The Effect of Foreclosure on Vacancy
At the Neighborhood Level

An Applied Research Paper Submitted for (Partial) Fulfillment of the Degree:

Master of City and Regional Planning

Prepared by: Min Na

Fall 2011 – Spring 2012

Submitted to: Professor Dan Immergluck

Department of City and Regional Planning

College of Architecture

Georgia Institute of Technology

April 30, 2012

Contents:

Tables:

Figures:

I. Introduction

After the U.S. foreclosure crisis and the larger financial crisis it precipitated hit the economy of the U.S. since 2006, people paid more attention to foreclosures than before. In 2010, about 2.9 million properties were reported receiving foreclosure filings, an increase of nearly 2 percent from 2009 and an increase of 23 percent from 2008[1]. Figure 1 shows the trend of increased foreclosure since 2006.

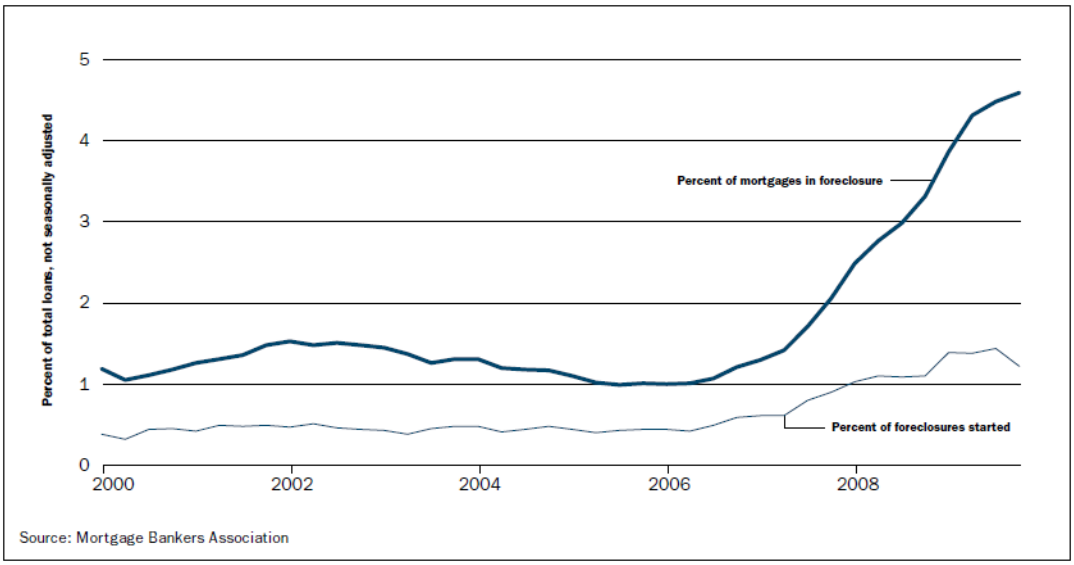

Figure 1. Percent of Mortgage in Foreclosure and Percent of Foreclosure Stated

Source: Frame, W. S. (2010)

There are two interesting approaches to study causes of foreclosures. One states that properties foreclose because they are in worse condition than surrounding properties (Scott Frame, 2010). Many studies focus on the physical condition of properties and modeling the foreclosure behavior. The other approach focuses on the owner, rather than the physical characteristics of the properties. They think that minority homeowners are more likely to experience foreclosures than white borrowers (Ryan Allen, 2011). That may because of they are more likely to have less financial literacy (Kristopher Geradi, Lorenz Goette, Stephan Meier), or

[1] RealtyTrac. Record 2.9 million U.S. properties receive foreclosure filings in 2010 despite 30- month low in December. Retrieved on November 15th 2011, from http://www.realtytrac.com/content/press-releases/record-29-million- us-properties-receive-foreclosure-filings-in-2010-despite-30-month-low-in-december-6309.

they are more likely to lose their jobs. Many empirical analyses have been done on the relationship between foreclosure rate and the characteristics of homeowners.

Although it is important to investigate the causes and mechanics of foreclosures so that policy makers can learn from it and improve the current policy. However, it is also necessary to understand the consequences of residential foreclosures. The markedly increasing foreclosures made people lose their homes, but more than that, the ripple effects or externalities of foreclosures "impose a wide array of costs-both financial and nonfinancial- on a variety of individuals, organizations, and communities" (Immergluck, p.133). Foreclosures can cause "tremendous reduction in the value of nearby properties" (Frame, 2010), and lead to vacant or even abandoned properties, which hurt our communities. "Foreclosures of single-family homes have been viewed as a serious threat to neighborhood stability and community well-being" (Immergluck, 2006). Many studies have been analyzing the causes and consequences of foreclosures, and many of which focus on the externalities of foreclosures on individuals, nearby property values and communities. Foreclosure will cause high vacancy rate, which will make neighborhoods suffered from abandonment and high crime rate (Dan Immergluck, 2006). After being hit severely by the 2006 – 2008 subprime crises, we need to estimate the effect of foreclosure on our communities.

This paper analyzes the effect of foreclosures on vacancy in the census tract level of 20-county metro Atlanta area by incorporating spillover effect of foreclosure into regression models. The basic model is estimated with neighborhood economic and demographic characteristics to measure the effect of foreclosure on vacancy rate. And then location variables are included to estimate the second model which measures if there is a significant difference of that effect from inner city than suburbs. At last but not least, to estimate how long it will take to transfer effect of foreclosures to neighborhood vacancy, variables measuring foreclosures in different time period are entering the model. The results suggest that controlling neighborhood economic and demographic characteristics, vacancy rate increases with foreclosure rate, but increases at a slower rate at higher foreclosure rate levels. One more foreclosure filings per mortgageable property[2] will increase the vacancy rate by about 2.2%. And vacancy rate of census tracts located inside the ten core counties is 1.2 percent lower than census tracts located outside the ten core counties, which shows suburb neighborhoods have a higher vacancy than central city neighborhoods during the period of 2006 to 2010. Census tracts whose closest employment center

[2] Mortgageble properties include housing units containing one- to four- dwelling units.

is downtown or Buckhead have the highest vacancy rate, followed by census tracts closest to the airport employment center. Census tracts whose nearest employment center is Perimter area have the lowest vacancy rate. And the subprime crisis in 2007 and 2008 do affect neighborhood vacancy, and its effect may last until 2009.

This paper is organized into six sections. After the introduction, section two of the paper is literature review, which is organized by the two different theories of causes of foreclosures and three types of consequences of foreclosures. Based on the reviews of other studies, section three raises three research questions and includes establishments of three models to address those research questions, respectively. Section four introduces variables used in this study and how geography conversion is conducted. Section five includes results of three regression models and interpretation of variables. Finally, section six presents the conclusion of this paper, innovations and limitations of the methodology as well as possible further studies.

