to their mortgage balance every month until the cap is reached. These borrowers face the largest monthly payment increase at the reset due to the change in structure that requires them to begin paying down interest in addition to an increase in rate from the initial "teaser" rate.

Figure 4 – Adjustable Rate Mortgage Resets[6]

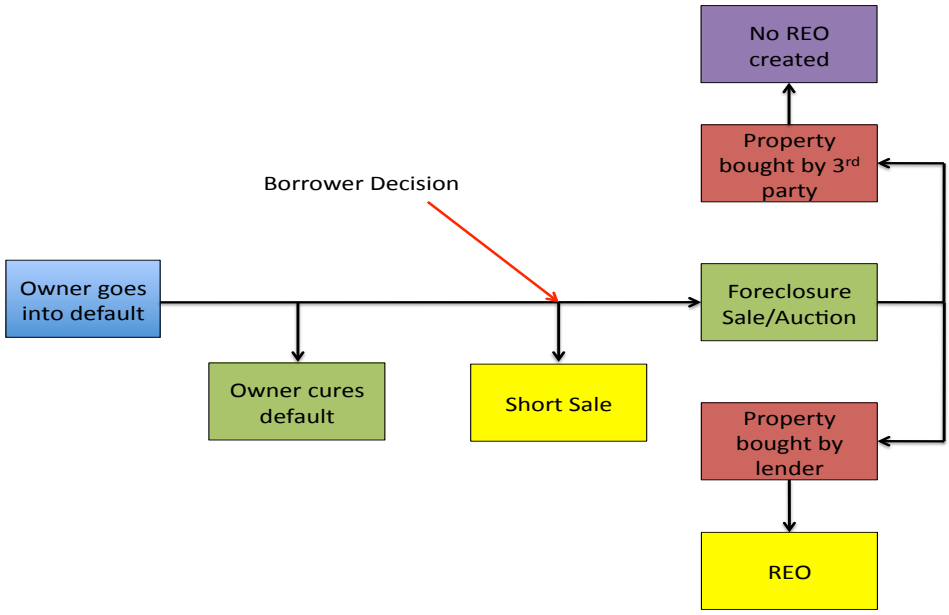


For the purpose of this study, Strategic Default is defined as when a homeowner defaults on his mortgage when he is able to continue making regular payments. The strategic reason to default would be to eliminate the under-water (negative equity) condition of any owned property. This decision would serve to accomplish two main objectives—increasing an owner's net worth by selling an asset that is worth less than is owed, and increasing monthly cash flow. For owner

[6] see http://www.imf.org/external/pubs/ft/gfsr/2007/02/pdf/chap1.pdf

occupied residences, increasing monthly cash flow is achieved by purchasing or renting new housing for less than the current monthly mortgage payment.

Figure 5 – Borrower Default Flow Chart



At the point of a borrower's default there are only two possible outcomes – curing the default or disposition of the property. Figure 5 shows the various possibilities and outcomes for a borrower once they default on their mortgage[7]. Assuming that the borrower does not become current on their payments, the end result is likely to be a short sale or a foreclosure resulting in an REO[8]. The other possible outcomes of default could be a deed in lieu of foreclosure or that the foreclosure is purchased at auction by a private party, thus not returning to the bank as an REO. Neither of these possibilities occurs often, additionally, data is not

[7] see Mallach (2010) for further explanation of the foreclosure track process

[8] REO is an abbreviation for Real Estate Owned, it is a property that a lender has taken back through the foreclosure process

readily available to capture the outcomes; therefore the focus of this study will be on short sales and REO as the two possible outcomes for a distressed sale.

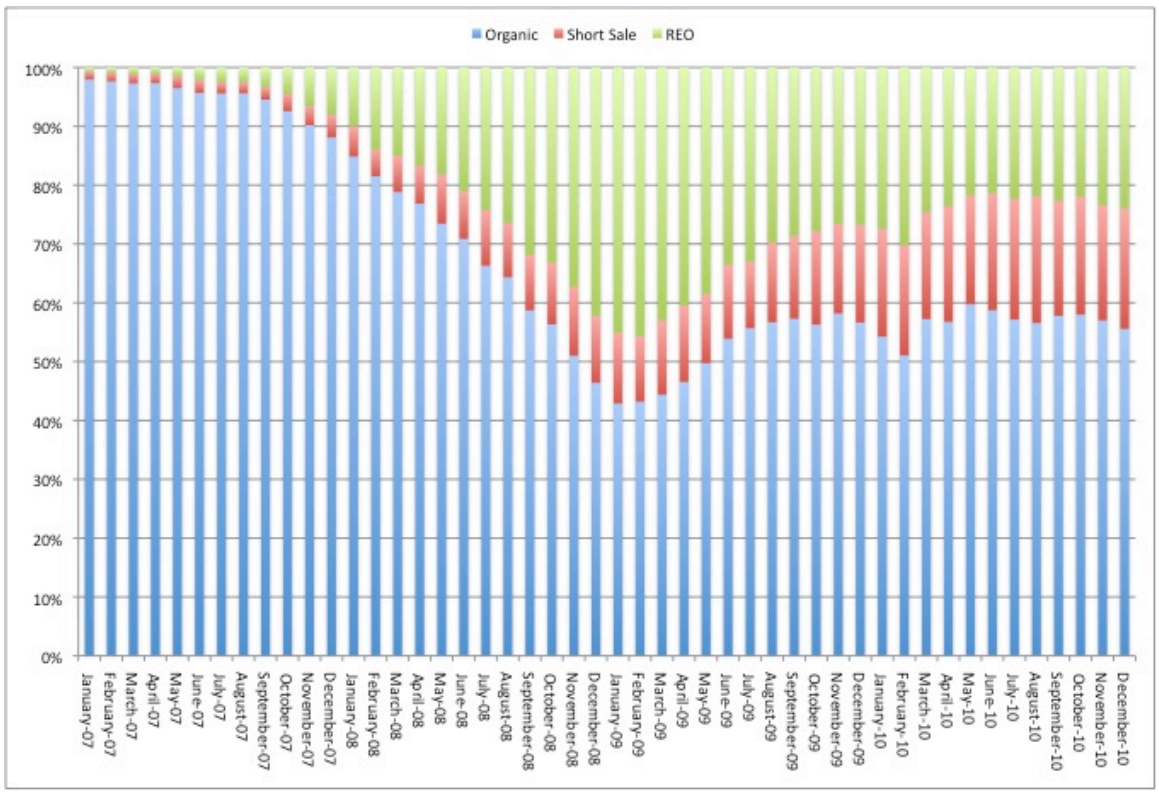
Southern California is an ideal location to study due to the volume of sales, diversity of control variables, but most importantly the large rise and subsequent decline in the home prices from 2000 to 2010. California was one of the top states in appreciation rate during the rise of the housing market; not surprisingly, it was also one of the top states for depreciation once the housing market bubble burst. It now boasts one of the highest rates of foreclosure in the country, making it an ideal candidate for empirical study. Areas of the country that did not experience such variance in the housing market do not make for interesting studies of strategic default. A necessary condition for strategic default is negative equity; studies looking at strategic default in previous downturns did not observe a high occurrence due to the minimal decline in market prices. Studying data from this downturn in markets that experienced less than a 20% decline would yield similar results to previous studies[9].

The dataset used for this study is a complete record of all sales in Los Angeles County from 2006-2010. Sales data was taken directly from SoCal Multiple Listing Service (MLS) at the address level, and includes a detailed record about the property, including the actual date and condition of sale. For this study, each sale is coded into one of three categories – 1) organic sale 2) Short Sale or 3) REO. The timing of the dataset will allow for a unique perspective on the emergence of consumer behavior. In 2006, less than 1% of sales were distressed sales; 2006 will

[9] see Foote, Gerardi, and Willen (2008) and their review of Massachusetts during the 1990's.

not be incorporated extensively in this study, but rather used to determine a baseline. Figure 6 shows a time series by sale type for 2007-2010. The emergence of distressed sales occurred during 2008; in December 2007, they represented less than 10%, by December 2008 they had grown to over 50%. While the percentage of distressed sales has remained relatively constant since 2008, the ratio of short sales to REOs has fluctuated (see Figures 7 and 8).

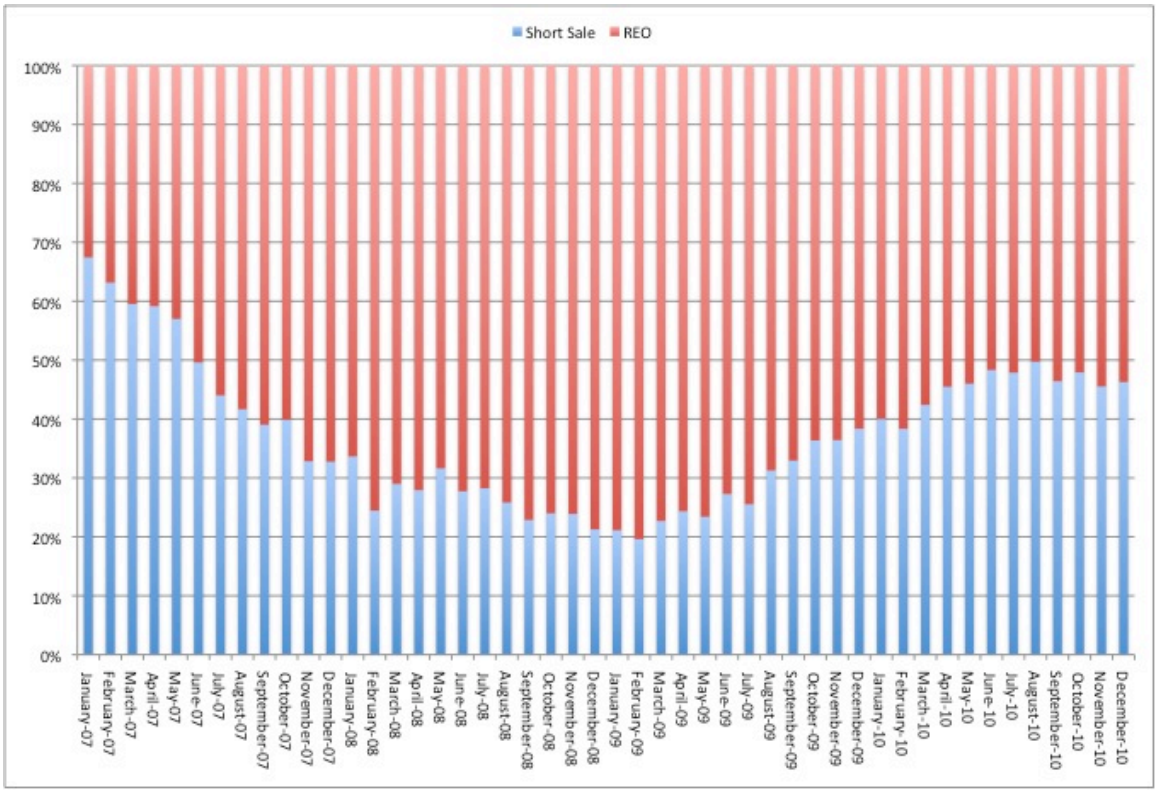
Figure 6 – Sale by type in Los Angeles County



An additional important variable to consider is that California is a non-recourse state. In California, lenders cannot pursue borrowers for a deficiency judgment if they default on a purchase money loan on their primary residence. Ghent and Kudlyak (2009) showed that state law regarding deficiency judgments was an important variable in a homeowner's decision to default. This is an

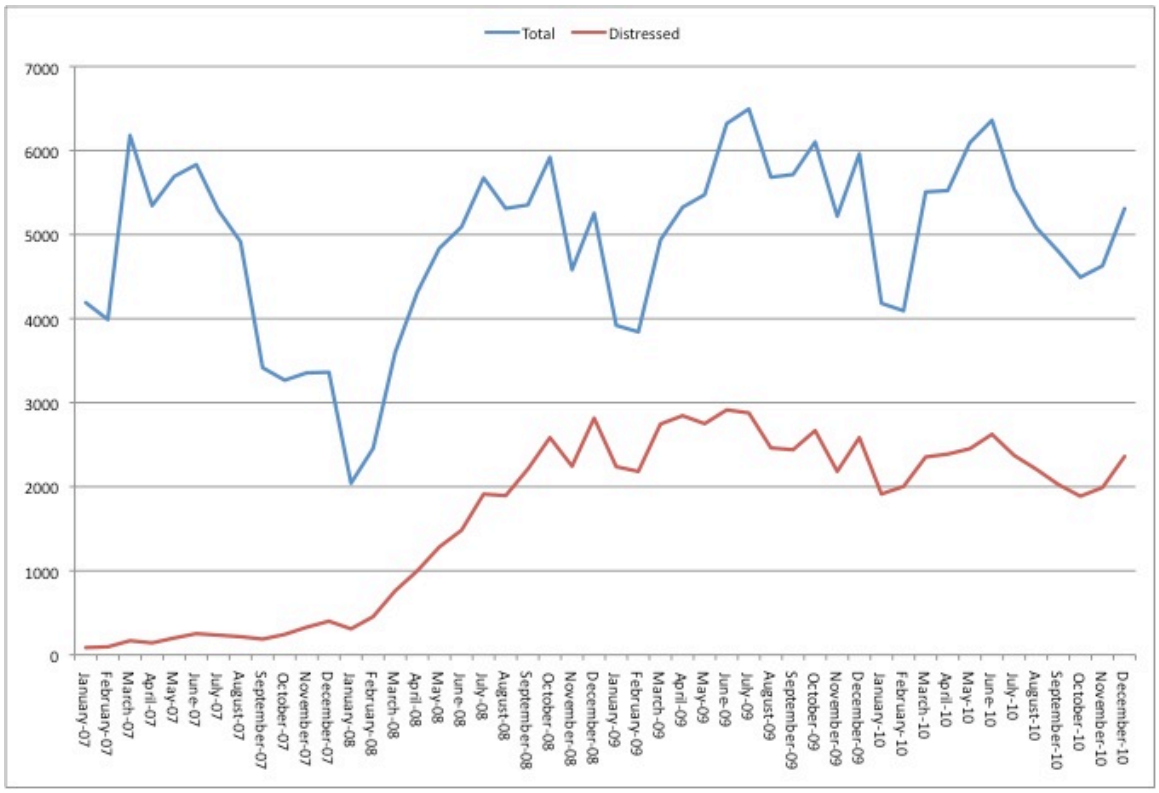
important detail when looking at the decision to short sale versus simply defaulting on your payments until the lender eventually forecloses. In recourse states, borrowers are incentivized to short sell their property in the hopes of avoiding deficiency judgments. In California, borrowers who simply purchased a home are not incentivized for this reason, however, may be looking to minimize transaction costs such as minimizing damage to their credit score. If a mortgage is held on an investment property, or taken out as a cash-out refinance or equity line, the borrower would be subject to recourse[10].

Figure 7 – Distressed Sales Breakdown in Los Angeles County



[10] see section 580e - http://www.leginfo.ca.gov/cgi-bin/displaycode?section=ccp&group=00001-01000&file=577-582.5 - recent changes in CA state codes have eliminated the concern for recourse, however, during the sample it was still a relevant concern for borrowers

Figure 8 – Sales in Los Angeles County (not Seasonally Adjusted)



Given these conditions, we can hypothesize that people short selling their homes are much more likely to strategically default than people who are foreclosed upon. If a borrower is not subject to a deficiency judgment, but opts to short sell their house, his or her motivation would be to lower their transaction costs. This can be considered a strategic option; if he or she did nothing they would be foreclosed upon, by choosing to short sell they are acting in their self-interest. If a borrower were able to continue making payments, but realized the expected utility of default is greater than continuing to make payments, a short sale is a preferred outcome to foreclosure.

The benefits to a borrower associated with both short sales and foreclosures are that they both eliminate negative equity, they can live rent free while not making payments, and future rental housing would be at a lower monthly cost. The additional benefits to a short sale are the certainty of a planned move out date, and the ability to extend the trustee sale while the short sale is being negotiated. The costs that are similarly associated with both short sales and foreclosures are moving costs, the loss of any intrinsic value of home ownership, and the tax deductions from homeownership.

The negative aspects of a foreclosure are greater than a short sale in two key ways—a foreclosure damages credit scores more than a short sale, and foreclosures have a greater social stigma. Foreclosures are a more public process than short sales, as the notice of default is visibly posted on the property, thus it is expected to generate a greater social stigma. Previous costs such as potential deficiency judgments from foreclosures and borrowers needing to bring cash to close or sign promissory notes for short sale have been rendered moot due to recent changes in California law [11], however during the data sample were relevant costs to consider.

Depressed housing prices have a negative spillover effect on the overall economy; as such the government has tried to enact various public policy programs to help stimulate the housing market. There are two main channels for which the value of the housing stock interacts with the economy – the income effect and the wealth effect. The income effect was present when borrowers were able to withdraw equity from their homes to supplement their income levels. As the

[11] see section 580e - http://www.leginfo.ca.gov/cgi-bin/displaycode?section=ccp&group=00001-01000&file=577-582.5

housing prices crashed, this supplemental income and economic stimulus evaporated. The wealth effect is reflected by the change in consumer consumption based on various levels of perceived wealth. A good proxy to represent the wealth effect is the ratio of home price to disposable personal income (see Figure 9). Stabilizing home prices would serve to increase the income and wealth effects and would help stimulate economic growth.

Figure 9- National Home Price to Disposable Income per Capita[12]

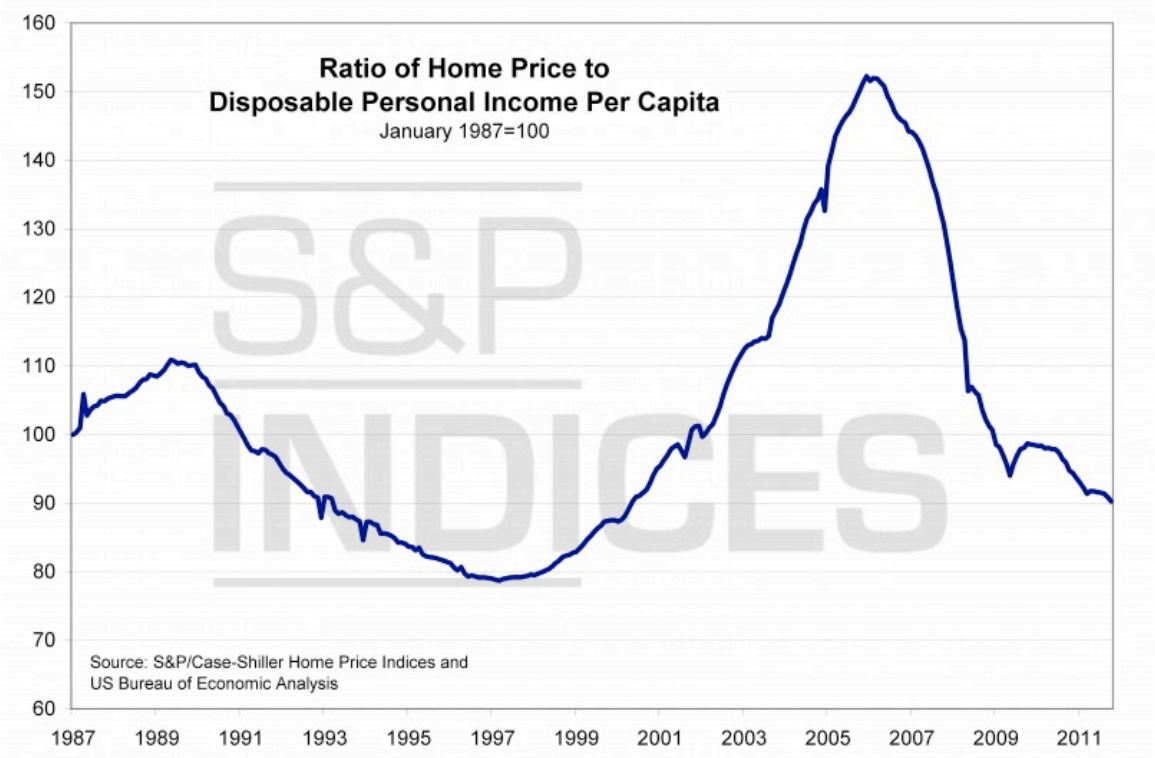
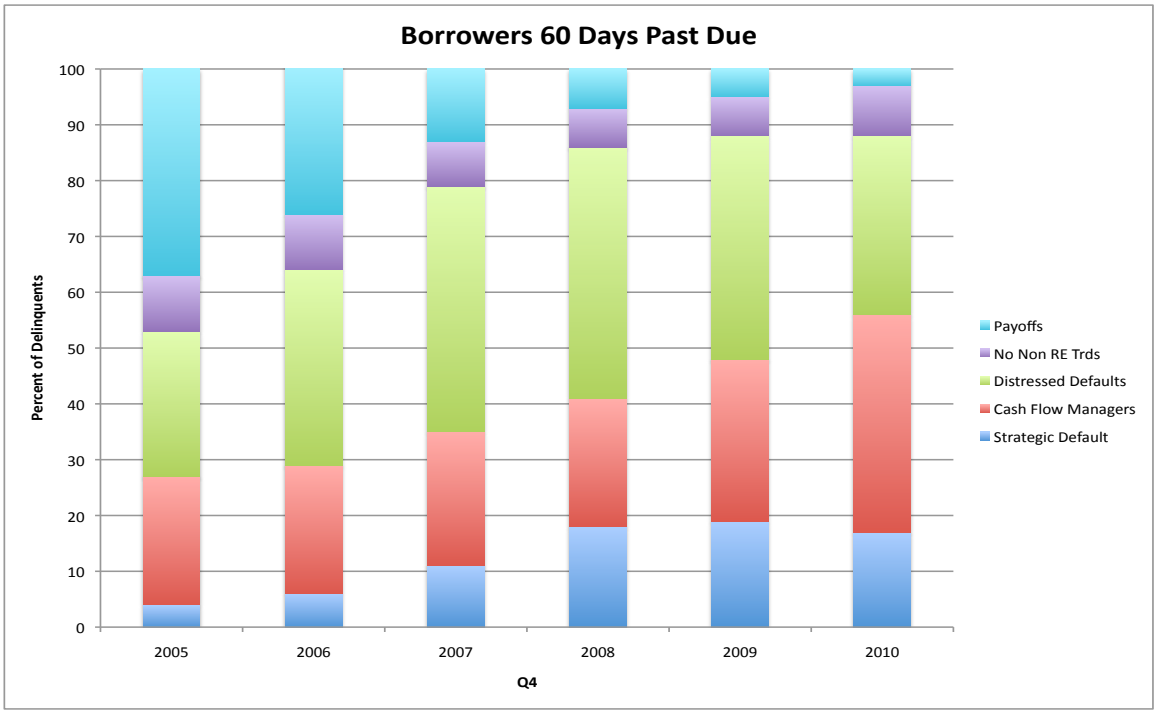


Figure 10 represents the various types of default as defined by Oliver Wyman/Experian (2011). In their study they define strategic default as a borrower who goes straight from 60 days past due to 180+ past due, while continuing to pay on their non-mortgage related debts such as credit cards or auto loans. They

[12] chart from http://www.housingviews.com/2011/12/29/rent-buy-and-price-income-ratios-look-positive/

suggest that if a borrower were truly distressed, they would cease all payments; these borrowers are represented by the distressed defaults category. The most drastic change since 2004 has been the reduction in the amount of borrowers who cure their debts after going 60 days past due. In 2005, 40% of borrowers became current again, this number has steadily declined and as of 2010 was only 3%. Understanding the consumer decision-making process once default occurs is now crucial, given that almost every default leads to a distressed sale.

Figure 10 - Mortgage Default Segments for 60 Days Past Due Borrowers



The focus of this dissertation is to determine under what conditions people choose to strategically default. By focusing on differentiating the types of default, short sale versus foreclosure, this study will add to the existing literature on strategic default. When a homeowner with negative equity wants to sell their home, they must seek the approval of the lender in order to walk away without

bringing funds to the closing of escrow to make up for the equity shortfall. Borrowers facing default can choose to do nothing, until which time the lender forecloses, or they can take a proactive approach, contacting the lender and listing their property for short sale. This critical choice the borrower makes can have a significant personal impact but also create a local effect by influencing the decision of others and the subsequent market response. The vast majority of studies on strategic default focus on the effect of negative equity on foreclosure, but do not look at short sale as another potential option for a homeowner.

Foreclosures have shown to have a contagion effect, a negative externality, on nearby property values. This study will expand on previous research, also incorporating short sales into the analysis in order to completely measure the effect that defaults have on neighborhood property values. Differentiating the borrowers decision-making process will allow for public policy recommendations to reduce the number of foreclosures. Similarly, if the price contagion effects of foreclosures are shown to be more deleterious to neighborhood prices, the economic impact to communities can be reduced through effective policy.

Chapter 2-

Modeling Consumer Behavior: The Choice Between Short Sale and Foreclosure

"Even if home prices stabilize, it seems unlikely that we will again see the confluence of factors (or one might say mistakes and debacles) that facilitated the millennial wave of consumption. For many, the home has morphed from piggy bank to albatross. The questions now are, how will this wealth destruction drag on consumption and how will outsized mortgage burdens be resolved?" Weaver and Shen (2009)

Introduction

This dissertation begins by studying the choices borrowers facing mortgage default have at their disposal if they are not able or choose not to cure their mortgage deficiency. When a borrower falls behind on their mortgage payments, the lender will issue a notice of default and if the borrower takes no other action, he will eventually face a foreclosure. Borrowers have another option, they can contact their lender and opt instead for a short sale, whereby they will sell their home for less than is owed to the owner of the mortgage note. This is a strategic choice that borrowers have the ability to exercise. This purpose of this chapter is to create an empirical model that will aid in predicting the critical choice consumers facing mortgage default have to make.

Southern California will be used as the area of analysis for this study; it makes for an ideal location to study based on the volume of sales, diversity of control variables, but most importantly the large rise and subsequent decline in the home prices from 2000 to 2010. It now boasts one of the highest rates of foreclosure

in the country, making it an ideal candidate for empirical study of distressed sales. The current literature focuses almost entirely on foreclosure as the outcome of mortgage default, in doing so they omit short sales as another possible outcome to default. Short sales account for 14% of all sales in the sample, compared to foreclosures, which represent 28% of the sample; omitting short sales from the analysis of distressed borrowers would skew the results as they account for a large portion of sales outcomes. Studies using data from previous market downturns were not able to factor in such significant price drops, therefore their findings do not accurately depict current market conditions. This study will add to the literature by using current data from 2006 through 2010, but also by adding short sale as another possible outcome for mortgage default.

What follows next is a review of the literature on mortgage default, specifically focusing on recent developments regarding theory on strategic default. Next, it will develop the methodology used to model borrower decision-making and predict the theoretical relationships between the variables. The following section will present the results of the mortgage default decision-making model, as well compare the findings to the predicted outcomes. Finally, the chapter ends by interpreting the results from the model and offering public policy recommendations based on the findings.

Literature Review

Research on strategic default is a recent development as an area for study. This section will begin with a brief look at the first articles written on default, then focus on the current literature.

Early literature on mortgage default positioned the option to default similarly to a put on a stock option. The put option—mortgage default—would be exercised when it was in the money[13], which in this case meant negative value of the mortgage. Foster and Van Order (1984, 85) studied whether homeowners were "ruthless," defaulting immediately when there was negative value of the mortgage. In an economic model without transaction costs, it would be expected that people would default ruthlessly, however their findings did not confirm the theory. Instead, they posited that only 4.2% of mortgages with the loan to value ratio[14] in excess of 110% defaulted, attributing this to "transaction costs that, presumably, drive the model" (1984).