II. Literature Review

1. The Causes of Foreclosure

(1) Price Depreciation and Subprime Loans

Many studies have been done to investigate the causes of the foreclosure crisis. Some consider foreclosure as a result of house price depreciation and bad underwriting (Gerardi, Shapiro, Willen, 2011 and Been, Chan, Ellen, Madar, 2011). Though they have different opinions on which is the primary cause, those two factors together are the direct reasons of foreclosure crisis. Foreclosures rise when house prices decline especially when homeowners have negative equity, which means the property value is less than the loan amount. Nationally, 22.5 percent of homeowners with a mortgage are in a negative-equity position. This rate is slowing declining but, unfortunately, not because home prices are improving but instead because foreclosures have removed some loans from this category[3].

Gerardi, Shapiro and Willen (2009) used a dataset including every residential mortgage, purchase-and-sale, and foreclosure transaction in Massachusetts from 1989 to 2008 and ran a two-period model to simulate the default decision. The authors concluded that negative equity is a necessary condition for default; however, negative equity is not sufficient for default, because future house price appreciation may make it profitable to continue making mortgage payments. If a borrower can sacrifice small percentage of current consumption, he may decide to continue making payments; otherwise, defaulting is financially optimal.

Also, many of the mortgage foreclosures are subprime loans together with exotic loans. Subprime loan grew over 250% from 2001 to 2004 (Immergluck, 2009). Immergluck (2009) summarized three factors leading to the boom in high-risk lending: 1) vertical disintegration of the lending industry as securitization grew; 2) rapid appreciation of home values; 3) increased supply of high-risk capital.

Subprime mortgages lie at the center of recent turmoil in housing and credit markets (Foote, et al, 2008). Subprime loans became foreclosed at an annual rate of over 17% by the second quarter of 2008 (Immergluck, 2009). And Foote, et al (2008) also found that subprime mortgages have proven especially fragile during the current housing downturn. And defaults among subprime

[3] Real Estate Industry News. Housing market not out of the woods yet. Retrieved on November 17th 2011, from http://www.realestateindustrynews.com/foreclosures/housing-market-not-out-of-the-woods-yet/.

adjusted-rate mortgages are more sensitive to house price declines than defaults on subprime fixed-rate mortgages; however, it is possible that the higher sensitivity stems from features of the characteristics of borrowers. Some studies have examined the relationship between subprime lending and the level of foreclosures (Burnett, Herbert, and KAUL, 2002; Gruenstein and Herbert, 2000; Zimmerman, Wyly, and Botein, 2002). Immergluck and Smith (2005) argued the subprime lending is a very strong determinant of neighborhood foreclosures levels. They conducted a study of subprime lending on neighborhood foreclosure levels in Chicago. After controlling for neighborhood demographics and economic conditions, the authors find that subprime loans lead to foreclosure at far greater rate than do prime loans. Moreover, subprime lending appears to account for a substantial share of foreclosure activity in high-foreclosure neighborhoods.

Except those macro factors, homeowners have a high chance to go foreclose when they are facing loss of employment, increases in mortgage payments, family turnover, and health issues (Pollack, et al, 2011; Rogers, 2008). Robertson, Egelhof, and Hoke (2008) find through their survey that cover 2,000 homeowners in four states, that about one third homeowners said increasing mortgage payments were a factor in their default, 76% reported that their foreclosure was caused by a drop in income, and about half of the respondents said their foreclosure was caused at least in part by a medical problem.

(2) Foreclosure Discount

Some scholars argue that foreclosure is a characteristic describing the seller of the property, not necessarily the condition of the property (Rogers, 2010). It is largely accepted that there is direct connection between the two. Because of the price depreciation and high risk lendings, foreclosed properties have to be sold on a discount price, if there is a market at all. Foreclosed properties sell at a discount price, because homeowners will spend less on maintenance.

Studies found the discount on foreclosed property between 20 and 25 percent (Shilling, Benjamin, and Sirmans, 1990; Forgey, Rutheford, and VanBuskirk, 1994; Carroll, Clauretie, and Neill, 1997). Frame (2010) summarized three reasons of discount value for foreclosed properties: 1) systematic differences in property characteristics, 2) lower average property condition or quality, and 3) a liquidity discount. Pennington-Cross (2006) runs a repeat sales price indexes model and the empirical result shows that foreclosed property appreciates on average 22% less than the area average appreciation rate. However, the magnitude of the difference or the foreclosure discount is sensitive to housing conditions, legal constraints and loan characteristics. And the longer a lender owns a piece of property after default, the larger the foreclosure discount.

Clauretie and Daneshvary (2009) distinguished a stigma effect and a proxy effect of foreclosure. They thought many studies estimated a greater than 20% discount associated with the sale of foreclosed properties, which is actually the proxy effect (a discount because deteriorated physical condition and/or neighborhood characteristics). Their empirical results suggested estimates of foreclosure discount reported by previous studies are about one-third higher than the true discount caused by foreclosure per se.

2. The Consequences of Foreclosure

The foreclosure process can generate significant costs for families as well as the society as a whole. Families going under foreclosure can lose accumulated home equity and incur moving expense; also foreclosures can damage credit ratings, hurting the owners 'prospects not only in credit markets but also in labor and insurance markets' (Immergluck, 2006). Social costs may arise from both higher municipal costs and reduction in the value of nearby properties, which is known as spillover effect. Most studies fall into three categories: effect on families; effect on nearby properties; and effect on neighborhood. Many empirical studies about the externality of foreclosures are spillover effect on nearby property values, which means foreclosure affect not only the property going under foreclosure itself, but also the neighboring properties. And because of this kind of externality, the quality of community decreases as well.

(1) Effect on Individuals

Firstly, foreclosure may hurt the personal quality of life. Pollack, et al (2011) found that people who undergo foreclosure may be in poor health compared and may be more likely to experience reductions in their health care utilization prior to receiving a notice of foreclosure.

Been, et al (2011) studied how foreclosures in New York City affect the mobility of public school children across schools. The empirical results show that public school students in New York City living in buildings that entered foreclosure were more likely to move to different public schools in the City in the year after the foreclosure notice was issued. Moreover, students moving to new schools tended to move to lower-performing schools.

(2) Effect on Nearby Properties

Many empirical studies adopt hedonic model to estimate the effect of foreclosures on nearby property values, which can measure the marginal influence of every factors (Rogers, 2008; Immergluck and Smith, 2010; Schuetz, et al, 2008; Wassmer, 2011; Kobie and Lee, 2011; Lin, et al 2009). A general hedonic consider sale price as dependent variable and has a several categories

of independent variables, such as characteristics of the property itself, the location characteristics, and some variables about foreclosure rates.

Immergluck and Smith (2006) adopted a hedonic model to estimate the impact of foreclosures on the value of nearby single-family properties in Chicago by controlling 40 characteristics of properties and their respective neighborhoods. The empirical result shows each conventional foreclosure within an eighth of a mile of single-family home results in a decline of 0.9 percent in value, which means, for the entire city of Chicago, per foreclosure will reduce nearby property values for an average of $159,000.

Schuetz, Been, and Ellen (2008) used a hedonic model to identify the effects of foreclosure filings in New York from 2000 to 2005 to identify the foreclosure starts on housing prices in the surrounding neighborhood. The empirical results suggested that above some threshold, proximity to properties in foreclosure is associated with lower sales prices.

Wassmer (2011) ran a hedonic model to measure external effects of mortgage foreclosure for Sacramentro, CA. The empirical result suggested that the selling price of an average non-real estate owned homes, due to the presence of real estate owned sales of neighboring homes, fell by $48,827 or 31.9% percent.

Kobie and Lee (2011) used a hedonic model to estimate the negative effect of foreclosures on nearby property values in parcel level in Cuyahoga County, Ohio. This study incorporated both spatial and temporal factors. It analyzed foreclosures' impact based on blocks, not straight-line distances, which is widely used in other studies. The major findings of the model are: 1) foreclosures do have negative impact on nearby property values, but no until a year after the foreclosure filing; 2) properties sold at postforeclosure have a larger negative impact than the preforeclosures that have taken longer than a year; 3) foreclosures' impact in city is different from the suburbs because the concentration of foreclosures in city. In city of Cleveland, any single additional foreclosure is not likely to have a significant impact on property values (the marginal impact is little), but the suburban model has a significant negative relationship between property values and foreclosures.

Lin, Rosenblatt, and Yao (2009) did a hedonic regression with Chicago as study area to study the spillover effect of a foreclosure on neighborhood property values. The empirical results based on 2006 sample showed that the spillover effect is significant within a radius of 0.9km (roughly

10 blocks) and within 5 years from its liquidation. Based on an alternative sample of purchase transactions in 2003, the estimated spillover effects in booming years are reduced by half.

Rogers (2010) tested the temporal stability of the spillover effect. The author used a hedonic model to estimate single-family housing sales in Saint Louis County, Missouri, and compared the marginal foreclosure discount for distressed sales in 2000 with the marginal discount of new distressed sales in 2007, found that foreclosure events generate a negative impact on property value, and that impact is shrinking even as the number of foreclosures is increasing.

(3) Effect on Neighborhoods

Leonard and Murdoch (2009) argued that foreclosure events have real, long-term impacts on neighborhood quality. They ran a hedonic model with sales prices, characteristics, and location information for 23,218 single-family homes in and around Dallas County, Texas sold during 2006. The study found that changes in nearby foreclosures reveal changes in neighborhood quality. And according to their empirical results, foreclosure within 250 feet of a sale depreciate selling price.

Immergluck and Smith (2006) examined the mechanism of the effect of foreclosure on crime. They thought foreclosure harm neighborhoods through the triggering of extended vacancies or abandoned and blighted buildings, and it is through longer-term vacancy and abandonment that foreclosures affect neighborhood crime. Their regression model provided evidence that higher neighborhood foreclosure rates lead to levels of violent crime at appreciable levels.

Shlay and Whiteman (2004) argued that abandoned housing has been central to understanding blight, both because important policy issues have revolved around demolition of vacant structures and because the dynamics of abandonment have long represented an enormous challenge for many urban housing markets. Through his comprehensive empirical study about Philadelphia, they found that housing within 150 feet of an abandoned unit experienced a net decreased in sales price of $7,627. Housing within 150-299 of an abandoned unit experienced a lower but sizeable net decrease in sales price of $6,810. Housing within 300-449 of an abandoned unit experienced a net decrease in sales price of $3,542. The effects of abandonment on sales price diminished at distance over 450 feet.

Baxter and Lauria (2000) focused on explanation of neighborhood change. Foreclosure is one of the intermediate variables, which interacted with characteristics of neighborhoods. The authors used structural equation model using New Orleans as a case, and the results indicated that racial

transition and loss of employment and income increased foreclosure rates, which in turn differentially affect vacancy rates, the change in black population, and the housing tenure status.

Li and Morrow-Jones (2010) examined residential foreclosures from 1983 through 1989 in Cuyahoga County, Ohio (Cleveland area), on selected neighborhood change variables in the area between 1990 and 2000, allowing enough time lags for the effects to take place. The results suggested that higher foreclosure rates are positively related to changes in percentage black population, female headship rate, median household income, and unemployment rate. And they concluded that foreclosures speed up the housing filtering process, and racial and economic turnover of residents.

III. Research Design

1. Research Question

Foreclosures of single-family homes have been viewed as a serious threat to neighborhood stability and community well-being (Immergluck and Smith, 2006). And a key aspect of the U.S. subprime crisis was the accumulation of vacant, foreclosed properties in many neighborhoods and localities (Immergluck, 2010). Some studies consider vacancy and abandonment as the important harm of foreclosures on neighborhood. Li and Morrow-Jones (2010) examined the mechanism that foreclosure decrease the housing price, when the housing price continues to drop to large scale demolition, there will be high vacancy (Figure 2).