The transaction costs associated with mortgage default have been estimated as an explanation for why non-ruthless mortgage default occurs. Cunningham and Hendershot (1984) created a theoretical model to estimate the benefits to default as compared to the costs associated with exercising the put option. The gains to be expected from default are the recapture of negative equity and the free rent gained between the time of default and foreclosure. The costs would include the quality of

[13] An option is in the money when the price crosses the exercise price. In the case of a put, when the price of the good drops below the exercise price, it is said to be in the money. If the price continues to drop, it has no impact to the owner of the put, as they can sell the good for the exercise price of the option.

[14] Loan to value(LTV) ratio = price of the home/value of the mortgage, in this case a LTV ratio of 110% would mean the home is 10% underwater

housing alternatives, the recourse from the lender, and their "psychological aversion" to default. It is assumed that owning is preferred to renting; the authors estimate that a foreclosure would prevent an individual from obtaining credit for another mortgage for up to ten years. They factor this in as a cost to default in terms of the present value of owning versus renting for an extended period. In their simple model, if the costs of default exceed the benefits, a homeowner would not exercise the put option on the mortgage. They estimate that the cost of default for a household to be between 20 and 25 percent of the value of the house.

Kau, Keenan and Kim (1993, 94) look at loan to value at origination as an important variable in understanding the exercising of the mortgage put option. They constructed a theoretical model to forecast the differing probabilities for default by changing the initial conditions and inserting shocks. House price variance was used as one of the experimental variables; 15% was chosen as the maximum variance. They found that LTV at origination to be a significant variable, for price decreases of 15%, they found that loans with 80% LTV at origination would default 2.85% of the time; while mortgages with 95% LTV at origination would default 19.06% over the 30 year duration of the mortgage. Other factors they considered were interest rates and transaction costs. They note, however, that it isn't the lack of transaction costs that lowers the probability of default, but similar to stock options, when the option is in the money, it does not always get exercised. The homeowner always has the ability to default in the future if prices continue to decrease.

The aforementioned studies were all successful in identifying the important variables in the homeowner's decision-making process to default on their mortgage.

None of these studies however, were able to utilize actual data in drawing their conclusions of how homeowners would react in extreme drops in the housing market. For example, Kau, Keenan and Kim (1993,94) used 15% as the maximum price reduction in their model, in the recent housing crash, some markets experienced more than a 50% drop. Recent studies have had the benefit of analyzing this recent crash to see whether people default ruthlessly, or if other factors such as transaction costs affect their decision to walk away from their home. The current literature has formed two hypotheses—the double trigger default and the strategic default.

The double-trigger hypothesis is that negative equity is a necessary, but not sufficient condition for default. Proponents of this view argue that an income shock is needed in addition to negative equity in order for a default to occur—they do not believe in ruthless default. The main study cited that supports this view is the Boston Fed report authored by Foote, Gerardi, and Willen (2008). They studied homeowners in Massachusetts who had negative equity in the early 1990s and found that less than 10% of these homeowners eventually lost their home to foreclosure. Based upon their findings, they conclude, "borrowers with negative equity and a stable stream of income will, in most cases, prefer to continue making mortgage payments." In addition to finding strategic default to be a minor occurrence, they also argued that the government should not sponsor any homeowner retention policies such as loan modifications. Based on the notion that income shocks are the necessary condition for default, any polices designed to lower

payments would find that "the costs of forgone income from borrowers who would have made payments often exceeds the benefits of fewer foreclosures."

Subsequent studies have found a preponderance of evidence pointing to strategic default as a much more likely explanation describing homeowners use of the put option. Within the extant literature, studies have focused on recourse vs. non-recourse states, borrower credit scores, the types of mortgages initially obtained, and home equity loans as explanatory variables to help understand borrowers motives for strategically defaulting.

The latter of these examples, home equity extraction, is an example of a borrower worsening their initial condition by taking on additional debt. Home equity loans were often referred to as a home ATMs, as home prices continued to increase, the cash availability on home equity loans continued to increase. Once the market peaked and subsequently crashed, the homes, and specifically additional home equity loans, "morphed from piggy bank to albatross" (Weaver and Shen 2009). Mian and Sufi (2010) estimated that homeowners borrowed 25% of all the home equity gains from 2002 to 2006. Their findings were that 1.25 trillion dollars in household debt from 2002 to 2006 was attributable to increased borrowing against the value of the home. In their study of defaults between 2006 and 2008 they found that 39% of borrowers who defaulted had borrowed "aggressively against the rising value of their houses."

Homeowners taking out additional home equity mortgages in combination with declining market prices resulted in an unprecedented level of underwater borrowers. Another major contributing factor to the rise in negative equity was the

types of loans used to purchase homes. Exotic loans where people could put as little as 0% down became commonplace; with 100% financed properties, any decline in the market immediately causes negative equity. Prior to the loosening of down payment and underwriting standards, homeowners that put 20% down could withstand most market corrections without going underwater. Butta, Dokko and Shan (2010) studied what they believed to be the most likely group of homeowners to default to determine, at the extreme, how prevalent strategic default could be. Their study only focuses on homeowners who purchased homes in 2006 with 0% down payments in Arizona, California, Florida, and Nevada. These homeowners purchased right before the crash; as a result they would not have experienced much appreciation, but could have seen depreciation by more than 50% in the following two or three years. Their findings were that the median borrower does not strategically default until equity falls to 62% of their homes value (38% underwater). However, once negative equity reaches at least 50%, then half of the defaults are driven by negative equity. Of all the homeowners in the study, they found that only 20% of all defaults were strategic.

Looking at cross sectional data across states can omit important differences in state laws that would effect the decision to strategically default. One such crucial difference is the ability of lenders to pursue borrowers for a deficiency judgment in the case of default. In recourse states, lenders can sue the borrower for damages for any amount the lender isn't able to recover from the sale of the property including any legal costs associated with a foreclosure. Some states, however, are non-recourse states; in such states, if a borrower defaults on a loan, the lender cannot

pursue the borrowers for any losses. Therefore, borrowers in non-recourse states are more likely to exercise the default option, as the transaction costs are much lower than when a lender can pursue a deficiency judgment.

Ghent and Kudlyak (2009) look at mortgage default and separate states according to their recourse laws. They find that the probability of default is 20% higher in states with no recourse; however, they find that this difference is only present for borrowers with significant assets. For borrowers with no assets, the threat of a deficiency judgment carries no additional deterrence; they have no assets to protect from lender lawsuits. The authors used purchase price of the home as a proxy for wealth, finding a positive correlation between purchase price and default. For houses worth less than $200,000, there was no difference based on recourse. As prices increased to the $300,000 to $500,000 range, they found that borrowers in non-recourse states were 59% more likely to default.

Another variable to consider is the credit score of the borrower; when taking transaction costs into account, high credit score borrowers would face higher transaction costs than those with low credit scores. It takes years to rebuild credit scores; therefore borrowers with higher credit scores should in theory face higher transaction costs due to the value they place on having good credit. Oliver Wyman (2009) partnered with Experian to conduct a study focusing on identifying patterns for strategic defaulters. This research design included the pairing of mortgage data along with credit report information for borrowers; this unique data allowed the researchers to incorporate consumer decision-making into their model.

The Wyman-Experian study defines strategic default occurring when a borrower is only in default on their mortgage, but not any of their credit cards or other monthly debt payments. In addition, borrowers must go straight from current to 60+ days delinquent, that is to say borrowers who fall 30 days behind and then cure the debt would be excluded in the future when they fall 60 days late. Using this definition, they found that 18% of mortgages in default in the fourth quarter of 2008 could be defined as strategic. In California from 2005 to 2008, there was an estimated 6800% increase in the number of strategic defaults. The study also found that borrowers with higher origination balances and high credit scores were more likely to be strategic defaulters. Looking at borrowers with Vantage Scores higher than 900, they accounted for 30% of all mortgages, but only 3% of all defaults. However, within the small number of defaults, 27% were found to be strategic, compared to 15% of the overall population. This indicates that high credit score borrowers were twice as likely to strategically default than the mean population.

The first survey conducted regarding individual's thoughts on strategic default was published by Guiso, Sapienza, and Zingales (2009). Using data from the Financial Trust Index (FTI)[15], they studied the impact of certain demographic variables on a borrower's propensity to strategically default given a hypothetical underwater condition. The authors used age as a proxy for relocation costs, since it is assumed that older people have higher relocation costs, partially due to having children, therefore more of an attachment to the community. Their findings were that people over 65 were more likely to default strategically. When looking at

[15] www.financialtrustindex.com - compiled by the University of Chicago Booth School of Business and the Kellogg School of Management at Northwestern University

income levels, they found a negative correlation to strategic default, however, the findings were not statistically significant in their models. The inclusion of ethnicity variables did not prove to be generally statistically significant in most models, however, Hispanics were positively correlated when looking at the possibility of being $100k underwater. Employment levels were statistically significant, but had no real impact on default with a coefficient of .001. When surveyed, people with a college education, were less likely to say that strategically defaulting was morally wrong. Finally, ceteris paribus, people who have been in their home for more than 5 years were 78% less likely to default.

Fannie Mae conducts a National Housing Survey quarterly, the 3rd quarter 2011 survey focused on demographic characteristics of underwater homeowners compared to all homeowners with a mortgage (Fannie Mae 2011). Fewer underwater homeowners graduated college than the mean sample of all owners with a mortgage; 40% compared to 48% of all mortgagees. The age profile for both groups was almost the same, with 11% of homeowners and underwater borrowers being over 65 years old. For underwater homeowners, 28% are between 50 and 64, while the number for all owners with a mortgage drops to 25%. Underwater homeowners were also more likely to be from minority groups; 14% were Black and 12% Hispanic, compared to 9% Black and 10% Hispanic for all homeowners with a mortgage. Income levels for underwater borrowers were slightly lower than those of all borrowers; 35% were between $50k and $99k, compared to 39% for all borrowers. Finally, underwater borrowers reported having fewer assets; 71% reported having less than $100k in assets, compared to 64% of all borrowers.

A different research design to model strategic behavior is to create a consumer decision model where each mortgage outcome is either current on their payment or results in a distressed sale. An example of this methodology was employed by Bajari, Chu, and Ming (2008) in their study of subprime loans between 2000 and 2007. The authors obtained national individual level mortgage data from Loan Performance (LP) for a sample of sub prime mortgages. Monthly payments were coded as either current or as a default ending in foreclosure. LP made some individual borrower characteristics available such as the term of the loan, initial interest rate, level of documentation, appraised value and FICO score. The initial value of the home was merged with the S&P Case Shiller Home price index for each of 20 major markets, then adjusted monthly to track the changes in market pricing. Additionally, Census data was merged at the zip-code level for demographic variables such as per-capita income, education, age and ethnicity and included as explanatory variables in the study.

Using a bivariate probit to model the loan outcome for the sample of sub-prime borrowers, Bajari, Chu, and Ming (2008) found that a 20% decline in home prices would make the borrower 15.38% more likely to default than a similar borrower who did not experience any price reduction. Their findings were that income and employment levels were both significant; a one standard deviation increase (12%) in the ratio of income to mortgage payment leads to a 17.15% increase in the probability of default. Similarly, a one standard deviation increase in the unemployment rate (1.42%) led to a 10.09% increase in the probability of default.

Theory and Methodology

The choice borrowers face when they have defaulted on their mortgage can be classified as a discrete categorical unordered choice. The dependant variable is represented by the 3 categories of real estate sales (1) Organic Sale – A non-distressed sale (2) Short Sale – sale requiring lender approval where the sale price is below what is owed on the mortgage (3) REO – Sale by lender after the property has been foreclosed. In order to model the choice an individual faces, a Multinomial Probit model (MNP) will be employed. Individuals in the MNP are assumed to be utility maximizers who will choose the option that maximizes their utility—the summation of the probability for the three possible outcomes must always be equal to one. The base case for the MNP will be REO, once borrowers default on their mortgage, they must decide to take action in order to avoid foreclosure. This would be the natural outcome if no action were taken, and functions as the base case. The base case allows us to model the decision choice between foreclosure and short sale for that borrowers who have defaulted on their mortgage face. The MNP does not have the assumption of independence of irrelevant alternatives (IIA), therefore any possible omitted choices would not change an individual's evaluation of one alternative relative to another.

The sales level data was taken from SoCal MLS, it was exported for all closed sales in Los Angeles county from Jan 1, 2006 through Dec. 31 2010. Each individual sale was coded as either an organic, short sale, or REO based on the information contained in the "sold terms" or "special conditions" categories. In order to determine the annual change in price for each census tract, the mean price per

square foot (psqft) of all closed sales was calculated. Using 2006 as the baseline for price per square foot, a price change was calculated for each year between 2007-2010. For any given year x:

$$\text{Pricechange}(x) = ((\text{psqft}(x) - \text{psqft2006}) / \text{psqft2006}))$$

Table 1 – Summary Statistics by Sale Type and Price Drop

Variable	N	Mean	Std. Dev	Min	Max
Short Sale - 2007	1972	0.0224	0.0501	0	1
Short Sale - 2008	1969	0.0822	0.099	0	1
Short Sale - 2009	1985	0.1245	0.1003	0	1
Short Sale - 2010	2044	0.1956	0.1134	0	1
Short Sale - All	2047	0.1429	0.0769	0	0.75
REO - 2007	1972	0.0322	0.0686	0	1
REO - 2008	1969	0.2754	0.2264	0	1
REO - 2009	1985	0.3542	0.237	0	1
REO - 2010	2044	0.247	0.1461	0	1
REO - All	2047	0.2882	0.1618	0	1
Price Change - 2007	1957	-0.0317	0.135	-0.6163	2.81
Price Change - 2008	1947	-0.262	0.152	-0.7957	0.4769
Price Change - 2009	1962	-0.3793	0.1678	-0.8284	0.5352
Price Change - 2010	1985	-0.3367	0.1978	-0.8822	1.39

The price change for each individual sale is represented by the aggregate price drop of all sales within the given census tract[18]. Table 1 contains the summary statistics for the sale type and price drop statistics[19]. The percentage of short sales in Los Angeles County increased in every year from 2007 through 2010, while the mean percent (14.29%) was higher than in any year but 2010 (19.56%). The

[18] Using mean price per square foot prices for a given census tract is a good proxy for understanding local market conditions. Other measures such as mean sales price do not account for quality or size of homes, therefore do not accurately reflect changes in market prices, but rather are skewed to reflect the types of homes sold in a given period. Similarly, measures using the repeat sales methodology are only available at the city and MSA level, therefore do not accurately reflect local market changes.

[19] Organic sales summary statistics were not included as they are not the area of focus for this study, the percent of organic sales can be calculated by taking 1 minus the total percent of short sales and REOs.

percentage of REO sales increased from 2007 to 2009, then decreased in 2010. Prices dropped from 2007-2009, with the majority of the drop (23.1%) coming between 2007 and 2008; prices then increased slightly in 2010 (4.2%).

Demographic variables were exported from Census Bureau data and from supplemental census data contained on Simply Map[20]. Every sale was geo coded in ArcGIS using the 2010 census shapefiles,[21] then placed within the relevant census tract; socio-demographic variables were then aggregated to the census tract level on an annual basis. The descriptive statistics for the independent variables used in the MNP models can be found in Table 2. The data is for the years 2007 through 2010, the 2054 census tracts in Los Angeles County have unique data for every year of the sample.

Table 2 – Summary Statistics for Socio-Demographic Variables

Variable	N	Mean	Std. Dev	Min	Max
Employment	234029	91.64	6.04	14	100
Income (Per Capita)	234026	32296	22440	1810	230620
Income Shock	233973	30204	21812	843	230620
Sales Price	234559	553171	629866	14500	36700000
Education	234559	19.59	11.07	0	100
Credit Card Debt	234026	0.3087	0.2277	0.009	3.56
Net Worth	234486	599163	290424	83506	1973890
Stability	234559	37.47	11.48	0	65
Owner Occupancy	234559	59.51	24.31	0	100
Age	234098	34.85	6.85	17	70
Asian	234559	13.89	14.03	0	84
Hispanic	234559	40.4	29.48	0	98
Black	234559	8.4	14.31	0	91

Proponents of the "double trigger" hypothesis (Foster and Van Order 1984)(Foote, Gerardi, and Willen 2008) argue that an income shock is required in

[20] Simplymap.com

[21] http://www2.census.gov/cgi-bin/shapefiles2009/state-files?state=06

order for borrowers to choose to strategically default on their mortgage. The alternative hypothesis—strategic default—proposes that negative equity is a sufficient condition for strategic default and that an income shock is not necessary (Cunningham and Hendershot 1984)(Butta, Dokko and Shan 2010)(Ghent and Kudlyak 2009)(Oliver Wyman 2009)(Guiso, Sapienza, and Zingales 2009).

The first component of an income shock is employment levels; the ideal measure would be to have individual data on whether the borrower is currently employed. For this study, a proxy of the average employment rate within the census tract was used. Most studies utilize unemployment levels, however, based on the persistent high rates of unemployment, the number of discouraged workers has increased. Individuals no longer looking for work are not included in the unemployment numbers, therefore using the employment rate will capture the total percent of people working rather than those simply looking for work. The preponderance of the findings using data from the most recent market crash suggest that income shocks are not a necessary condition for default; it is therefore expected that employment will have an insignificant impact on default.

In addition to employment levels, income levels are also incorporated to further analyze the impact of income shocks on default. The ideal measure of income would be to have the income level for each homeowner in the sample. A proxy for income was used, measured by the mean household income per capita for each census tract. Guiso, Sapienza, and Zingales (2009) found income levels to be negatively correlated with strategic default, but it was statistically insignificant in their model. The National Housing Survey (Fannie Mae 2011) found that income

levels were lower for underwater homeowners than the general sample of all borrowers. Bajari, Chu and Park (2008) studied a sample of subprime mortgage from 2000 through 2007 and found that default is more prevalent in areas of lower income. They found that taking the first difference of one standard deviation (12%) in the ratio of mortgage payments to monthly income yielded a 17.15% increased in the predicted probability of default. Based on the findings in the literature, it is expected that income will have a negative impact on default, such that a raise in income levels will lower the probability of all distressed sales.

A change in the price level of the home is represented by a proxy of the change in the mean price per square foot of all sales since 2006. The data is aggregated annually, so, for any given sale, the mean price from that year is compared to the 2006 baseline. The ideal measure would be to have the actual amount of equity for each homeowner at the time of sale for the entire sample. All of the literature on mortgage default finds that a reduction in price is strongly tied to an increase in defaults. Bajari, Chu, and Park (2008) found in their study of borrowers with no down payment, that a 20% decline in home prices would lead to a 15.38% increase in the likelihood of default. In a similar study of borrowers financing 100% of the purchase price, Butta, Dokko and Shan (2010) found that the median borrower does not strategically default until they are 38% underwater. Based on the findings in the literature it is expected that a reduction in home prices will have a strong positive relationship to default.

Taking the measures of income and employment individually does not represent an income shock, but rather it is the combination of the two that creates

the shock. Income shocks can be the result of either a reduction of income, or the loss of employment, therefore a variable was constructed to represent the net effect of employment and income. Income Shock is represented by the mean household income per capita divided by the employment level in a census tract. The newly created variable will allow for the direct testing of the double trigger hypothesis; the construction of an interactive variable between price change and income shocks will demonstrate whether both price changes and income shocks are necessary for distressed sales to emerge.

Several models will be constructed based upon the theories presented in the relevant literature. The first model—the baseline model—was created from the 3 variables listed above on their own: employment, income levels, and price reduction. A second model—the income shock model—was created comprised of the income shock and price change variables along with the interactive variable between the two. The purpose of this model is to directly test the double trigger hypothesis that states an income shock is a necessary condition for strategic default. This model will allow for the comparison of the effects that income shocks and price change have in combination on the borrowers decision to short sale or take no action and be foreclosed upon by the lender.

A third fully specified model includes various socio-demographic variables that are identified in the literature in addition to the baseline model. The first of the independent variables that will be added to the baseline model is education; it is a measure of the percent of college graduates within the given census tract. This is a proxy trying to capture the homeowners awareness of the cost benefit analysis of

short sale compared to foreclosure. An ideal measure would be to have survey data from homeowners selling their homes in the sample that captured the knowledge regarding the cost or benefits regarding distressed sales outcomes. Guiso, Sapienza, and Zingales (2009) found that people with a college education were less likely to say that strategically defaulting was morally wrong. Similar results were found by Bajari, Chu, and Park (2008), who found that default is more prevalent in areas with less education (as measured by the percent of college graduates). Anecdotal evidence of education impacting decision-making can be observed by the fact that the Mortgage Bankers Association (MBA) defaulted and short sold their headquarters. It is assumed that the MBA would be highly informed on the cost and benefits associated with default, they decided to short sell rather than foreclose based on their knowledge. Based on the literature, it is expected that education will have a negative relationship to default. Further, based on the net gains to borrowers associated with short sales compared to foreclosures, it can be argued that more informed borrowers will be equipped to calculate which outcome is in their best interest.

The second variable added to the fully specified model is a measure to capture the impact of credit card debt, in this case as a percent of income. The income percentage is used in order to normalize the impact of the debt at various levels of income. An ideal measure would be to have the debt-to-income ratio for credit card debt for each homeowner in the sample. For the study, a proxy was used comprised of the mean credit debt as a percentage of household income per capita for each census tract. Including the consumer debt variable will aid in further

examining the impact that income has on borrowers default decision-making. In the Wyman-Experian (2011) study on strategic default, they identified strategic defaulters as borrowers who continued paying their credit cards while defaulting on their mortgages. It can also be surmised, that consumers use credit cards to make up for income shortfalls, such that increased levels of credit card debt can be interpreted as a measure of insufficient income to cover monthly expenses. It is therefore expected that credit card debt will be positively related to default, but that it should have less of an impact on short sales, which is more likely to be a strategic behavior.

Conversely, the accumulation of assets indicates an income surplus, therefore the inclusion of a net worth variable can be used as a proxy measuring consumers that have sufficient income to cover their monthly expenses. The ideal measure would be to have the income surplus for each individual borrower in order to capture the homeowner's ability to cover their mortgage. Ghent and Kudlyak (2009) studied the impact that deficiency judgments had on strategic default, in doing so they used home price as a proxy for wealth. Their finding was that as prices increased in non-recourse states, borrowers were more likely to default. Net worth is a measure of an individuals wealth, therefore it is expected that it will have a positive relationship to default.

The next independent variable represents the makeup of residents within a census tract; owner occupancy is a measure of the percentage of residents who are occupying their primary residence. Rather than the proxy for the census tract level data, the ideal measure would be the occupancy status for each individual

homeowner, that is to say is the property a rental or owner occupied. Measuring the profile of the census tract, however, does provide additional insight into the makeup the neighborhood quality that is not captured by the individual property data. It therefore serves as a valid measure for capturing neighborhood quality in addition to acting as a proxy for individual level analysis.

The literature has mixed findings on the impact of owner occupancy on default. Bajari, Chu, and Park (2008) found that 8.28% of loans held by investors ended in default, the percentage increased to 11.02% for owner occupants. Conversely, Cowan and Cowan (2004) in their study of subprime mortgages from 1995-2001 found that properties owned by investors were three times more likely to default ending in foreclosure than owner occupied homes. In the Wyman-Experian (2011) on strategic default, they found that owner occupants (owners with 1 mortgage) were the least likely to strategically default, but the most likely to have a distressed default. As the number of properties with mortgages increased, the number of distressed defaults decreased, while the number of strategic defaults increased[22]. Based on the literature, it is unclear what directional relationship owner occupancy will have on default.

A related variable to owner occupancy is the duration that a resident has lived at the same address. In order to capture stability within a neighborhood, the percentage of occupants residing at the same address for 5 or more years (stability) was added to the model. This measure is a good proxy for neighborhood quality, but

[22] The study broke down 1 through 5 properties, and then had a category for 5+ properties. Strategic default was estimated at 14% for borrowers with 1 mortgage and 40% for 5+ mortgages. Distressed default was estimated at 35% for borrowers with 1 mortgage and decreased to 20% for 5+ mortgages.

also an additional measure to capture individual's social ties based on the duration of residence in a community. Guiso, Sapienza, and Zingales (2009) found that people who have been in their home for more than 5 years were 78% less likely to default. It can be argued that that longer individuals reside in a community, the more they will develop social ties, and will therefore be less likely to ruthlessly default. In addition to social ties, longer duration would imply that they purchased during the rapid price appreciation period before the housing bubble burst[23]. Given that likelihood of increased equity and stronger social ties, it is expected that stability will be negatively related to default.

The last control variable included is the sales price for the actual home in the data sample. This measure was included to determine if price level of the individual property has an impact on the borrowers decision-making. This is not being used as a proxy to capture other measures of quality, but rather as an exogenous measure. Sales price has been used in other studies to capture wealth (Ghent and Kudlyak 2009), in this case it is being used to capture any institutional incentives that may exist to influence borrower decision-making.

A third agent, in addition to the borrower and the lender, that is party to a short sale transaction is the real estate agent. Short sales require additional time and work to be completed by the real estate agent compared to an organic or REO sale. As such, real estate agents are incentivized to focus on higher priced properties so that they can be adequately compensated for their efforts. Ceteris Paribas, an agent will receive a larger commission on a higher priced home than for a lower

[23] Note that this is an observation based on the timing of the sample used for this study and not necessarily an observation that is generalizable to other studies

priced home. Given the additional work performed by the real estate agent, it can be argued that they may avoid marketing towards low priced properties. The expected relationship is that sales price will be negatively related to distressed sales, specifically favoring short sales at higher price points.

Finally, sets of demographic control variables were included in the model. Median age, percentage of Asian residents, percentage of Hispanic residents, and percentage of Black residents were all included in the fully specified model. Ideal measures would be to have individual homeowner level data, rather than a proxy for the census tract level data.

Findings and Analysis

Table 3 contains the results of the 3 multinomial probit models (MNP) where sales type is the dependent variable; the models include all closed sales, coded as either {1} organic {2} Short Sale or {3} REO (base outcome), in Los Angeles County from January 1, 2007 through December 31, 2010. The relationship of interest is the borrower's decision between foreclosure and short sale—represented by models 2, 4 and 6 in the results table. The direction sign of the coefficient indicates the directional relationship the variable has relative to the base outcome (REO), the value of the coefficients will be converted to a predicted probabilities for short sales and REO so that the directional relationship of the independent variable can be determined (see table 4 and figure 12). The statistical significance of coefficient the represents whether the variable impacts the borrowers decision between the outcome and the base case; the statistical significance of the predicted probabilities are calculated separately.