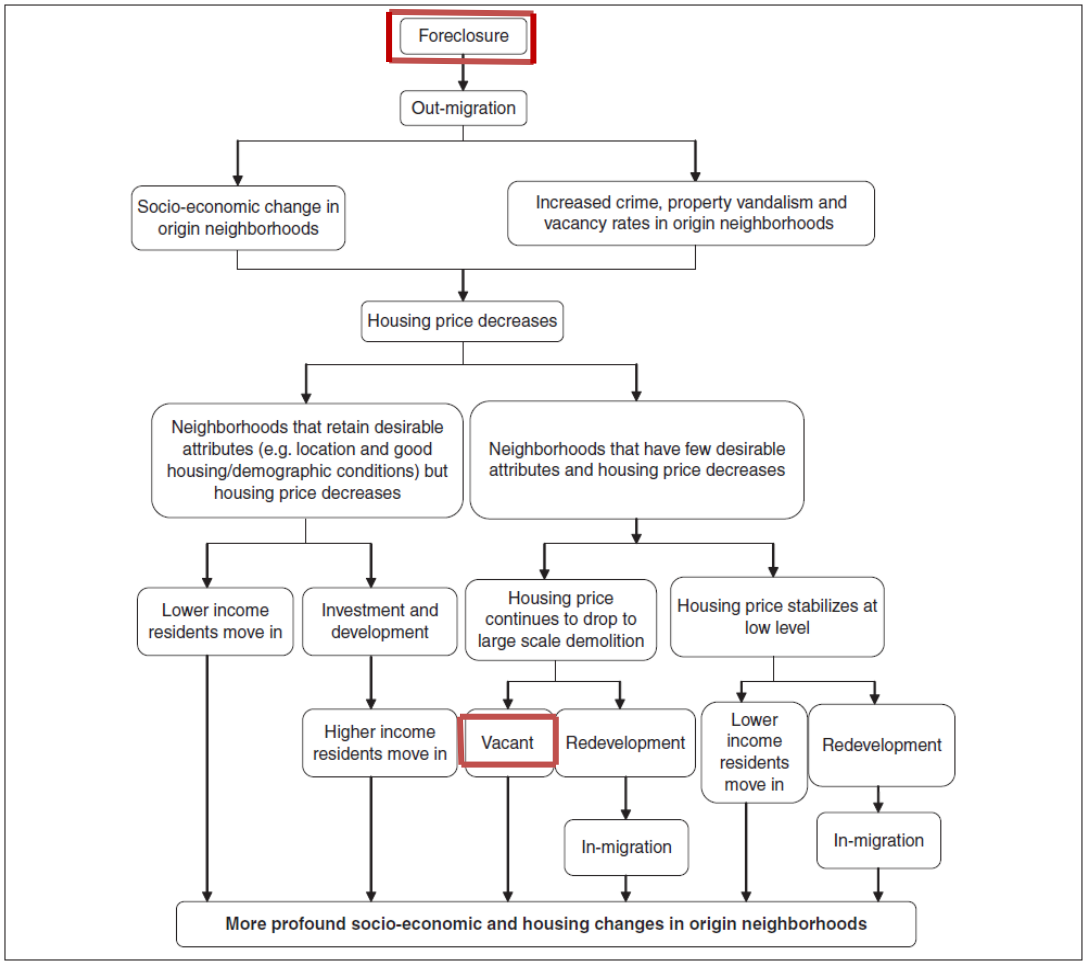

Figure 2. Conceptual Model of Foreclosures and Neighborhood Change

Source: Li and Morrow-Jones, 2010

Immergluck and Smith (2006) also considered vacant as a medium that foreclosure affect the crime in neighborhood. However, there are not many studies directly measure the magnitude of the effect of foreclosures on vacancy. This study aims to measure the effect of foreclosures on vacancy in the census tract level within 20-county metro Atlanta area. Because foreclosures are concentrated in central city neighborhoods within metropolitan areas (Immergluck, 2009), the effect of foreclosures on vacancy in central city neighborhoods may be different from its effect in suburban neighborhoods (Kobie and Lee, 2011). Moreover, it will take some time to transfer the effect of foreclosure to vacancy (Li and Morrow-Jones, 2010)

So the research questions of this study are: 1) is there a significant effect of foreclosure on vacancy in neighborhoods? 2) Is the effect different in central city neighborhoods than suburban neighborhoods? 3) How long will the effect take place, which means how long the temporal lag is?

2. Model and Data

Atlanta's economy suffered more deeply than the nation as a whole. Figure 3 shows Atlanta has a lower home price than the U.S. Since the starts of the recent recession, metro Atlanta has higher unemployment rate than the U.S, because in the past decade, there was 1-million population growth but nearly no job growth in metro Atlanta (Census Bureau). Metro Atlanta ranks fifth in the percent of all mortgages that are 90 or more days delinquent or already in the foreclosure inventory among the 20 most populous metros in the nation, as of December 2010; besides, metro Atlanta almost double the national average for number of lender-owned properties[4].

[4] Atlanta Regional Commission. Regional snapshot, a look at foreclosures in the Atlanta region. Retrieved on Nov 15th 2011, from http://www.atlantaregional.com/File%20Library/Info%20Center/Newsletters/Regional%20Snapshots/Housing/RS_July_2011_Foreclosures.pdf.

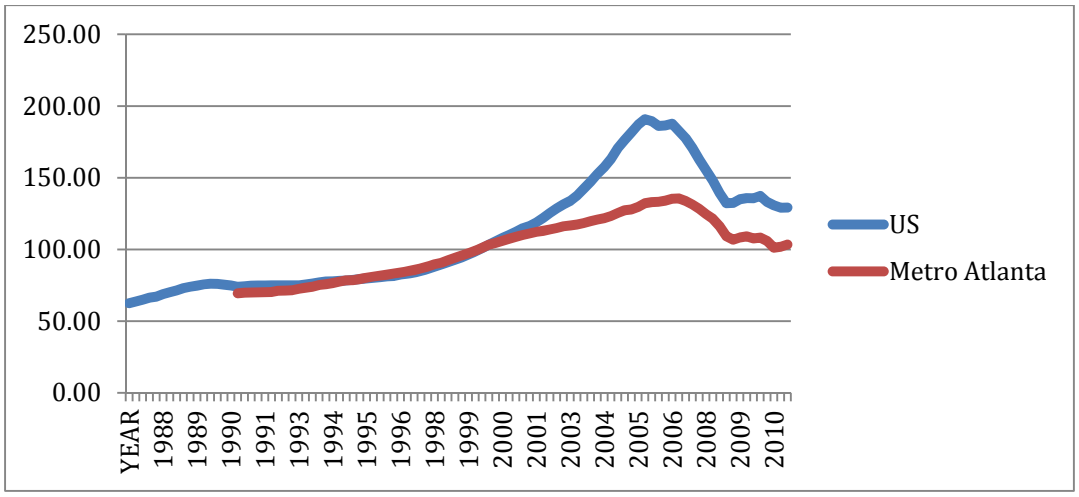

Figure 3. S&P/Case-Shiller Home Price Indices

Source: Standard & Poor's

This study chooses 20-county metro Atlanta as study area. Foreclosure filings data were obtained from Atlanta Regional Commission at the census tract level from 2007 to 2010 (Figure 4, Figure 5, Figure 6, and Figure 7). And Figure 8 shows the total foreclosure filings from 2007 to 2010.

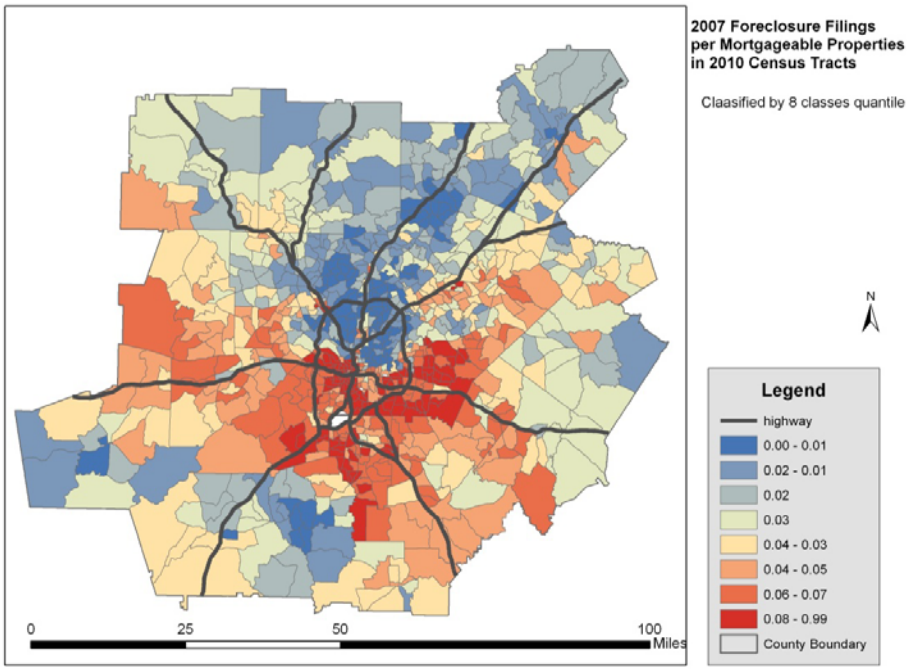

Figure 4. 2007 Foreclosure Filings per Mortgageable Properties, Classified by Quantile Method

Source: Atlanta Regional Commission

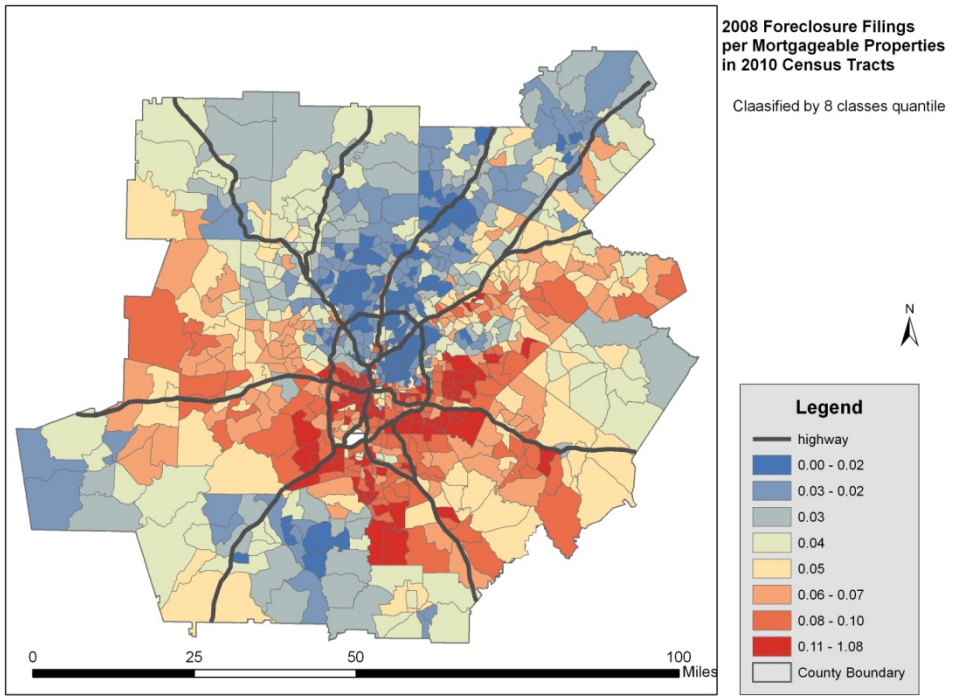

Figure 5. 2008 Foreclosure Filings per Mortgageable Properties, Classified by Quantile Method

Source: Atlanta Regional Commission

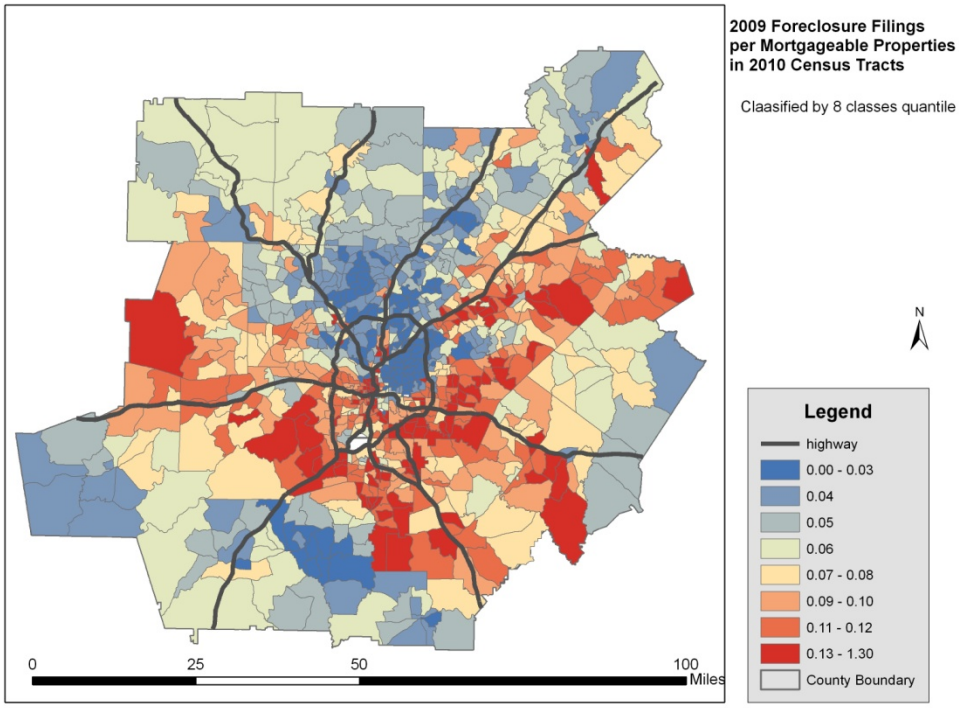

Figure 6. 2009 Foreclosure Filings per Mortgageable Properties, Classified by Quantile Method

Source: Atlanta Regional Commission

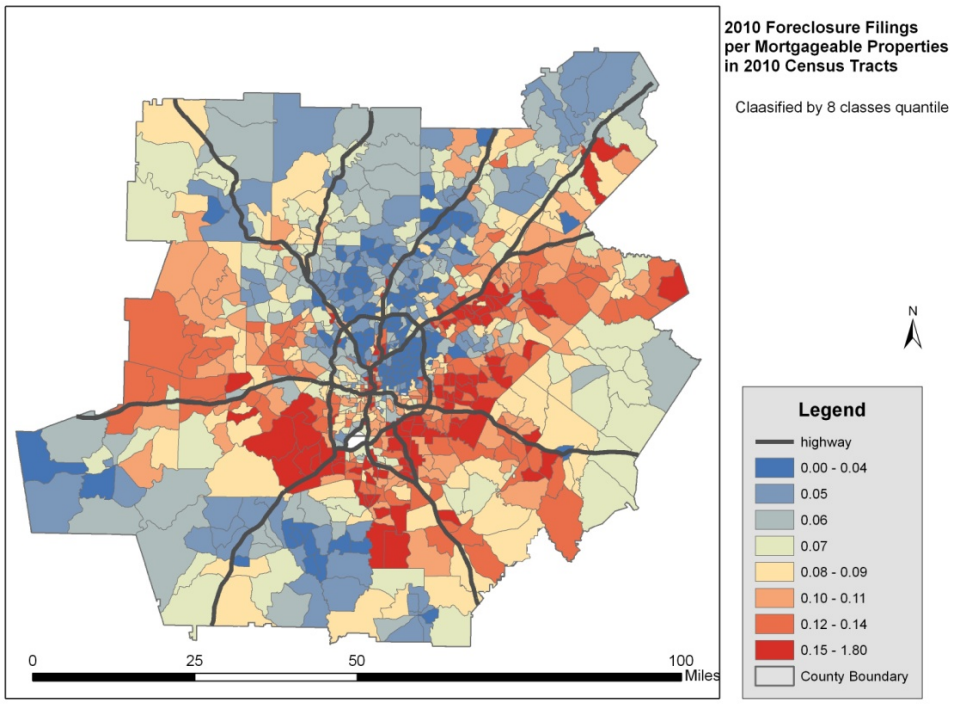

Figure 7. 2010 Foreclosure Filings per Mortgageable Properties, Classified by Quantile Method