Table 3 – Baseline Multinomial Probit Model Results

	(1) Baseline **Organic**	(2) Baseline **Short Sale**	(3) Income Shock **Organic**	(4) Income Shock **Short Sale**	(5) Full **Organic**	(6) Full **Short Sale**
Price Change	4.8*	1.31*	4.11*	1.63*	1.56*	.756*
	(.03)	(.036)	(.045)	(.054)	(.057)	(.068)
Employment	-0.0085*	-0.01653*				
	(.00088)	(.001)				
Income	0.0000119*	0.0000079*				
	(.00000027)	(.00000032)				
Income Shock			.0000175*	-.00000069	.0000024***	.0000084*
			(.00000052)	(.00000067)	(.00000089)	(.0000011)
Interactive (P & I)			.0000254*	-0000241*	0.0000248*	-.0000234*
			(.00000165)	(.000002)	(.0000018)	(.0000022)
Sales Price					.0000024*	.00000081*
					(.00000002)	(.00000003)
Education					.0027**	.0059*
					(.0011)	(.0013)
Credit Card Debt					-2.228*	-.4511*
					(.0416)	(.0506)
Net Worth					-.0000066*	-.00000042*
					(.00000005)	(.00000007)
Stability					.0126*	.0026*
					(.00074)	(.00086)
Owner Occupancy					-.00594*	-0.00007
					(.00045)	(.00052)
Age					-.0055*	-.0042**
					(.0016)	(.0018)
Asian					.0011*	-.00165*
					(.000441)	(.00053)
Hispanic					.00097**	-.00367*
					(.0004)	(.00045)
Black					-0.00079**	-.008*
					(.00036)	(.00045)
Constant	2.71*	1.25*	1.78*	-.0738*	1.56*	.1624*
	(.082)	(.094)	(.017)	(.022)	(.063)	(.076)
N	232952	232952	232952	232952	232952	232952
Log Likelihood	-170777	-170777	-170444	-170444	-161778	-161778
Wald chi^2	45957	45957	45184	45184	51613	51613
Prob > chi ^2	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses

**** p <0.10, ** p <0.05, *p<0.01*

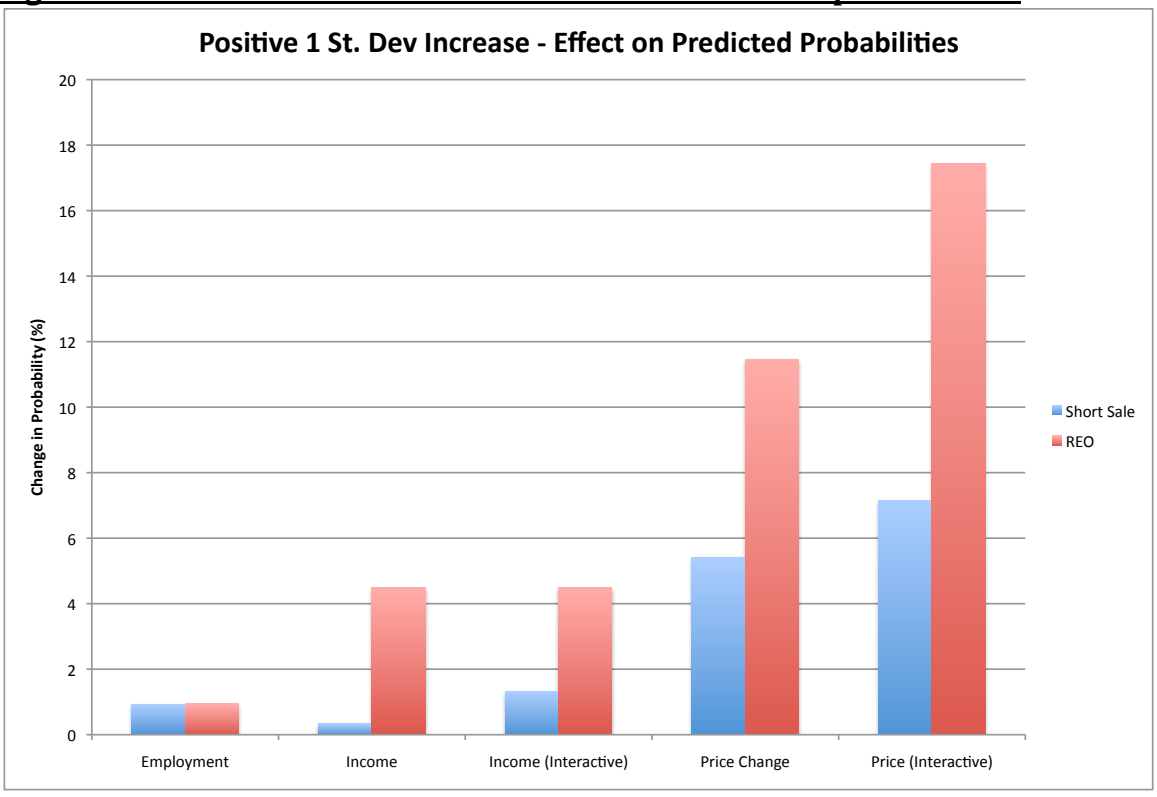
The baseline model measures the impact of employment, income level and price change on sales outcome; the results confirmed the theory in the literature that a reduction in price level has a positive impact on the probability of short sale and REO. Income level also had the predicted negative relationship to both types of distressed sales. Of note, was that employment had a negative relationship to short sales, but a positive relationship to REO sales (determined based on the predicted probability, not the coefficients in MNP model). Figure 11 displays the change in predicted probability for a positive one standard deviation increase from the mean values; all of the variables from the MNP and predicted probabilities were statistically significant at the .01% level.

The second model specification tests the interaction of price and income shocks in order to directly test the double trigger hypothesis. The income shock variable, along with price change and the interactive variable, were included as the independent variables. As predicted in the literature and confirmed in the baseline model, price level reductions are positively related to both short sales and REO, this relationship and the predicted probability were both significant at the .01% level. Income shock was not found to be statistically significant in this model, although the directional relationship was negative between short sales and REO, overall an increased income shock level led to lower distressed sales.

In order to test the double trigger hypothesis, the impact of income needs to be measured at various levels of price decreases. Figure 11 shows the effect of a positive one standard deviation shift from the mean and the resultant change in probabilities for the variables in the first two model specifications. In the first

model, employment levels have almost no impact on the probability of default for either short sale or foreclosure. The directional relationship is opposite, however, with short sales being negatively related to employment levels, while REOs were positively related. Income, measured by itself, or as an income shock had similar effects in both models; the relationship was negative for both sales outcomes, however, the effect on the probability of REO was greater than for short sales. Price changes had the greatest impact of the three independent variables in both the baseline and income shock models. The relationship of price decreases to both short sale and REO is negative, although the impact on the predicted probability of foreclosure is more than double that of short sales.

Figure 11 – Price and Income Effects for Baseline Model Specifications



The findings of the baseline models do not lend support to the double trigger hypothesis. The impact of income shocks will be further investigated in the fully specified model where the impact will be measured at various levels of price changes. The directional relationship of the coefficients of the fully specified model are consistent with the baseline model; income shock becomes statistically significant at the .01% level, along with all of the other variables except owner occupancy which is not statistically significant, and age which is significant at the .05% level. The statistical significance of the variables measures their relative impact in the decision-making between short sale and REO, not on the directional relationship to all sales outcomes. All variables were significant at the .01% level when measuring the predicted probabilities, indicating the general direction and slope of each of the variables relative to all sales outcomes. When taking into account the slight changes in the coefficients from the baseline models, the resultant change in predicted probabilities was minimal. Therefore, the findings in the fully specified model will be used as the basis for the remainder of the analysis in this section as they offer broader policy implications.

Table 4 lists the predicted probabilities for the fully specified MNP model for their mean value, as well as a positive shift of one standard deviation. Predicted probabilities were constructed by holding all variables constant at their mean, then taking a first difference of one positive standard deviation in order to determine the sensitivity of each variable to changes in values. Figure 12 displays a bar chart showing the magnitude of the first difference change in predicted probability for

each of the independent variables, the directional effects will be discussed below for each of the variables individually.

Table 4 – First Difference Predicted Probabilities for Fully Specified Model

	Mean Prob	+1 St Dev Prob	+ First Difference
Price Change	-25.5	-0.44	
SS	11.85%	16.09%	4.24%
REO	20.38%	26.68%	6.30%
Income Shock	30204	52016	
SS	11.85%	11.41%	-0.44%
REO	20.38%	22.33%	1.95%
Sales Price	$553,171	$1,183,037	
SS	9.78%	3.03%	-6.75%
REO	14.47%	1.89%	-12.58%
Education	19.59	30.65	
SS	9.78%	10.34%	0.56%
REO	14.47%	13.87%	-0.61%
Wealth	$599,163	$889,587	
SS	9.78%	10.03%	0.25%
REO	14.47%	17.74%	3.27%
Stability	37.47	48.94	
SS	9.78%	8.77%	-1.01%
REO	14.47%	12.50%	-1.97%
Credit Card Debt	31%	54%	
SS	9.78%	13.80%	4.02%
REO	14.47%	23.17%	8.70%
Owner Occupancy	59.51	83.82	
SS	9.78%	11.23%	1.45%
REO	14.47%	16.54%	2.07%
Asian	13.88	27.91	
SS	9.78%	9.33%	-0.45%
REO	14.47%	14.33%	-0.14%
Hispanic	40.4	69.87	
SS	9.78%	8.17%	-1.61%
REO	14.47%	14.40%	-0.07%
Black	8.4	22.71	
SS	9.78%	8.46%	-1.32%
REO	14.47%	14.99%	0.52%
Age	34.85	41.69	
SS	9.78%	9.78%	0.00%
REO	14.47%	15.10%	0.63%

Taking the mean probabilities for all variables yields a 9.78% likelihood of choosing short sale and 14.47% for foreclosure. The sales price of a home for REOs was the most sensitive variable to a first difference change; with a one standard deviation increase resulting in a 12.58% decreased likelihood of choosing foreclosure. Age had the least impact of any variable with a one standard deviation shift having no impact on the probability of a borrower selecting short sale. What follows next is an in-depth analysis of each of the variables, specifically constructing a sensitivity analysis based on the entire range of possible values to compare their impact on short sales and REO respectively.

Figure 12- First Difference Effect on Magnitude of Predicted Probabilities

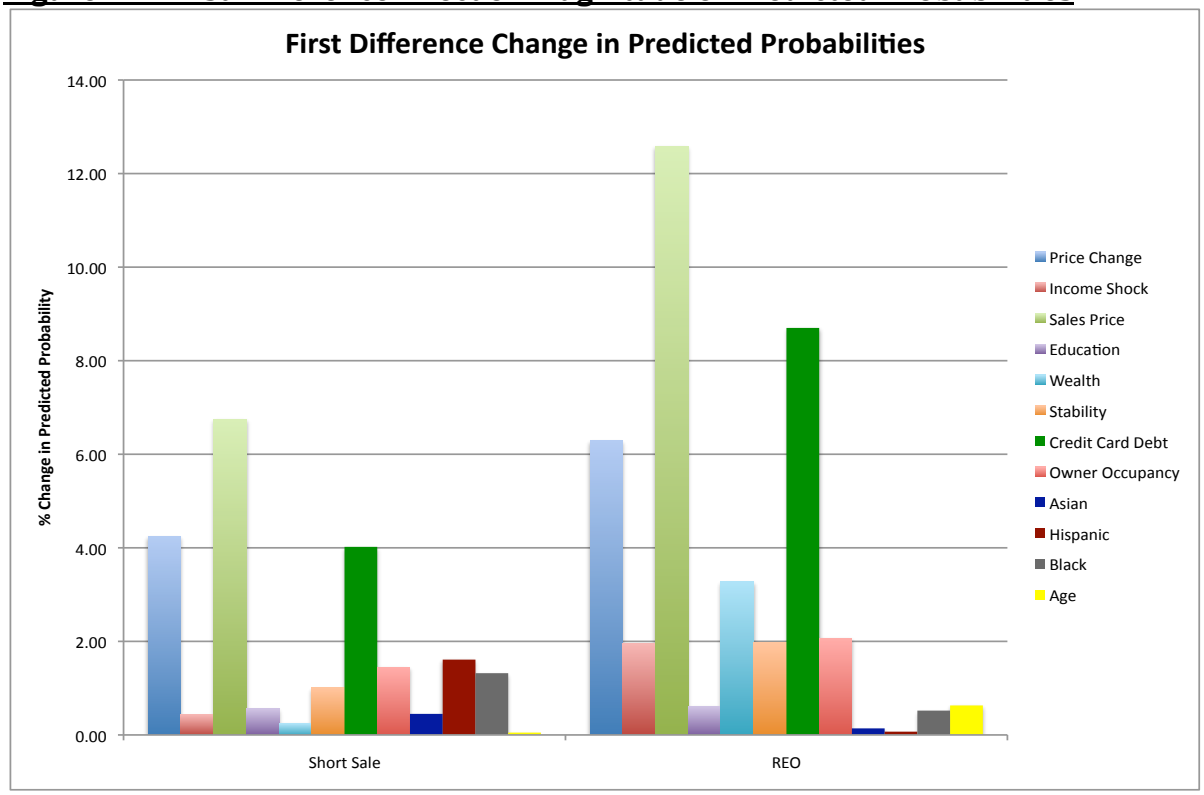


Figure 13 – Predicted Probability Chart for Price Change on Short Sales

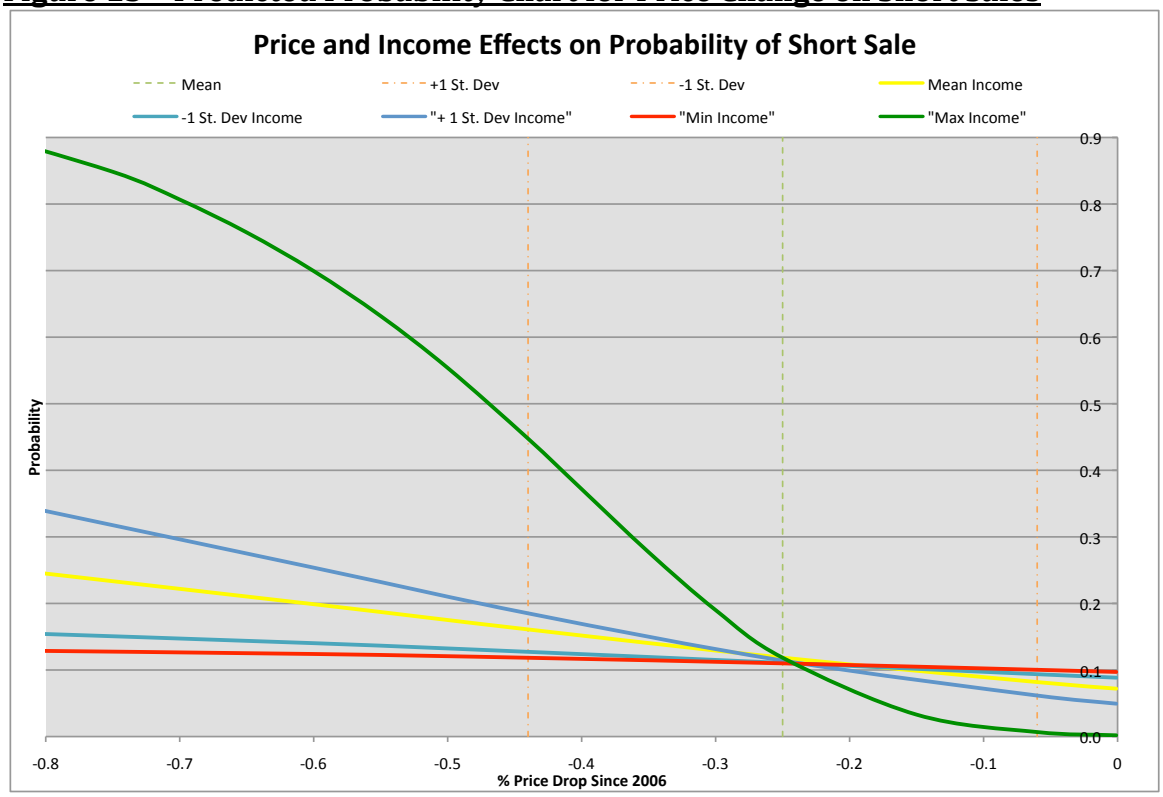
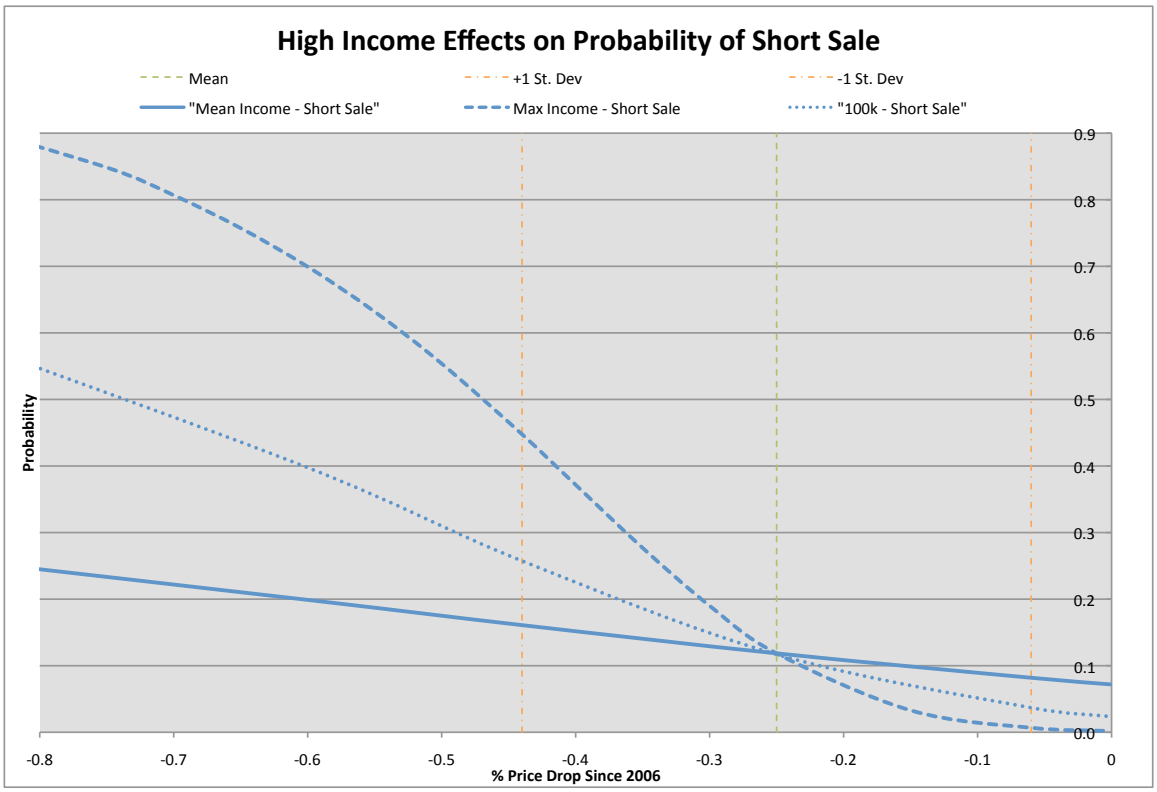


Figure 13 depicts the change in predicted probabilities for short sales for the entire range of values of a price decreases, holding all other variables at their mean values except for income shocks. The five curves represent various levels of income shocks for the entire range of price decreases. For all income levels, the first difference is greater for a one standard deviation increase in price change; that is to say, short sales are more responsive to large price decreases than they are to smaller reductions. Furthermore, the predicted probabilities for the entire range of income levels are almost identical at the mean price reduction of 25%. Interestingly, as the price range decreases from the mean, the probability of short sale is highest for the lowest income levels. The inverse is true as price reductions increase away from the mean, with the higher incomes having the largest

probability of short sale. The maximum income is an outlier to the data set, the value of 230620 represent an income of $230,620 with 100% employment, high income probabilities will be discussed further in the section below and are depicted in figure 14. These findings lend strong support to falsifying the double trigger hypothesis, as income levels have little impact on affecting a change in probability at any given price level.

Figure 14 – High Income Level Effects on Short Sale Probability



The mean income shock for the sample is 30204, which can be represented as an income of $30,204 with employment of 100% or income of $60,408 with 50% employment. The maximum income shock in the study has a value of 230620, which is 7.6 times greater than the mean, and is therefore an extreme outlier. A more representative level of high income shock would be 100000, which is almost

double the one standard deviation value of 52016. At this level of income shock, the predicted probability is reduced at all levels of price decrease greater than the mean, and increased for value less than the mean price drop. The difference in probability for a greater price increase drops to 9.66% for an income shock level of 100,000 compared to the 28.75% change for the max income shock. As prices increase from the mean price change level, the first difference changes are much lower, 4.5% for 100000 income shock, and 7.5% for max income. The caveat to the double trigger hypothesis would be that extreme high levels of income shocks and price drops have an impact on the probability of short sale.

Income shocks have a similar impact on affecting a change in the predicted probability of REO (see Figure 15), although the effect is more muted at high levels of income. The five curves reflect the range of income from min to max; other than at max income, the effect of varied income levels has very little impact on the probability of REO. At the mean price change level of -25%, the first difference for a one standard deviation increase in income is 1.95%, and for a decrease in income it is 1.43%. The findings provide a stronger refutation of the double trigger hypothesis than the findings for short sales. Conversely, the findings support the strategic default hypothesis for both short sales and REO, as changes in price holding all other variables at their mean value do generate higher probabilities of short sale and REO. For a decrease in price of one standard deviation, the probability of REO increases by 6.3%, a similar shift increasing prices yields a 5.71% change.

Figure 15 - Predicted Probability Chart for Price Change on REO

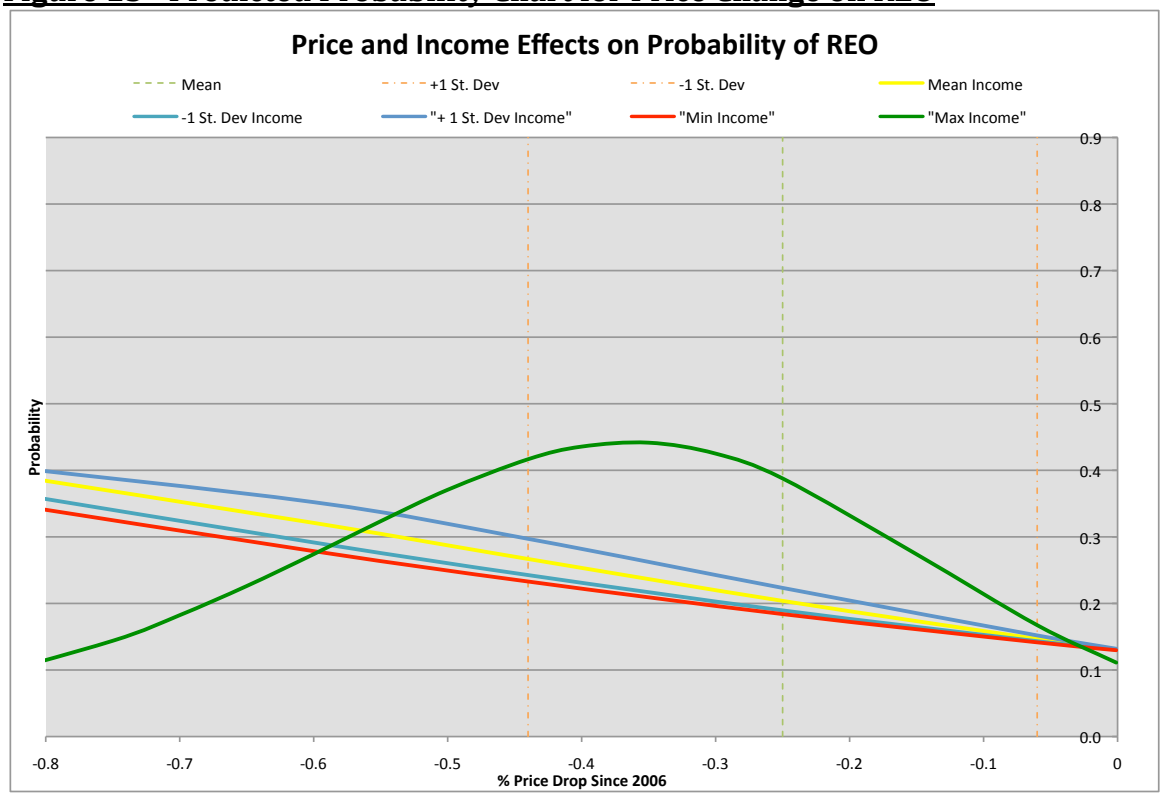
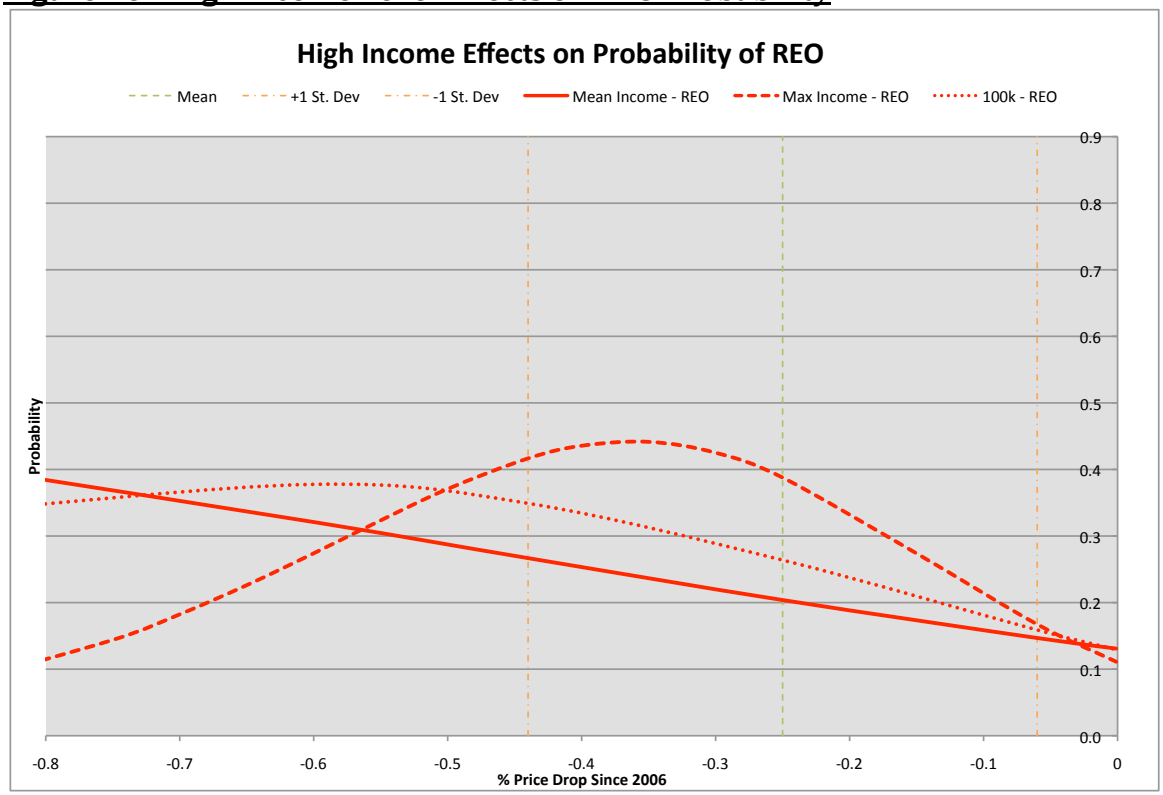


Figure 16 presents the predicted probabilities for high levels of income shocks for the range of negative price changes. The max income shock curve has a different functional form than the curve for short sales; the highest predicted probability of REO is for price decreases of 35%. Short sales had the highest probability of occurrence for the largest price reduction at the maximum income level. Setting income shock to 100000 reduced the probability of REO at the mean and at both one standard deviation levels compared to the max value. The difference in probability of REO at the mean price between income shock and 100,000 is 6%, which is greater than the impact on short sales at the same level. At maximum income shock levels, a 75% price reduction leads to 99% of all sales being distressed (short sale + REO), the probability drops to 86% at the 44% price drop

level (a one standard deviation downward shift). As was the case with short sales, extreme high values of income shock do have some effect on the probability of short sale, however, within normal ranges of values the impact is negligible, therefore confirming the strategic default hypothesis, and refuting the double trigger hypothesis.

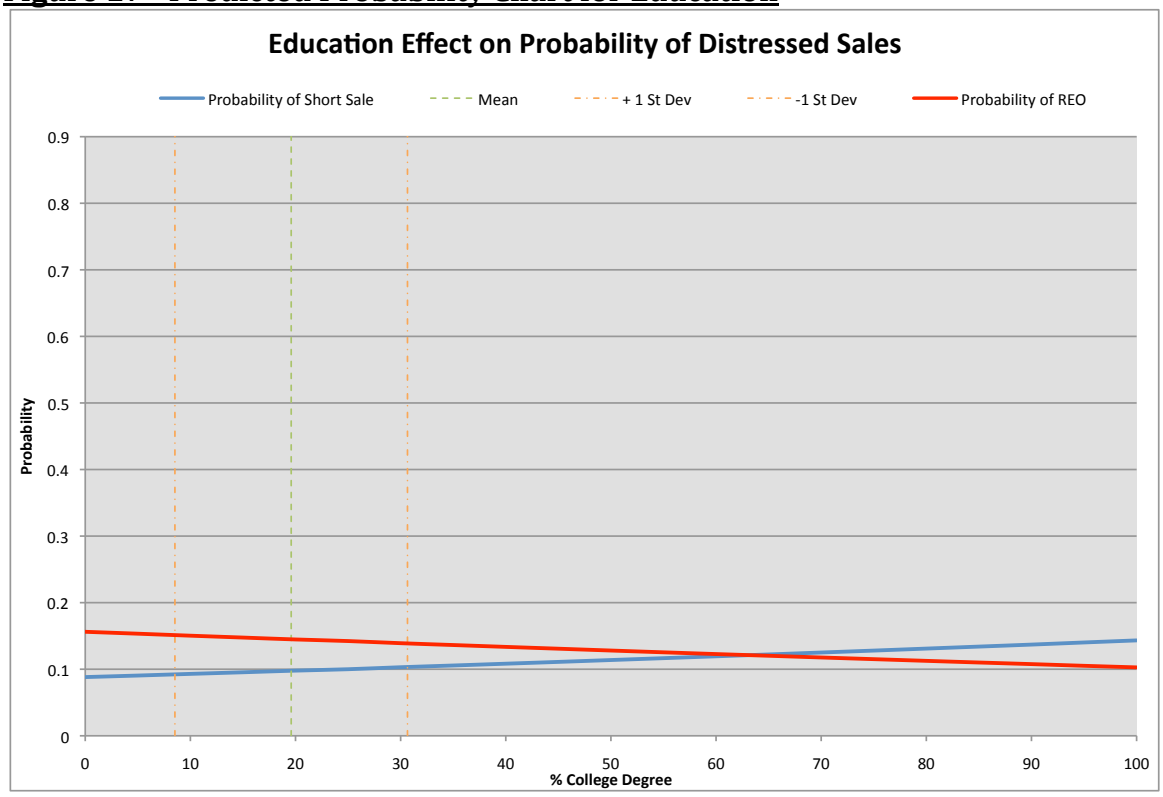
Figure 16 - High Income Level Effects on REO Probability



The range of predicted probabilities for education, holding all other variables at their mean are displayed in figure 17. Education has findings that differ from the expected relationships predicted in the literature; REOs have a negative relationship to default as predicted, however short sales increase as the percentage of education increases, which is the opposite effect predicted in the literature. Taking a first difference has a negligible effect, at less than 1% each, however the opposite

direction magnifies the effects. At the mean education level of 19%, the difference between short sale and REO is 4.69%. However, when holding all other variables at their means, at education levels of greater than 60%, the probability of short sale is higher than REO. Also of note is the direct trade off borrowers are making of short sales for REO; the percentage of organic sales is 75% for the entire range of educational values. This indicates that in this circumstance, borrowers make a direct substitution of short sale for REO as the level of education increases.

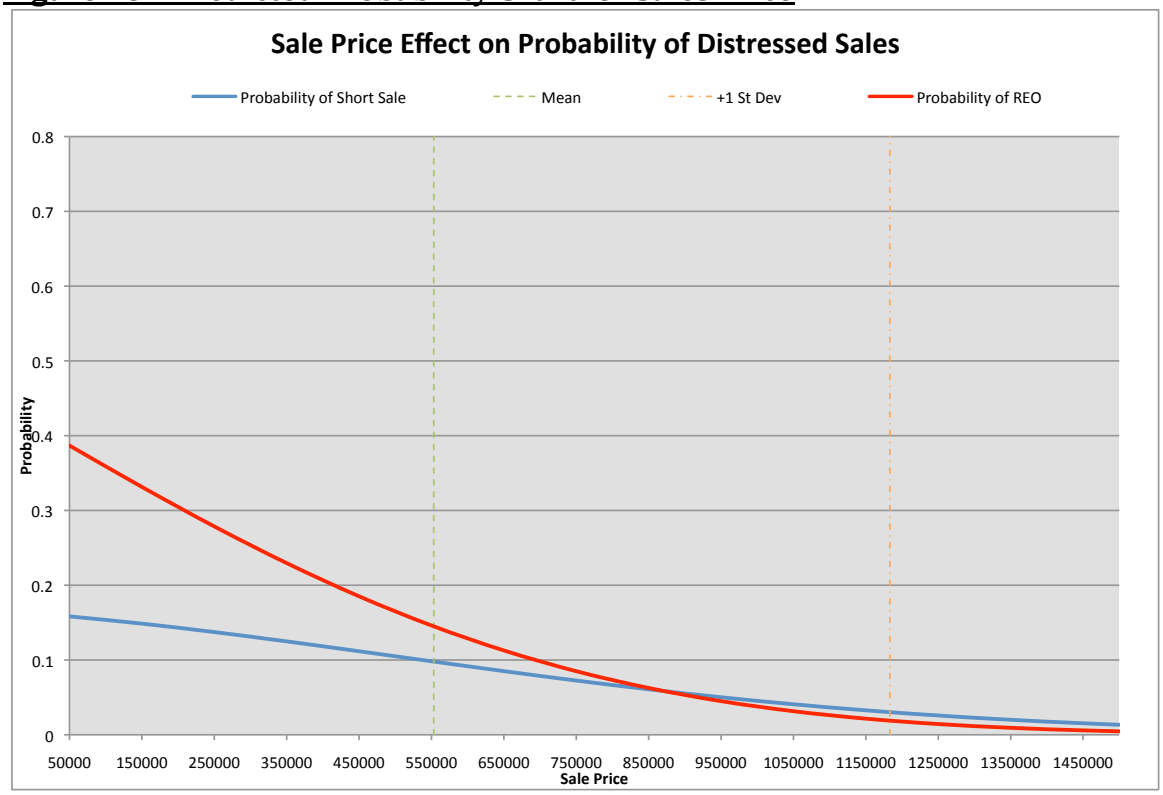
Figure 17 - Predicted Probability Chart for Education



The predicted probabilities for the range of sales prices (see table 18) confirm the hypothesis presented regarding sales price. Sales price has a positive coefficient for the decision relative to the base outcome of REO for homeowners, however the relationship to distressed sales is negative as is predicted by the

literature using sales price as a proxy for wealth. The first difference change is twice as large for REO, as it is for short sales. As a result, the probability of short sale is greater at sales prices higher than $850,000 and at the first difference price of $1,183,032 (one standard deviation increase) shorts sales are 1.2% more likely than REO.

Figure 18 – Predicted Probability Chart for Sales Price



The fully specified model results show a negative relationship regarding wealth for borrowers in the base case (REO) relative to short sales. For the range of values, wealth has almost no impact on the probability of short sale, less than 1% for the entire range of value (see figure 19). Conversely, the probability of REO is greatly impacted by changing values of wealth in a census tract, holding all other values at their mean. The first difference is 3.27%, however the slope of the curve is positive and increasing at a positive rate, so the probability of REO relative to short

sale continually increases. These findings, specifically regarding REO, are consistent with the theories presented in the literature, which posited a positive relationship to default.

Figure 19 – Predicted Probability Chart for Wealth

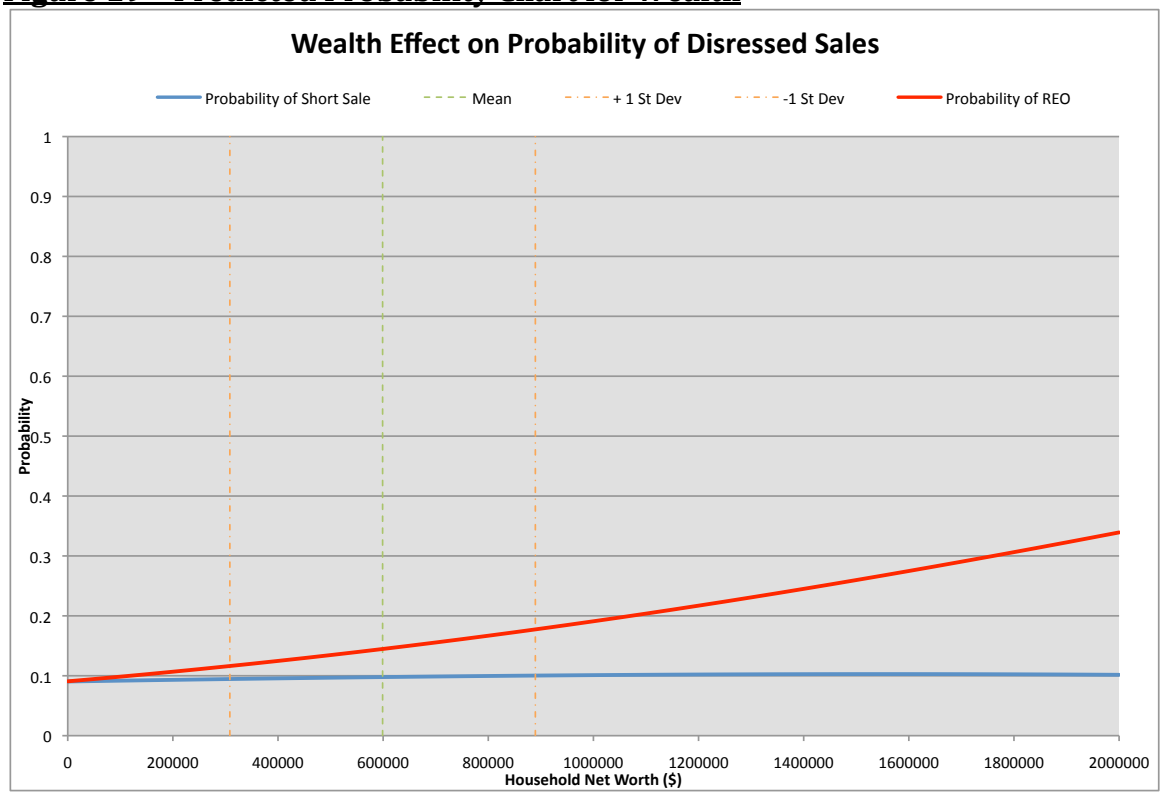
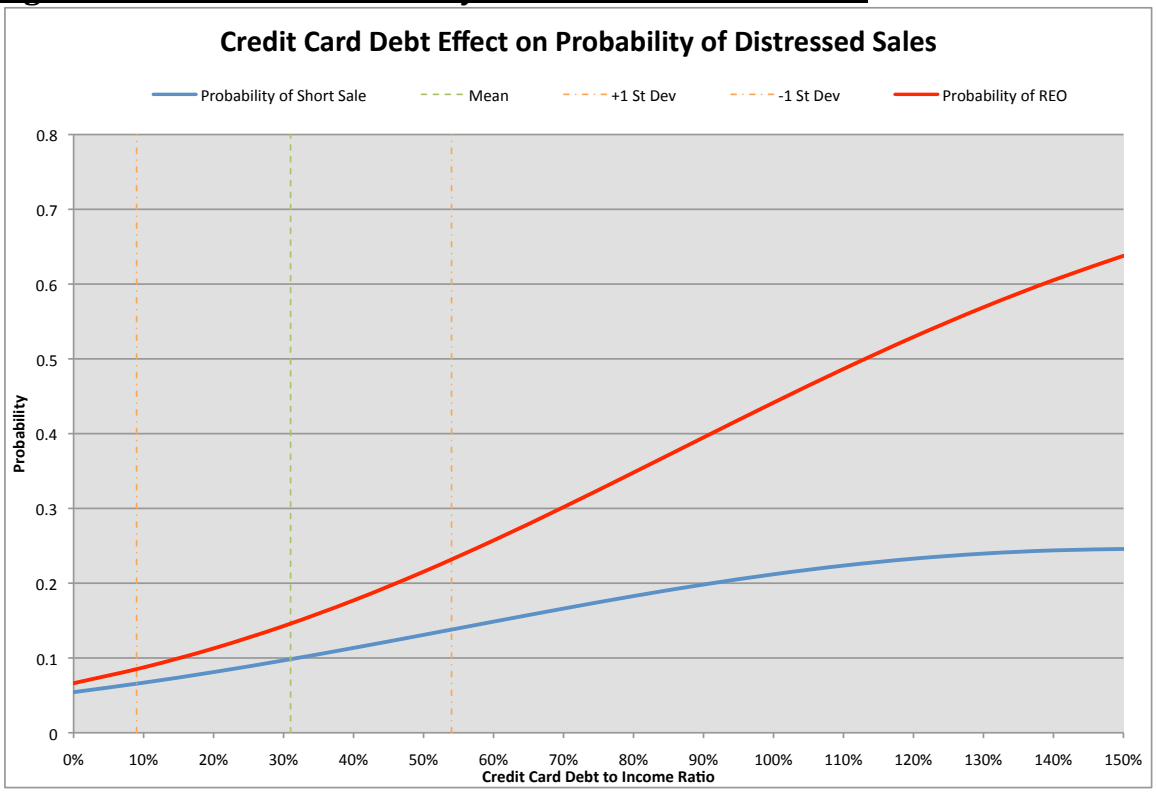


Figure 20 shows the range of predicted probabilities for the average credit card debt to income ratio per household for both distressed sale outcomes. As predicted in the literature, there is a positive relationship between credit card debt and distressed sales. Other than sales price decreases, probabilities for short sales and REO were the most sensitive to one standard deviation changes. Short sales were less sensitive to changes in credit card debt levels, an increase of one standard deviation over the mean causes a 4.08% increase in probability. For REO the magnitude was more pronounced; an increase of one standard deviation leads to a

8.7% rise in the probability. For credit card debt-to-income levels greater than 100%, the probability of short sale begins to stabilize around 24%, while it continues to increase greatly for REO, rising to a 64% probability of REO at the debt to income ratio of 150%.

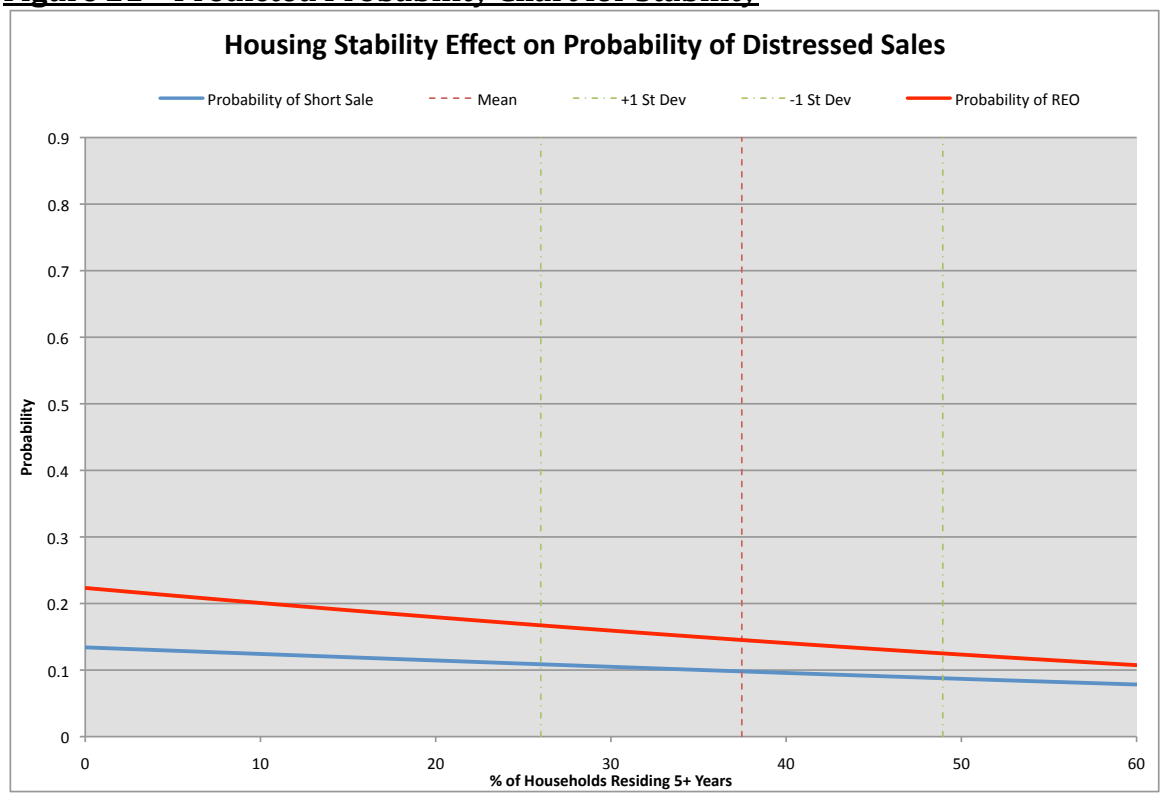
Figure 20 - Predicted Probability Chart for Credit Card Debt



The chart of predicted probabilities for housing stability is shown in figure 21 for the range of possible percentages of residents who have lived in the same location for at least the previous 5 years. The findings confirm the predicted negative relationship between homeowner stability and distressed sales, having a similar effect on both sales outcomes. Stability has a slightly greater effect on the probabilities of REO; a positive one standard deviation shift leads to a 1.97%

decrease in probability. The impact is less on the probability of a borrower opting for a short sale; with a positive first difference yielding a 1.01% decrease.

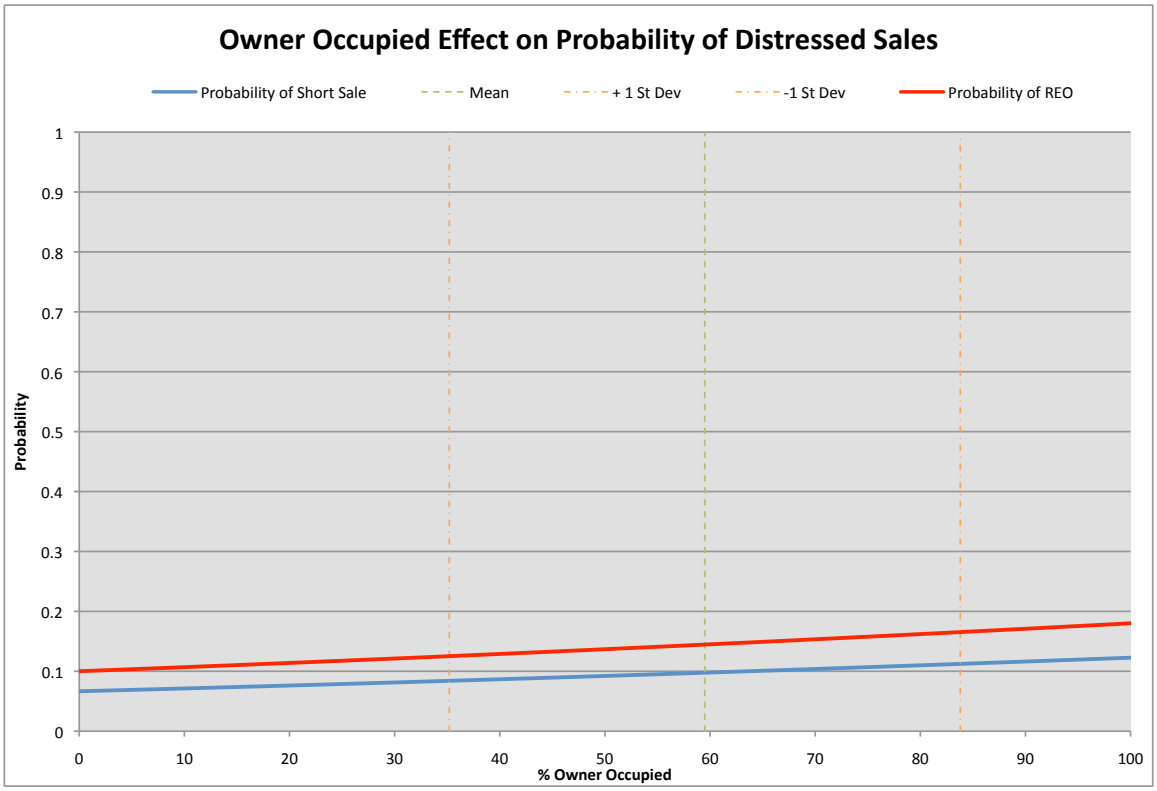
Figure 21 – Predicted Probability Chart for Stability



The predicted probabilities for the final policy variable, owner occupancy are depicted in Figure 22 for the range of all possible values in the dataset. There is not consensus in the literature as to the expected directional relationship between owner occupancy and default; the findings in this study show that there is a positive relationship. The impact of owner occupancy is very similar for both outcomes of distressed sale, taking a first difference yields an increase in probability of 1.45% for short sales and 2.07% for REO. There is no relative impact for either type of sale as the slopes of both curves are almost the same; this confirms the finding that the

relationship was not statistically significant for the borrowers deciding between REO and short sale.

Figure 22 – Predicted Probability Chart for Owner Occupancy



For the final sets of control variables, charts of the predicted probabilities will not be presented. There are no theoretical arguments presented in the literature as to the expected effect of these relationships; however, their impact on homeowner decision-making will be summarized below. Homeowner median age in the census tract had no impact on the borrowers decision at any range of values for short sales, and a first difference increase of .63% for REOs. Asian and Hispanic populations had a negative relationship to both short sales and foreclosures, although both were more sensitive to short sales. The first difference for Asian

population was minimal, at .45% for short sales and .14% for REO. For Hispanic population, the likelihood of short sale reduced for a one standard deviation increase by 1.61%, while the impact was negligible on REO affecting at .07% reduction. The percent of black population had different directional effects, with short sales being negatively related, while REOs were positively related. The first difference yielded a 1.61% reduction in the probability of short sale, and a .52% increase for REO.

Conclusion

This chapter set out to create a model that would aid in explaining the consumer decision-making process for borrowers facing mortgage default. The extant literature has two competing hypotheses explaining default—the double trigger hypothesis and strategic default. Proponents of double trigger hypothesis argue that income shocks, in addition to underwater mortgages are the necessary conditions for default. Strategic default, by contrast, argues that negative equity is the necessary and sufficient condition for default; borrowers may do so ruthlessly, or may take into account transaction costs before defaulting. The key distinction is the borrower's ability to pay their mortgage. The current literature focuses entirely on foreclosure as the only possible outcome for a distressed borrower. By adding short sales as another possible outcome for a distressed sale, we are better able to differentiate the conditions under which borrowers are making strategic decisions.

The findings from the multinomial probit models validate the strategic default hypothesis, while also refuting the double trigger hypothesis. In the baseline

model, employment was shown to have a minimal impact on the predicted probabilities and a different directional relationship for short sales and REO. Income in both the baseline and interactive model had minimal impact on the probability of short sale and a small impact on REOs. The fully specified model further confirmed the findings from the baseline models; by looking at the impact of income shocks at various price change levels, holding all other variables constant, the impact was minimal at most price levels. Changes in price levels affected changes in the predicted probability at all levels, as such, confirmed the strategic default hypothesis that negative equity is a sufficient condition for default.

At the maximum income shock level, which is an outlier to the data, and at high levels of price decrease there was a significant change in the predicted probability of short sales and REO. This is an extreme condition, although an important finding that at high levels of income and price decreases short sales are more prevalent than REO. In the normal range of values between plus and minus one standard deviation of income shock levels; the impact on the predicted probability is less than 2% for either type of sale outcome. This is the caveat to the double trigger hypothesis rejection, however it is does not provide compelling evidence to support the theory.

In addition to looking at income shocks and price level changes, the fully specified model also included other important variables identified in the literature. The first of these "policy" variables was education level; it was found that in neighborhoods with at least 65% of the population with a college degree, foreclosure is more likely than short sale. The results were not consistent with the

theory in the literature, as the predicted relationship was negative to default. Education had a different directional relationship to the sales outcomes, with a positive relationship to short sales and a negative relationship to foreclosure. Put differently, higher levels of education increases the probability of short sale, but reduces the probability of foreclosure. Holding all other variables at their mean, the percentage of organic sales remained constant for the entire range of education values. This indicates a direct substitution in the borrower's decision-making between short sale and foreclosure, which is an important finding for policy making. An increase in education could be considered a Pareto improvement as it encourages a positive outcome while not increasing the probability of REO.

Sales price of the individual property was found to be the variable affecting the greatest first difference change for both short sales and REO. The findings are consistent with the findings in the literature and with the theory presented earlier. Agents are incentivized to list high priced properties, their incentives are further increased due to the additional time and work attributed to short sales. For low priced properties, agents may avoid marketing their services, as they don't value the compensation for the amount of work required. Another way to capture this would be to research a sample of real estate agents that work in the location being studied. Their marketing pieces or websites could be coded to see if they contain expressions such as "short sale specialists" to capture if real estate agents are actively pushing short sales in the area[24].

[24] See http://shortsalesellit.com/ for an example of a website in Los Angeles specifically targeting short sales in their marketing

Credit card debt was found to have the expected positive relationship to default. In areas of high credit card debt, the probability for foreclosure increases more than for short sales, conversely in areas of low credit card debt, the gap between REO and short sale decreases. Credit card debt can be considered a proxy for an income shortage; therefore the increased probability of REO compared to short sale indicates that income shocks may have a less pronounced effect on borrowers' decision to select short sale. Borrowers who are acting strategically may be able to afford their payments, or could possibly be attempting to conceal their behavior from lender monitoring.

Borrowers living in neighborhoods with high levels of wealth are more likely to have a foreclosure. The literature predicted that short sales would increase at higher levels of wealth; this finding was not supported based on the findings in this chapter. Possible reasons for the reduction in short sales could be borrowers fear of bank recourse, or the demand for borrower contributions to close the sale. Banks require borrowers to disclose their assets before approving short sales; at high levels of wealth banks could refuse to approve the short sale, or they may demand that the borrower contribute significantly to the equity short fall. California passed new legislation in 2011 eliminating the ability of banks to require borrower contributions in order to approve short sale[25]. An area for further study would be to incorporate data from 2011 and beyond to see if the probability of short sale is impacted based on the new lender requirements.

[25] see section 580e - http://www.leginfo.ca.gov/cgi-bin/displaycode?section=ccp&group=00001-01000&file=577-582.5

Homeowner stability was found to have a negative relationship to the probability of distressed sales. The net effect of changing levels of homeowner stability had little differentiation in the relative probabilities between short sale and REO. These findings do not offer any substantial evidence to support or discredit either of the two theories on default, nor do they offer any insight into creating policy to encourage additional short sales.