Source: Atlanta Regional Commission

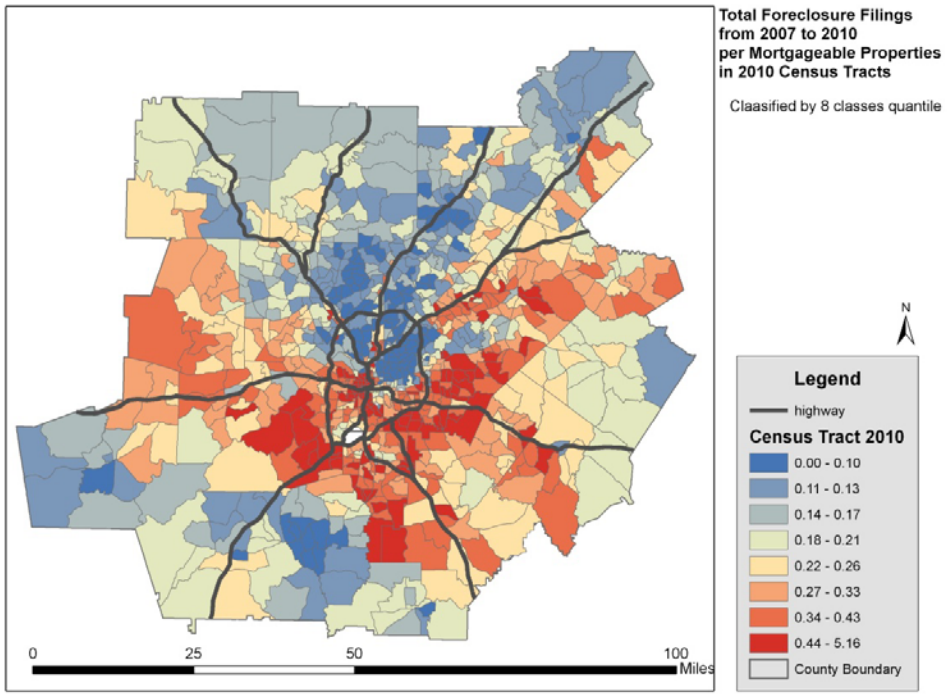

Figure 8. Total Foreclosure Filings per Mortgageable Properties, Classified by Quantile Method

Source: Atlanta Regional Commission

Vacancy data is available from ACS 2006-2010 (Figure 9) and census 2010 (Figure 10). The vacancy distribution pattern is very similar to the foreclosure filings pattern in either data set.

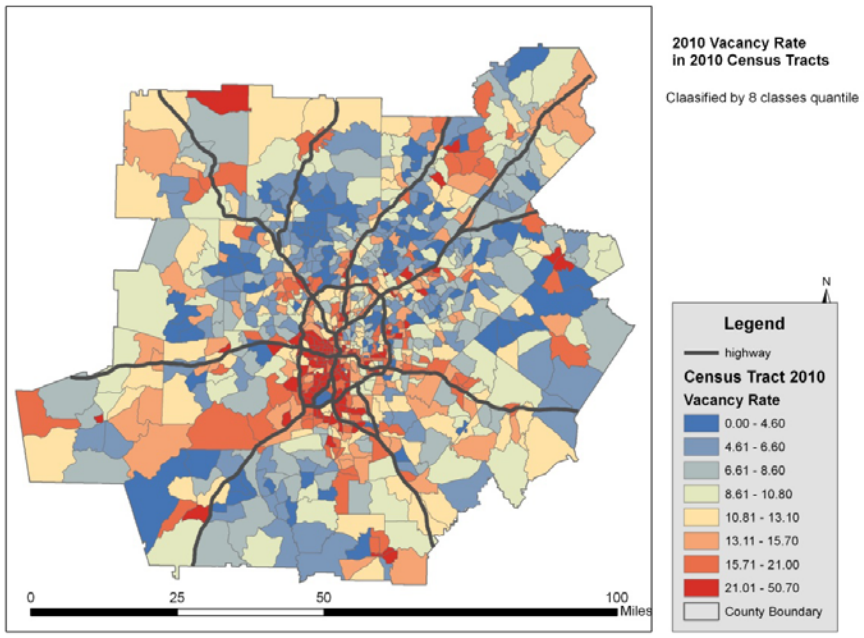

Figure 9. ACS 2006-2010 Vacancy Distribution Pattern, Classified by Quantile Method

Source: American Community Survey 2006-2010

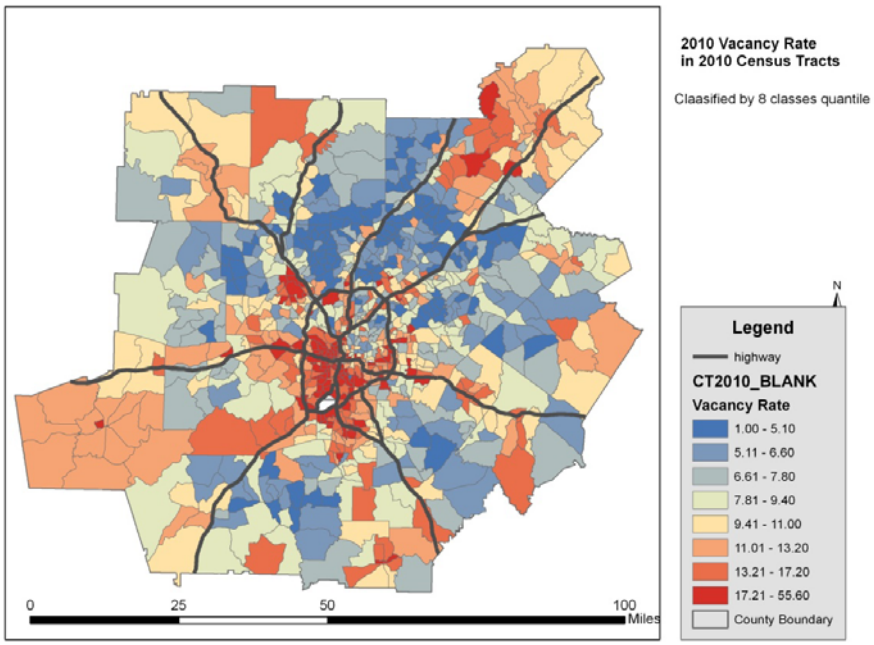

Figure 10. 2010 Census Vacancy Distribution Pattern, Classified by Quantile Method

Source: Census Bureau, 2010

Many existing empirical studies use hedonic models, which are vulnerable to spatial bias on neighborhood, because housing units characteristics instead of neighborhood characteristics are included in hedonic models. This study conduct regression model as: Vacancy = f (F, N, D), where F is foreclosure filings, N is a set of neighborhood economic characteristics, and D is a set of neighborhood demographic characteristics. To address the research questions, three different models are estimated to measure the effect of foreclosure on vacancy, the different effects on central city neighborhoods and suburban neighborhoods, and the temporal lag of the effect.