Finally, owner occupancy rates for neighborhoods were found to have minimal impact on differentiating a borrower's decision on the type of default. The findings show that owner occupancy has a positive impact on the amount of distressed sales, however the relative impact of effecting a change in probability is negligible as the difference between the outcomes remains similar for the entire range of values. The current literature does not have a consensus as the expected effects of owner occupancy. The findings in this study suggest that areas with more investment properties are less likely to have distressed sales. This could be the result of several factors, including that investor's value an investment based on cash flow, therefore a short run decrease in the price would not impact their long-term returns. Additionally, investors are more likely to use larger down payments than owner-occupants; therefore investors are more likely to have equity remaining despite the general decline in market prices. Finally, investors would be less likely to purchase real estate as the market experienced drastic increases, holding rents constant, as prices increase the returns on investment decrease.

Based on the findings in the study, several public policies could be enacted to help reduce the number of foreclosures, while also promoting short sale as a better

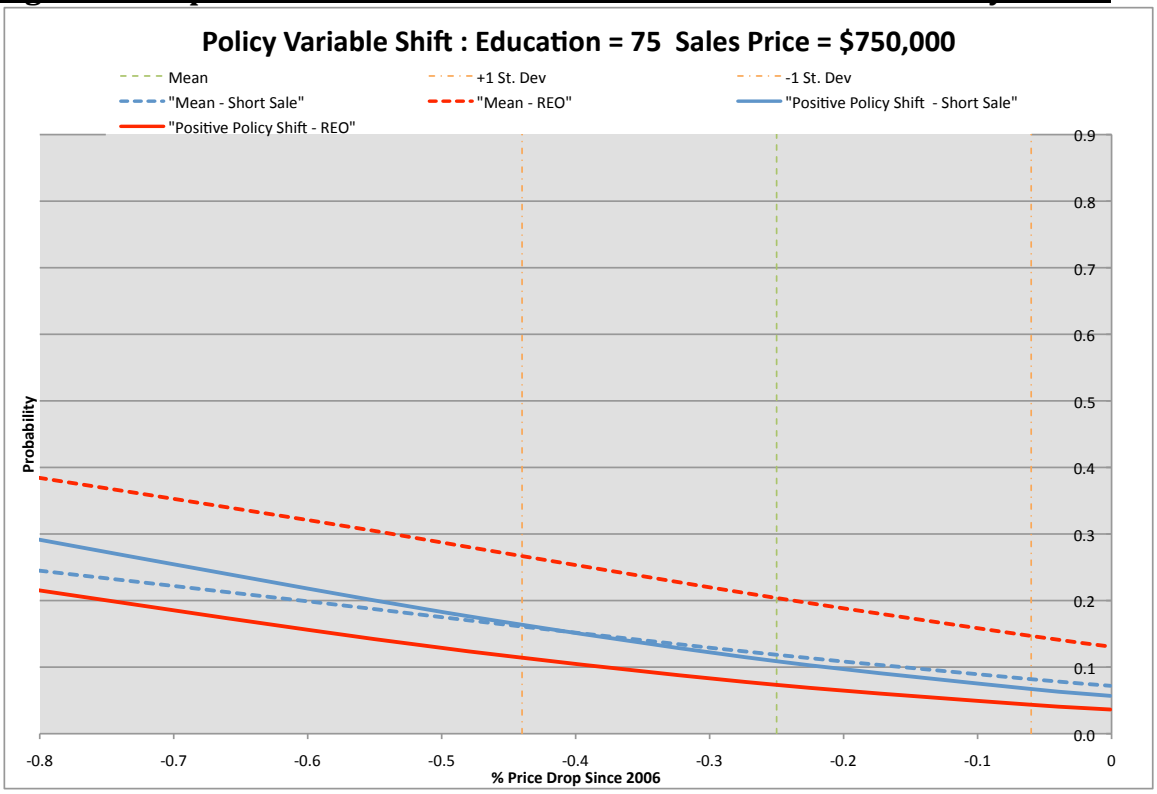
alternative for a borrower in default. Income shocks were not shown to have a major impact on strategic default, therefore loan modification programs focusing on lowering borrower payments are unlikely to reduce the number of distressed sales. Credit card debt was found to have a positive relationship to default, specifically foreclosures, if this type of debt is considered to be a proxy for income shortfalls, a program of payment deferment may be a better solution, without the moral hazard associated with loan modification for all borrowers.

In neighborhoods with high levels of education, the probability of foreclosure was less than short sales, holding all other variables at their mean value. Educating borrowers in default to the benefits to short sale should be a main focus for lenders and government programs. Currently, the government offers small incentives for borrowers and lenders who choose short sale. Simplifying and streamlining the short sale process for the borrower, in addition to offering larger incentives for borrowers, could help induce the desired behavior. Another possible policy would be to reduce the amount of time until a borrower is able to qualify for a government backed loan after short sale. There is currently a great deal of uncertainty as to the consequences of short sale, if the government can educate and incentivize borrowers, it should lead to a reduction in foreclosure.

The results of an upward shift in education to 75% of the population with college degrees and the sales price to $750,000, holding all other variables at their mean, for the range of price decreases can be seen in figure 23. At the mean value for price drop, the probability of REO is lower than short sale for the upward shift, and also lower than the original mean value for short sales. Educating the

population and offering incentives to real estate agents to list lower price properties could yield the optimal policy approach of reducing the number of foreclosures while encourage additional short sales.

Figure 23 – Upward shift in Education effect on Predicted Probability of REO



A final note on possible public policies would be to specifically target neighborhoods with high percentages of minorities, specifically black populations, with additional information on the benefits of short sale. The findings in this chapter showed that in areas with large minority populations, borrowers were less likely to short sale. Areas with large black populations are positively related to the probability of REO, so additional attention should be given to reducing foreclosures in those neighborhoods.

Future studies would benefit from incorporating short sales into the analysis when modeling distressed sales and strategic default. Surveys of borrowers who have declared themselves as strategic defaulters do not exist, as consumers are weary of divulging their true intent to lenders. As such, research design is key in order to accurately measure borrower decision-making. Future studies where individual mortgage data is paired with sales data would be better able measure individual consumer decision-making, rather than attempting to use neighborhood level proxies. In addition, the methodology used in this study could be expanded to other areas of the country to determine if the effects can be generalized to all areas.

Chapter 3 –

Neighborhood Effects: Measuring Contagion and the Impact of Social Stigma on Borrower Decision Making

"While strategic default is frequently a rational economic choice for underwater homeowners, if rationality was the driving force, most strategic defaulters would walk away much sooner than they actually do. Instead, most strategic defaulters don't walk away until they are more than 50% underwater" – White (2010)

Introduction

The previous chapter studied distressed homeowner decision-making, identifying key property and neighborhood level variables that influence the borrower's choice between foreclosure and short sale. An additional variable that is often overlooked when trying to identify causal relationships is the factor that spatial association can have on influencing an individual's behavior. This can emerge in a variety of methods, but usually involves some type of contagion effect, whereby the characteristics of an individual are observed and then influence other individuals in neighboring locations. In the case of distressed sales, contagion manifests itself in two main behaviors—social stigma and price contamination/discount.

This chapter will focus on identifying any such social stigmas that may either encourage or discourage borrowers decision-making. Guiso, Sapienza, and Zingales (2009) found that when holding morality constant, people that knew somebody who defaulted strategically were 82% more likely to also use the put option and strategically default. Homeowners that are living in an area saturated with foreclosures and the resulting abandoned and neglected properties are likely to be

influenced by the negative externalities. This chapter will seek to identify any spatial associations using a variety of statistical techniques and measures. What follows is a review of the literature and the resultant theories and methodology that emerge based on this area of study. The chapter will then present the results and findings from the various spatial statistical techniques employed. Finally, the chapter will conclude with a summary of the findings and implications for future study.

Literature Review

In a 2008 speech, Fed Chairman Ben Bernanke noted "high rates of foreclosure can have substantial spillover effects on the housing market, the financial market and the broader economy"[26]. Numerous studies have been conducted to measure such "spillover" effects—these effects are often referred to as contagion. Foreclosure contagion effects studies generally fall into two categories—hedonic price models or spatial models. The majority of studies employ some form of hedonic price models[27]. These models use the log of the house price as the dependent variable, and then neighborhood and individual house characteristics as the independent variables. To measure the contagion effect, they will include the number of foreclosures within a specific distance as an additional independent variable. An example of such a study would be Immergluck and Smith (2005), who look at foreclosures in Chicago during 1997 and 1998. Their findings were that each foreclosure within an eighth of a mile of a single-family residence reduces the value

[26] http://www.federalreserve.gov/newsevents/speech/bernanke20080505a.htm
[27] see Rosen, Sherwin (1974) for additional information on the methodology used in hedonic price models

by 0.9 percent. Chapter 3 will focus on identifying any possible price contagion through the use of a hedonic price model, the remainder of this chapter will focus on spatial dependence associated with social stigma.

A different approach to measuring contagion is to use spatial models rather than hedonic price models. Schintler et. al analyzed New England[28] using spatial temporal data from January 2007 through March 2008, the unit of analysis is the census tract level. Foreclosure contagion is defined as an "increase in neighborhood foreclosures that spreads over time from neighborhood to adjoining neighborhood." This approach varies greatly from the hedonic price models; looking at neighborhood trends, rather than individual price effects of foreclosures within distances of under a quarter of a mile. Census tracts are coded as hot spots, cold spots or transitory. Hot spots are areas of high foreclosures surrounded by other tracts with high rate of foreclosure. Cold spots, conversely, are areas with low levels of foreclosure surrounded by other tracts with low levels. Transitory tracts can be low areas adjacent to high areas, or vice versa.

Schintler et. al (2009) used Global Moran's I Statistic (spatial autocorrelation) to analyze contagion between census tracts. The spatial temporal analysis showed that transitory neighborhoods (low to high and high to low) increasingly become like the hot or cold spots in the adjacent tracts. Cold spots exhibited the most growth of any of the categories over the time period examined. The authors used rook first order contiguity to measure spatial association; the connectivity used only measure tracts directly adjacent to the observed tract that

[28] New England is comprised of New Hampshire, Massachusetts, Rhode Island, and Connecticut

are north, south, east or west (similar to a rook's movements in chess). This methodology has some drawbacks as it does not necessarily measure all of the adjacent census tracts, it also does not account for varying distances. A large census tract may have a neighbor that is several miles away from its center, while a small tract may have adjoining tracts located within a 1000m radius. Each area of analysis needs to be carefully considered so that the appropriate spatial association is used.

Can (1998) provides an overview of spatial analysis and the incorporation of GIS, noting that "GIS technology provides the optimal environment for investigating neighborhood effects in the housing and mortgage markets." The author suggests a two tier approach to spatial analysis; the exploratory spatial data analysis (ESDA), followed by the confirmatory data analysis (CDA). In the ESDA, the goal is to identify the spatial structure and distributional patterns. The goal of CDA is to formally model the spatial association and quantify the strength of any relationships. Spatial spillover effects can be both positive, neighbors maintaining and improving their property, or negative when abandoned properties sit vacant for long periods of time.

Another factor to consider when studying spatial association is the social stigma created when a home defaults on their mortgage. Brent White summarizes over 350 personal accounts of individuals who decided to strategically default, describing some of the social stigmas associated with defaulting on a mortgage. Using anecdotal evidence, White lists anxiety, fearfulness/uncertainty about ones financial future, and the unwillingness of the government to provide helpful policy solutions as driving factors for an individual's action/inaction regarding the

decision to default. White poses an interesting question—do homeowners act as depicted in the strategic default literature, calculating the present value associated with owning their home, and then decide whether it is in their best interest to exercise the put option on their home. That is to say are homeowners' rational acting utility maximizers, or are they influenced by the behavior of surrounding neighbors and acquaintances. White found that the elderly, the highly educated, and those with high credit scores were the most likely to strategically default.

The first survey conducted regarding individuals' thoughts on strategic default was published by Guiso, Sapienza, and Zingales (2009). Using data from the Financial Trust Index (FTI)[29], respondents were asked about their views on mortgage default. They authors argue that it is difficult to study the decision to strategically default, "because it is de facto an unobservable event." There is no such data set available that indicates which mortgage defaults were strategic, and which ones were due to an income shock. Additionally, they found that when controlling for changes in unemployment, mortgage delinquencies are highly sensitive to decreases in home prices. Therefore, their finding was that "that people default because of the size of their negative equity, not just because they cannot afford to pay" (2009). While some studies have tried to combine information about credit scores with mortgage default information[30], borrowers are incentivized to try to hide their true intentions so as to not alert the lender if they are not actually suffering a financial hardship. No study to date has been able to directly survey

[29] www.financialtrustindex.com - compiled by the University of Chicago Booth School of Business and the Kellogg School of Management at Northwestern University
[30] See Wyman-Experian (2009)

individuals who defaulted on their mortgages to determine what percentage defaulted strategically.

The FTI surveyed randomly selected homeowners from around the country, asking if they believed strategically defaulting was immoral. They found that 81% of all homeowners thought it was immoral. However, when the same respondents were asked to answer the same question while hypothetically $100,000 underwater on their mortgage, the percentage of people who thought it was immoral dropped to 57%. Ceteris Paribus, people who have been in their home for more than 5 years were 78% less likely to default. In the overall sample, 26% of households knew somebody who has defaulted, while 9% knew somebody who had defaulted strategically. Finally, they confirmed the findings of previous studies on foreclosure contagion, noticing a non-linear relationship between the attitudes towards default and the number of defaults within specific ZIP codes. That is to say, as the number of foreclosures increased in a ZIP code, the attitude towards default increased by a larger percentage, indicating that contagion could contribute towards the reduction of any social stigmas.

Fannie Mae conducts their National Housing Survey quarterly, surveying the general population of homeowners on a variety of issues, making distinctions for those with mortgages and for underwater borrowers. The 3rd quarter 2011 survey specifically focuses on the issue of default and strategic default; the study provides additional insights on various demographic groups views on default. The survey found that owners are more likely to consider default if they know somebody else that defaults – 6% of owners who know a defaulter would consider default,

compared to 3% for owners who do not know somebody that has defaulted. 54% of underwater homeowners reported knowing somebody in their neighborhood who has defaulted on their mortgage, the percentage drops to 41% for the general population. According to the survey, underwater homeowners are also more likely to know a strategic defaulter—28% compared to 20% of the general population. Underwater homeowners reported that 30.9% of their gross income goes into their first mortgage payment; the mean for all homeowners with a mortgage is 27.4%.

Social stigmas are often compared to diseases by the manner they spread through contagion. When looking at the housing market bubble, Akerlof and Shiller (2009) noted that confidence, or the lack thereof, may be as contagious as any disease. They also point to "money illusion" in explaining the housing bubble—people often remember the purchase price of their home from a long time ago, and assume that it has grown in value. By not factoring in inflation, they often assume huge gains and that housing is always a good investment. This line of thinking can also lead to feedback loops, where speculative prices encourage economic growth, which then reassures the growth, causing additional speculation. These "information cascades" are often referenced as causal effects for the forming of bubbles, however, the same behavior occurs in the opposite as markets crash[31].

[31] For more information on information cascades or herd effects see Surowiecki, James (2004) The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations or Bikhchandani, Sushil , Hirshleifer, David and Welch, Ivo (1992) "A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades." *Journal of Political Economy*, Vol. 100, No. 5, pp. 992-1026.

Theory and Methodology

The first methodological decision that must be determined when measuring spatial dependency is the type and scope of the spatial connectivity relationship. The two methods that will be employed in this study are "queens" first order connectivity and a strict distance band. The queen's connectivity allows for adjoining neighboring census tracts in all directions to exert some spatial influence on the observed tract. First order signifies that tracts that share a border are included, second order would be tracts that do not only share a common border, but also add on tracts that share a common neighbor. The second measure is a strict distance band, whereby all tracts that fall within the given distance are included, regardless if they share a border. A strict distance allows for a more consistent application due to the varying sizes of census tracts within Los Angeles County.

Figure 24- Queen's First Order Connectivity – Spatial Dependence

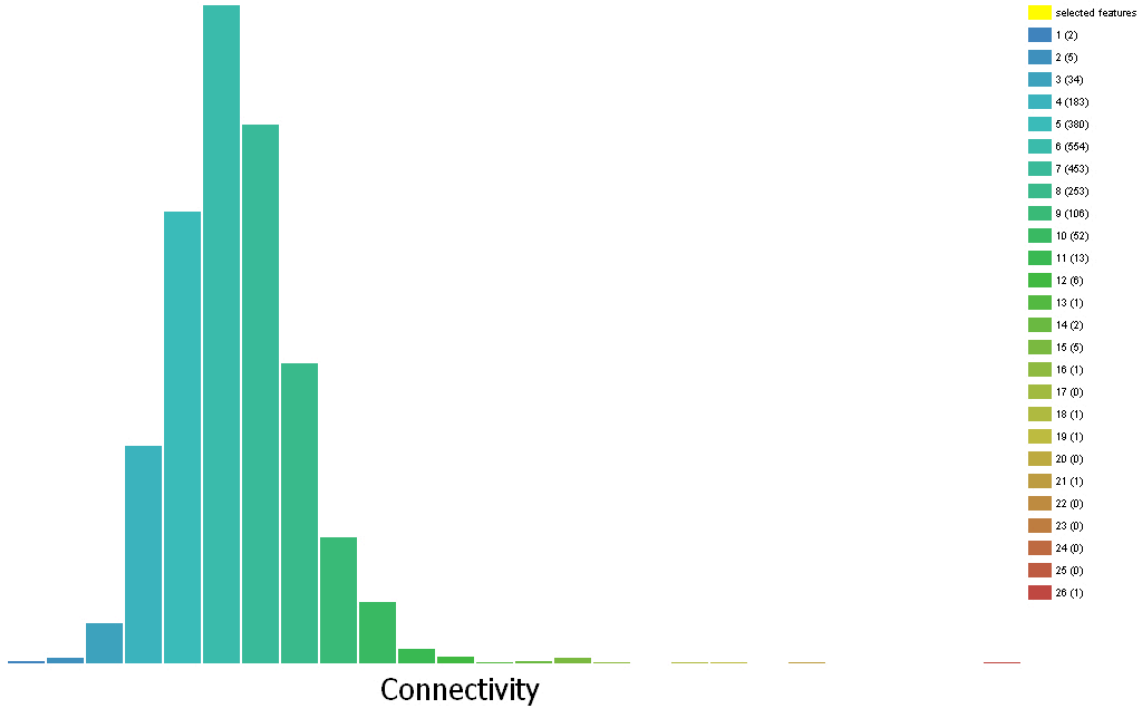


Figure 24 is a histogram of the number of neighbors for all of the census tracts using queens first order connectivity. The minimum number of neighboring tracts is 1 (2 tracts) and the maximum is 26 (1 tract). The mean number of neighbors is 6.41; the most observed connectivity is 6 neighbors, with 554 of 2054 (27%) tracts falling into this category. Queen's first order is a more consistent measure than rook's connectivity, where only neighboring tracts directly north, south, east and west are included. In an ideal research design using queen's connectivity, there would be a consistent number of neighbors for all tracts. Los Angeles County has census tracts of vastly different areas, therefore the use of a strict distance makes more theoretical sense for this study based on the idea that contagion occurs at the neighborhood level. The number of neighbors isn't consistent, however, distance is more likely to influence consumer behavior than unobserved geographical census tracts. Certain statistical analyses are limited to the use of queen's connectivity; when both methods are available, the results will be compared.

Once the spatial relationship is established, there are several different measures that can be used to identify any spatial associations. Morans Global I measures the spatial association (spatial autocorrelation) of all of the census tracts in the system. It is measured on a scale from -1 to 1, with 0 indicating no spatial association, negative values indicate negative association and positive numbers indicate positive association. A positive association indicates that values that diverge from the mean (positive or negative) are clustering near each other, a negative association indicates that higher than mean areas are located near lower

than mean areas. It should be noted that Moran's Global I values are unique to particular systems, and values cannot be compared from one study to another with a different geographic area of analysis.

As the title suggests, Moran's Global I statistic looks at the entire system, and then assigns a value, it does not distinguish between areas within the system, as such it does not allow for narrower unit of analysis observation for specific areas within the system. Anselin (1995, 2000) developed the Local Indicators of Spatial Association (LISA) that allow for analysis of specific tracts within the global system. He created 4 categories of local relationships, High-High, (dark red on map) High-Low (light red), Low-High (light blue), and Low-Low (dark blue). In order for the spatial association to be depicted on the maps the p-values need to be statistically significant at the .01% level. The LISA statistics used in the study use the queen's first order connectivity as the spatial reference.

Another local measure of spatial association that will be used in this chapter is the Getis-Ord-Gi* statistic (Getis and Ord 1992). This method is similar to Anselin's LISA statistic in that they both identify clusters of hot and cold spots. For the Getis-Ord-Gi* statistic, the spatial reference used was a fixed distance of 3000m. Global Moran's I statistics were used at fixed distances of 1000m, 2000m, and 3000m to determine which distance had the highest z score; 3000m was more significant than the other distances. Distances of more than 3000m were not considered for this study, as the goal was to identify neighborhood effects. The results for the Getis-Ord-Gi* are reported in terms of their standard deviations; Hot

or Cold spots are identified for tracts that are more than 2.58 standard deviations away from the mean.

Based on the spatial foreclosure literature (Schintler et. al 2009), it is expected that evidence of spatial contagion will be present in this study for both REO and short sales. The findings from the spatial literature are supported by the findings of the Financial Trust Index (Guiso, Sapienza, and Zingales 2009) where they found that borrowers were more likely to default if they knew somebody who has defaulted. Social stigma is a difficult phenomena to capture, however, spatial contagion is a good proxy as it shows that based on location, an observed event is being influenced by the surrounding area. Both short sales and REO will be tested to determine if contagion is occurring using global and local indicators.

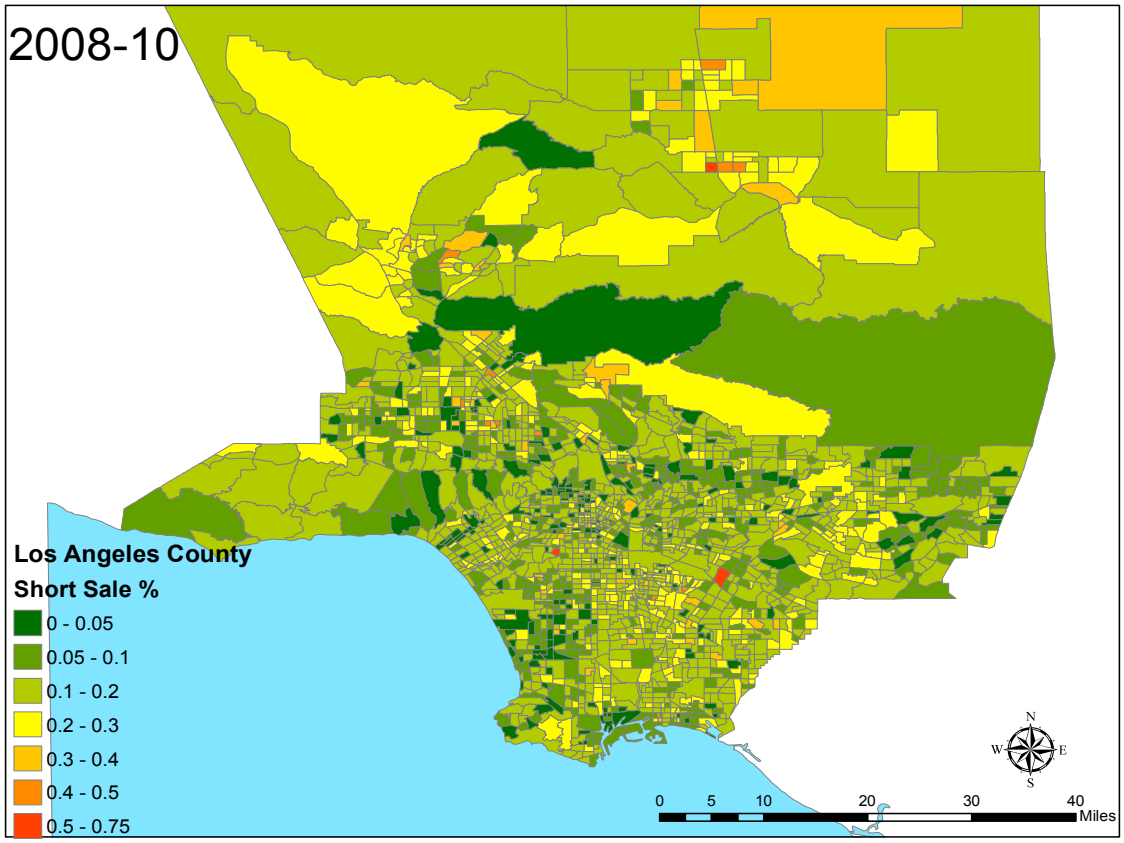
The two main types of spatial dependence that emerge are spatial error and spatial lag (Anselin 2005). Spatial error indicates that error terms across different spatial units are correlated, which would indicate that covariates could be omitted which would affect the inference in the model. Spatial lag still has the problem of correlated error terms, but also violates the assumption of independent observations. The spatial lag is present when the dependent variable in location i is affected by independent variables in location i and also in location j. The spatial analysis software GeoDa[32] will be used to test for the presence of spatial lag and spatial error.

[32] See http://geodacenter.asu.edu/ for more information and to download the software.

Findings and Analysis

The first aspect of spatial dependence to be evaluated will be to study the emergence and any possible subsequent contagion of distressed sales. Figure 25 shows the average percent of short sales[33] in each census tract from 2008 through 2010. It is clear that there are clusters of both high and low areas for short sales. Of the 2054 census tracts in Los Angeles County, 52 had no short sales during the period of study. The maximum percentage of short sales within a census tract was .75%, six tracts had a percentage of greater than 50%, while 610 tracts (30% of the total sample) had less than 10% of the total being short sales.

Figure 25- Short Sale Percentage Heat Map 2008-10



[33] Other possible sales outcomes in this study are an organic (non-distressed) or REO (bank owned distressed sale)

Figure 26 represents the heat map for the percentage of REO sales in each census tract for period of 2008 through 2010. During the period of study, 18 census tracts did not have any REO sales, while one tract had only 1 sale and it was an REO. The number of tracts with 50% or more of the sales being REOs was much larger than for short sales (235 vs. 6), while 307 tracts had less than 10% of the sales outcomes being foreclosures, which was half as many as for short sales (610). It is clear that there are more higher and lower concentration tracts for REOs compared to short sales, further analysis needs to be conducted to see if these areas are clustering or are randomly distributed.

Figure 26- REO Percentage Heat Map 2008-10

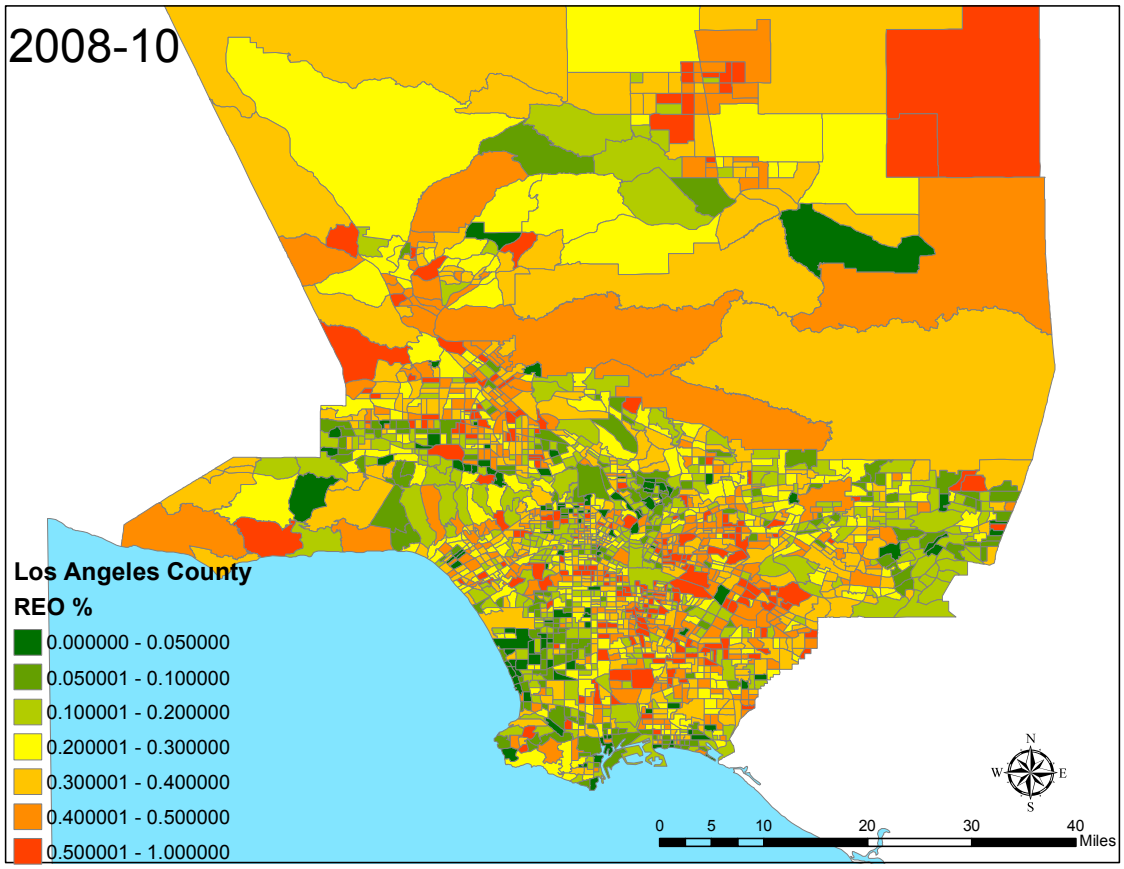
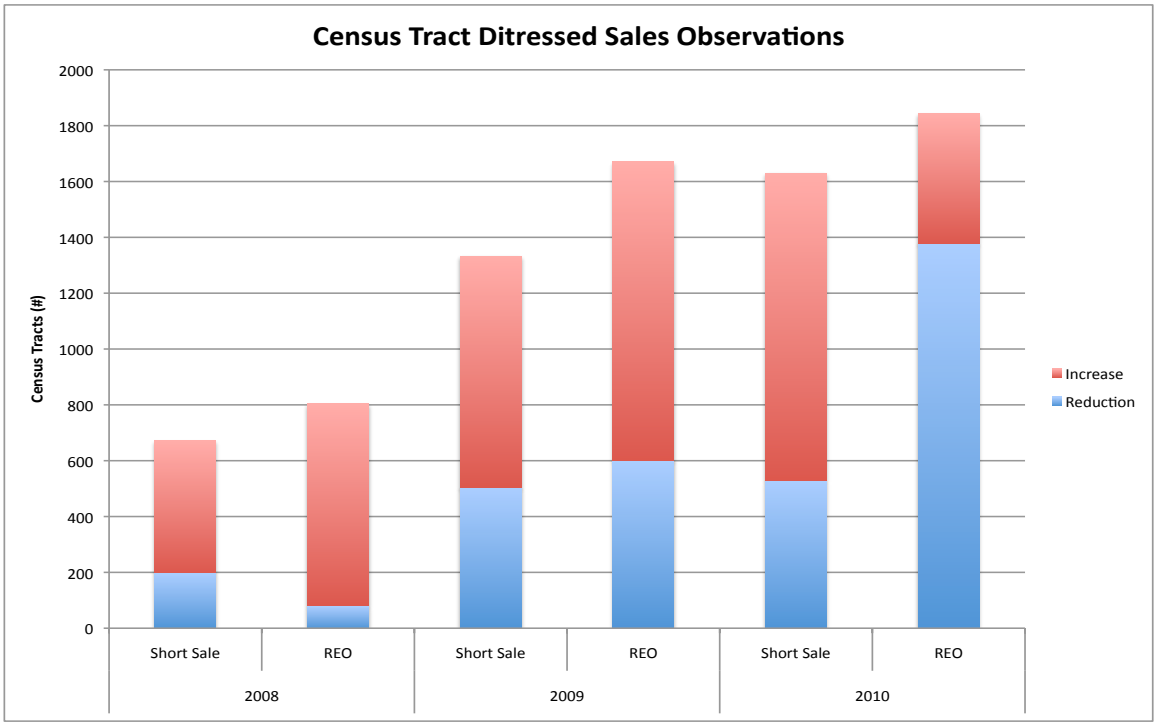


Figure 27 – Direction of Sale Type Change by Census Tract 2008-2010



The complete breakdown of the annual percentage change of sale type at the census tract level is presented in figure 27. The number of tracts with a repeat sale increases for each year of the sample for both distressed sales outcomes. Similarly for short sales and REO, the absolute number of tracts that showed a decreased percentage of the total sales from the previous year increased throughout the sample years. For each subsequent year in the sample, there were more tracts that had a lower percentage of short sales/REO than the previous year. This indicates the creation of cold spots where distressed sales are not growing in number. Additionally, because the total percentage of distressed sales grows throughout the sample, it indicates that where short sales and foreclosures are occurring they are also growing in number, also known as a hot spot.

Figure 28 – Short Sale Heat Map – Percentage change from 2007 to 2008

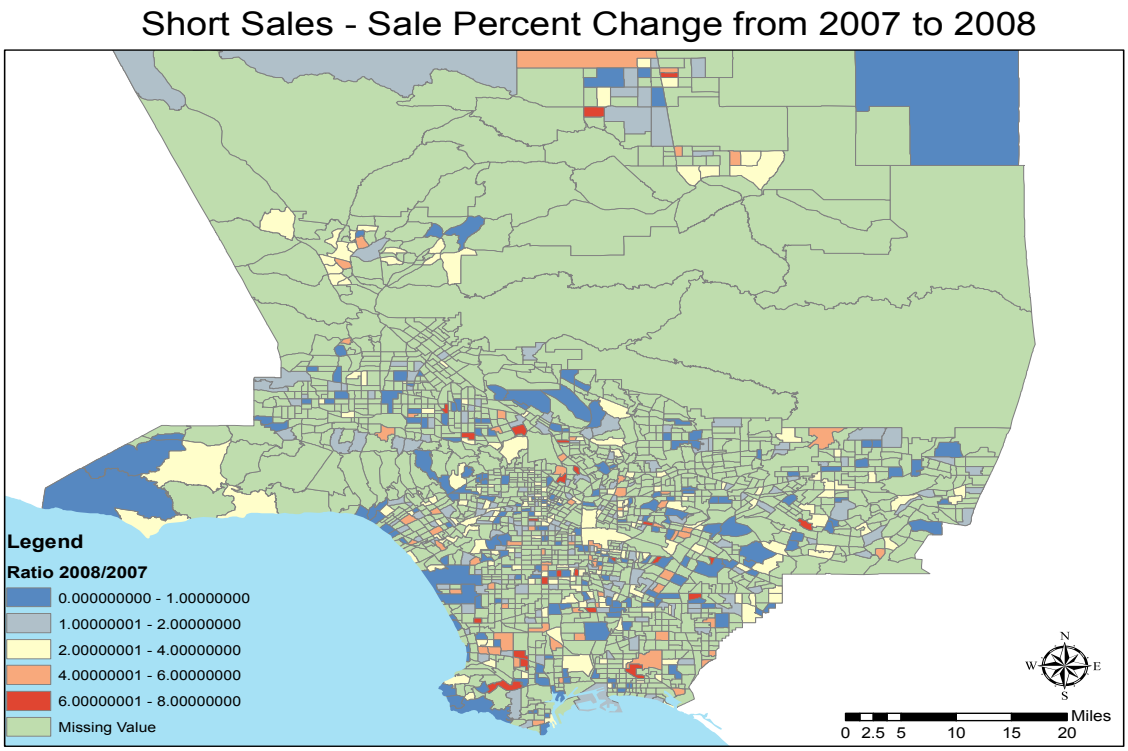


Figure 29 – Short Sale Heat Map – percentage change from 2008 to 2009

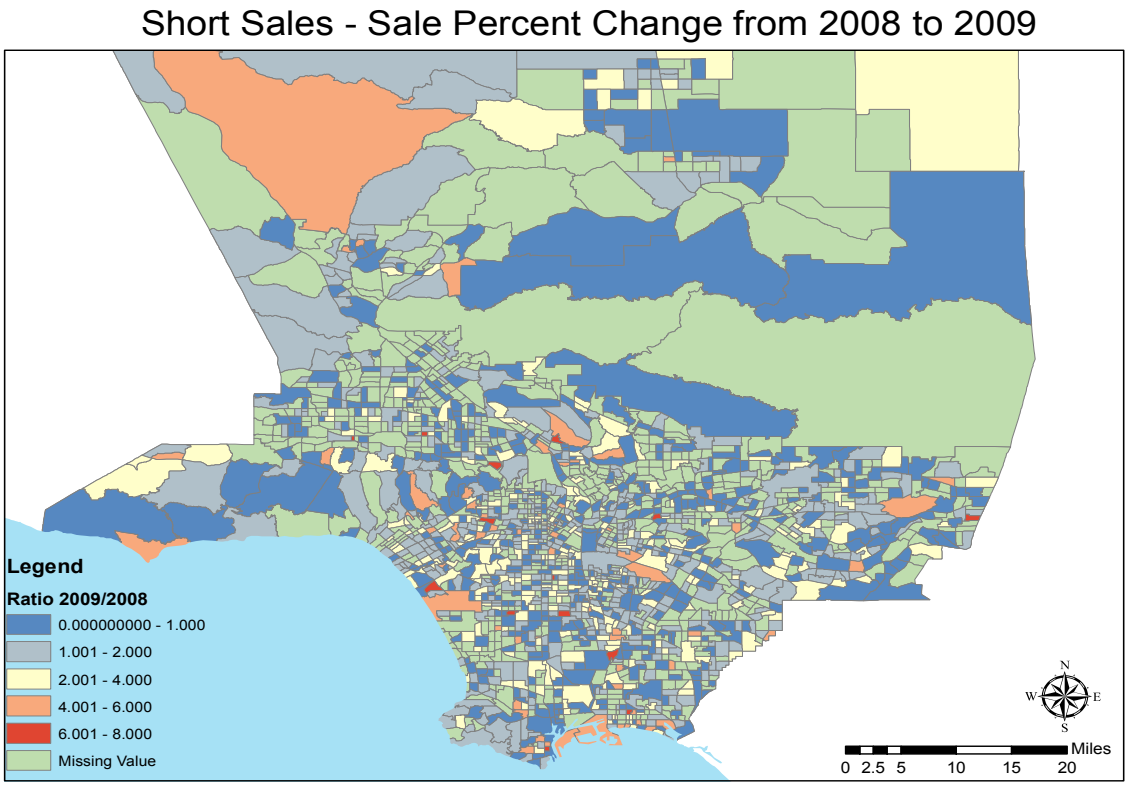
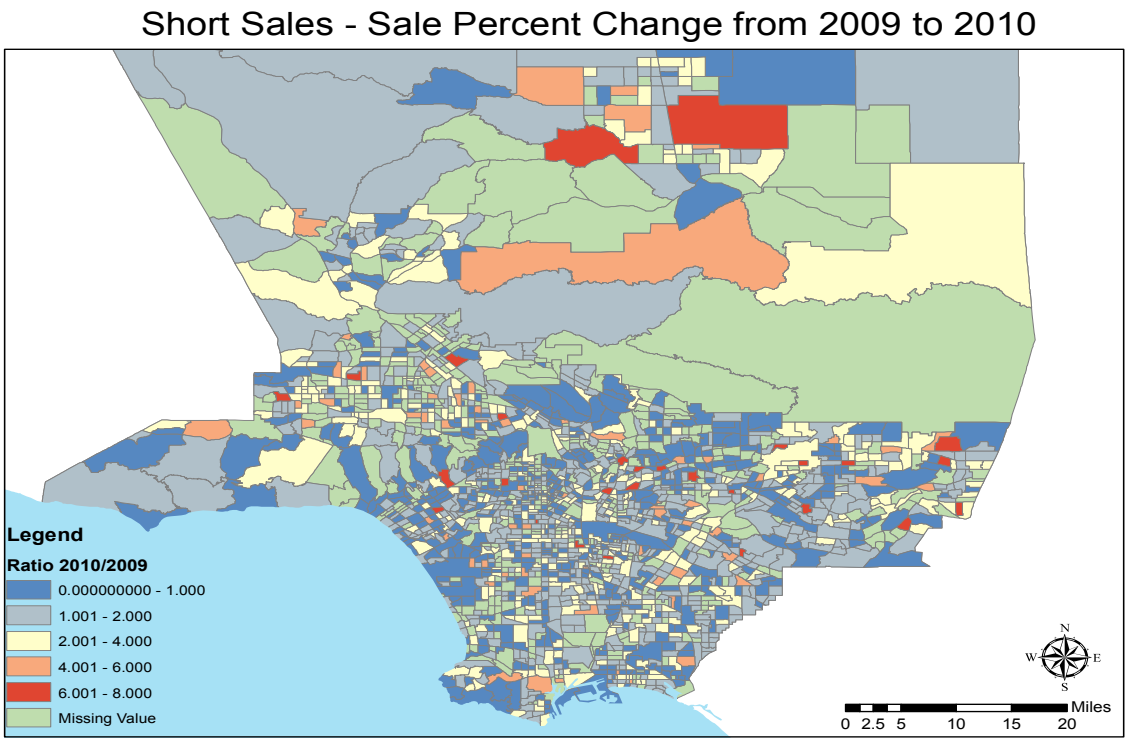


Figure 30 – Short Sale Heat Map – percentage change from 2009 to 2010



In order to determine if contagion of distressed sales is present, a time series approach must be taken to see if the clusters occurred organically, or emerged centered around the initial occurrence of the phenomena. Figures 28 through 30 depict the annual change in the percent of short sales for each census tract. Missing values occur when there are no observances of short sale for either or both of the years represented in the map. The dark blue areas represent tracts where there was a decrease in the percentage of sales from the previous year; all other colors indicate an increase in the percentage over the previous year. In total the percentage break down is fairly consistent throughout the three years, ranging between 30% and 38% of tracts decreasing from the previous year.

Figure 31 – REO Heat Map – percentage change from 2007 to 2008

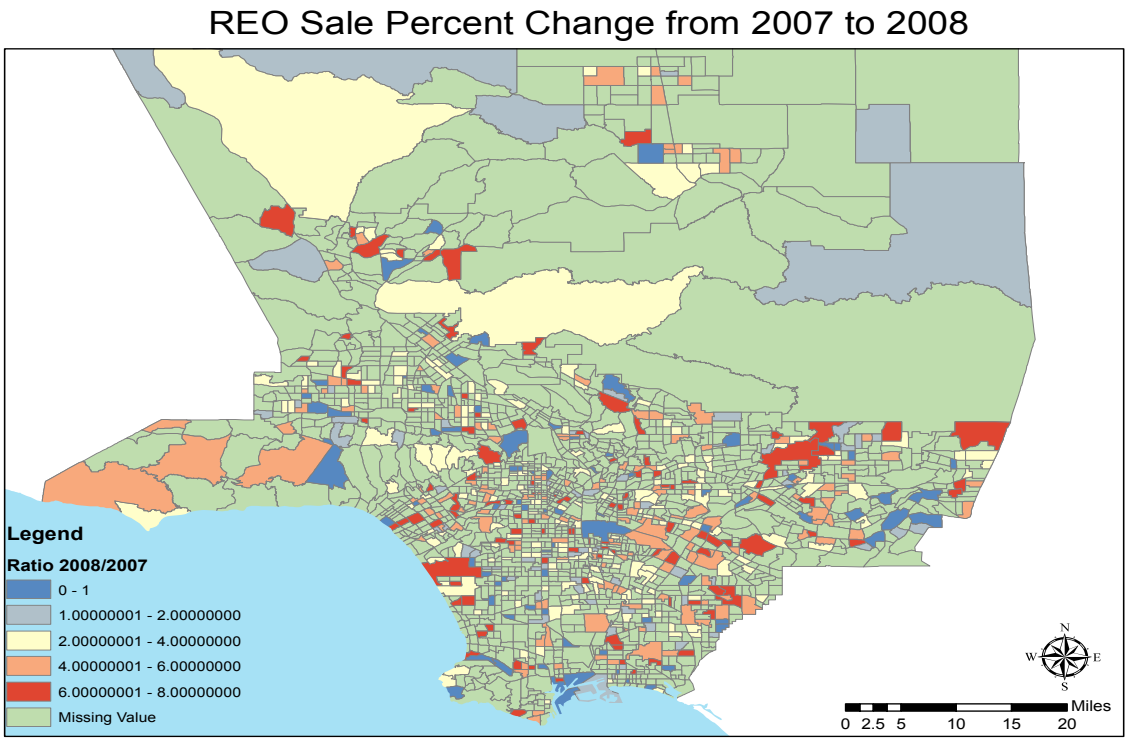


Figure 32 – REO Heat Map – percentage change from 2008 to 2009

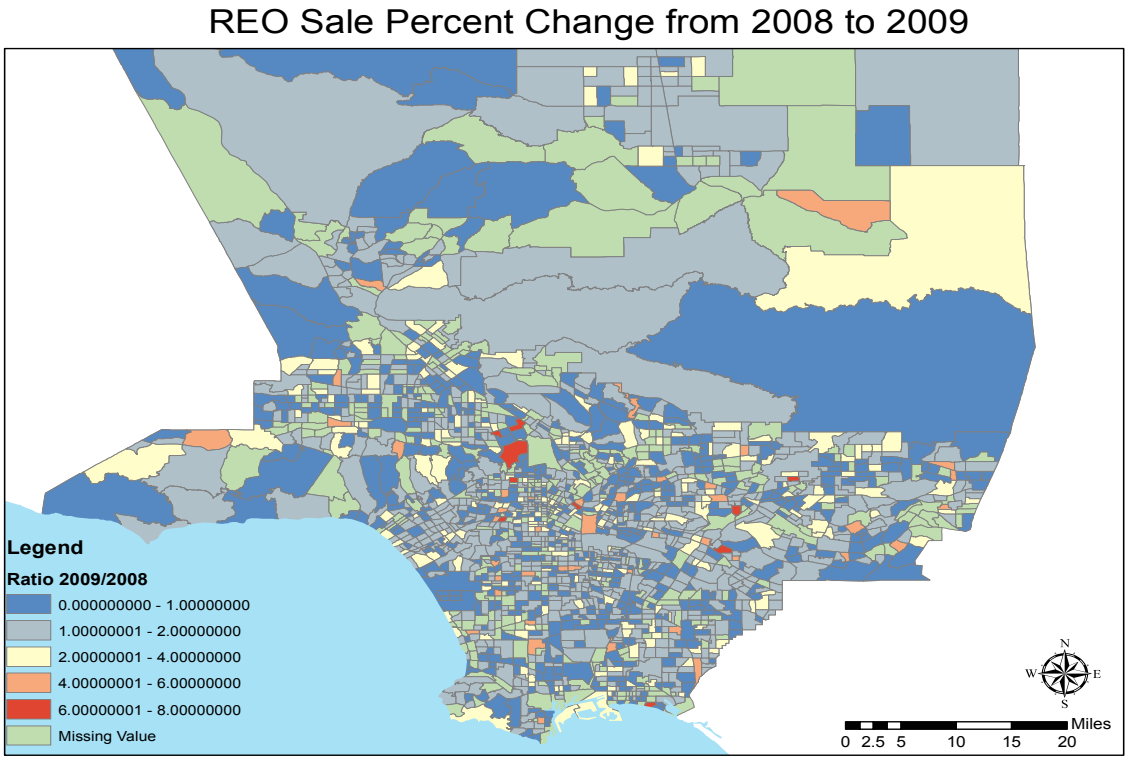
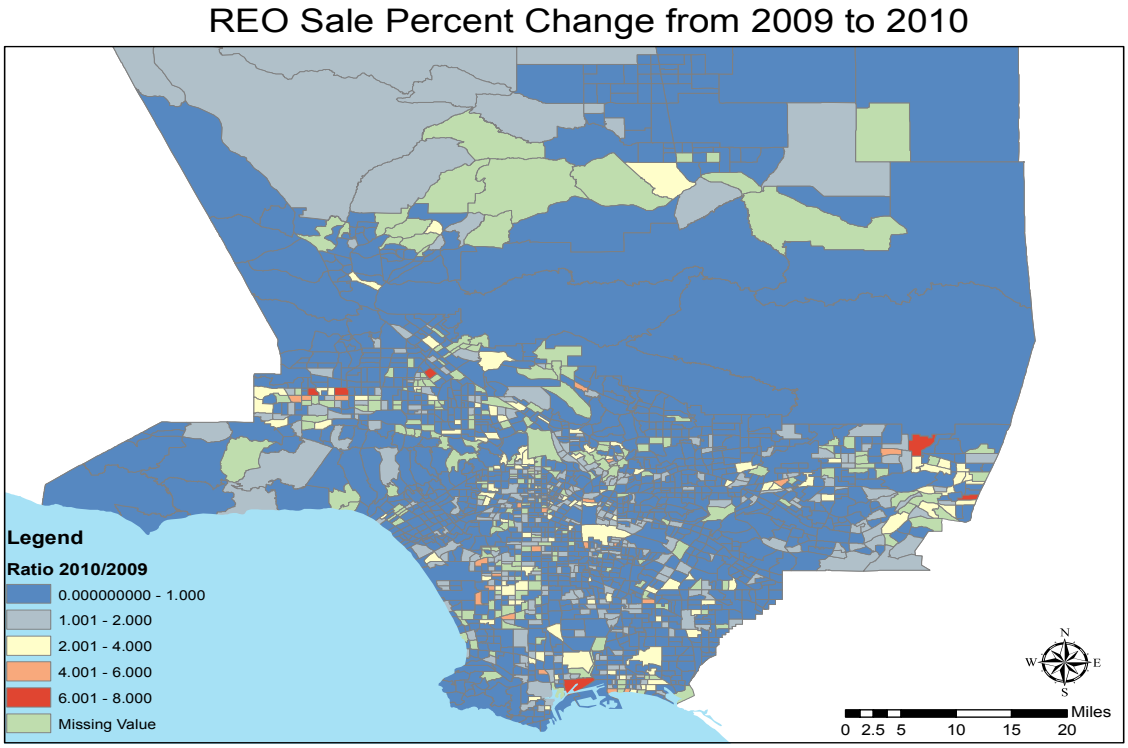


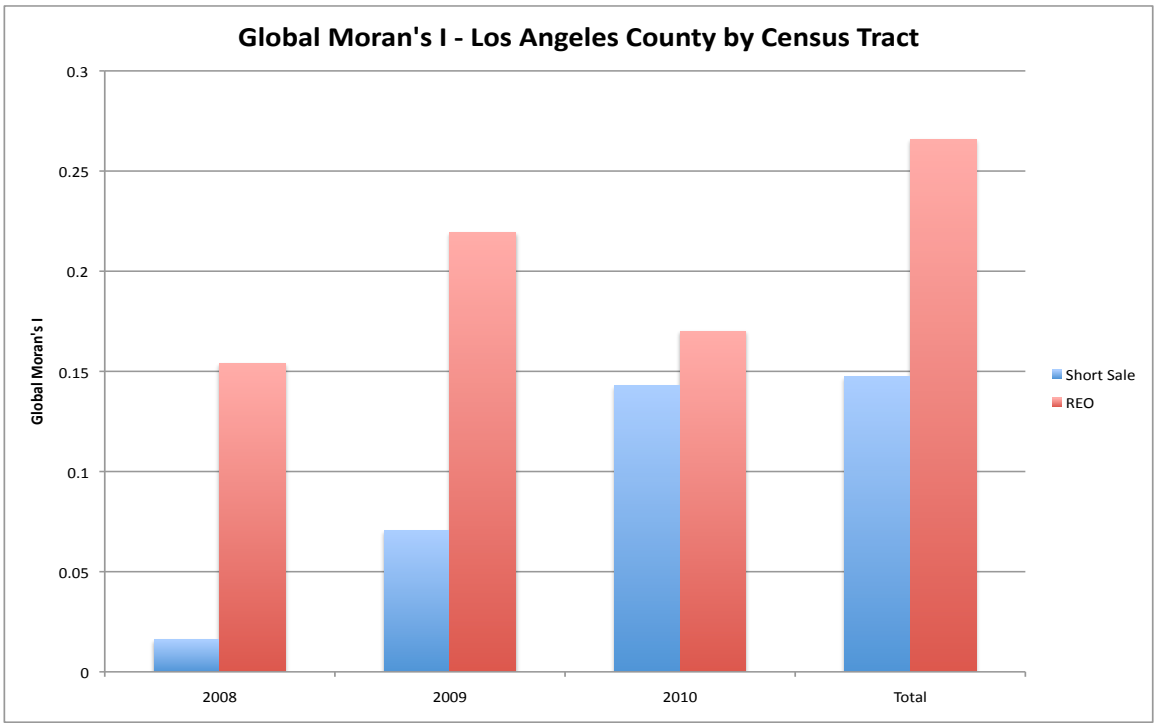
Figure 33 – REO Heat Map – percentage change from 2009 to 2010



A similar heat map approach was taken for REO for the years between 2008 and 2010, however, the results differ significantly (see figures 31-33). The percent of tracts that decreased from the previous year rose steadily throughout the sample; starting at 10% in 2008, growing to 36% in 2009, and ending at 75% in 2010. It is more difficult to visually identify hot and cold spots for REO as the general trend is more similar for the entire system. Figure 34 displays the Moran's I coefficients for the entire county using queen's first order contiguity, all the values were positive which indicate the observations are more clustered than would be randomly predicted. For short sales the Moran's I value increases for each successive year in the sample, while for REO, the peak value was in 2009. Taking a cross-sectional approach for the entire sample yields the higher Moran's I values than for the

individual years; the values for REO are higher for all categories than short sales, which indicates that clustering is more likely for foreclosures.

Figure 34 – Global Moran's I Los Angeles County Census Tracts 2008-2010



In order to determine statistically significant clusters, the Local Indicators of Spatial Association (LISA) developed by Anselin (1995, 2000) were used to look at how the previous year influenced the occurrence of short sales in the following year. LISA uses first order queen's contiguity, and reports findings that are statistically significant at the .01% level for the four categories of possible relationships. Figure 35 displays the three year time series from 2008 to 2010. As can be seen, clusters of High-High and Low-Low develop over time; this is consistent with the global Moran's I values which also increased for each year of the sample.