Model 1: Vacancy=f (F_{total}, N, D)

Model 2: Vacancy=f (F_{total}, N, D, L), where L is a dummy variable of whether the census tract is located within a central city neighborhood or suburban neighborhood.

Model 3: Vacancy= f (F_{total}, P_{0708} , P_{09}, N, D, L), where P is the percentage measuring foreclosure filings in certain years of total foreclosure filings.

IV. Variables and Regression Specification

1. Variables

(1) List of Variables

To examine the effect of foreclosure filings on vacancy rate, other factors that may affect the vacancy rate need to be controlled. Those control variables include the income, poverty, population density, demographic composition, and housing unit characteristics, and so on. Considering data availability, an initial variable list is shown in Table 1.

Table 1. Initial List of Variables

	Variable	Source	Geography
Foreclosure Filings	Foreclosure	ARC	CT 2000
Neighborhood Economic Characteristics	Percentage of single-family housing units in 2008[a]	ACS 2006-2010	CT 2010
	Change of single-family housing percentage from 2000 to 2008	Census 2000; ACS 2006-2010	
	Employment density in 2008	ACS 2006-2010	CT 2010
	Employment density change from 2000 to 2008	Census 2000; ACS 2006-2010	
	Dummy variables about employment types	ARC	CT 2000
	Median household income in 2008	ACS 2006-2010	CT 2000
	Unemployment rate in 2008	ACS 2006-2010	CT 2010
	Change of unemployment rate from 2000 to 2008	Census 2000; ACS 2006-2010	
	Poverty rate in 2008		
	Population Density in 2010	ACS 2006-2010	CT 2010
Neighoborhood Demographics Characteristics	Population density Change from 2000 to 2010	Census 2010	CT 2010
	Percentage of African American Population in 2010	Census 2000,2010	
	Change of percentage of African American Population from 2000 to 2010	Census 2010	CT 2010
	Percentage of Spanish Population in 2010	Census 2000,2010	
	Change of percentage of Spanish Population from 2000 to 2010	Census 2010	CT 2010
	Percentage of female householder with kids under 18 in 2010	Census 2000,2010	
	Change of percentage of female householder with kids under 18 from 2000 to 2010	Census 2010	CT 2010
	Median age in 2010	Census 2000,2010	
	Median age change from 2000 to 2010	Census 2010	CT 2010
Dependent Variable	Vacancy Rate in 2010	Census 2000; ACS 2006-2010	CT 2010

Note: a. ACS data are collected as a continual rolling sample basis and are combined to represent the characteristics over a period time. So ACS 2006 -2010 is measuring the neighborhood characteristics during the 5 year period and the midpoint is 2008.

(2) Geography Conversion

As Table 1 shows, some variables are available in 2010 census tract, while others are available in 2000 census tract. Within 20-county area, there are 676 census tracts in 2000 and 948 tracts in 2010. To run regression models, all variables need to be converted into the same geography, so that every census tract in 2010 has values of all variables either from 2000 or 2010 Census or American Community Survey datasets.

John R. Logan, Zengwang Xu, and Brian Stults have developed a tool, the Longitudinal Tract Data Base (LTDB), which can create estimates of census 2000 variables within 2010 census tract. A public-use tool "crosswalk" is provided in Microsoft Access program to bridge 2000 census tract data to 2010 census tracts (Zengwang Xu). In the converted file, every row lists a change type occurred between 2000 and 2010 (1 = no change; 2 = consolidation; 3 = split; 4 = many-to-many), a 2010 tract ID and the ID of a 2000 tract that contributes to it, which is based on the share of the source tract's population attributes that should be allocated to the 2010 tract.

Using LTDB, the 676 of 2000 census tracts in 20 counties are converted into 956 of 2010 census tracts. There is a difference between the converted 958 tracts and the original 948 tracts. The 8 more tracts exist because the 8 tracts or part of them in 2000 are redistricted into counties out of the 20-county area (Table 2). Because those 8 tracts are not in the 20-county study area so they can be removed. Therefore, 676 of 2000 census tracts are converted into 948 2010 tracts.

Table 2. Census Tracts Conversion Result

Tract 2000	County 2000	Tract 2010	County 2010
13151070402	Henry	13035150100	Butts
13151070402	Henry	13035150300	Butts
13015960200	Bartow	13129970700	Gordon
13015960100	Bartow	13129970900	Gordon
13139001603	Hall	13157010103	Jackson
13139000202	Hall	13311950201	White
13217100200	Newton	13159010100	Jasper
13297110200	Walton	13211010100	Morgan

Because the geography conversion is based on population distribution, variables such as median value, or unemployment rate would have a large error after this conversion. To minimize errors coming from the spatial conversion, variables that are either a percentage or a rate are excluded or replaced by other variables that are raw counts; variables related to change from 2000

to 2010 are excluded as well, except the population density change. Table 3 is the adjusted variables used in this analysis, only foreclosure filings and population density in 2000 are in 2000 tracts and need to go through the LTDB geography conversion, which minimize the geography conversion error and also meet the regression requirement to explain the variance of vacancy rate.

Table 3. Adjusted List of Variables

	Variable	Source	Geography
Foreclosure Filings	Foreclosure filings 2007-2010	ARC	CT 2000
Neighborhood Economic Characteristics	Vacancy in 2008	ACS 2006-2010	CT 2010
	Median household income in 2008	ACS 2006-2010	CT 2010
	Percentage of owner occupied housing Units	ACS 2006-2010	CT 2010
	Percentage of owner occupied housing units with a mortgage	ACS 2006- 2010	CT 2010
	Number of occupied housing units with no vehicle	ACS 2006-2010	CT 2010
	Unemployment rate in 2008	ACS 2006-2010	CT 2010
	Median value of owner occupied housing units	ACS 2006-2010	CT 2010
	Percentage of people commute by public transit	ACS 2006-2010	CT 2010
	Percentage of people commute by driving alone	ACS 2006-2010	CT 2010
	Median selected monthly owner cost (SMOC)	ACS 2006-2010	CT 2010
	Ratio of householders moving into units before 2005 by moving in after 2005	ACS 2010	CT 2010
Neighborhood Demographics Characteristics	Population Density 2010	Census 2010	CT 2010
	Population density Change from 2000 to 2010	Census 2000, Census 2010	
	Percentage of African American Population in 2010	Census 2010	CT 2010
	Average Household size in 2010	Census 2010	CT 2010
Dependent Variable	Vacancy in 2010	Census 2010	CT 2010

(3) Dependent Variable

Both Census 2010 and American Community Survey 2006-2010 five-year estimates report the vacancy rate in census tract level. A T-test is conducted to measure if there is a statistically significant difference between the two measurements of vacancy rate. Table 4 shows the t-test result of paired samples. The hypothesis of the same mean is rejected even at the significant level of 0.01. ACS vacancy has a higher mean as well as standard deviation than Census vacancy.