Figure 35 – Short Sale LISA Cluster Map Time Series for 2007-2010

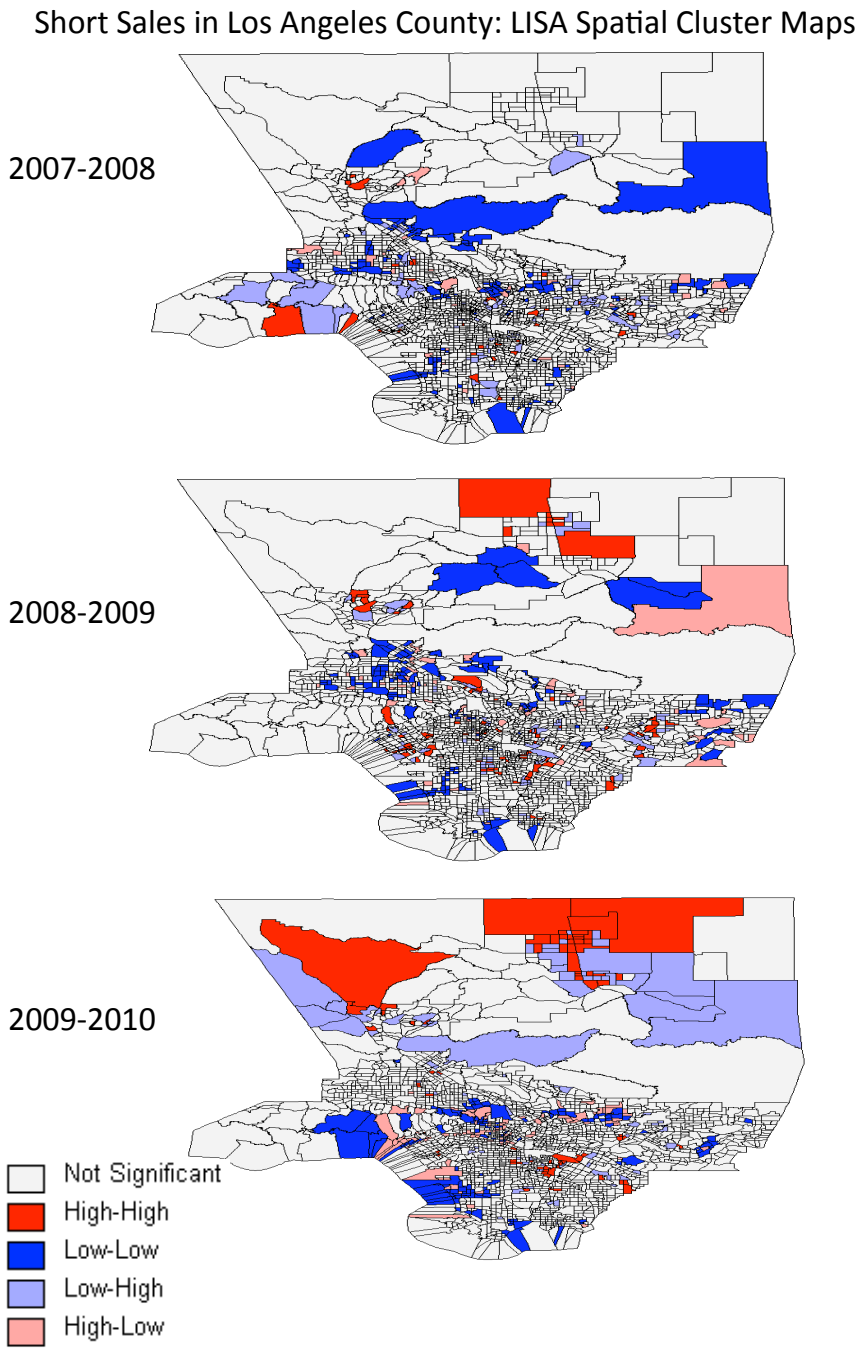


Figure 36 - LISA Cluster Map Time Series for 2007-2010

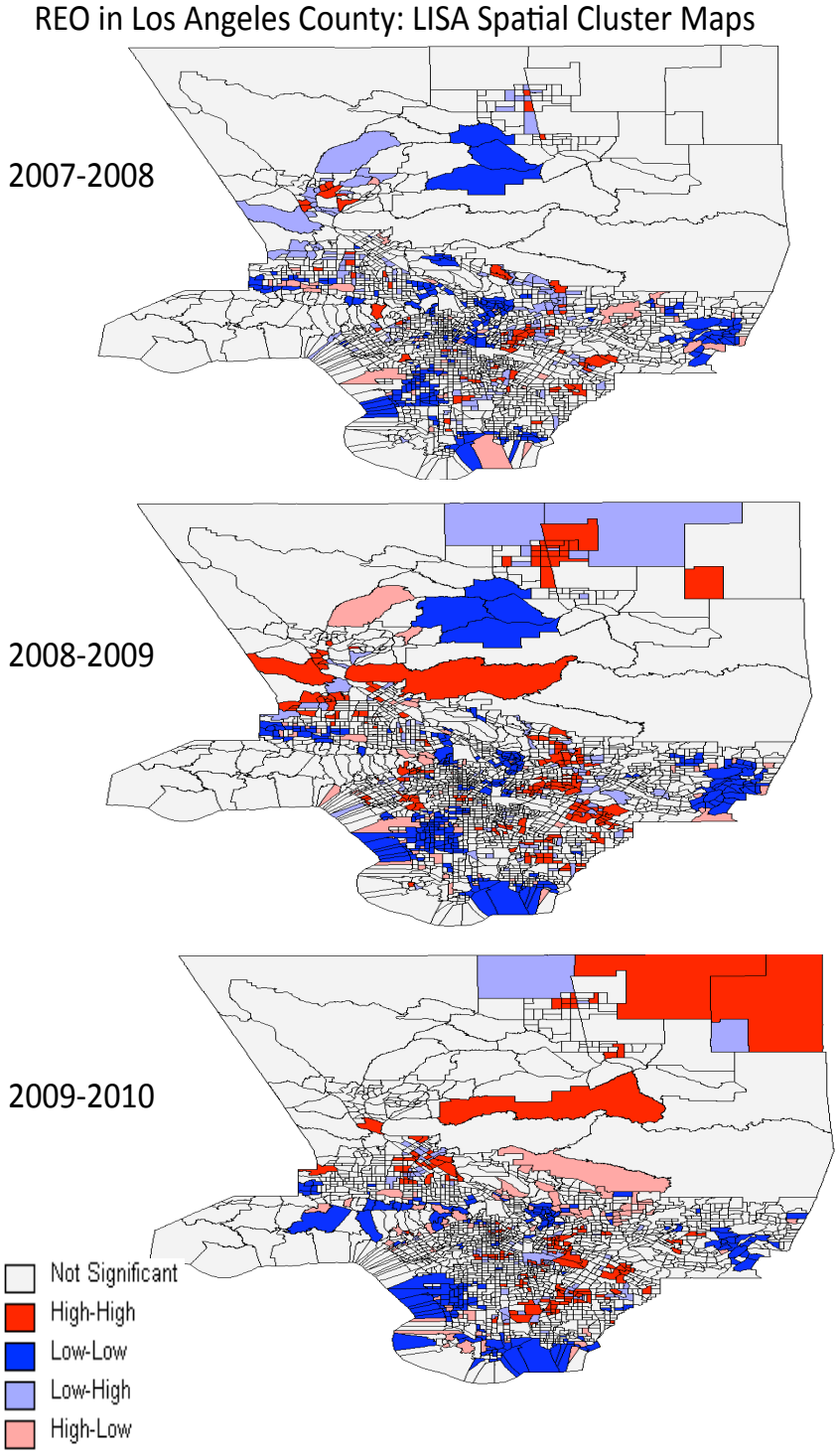
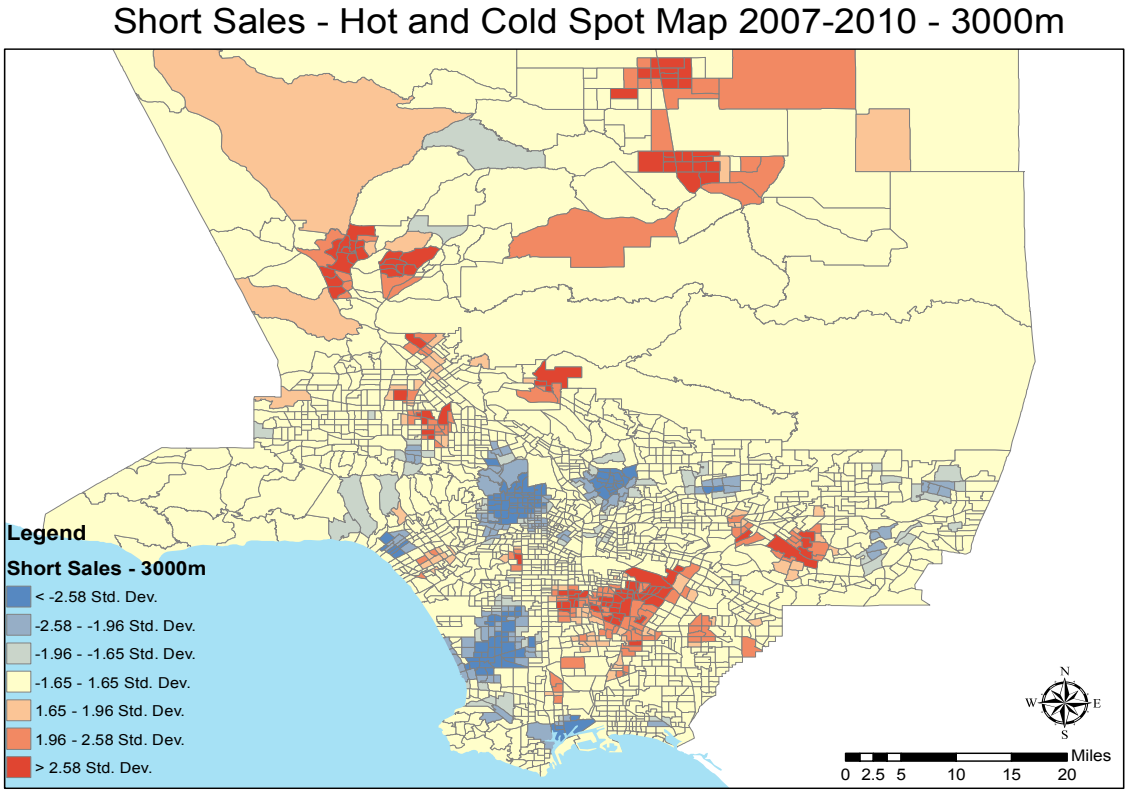


Figure 36 presents the same time series of LISA for REO for the years 2008 through 2010. Clusters of both High-High and Low-Low emerge in 2008, then continue to strengthen for 2009 and 2010. The global Moran's I value increases from 2008 to 2009, then decreases slightly in 2010. Despite the global decrease, the local systems of clusters remain statistically significant, this is indicative of social contagion occurring, as local neighborhoods remain significant while the global system becomes slightly less clustered.

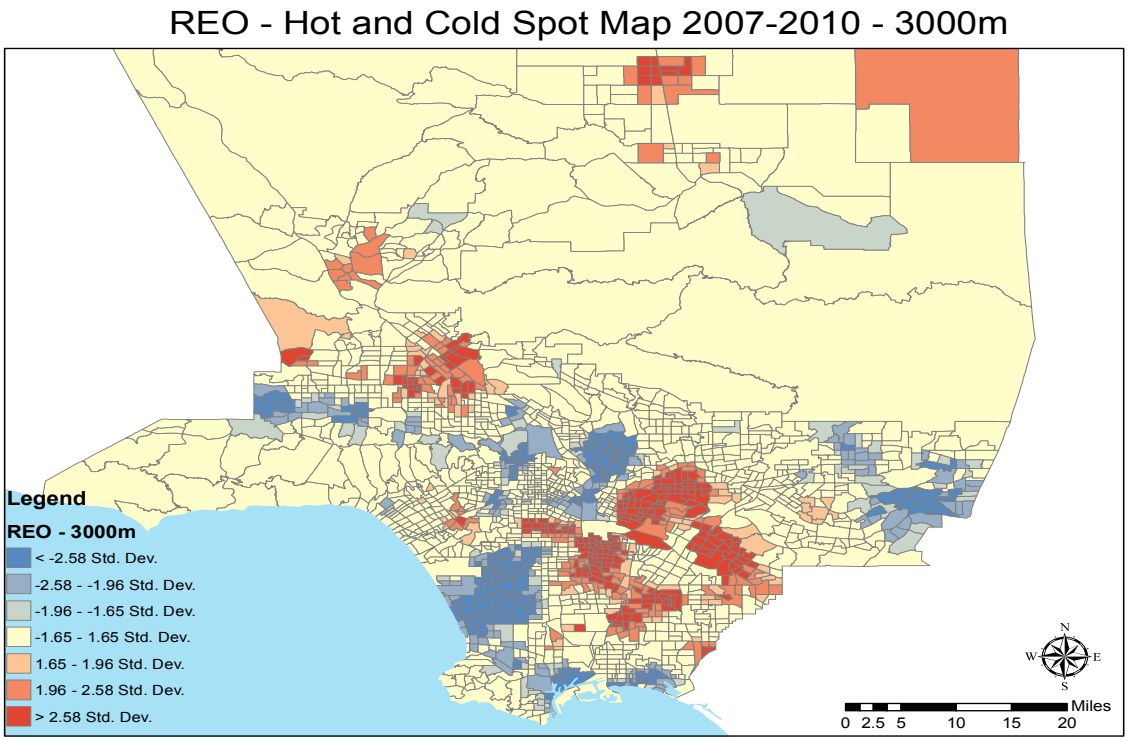
Figure 37- Short Sale Hot and Cold Spots – 2007-2010



The next section uses the Getis-Ord-Gi* statistic as an alternative approach to measuring local spatial contagion (Getis and Ord 1992). This methodology uses the fixed distance band rather than contiguity as the measure for spatial reference. The distance used was 3000m, which means that the central location of any census tract

within 3000m is considered to have some spatial association. A cross sectional approach was taken for both short sales (se figure 37) and REO (see figure 38), the results confirm the findings using the LISA methodology that clusters of hot and cold spots emerge for both short sales and REO.

Figure 38- REO Hot and Cold Spots – 2007-2010



The final test of spatial dependence was to determine the presence of spatial errors and lags. Using GeoDa, an OLS regression was run using both short sale and REO as the dependent variables to establish a baseline. The independent variables were the same as identified in chapter 2 as specified by the literature review. The purpose of the methodology is not necessarily to attempt to construct a model that identifies the determinants of short sales and REO, but rather to establish if any type

of spatial dependence is present. Based on the OLS model results, five tests for spatial dependence were run; Lagrange Multiplier (LM) to test for spatial error, LM for spatial lag, Robust LM for spatial error, Robust LM for spatial error, and an LM spatial auto-regressive moving average (SARMA).

Table 5 – Diagnostics for Spatial Dependence - Short Sales and REO

Spatial Dependence Test	Short Sale	REO
LM - Spatial Lag	*	*
Robust LM - Spatial Lag	*	*
LM - Spatial Error	*	*
Robust LM- Spatial Error		**
LM - SARMA	*	*
N	2054	2054
Adjusted R-Squared	0.2148	0.6253
Log likelihood	1827	2600

LM = Lagrange Multiplier
*** *p <0.10, **p <0.05, *p<.01*

The spatial dependence tests were all statistically significant at the .01% for short sales except for the Robust LM test for spatial error, which indicates that spatial lag is not statistically significant when the error term for the dependent variable is present. The diagnostics for spatial dependence were also observed to be statistically significant at the .01% level for REO, except for Robust LM for spatial error which was statistically significant at the .05% level. The individual spatial lag and error terms were both statistically significant, therefore neither phenomena can be discounted; separate models for each were run to determine which association is more likely to describe the relationship.

Table 6 – Spatial Regression Model Results for Short Sales and REO

	Error **Short Sale**	Lag **Short Sale**	Error **REO**	Lag **REO**
LAMDA	0.2*		.1955*	
	(.035)		(.0356)	
Weighted Dependent		.2013*		.145*
		(.032)		(.025)
Price Change	.1081*	.106*	-.412*	-.411*
	(.0196)	(.0195)	(.0286)	(.0285)
Income Shock	-.00000071*	-.00000067*	.0000012*	.0000012*
	(.0000003)	(.0000002)	(.00000034)	(.00000034)
Interactive (P & I)	-.00000061*	-.000006*	.0000028**	.0000031*
	(.000000023)	(.0000008)	(.000000034)	(.0000012)
Sales Price	-.000000005*	-.0000006*	-.0000001*	-.0000001*
	(.000000007)	(.000000007)	(.000000011)	(.00000011)
Education	-.0014*	-.0013*	-.0028*	-.0027*
	(.000029)	(.00028)	(.0004)	(.0004)
Credit Card Debt	0.000021	0.000018	-.00044*	-.00046*
	(.00011)	(.00011)	(.000016)	(.00016)
Net Worth	-.000000004	-.000000002	-.00000001	-.00000001
	(.000000018)	(.000000018)	(.00000002)	(.0000002)
Stability	-.0015*	-.0015*	-.0032*	-.0032*
	(.00023)	(.00023)	(.00034)	(.00033)
Owner Occupancy	.00088*	.00084*	.002*	.002*
	(.00014)	(.00014)	(.0002)	(.0002)
Age	-.0011*	-.0011*	-.0032*	-.0031*
	(.000041)	(.0004)	(.00059)	(.00059)
Asian	0.00019	0.00017	0.000076	0.000065
	(.00013)	(.00013)	(.00019)	(.00019)
Hispanic	-.000068	-.000084	.001*	.001*
	(.00011)	(.00011)	(.00016)	(.00015)
Black	-.00051*	-.00047*	.0015*	.0014*
	(.00013)	(.00012)	(.00018)	(.00018)
Constant	.2549*	.2255*	.321*	.2813*
	(.0168)	(.0317)	(.0245)	(.0251)
N	2054	2054	2054	2054
R-Squared	0.236	0.241	0.633	0.634
Log Likelihood	2616	2621	1842	1848

Standard errors in parentheses *** p <0.10, ** p <0.05, *p<0.01*

Results from the OLS models for short sales and REO were re-estimated using the maximum likelihood approach while controlling for spatial error, and then spatial lags (see table 6). For the spatial error model a LAMBA variable was added to represent the spatially correlated errors. In order to control for spatial lag, a weighted variable W_short_sale or W_REO was added to control for the influence neighboring tracts have on observations. The spatial lag models were found to be better fits as they increased the R-squared and log likelihood more than the spatial error controls. Both of the REO models had higher r-squared values than the short sale models, however the W_ coefficient for short sales had a larger magnitude. In both cases the additional lag variable was positive and statistically significant at the .01% level.

Conclusion

This chapter set out to identify any underlying spatial associations that may impact the contagion of short sales and REO. The goal was to identify phenomena not captured by demographic or economic variables that influence distressed homeowner decision-making through the imposing or reduction of social stigmas associated with default. Two methods of spatial reference were employed in the chapter—first order queen's connectivity and a 3000m fixed distance band. Although theoretical evidence exists to suggest that a fixed distance band is a more appropriate measure given the spatial configuration of Los Angeles County, the results were similar for both spatial references where they could be used to

measure similar variables. Therefore all of the findings in the chapter are given equal weighting regardless of the spatial reference used.

The first spatial analysis conducted was the use of heat maps to display the different distribution of sales outcomes. The number of tracts with a recorded short sale or REO increased for each year of the study. Both distressed sales outcomes had an increasing number of tracts that showed a negative year over year change, although REO had a larger percentage of tracts with a reduction in percentage of sales from the previous year. Short sales had a range of between 30% and 38% of tracts having a decreased sales percent from the previous year; the same measure for REO had a range of between 36% and 75%. Given the increase in mean percentage for distressed sales, this indicates a consolidation of observations into hot and cold spots.

Global Moran's I values were taken for the entire system for each of the years in the sample, as well as a pooled data set. The results showed that positive spatial association was statistically significant at the .01% level, which indicates observations are more clustered than would be randomly predicted. The degree of global system spatial association increased for each year in the sample for short sales, and was highest in 2009 for REO. The pooled data set had higher Global Moran's I values respectively than any individual year in the sample.

In order to identify individual neighborhood effects, the use of local indicators were used to measure spatial association. LISA and the Getis-Ord-Gi* measures both identified the emergence of hot and cold clusters for short sales and REO. There were more observed hot and cold spots for REO than for short sales,

although in some cases individual tracts were represented as a hot or cold spot for both distressed sales outcomes.

The final analysis conducted was to construct baseline OLS models, then test for the observance of either spatial errors or lags. The diagnostics indicated that both spatial error and lags could be present, although the robust test for spatial error was not statistically significant for short sales and significant at the .05% level for REO. These findings indicate that the spatial lag is not statistically significant when the error term for the dependent variable is added. In order to confirm which type of spatial association is most likely present, the OLS models were re-estimated using the maximum likelihood approach with specific controls for spatial error and lag. In both distressed sales outcomes, it was found that spatial lag was a better fit, therefore the more likely spatial association for the system.

The implications for all the spatial diagnostics that were employed are clear—there is positive spatial association for both short sales and REO. Put differently, clusters of high or low percentages of distressed sales form that are statistically different than would be randomly formed. These clusters are observed whether using a time series or pooled approach and either of the two spatial reference methodologies. These clusters are unobserved by other traditional statistical measures, and represent social stigma that impact the decision-making of borrowers who are in default on their mortgage. These stigmas can have either a positive or negative effect on the emergence of a particular behavior.

The policy implications that emerge from this analysis are that localized policies should be enacted targeting specific neighborhoods. If positive actions can

be taken to increase the social stigma associated with REO, and decrease the social stigma surrounding short sales, contagion can be controlled in an optimal manner. Studies that do not study neighborhood effects do not have the ability to capture spatial dependence. Units of analysis at the zip-code, city or MSA levels cannot capture or account for the spatial association, as such their findings will be biased.

Future studies can be improved by selecting census tract level data that can benefit from the use of spatial statistical analysis. Unfortunately, the incorporation of spatial association controls is not easily implemented for all types of research design. The majority of the literature on contagion of distressed sales focuses entirely on price contagion, specifically on REO price discount. This chapter contributes to the literature by adding short sales to the contagion framework, and also by looking at contagion as it impacts the decision-making, rather than simply the price effects. Price contagion effects are certainly an important measure to understand, and will be explored in the subsequent chapter; however understanding how the behavior is transmitted allows for policies targeting the undesired externalities. Identifying a price discount should be a secondary concern; if the undesired REO outcome can be reduced through effective policy, the impact of the price discount becomes less relevant.

Chapter 4 –

Distressed Sales Market Impact: Evaluating Price Contagion of REO vs. Short Sales

"An abandoned property resulting from foreclosure in a neighborhood acts as a catalyst by reducing the expected return on investment on surrounding properties. Homeowners and investors adjacent to abandoned or vacant properties are less likely to invest because of the anticipated spillover effects of these properties on the value of their property. This will start the familiar self fulfilling prophecy of less investment, leading to lower quality, lower demand, lower price, higher LTV, and finally foreclosure and abandonment." Can (1998)

Introduction

The main mechanism through which distressed sales have a negative impact on the economy is through a price reduction contagion. Results from the first chapter identified key variables that effect distressed borrower decision-making. The second chapter identified spatial associations that were not observed in the first chapter that also impact decision making through the contagion of social stigmas that can positively or negatively promote behavior. Understanding the effect REOs compared to short sales have on neighborhood property values provides the final piece to understanding the impact distressed sales have on the economy. If the price discount is found to be the same for short sales compared to REO, the implications for promoting short sales as a preferred outcome become less clear. By contrast, if as predicted, short sales have less of an impact on neighborhood prices—the findings from the first two chapters become relevant for generating policies aimed at the reduction of foreclosures while promoting short sales as the preferred outcome.

The remainder of the chapter begins with a review of the extant literature on distressed sales price contagion. The main contribution of this chapter is adding short sales to the analysis of the price contagion models. The next section outlines the methodology employed to model the impact of distressed sales on neighborhood pricing. Results of the model are presented and then summarized to conclude the chapter.

Literature Review

The most used methodology to capture price contagion for foreclosures is the hedonic price model, where the dependent variable is the sales price and the independent variables are comprised of individual property attributes and neighborhood quality measures. An oft-cited paper by Immergluck and Smith (2005) outlines the basic methodology of the hedonic price model for a sample of 9,600 single-family properties in Chicago from 1997 to 1998. In their study they include concentric circles of one–eighth and a quarter mile around each foreclosure as explanatory variables, along with census tract level control variables. For every foreclosure within one-eighth of a mile, there was a negative price effect of .09%, the relationship was also negative for a quarter mile, however, the results were not statistically significant.

Recent studies have added to the hedonic price model methodology, Leonard and Murdoch (2009) study the effect foreclosures have on neighborhood quality. A foreclosure can be seen as a "nonpecuniary externality," as it reduces the quality of the neighborhood, which can be seen as a local public good. In their model, they create rings of 250, 500, 1000, and 1500 feet around each foreclosure to

measure the spatial reach of the contagion. The list of control variables they used to measure neighborhood effects were: minority populations, population over 65, owner occupancy rate and school district. Overall, they found the effect of a foreclosure within 250 feet to be .5%, this dropped to be almost negligible at over 1000 ft. One difference in their methodology was the use of any stage of the foreclosure process as a signal of decreased neighborhood quality—this is different than only looking at the auction date or the sale of the REO by the bank as the observed data point.

Harding, Rosenblatt, and Yao (2009) contribute to the literature by looking at repeat sales transactions—this research design allows them to better control for the overall changes in market prices and to measure more accurately the impact of foreclosures. By looking at all 3 stages of foreclosure—pre-foreclosure, auction, and REO sale—this study was able to identify the varying degrees of contagion during the foreclosure process. They found contagion effects present up to one year before the REO sale, but found the largest effect on price to be at the REO sale date. A single foreclosure has an impact of 1% decline in value for homes within 300 feet. On average, they found that the REO sale occurred 10 months after the lender took possession of the property.

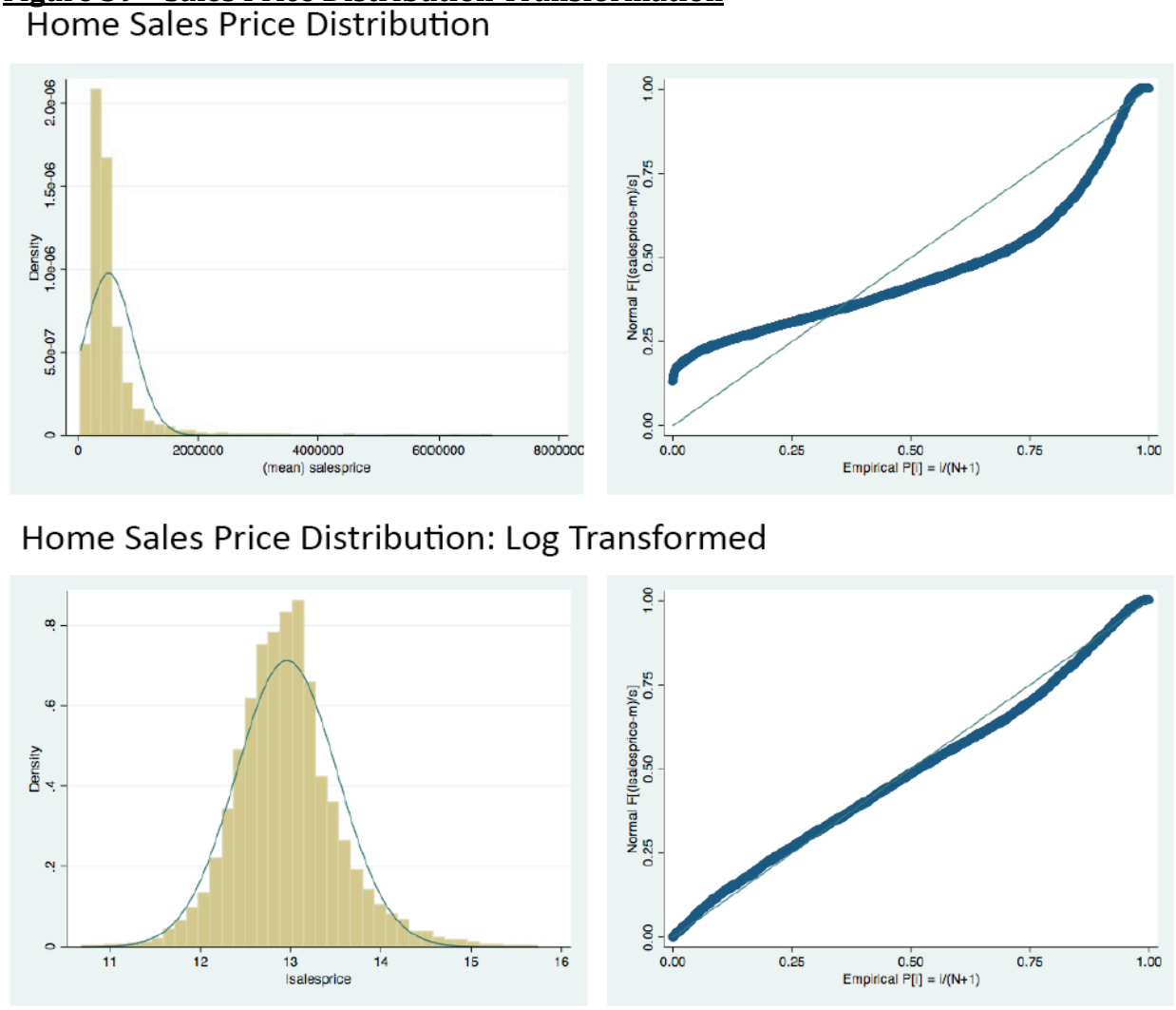
Another example of research design to capture foreclosure price contagion was used by Rauterkus et al (2009) in their study of the Chicago market from 2003 to 2008. They used zip code as the unit of analysis and theorized that neighborhoods with low foreclosure rates (as a percentage of total sales) would have a greater price gap. This so called "REO discount" would have the opposite

effect in areas with high rate of REO sales, where the authors argue that the entire market will become contaminated and thus less sensitive to a price gap for REO sales. An additional hypothesis advanced was that a tipping point would occur where there would be a reversal of the REO discount once a saturation level was reached. Their results confirmed the hypothesis of a large REO discount for areas with low foreclosures rates, and vice verse for areas with high rates. The findings did not confirm the theory on the emergence of a tipping point where the rate of change for the REO discount would reverse directions.

Theory and Methodology

The methodology used for this chapter will be a hedonic price model, where the sales price is the dependent variable and a variety of property specific variables are used as the independent variables. Sales price is not normally distributed, the data reflects a better fit in log form, therefore the sales price was log transformed and then used as the dependant variable (see figure 39). All of the data was aggregated by year at the census tract unit of analysis; the data will be modeled in panel form for the years 2007, 2008, 2009 and 2010 for the 2054 census tracts in Los Angeles County. Although price contamination effects are likely present for the various stages leading up to the creation of an REO, Harding, Rosenblatt, and Yao (2009) found the largest effect to be present at the date of REO sale. As such, in order to capture the largest effect, lagged variables measuring REO were not used.

Figure 39 – Sales Price Distribution Transformation



The descriptive statistics for the number of distressed sales are displayed in table 6 for the years 2007 through 2010. Rather than using the percent of distressed sales to capture the price contagion, the number of short sales and REO sales were used. The theoretical reason for doing so is due to the distribution of the sample of sales; when there are low occurrences of distressed sales, the percentages can be skewed and lead to severely misspecified model results. For example, in 2007 the mean value for REO sales was .71, the effect of 1 REO in a tract with 10 total sales compared to a tract with 100 sales would yield vastly different

implications if the percentage of sales were used. The problem with using sale counts as opposed to sales percentage is that when the number of sales is high, the opposite problem of bias would occur as with small samples.

For the four years in the sample there were 7970 out of a possible 8216 tracts that had at least one sale during the observed year, the 245 omitted variables were for tracts that had no sales. Tracts that had 10 or less short sales accounted for 93.5% of the sample, and tracts with 20 or less accounted for 99.25%. There were only 60 tracts that had more than 20 short sales in a given year. For REO, 79% of the census tracts had 10 or less sales, while 93.25% had 20 or less. There were 537 tracts that had more than 20 REO in a given year. Given the low number of tracts that had high counts for short sales or REO, the methodology of using the number of sales compared to percentage is the preferred measure.

Table 6 – Descriptive Statistics for Sales Type (count) 2007-2010

Variable	N	Mean	Std. Dev	Min	Max
Short Sales -2007	1972	0.58	1.07	0	11
REO - 2007	1972	0.72	1.11	0	9
Short Sales -2008	1969	2.45	3.26	0	34
REO - 2008	1969	7.17	8.25	0	89
Short Sales - 2009	1985	4.39	5.05	0	68
REO - 2009	1985	11.16	11.58	0	83
Short Sales - 2010	2044	5.79	4.64	0	38
REO - 2010	2044	6.98	5.26	0	37

Table 7 contains the descriptive statistics for the three possible sales outcomes for a variety of sales price variables. For both sales price and price per square foot variables, it is clear that there is a large difference for both short sales

and REO. The difference in mean values for short sales compared to organic sales is 26% for sales price and 19% on a price per square foot basis. The difference is of a larger magnitude for REO compared to organic sales, with mean sales prices being 33% lower and price per square foot 24% less. These values do not necessarily represent the price discount or stigma associated with distressed sales, but rather a lower quality of product for distressed sales compared to organic sales.

Table 7 – Descriptive Statistics for Sales Price -2007-2010

Variable	N	Mean	Std. Dev	Min	Max
Organic Sales (%)	7970	0.67	0.27	0	1
Short Sales (%)	7970	0.11	0.11	0	1
REO (%)	7970	0.23	0.22	0	1
All Price per Sq. Ft.	7970	316	135	37	1635
Organic Price per Sq. Ft.	7848	331	135	53	2019
Short Sale Price per Sq. Ft.	5570	267	105	38.5	1970
REO Price per Sq. Ft.	6302	251	99	31	1485
All - Sales Price	7970	507611	410134	43800	6883914
Organic - Sales Price	7848	540928	426857	50000	6883914
Short Sale - Sales Price	5570	399175	247897	32000	6500000
REO - Sales Price	6302	362244	248307	44000	9700000
All - List Price	7970	548593	467401	54425	7847846
Organic - List Price	7848	585652	490264	50000	7847846
Short Sale - List Price	5570	447337	293893	32144	6995000
REO - List Price	6302	381014	248074	55000	7500000
Organic - List Price Discount	7848	0.06	0.06	-1.02	0.54
Short Sale - List Price Discount	5570	0.08	11	-0.69	0.62
REO - List Price Discount	6302	0.04	0.08	-0.88	0.58

On average the price reduction from list price to sale price was greatest for short sales and smallest for REO. This is likely due to the vastly different objectives and incentives of the seller. REOs are bank owned, therefore the goal is to sell the

property as quickly as possible to recapture the capital and put it back to productive use; as such, the properties are priced competitively to sell as quickly as possible. Short sales often start priced at a level of where the seller can cover the amount owed on their mortgage. Once the market determines that this price is not achievable, the price is lowered, often times substantially. The goal of the owner shifts to simply obtaining an offer to submit to the bank for short sale approval. Owners of properties listed for short sale have no incentive to achieve a higher price for the property since they will receive no proceeds from escrow. Lenders are incentivized to take lower than market prices, as the alternative is to foreclose at a substantial cost, then have to disposition the property as an REO that often incurs additional repair costs.

The results in table 7 demonstrated a large gap in pricing between distressed and organic sales, the descriptive statistics in table 8 indicate this is largely due to a noticeable difference in quality of the various categories of sale. The first category is not a measure of quality, but simply how many days on average a property is on the market. As predicted by the theory, short sales take the longest to close, and REO the shortest. Due to the nature of the negotiation with the lenders, short sales take the longest to close, conversely, REO are priced with the intention of selling quickly. The data demonstrates that this is case, with REO taking on average almost a third less days on the market to sell compared to short sales. The other measures of quality (square footage, bathrooms, bedrooms, and lot size) are all consistently ordered; organic sales are observed with the highest measure of quality, short sale the middle, and REO the lowest. When looking at the year built, the results do not

conclusively show any difference between the three categories of sale, the difference in means is less than three years between the categories.

Table 8 – Descriptive Statistics for Property Detail Variables 2007-2010

Variable	N	Mean	Std. Dev	Min	Max
All - Days on the Market	7970	77	28	0	512
Organic - DOM	7848	77	35	0	522
Short Sale - DOM	5570	123	65	0	551
REO - DOM	6302	*52*	37	0	1140
All - Square Feet	7970	1562	524	377	6889
Organic - Square Feet	7848	1593	554	377	6889
Short Sale - Square Feet	5570	1516	564	377	8571
REO - Square Feet	6302	1462	534	377	8484
All - Bathrooms	7970	2.08	0.58	0	7
Organic - Bathrooms	7848	2.11	0.61	0	7
Short Sale - Bathrooms	5570	2.1	0.82	0	33
REO - Bathrooms	6302	2.01	0.65	0	8
All - Bedrooms	7970	2.93	0.56	0	10
Organic - Bedrooms	7848	2.96	0.6	0	10
Short Sale - Bedrooms	5570	2.95	0.73	0	8
REO - Bedrooms	6302	2.85	0.67	0	6
All - Lot Size	7970	42329	976230	0	4800000
Organic - Lot Size	7848	59249	1598790	0	8920000
Short Sale - Lot Size	5570	35534	1776642	0	132000000
REO - Lot Size	6302	21290	852613	0	65000000
All - Year Built	7968	1958	19	1889	2009
Organic -Year Built	7846	1958	19	1889	2010
Short Sale - Year Built	5559	1960	20	1880	2009
REO - Year Built	6300	1957	20	1890	2008

The advantage to the use of panel data is the ability to control for unobserved heterogeneity of the various census tracts. The model is controlled for fixed effects at the tract level, and the standard errors are clustered at the tract level. The equation used in the study is represented by equation (1):

$$y_{it} = x_{it}b + a_i + u_{it} \quad (1)$$

y_{it} = log sale price of census tract$_i$ at time$_t$

x_{it} = time varying characteristics at time$_t$

a_i = unobserved census tract effects

u_{it}= error term

The variables used to capture the time varying characteristics are found in Table 9 of the following section.

Findings and Analysis

Results from the model based on equation (1) are presented in table 9, the coefficients represent a percentage change rather than a unit change due to the log transformation of the independent variable. A hausman test was conducted to determine if random effects or fixed effects were present; the results rejected the null hypothesis of random effects, therefore fixed effects were used to capture the unobserved effects. For every REO within a census tract, there is an expected price discount of 1.7%. The REO discount is almost three times larger than the .468% discount associated with each short sale. In general, the property-specific details had more of an impact on sales price than did neighborhood quality controls.

The main driver of sales price is the square footage of a property; every additional square foot leads to a .05% increase in price. As would be expected, additional bathrooms have a positive impact on pricing, adding 6.5% to the sales price for each unit. An interesting finding was that bedrooms do not add additional value; holding square footage constant, adding an additional bedroom reduces the

sales price by 6.2 percent. Intuitively this makes sense, as buyers value the size of the rooms more than the number of rooms. The vast majority of Los Angeles County is urban; therefore lot sizes are generally small and similar across a broad range of prices. Lot size did have a positive impact on sales price ceteris paribus, however, it was not statistically significant. Similarly, the year built for the sales in a census tract was not statistically significant, it also did not have any substantial effect on the sales price in the census tract.

Table 9 –Hedonic Price Mode Results –Los Angels County Sales 2007-10

	Log Sales Price
Sq. Ft. Total	.000595*
	(.000035)
Short Sale (#)	-0.0047*
	(.0011)
REO (#)	0.0171*
	(.00059)
Bathrooms	0.0658*
	(.0209)
Bedrooms	-0.0623*
	(.0194)
Lot Size	0.000000003
	(.000000002)
Year Built	-0.00056
	(.0005)
Rent	-0.00128*
	(.00015)
College	-0.0289*
	(.0097)
Income	-0.000005**
	(.0000002)
Owner Occupancy	0.0028
	(.0032)
Constant	15.23*
	(1.01)
N observations	7968
R-Squared	0.56

Standard errors in parentheses

**** p <0.10, ** p <0.05, *p<0.01*

Conclusion

The objective of this chapter was to identify the price discount associated with both short sales and REO. Price discount is the impact that individual distressed sales have on the sales prices of other properties; in this case the unit of analysis was the census tract. The first finding that emerged from the data was the clear difference in quality that separated the three possible sales outcomes. Organic sales had the highest sales price, but this was due to the higher quality associated than category of sale. They had the largest square footage, the most bedrooms and bathrooms and the largest lot size. Short sales were the second highest in the preceding variables listed, while REO had the lowest in all of the categories.

The second finding was the short sales on average had the most days on the market prior to closing the sale, and also the largest price decrease from the listing price. REO had the lowest price drop and also fewest days on the market. These findings are intuitive given the incentive structure for the sellers of each type of property. Individual property level time varying characteristics had a greater impact than the neighborhood quality measures.

The important finding of the chapter was that short sales had almost three times less of a price discount compared to REO. Each additional short sale has an average a .47% reduction on sales in the same census tract, for REO the impact is 1.7%. Both of these coefficients were statistically significant at the .01% level while controlling for fixed effects in the panel regression.

Chapter 5 –

Conclusion

This dissertation focuses on mortgage defaults in Southern California during the housing bubble of the 2000s. The rapid decline in the housing market that precipitated the current recession has been accompanied by an unprecedented number of loan defaults and foreclosures. Recent studies have identified two major theories of default—the "double trigger" hypothesis, where negative equity and an income shock are necessary conditions for default—and "strategic default" where negative equity is a sufficient condition for default. The literature on default focuses exclusively on foreclosure and the outcome of mortgage default—it therefore follows that all the implications and policy advice is solely focused on foreclosure.

The area of focus for this study was Los Angeles County, where every closed sale from 2007 to 2010 was coded into three possible sales outcomes: 1) Organic 2) Short Sale 3) Real Estate Owned (REO). In doing so, another possible outcome for default—short sale—was added to the analysis. Short sales represent 14% of all sales in the sample, compared to 28% for REOs; omitting short sales as another outcome eliminates a significant portion of all distressed sales from the analysis of mortgage default. Chapter 2 created a multinomial probit model to understand the important variables for borrowers who default on their mortgage; the dependent variable is sales outcome, based on the three categories outlined above.

The findings from the multinomial probit models validate the strategic default hypothesis, while also refuting the double trigger hypothesis. In the baseline

model, employment was shown to have a minimal impact on the predicted probabilities and a different directional relationship for short sales and REO. Income in both the baseline and interactive models had minimal impact on the probability of short sale and a small impact on REOs. The fully specified model further confirmed the findings from the baseline models; by looking at the impact of income shocks at various price change levels, holding all other variables constant, the impact was minimal at all but extremely high-income levels. Changes in price levels affected changes in the predicted probability at all levels, therefore confirming the strategic default hypothesis that negative equity is a sufficient condition for default.

In addition to looking at income shocks and price level changes, the fully specified model also included other important variables identified in the literature. The first of these "policy" variables was education level; it was found that in neighborhoods with at least 65% of the population with a college degree, short sale is more likely than foreclosure. The results were not consistent with the theory in the literature, as the predicted relationship was negative to default. Education had a different directional relationship to the sales outcomes, with a positive relationship to short sales and a negative relationship to foreclosure. Holding all other variables at their mean, the percentage of organic sales remained constant for the entire range of education values. This indicates a direct substitution in the borrower's decision-making between short sale and foreclosure, which is an important finding for policy making.

Sale price of the individual property was found to be the variable affecting the greatest first difference change for both short sales and REO. The findings are consistent with the findings in the literature and with the theory presented earlier. Real Estate agents are incentivized to list high priced properties, their incentives are further increased due to the additional time and work attributed to short sales.

Chapter 3 focused on identifying any spatial association present for short sales and REO, these effects are unobserved by traditional statistical measures, so add to the literature on mortgage default. Contagion of distressed sales can emerge via social constraints that effect borrower behavior. These social stigmas can either promote or discourage either type out distressed sale outcome. Two methods of spatial reference were employed in the chapter—first order queen's connectivity and a 3000m fixed distance band. Although theoretical evidence exists to suggest that a fixed distance band is a more appropriate measure given the spatial configuration of Los Angeles County, the results were similar for both spatial references when they could be used to measure similar variables.

Global Moran's I values were taken for the entire system for each of the years in the sample, as well as a pooled data set. The results showed that positive spatial association was statistically significant at the .01% level, which indicates observations are more clustered than would be randomly predicted. The degree of global system spatial association increased for each year in the sample for short sales, and was highest in 2009 for REO. The pooled data set had higher Global Moran's I values respectively than any individual year in the sample. The

strengthening of the spatial association indicates that contagion is occurring for both distressed sales outcomes.

The final research chapter concludes with a study of the price discount associated with distressed sales. The literature previously only investigated the impact of REO, by adding short sales to the analysis, a determination of their relative impacts can be made. Results from the hedonic price model showed that short sales had almost three times less of a price discount compared to REO. Each additional short sale has an average a .47% reduction on sales in the same census tract, for REO the impact is 1.7%. This is a crucial finding that ties together the other two empirical chapters. It can be demonstrated that short sales have less of a detrimental impact on neighborhood pricing. The results of chapter 2 and 3 focus on differentiating consumer decision-making regarding distressed sales and also identify the underlying spatial associations; which are important findings given the lessened price reduction associated with short sales.

Understanding the neighborhood variables that promote short sales or reduce the likelihood of foreclosure allow for the creation of policy to encourage the preferred outcome of short sales. The spatial associations identified allow for localized targeted policy-making to help encourage social stigmas that will reduce foreclosure and/or promote short sales.

An example of the economic impact that promoting short sales compared to foreclosure becomes clear when a comparison of the mean values is forecast for a reduction in foreclosures. The mean number of REO sales for each census tract in Los Angeles County for 2009 was 11. There were a total of 65,003 sales in 2009,

which represents a mean of 32 per tract, with a mean sales price of $462,295. If 25% of the REOs could be converted to short sales, it would increase the sales price by 3.4% (1.23% * 11 foreclosures * 25%) for each of the properties sold in the each census tract. This would generate an additional $502,976 in equity gains for every census tract for the year 2009 alone.

Future studies where individual mortgage data is paired with sales data would be better able measure individual consumer decision-making, rather than attempting to use neighborhood level proxies. In addition, the methodology used in this study could be expanded to other areas of the country to determine if the effects can be generalized to all areas. The emergence of spatial vector autoregressive models will make for an ideal methodology combining the various methodologies used in the three chapters into a more complete parsimonious model.

References

Akerlof, George and Shiller, Robert (2009) "Animal Spirits" Princeton University Press

Anselin, Luc (1995) "Local Indicators of Spatial Association—Lisa" *Geographical Analysis*, Vol. 27, Issue 2. pp. 93-115

Anselin, Luc (1998). "GIS Research Infrastructure for Spatial Analysis of Real Estate Markets." *Journal of Housing Research*. Vol. 9, Issue 1. pp. 113-133

Anselin, Luc, Syabri, Ibnu, and Kho, Youngihn (2000) "GeoDa: An Introduction to Spatial Data Analysis." *Geographical Analysis*, Vol. 38, Issue 1. pp. 5-22

Anselin, Luc (2005) "Exploring Spatial Data with GeoDa: A Workbook" http://www.csiss.org

Bajari, Patrick, Chenghuan, Sean Chu, and Park, Mingjung (2008). "An Empirical model of Subprime Mortgage Default from 2000 to 2007". National Bureau of Economic Research, Working Paper #14625. http://www.nber.org/papers/w14625

Barron's (2005) "The Bubbles New Home" June 20, 2005 http://online.barrons.com/article/SB111905372884363176.html?mod=article-outset-box

Bikhchandani, Sushil , Hirshleifer, David and Welch, Ivo (1992) "A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades." *Journal of Political Economy*, Vol. 100, No. 5, pp. 992-1026.

Bhutta, Neil, Dokko, Jane, and Shan, Hui (2010) "The Depth of Negative Equity and Mortgage Default Decisions" Federal Reserve Board, Washington, D.C. Finance and Economics Discussion Series

Can, Ayse (1998) "GIS and Spatial Analysis of Housing and Mortgage Markets" *Journal of Housing Research*, Vol. 9 Issue 1 pp.61-86

Corelogic (2011) "Corelogic 3Q Negative Equity Report" http://www.corelogic.com/about-us/news/asset_upload_file955_13539.pdf

Cowan, Adrian, and Cowan, Charles (2004) "Default correlation: An empirical investigation of a subprime lender" *Journal of Banking and Finance* No. 28 (2004) pp. 753-771.

Cunninghman, Donald and Hendershott, Patric. (1984) "Pricing FHA Mortgage Default Insurance" National Bureau of Economic Research. Working Paper No. 1382

Fannie Mae "National Housing Survey" Q3, 2011 http://www.fanniemae.com/portal/research-and-analysis/housing-quarterly.html

Federal Reserve (2012) "The U.S. Housing Market: Current Conditions and Policy Considerations" http://federalreserve.gov/publications/other-reports/files/housing-white-paper-20120104.pdf

Foote, Christopher, Gerardi, Kristopher, and Willen, Paul. (2008) "Negative Equity and Foreclosure: Theory and Evidence" Federal Reserve Bank of Boston. http://www.bos.frb.org/economic/ppdp/2008/ppdp0803.htm.

Foster, Chester, and Van Order, Robert (1984) "An Option-Based Model of Mortgage Default" *Housing Finance Review*, Vol. 4, No. 4 pp. 351-72

Foster, Chester, and Van Order, Robert (1985) "FHA Terminations: A Prelude to Rational Mortgage Pricing" *Journal of the American Real Estate and Urban Economics Association*, Vol. 13, No. 3 pp. 273-91

Getis, Arthur and Ord, J.K. (1992) "The Analysis of Spatial Association by Use of Distance Statistics" *Geographical Analysis*, Vol 24, Issue 3. pp.189-206

Ghent, Andra, and Kudlyak, Marianna (2009) "Recourse and Residential Mortgage Default: Theory and Evidence from U.S. States" Federal Reserve Bank of Richmond, Working Paper No. 09-10

Guiso, Luigi, Sapienza, Paola, and Zingales, Luigi (2009) "Moral and Social Constraints to Strategic Default on Mortgages" http://www.financialtrustindex.org/images/Guiso_Sapienza_Zingales_StrategicDefault.pdf

Harding, John, Rosenblatt, Eric, and Yao, Vincent. (2008) "The Contagion Effect of Foreclosed Properties" *Journal of Urban Economics*, Vol. 66, No. 3, pp.164-178

Hartley, Daniel (2010) "The Effect of Foreclosures on Nearby Housing Prices: Supply or Disamenity?" Federal Reserve Bank of Cleveland, Working Paper September 2010

Immergluck, Daniel (2010) "Neighborhoods in the Wake of the Debacle: Intrametropolitan Patterns of Foreclosed Properties" *Urban Affairs Review*, Vol. 46, No. 1, pp.3-36

Immergluck, Daniel and Smith, Geoff (2005) "There Goes the Neighborhood: The Effect of Single-Family Mortgage Foreclosures on Property Values" Woodstock Institute. June 2005

Kau, James, Keenan, Donald, and Kim, Taewon (1993) "Transactions Costs, Suboptimal Termination, and Default Probabilities for Mortgages" *Journal of the American Real Estate and Urban Economics Association*, Vol. 21, No. 3, pp. 247-63

Kau, James, Keenan, Donald, and Kim, Taewon. (1994) "Default Probabilities for Mortgages" *Journal of Urban Economics*, Vol. 35, pp 278-296

Leonard, Tammy, and Murdoch, James (2009) "The neighborhood effects of foreclosure" *Journal of Geographic Systems*, Vol. 11, No. 4, pp 317-332

Mallach, Allan (2010) "REO Properties, Housing Markets, and the Shadow Inventory" *REO & Vacant Properties: Strategies for Neighborhood Stabilization*, Federal Reserve Board http://www.financialtrustindex.org/images/Guiso_Sapienza_Zingales_StrategicDefault.pdf

Mian, Atif and Sufi, Amir (2010) "House Prices, Home Equity-Based Borrowing, and the U.S. Household Leverage Crisis" Chicago Booth Research Paper No. 09-20.

Rauterkus et al (2010) "Foreclosure Contagion and REO Versus Non-REO Sales" http://ssrn.com/abstract=1572074

Richter, Francisca (2008) "An Analysis of Foreclosure Rate Differentials in Soft Markets" Federal Reserve Bank of Cleveland, Working Paper November 2008

Rosen, Sherwin (1974) "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition" The Journal of Political Economy, Vol. 82, No. 1, pp 34-55

S & P Case –Shiller Home Price Index - http://macromarkets.com/real-estate/sp_caseshiller.shtml

Shiller, Robert (2007) "Understand Recent Trends in House Prices and Home Ownership" NBER Working Paper 13553 http://www.nber.org/papers/w13553

Shiller, Robert (2008) "The Subprime Solution" Princeton University Press

Smith, Margaret, and Smith, Gary (2006) "Bubble, Bubble. Where's the Housing Bubble?" Brookings Panel on Economic Activity, March 2006

Schintler, Laurie, et al. (2010) "The Spatial Aspects of the Foreclosure Crisis: A Look at the New England Region" GMU School of Public Policy Research Paper No. 2010-28

Surowiecki, James (2004) The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations , First Anchor Books, 2005

Vandell, Kerry (1995) "How Ruthless Is Mortgage Default? A Review and Synthesis of the Evidence" Journal of Housing Research, Vol. 6, Issue 2.

Weaver, Karen and Shen, Ying (2009) "Drowning in Debt – A Look at Underwater Homeowners" Deutsche Bank Securitization Report. August 5, 2009

White, Brent (2009) "Underwater and Not Walking Away: Shame, Fear and the Social Management of the Housing Crises" Arizona Legal Studies Discussion Paper No.09-35

White, Brent (2010) "Take this House and Shove it: The Emotional Drivers of Strategic Default" Arizona Legal Studies Discussion Paper No. 10-17

Wyman, Oliver(2009) "Understanding Strategic Default in Mortgages Part 1" Experian-Oliver Wyman Market Intelligence Report 2009 Topical Report Series, www.marketintelligencereports.com

Wyman, Oliver(2011) "Strategic default in mortgages: Q2 2011 update" Experian-Oliver Wyman Market Intelligence Reports 2011 Topical Report Series, www.marketintelligencereports.com