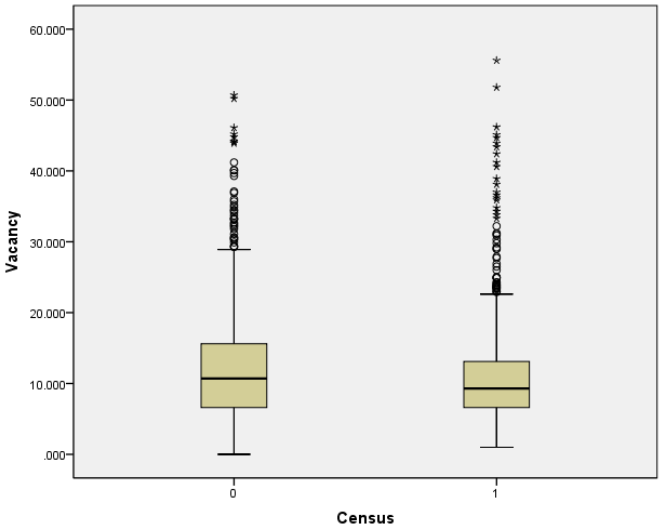

Figure 11. ACS Vacancy Rate and Census Vacancy Rate (Census = 0, ACS Vacancy Rate)

Table 4. T-test of ACS Vacancy Rate and Census Vacancy Rate

Paired Differences								
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Census - ACS	-1.3077	5.3763	0.1751	-1.6513	-0.9642	-7.470	942	0.000

Census vacancy rate 2010 is used as dependent variable because it covers the period of foreclosure filings from 2007 to 2010. ACS 2006-2010 five-year estimates represent the vacancy status during the five year period based on the rolling samples, which is actually measuring the midpoint of 2006 to 2010, the year of 2008. It enters the model as independent variable. 2008 vacancy rate can exclude the difference in vacancy before 2008 (or 2006, because it measures vacancy during 2006 to 2010), and can help measure the effect of foreclosure from 2007 to 2010 on neighborhood vacancy rate in 2010.

(4) Independent Variable

To have the comparable dimension with dependent variable, foreclosure filings need to be transformed into some percentage from. Foreclosure filings rate is calculated by dividing the number of foreclosure filings by mortgageable properties, which include housing units containing from one to four dwelling units (Immergluck, 2009).

(5) Variable Descriptive Statistics

Table 5 gives the mean and standard deviation of the dependent variable and all independent variables used in three models.

Table 5. Descriptive Statistics of Dependent and Independent Variables

Variables	Description	N	Mean	Std. Dev.
ForeclousreRate	Total foreclosure (2007-2010) filings per mortgageable property	943	0.2601	0.2711
Economic characteristics				
ACSvacancy0610	Vacancy rate in 2008	948	12.1594	8.0411
Median_HH_Income	Median household income in 2010	948	61094	28134
PerOwnerOccupied	Percentage of owner occupied housing units	944	0.6603	0.2471
LoanPeroccHU	Percentage of owner occupied housing units with a mortgage	939	0.7903	0.1120
own_0vehicle	Number of occupied housing units with no vehicle	948	121.3	135.7
UnempRate	Unemployment rate in 2010	948	9.2605	5.5272
Median_HU_Value	Median value of owner occupied housing units	948	208994	110414
Median_SMOC	Median selected monthly owner cost	948	1593.7	532.2
Transit_per	Percentage of people commute by public transit	944	0.0465	0.0791
DriveAlone_per	Percentage of people commute by driving alone	944	0.7559	0.1142
M05B_M05A	Ratio of householders moving into units before 2005 by moving in after 2005	944	1.8107	1.3290
Demographic characteristics				
PopDen10	Population density 2010	948	24078	2253
Blackper10	Percentage of African American Population in 2010	944	0.3468	0.3083
PopDenCh	Population density Change from 2000 to 2010	948	139.6	1602.9
Avg_hhsize10	Average household size in 2010	948	2.6722	0.4537
CensusVacancy10	Census vacancy rate in 2010	948	10.8706	6.8614

2. Models Specification

The dependent variable and independent variables may not correlate in a simple linear form; non-linear models need to be considered. Scatter plots of vacancy rate and the independent variables are used to determine the form of independent variables in models. Four variables are found have non-linear relationship with vacancy rate. Both linear and quadratic terms are used for the following four variables: foreclosure per mortgageable properties, median household income, median value of owner occupied housing units, and number of occupied housing units with no vehicle (Figure 12, Figure 13, Figure 14, and Figure 15).

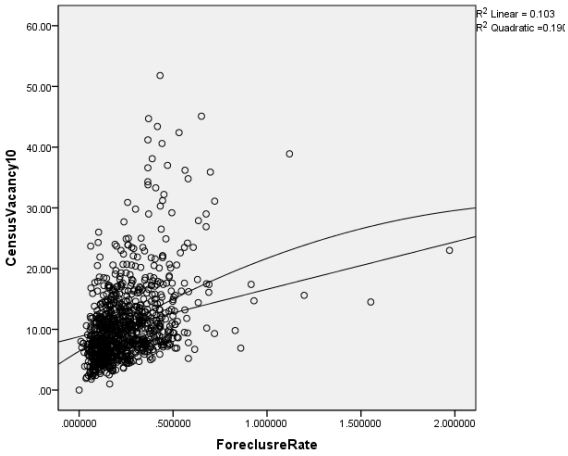

Figure 12. Total Foreclosure Rate

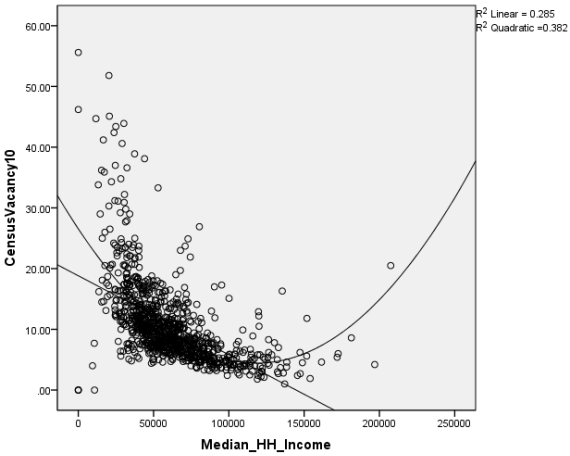

Figure 13. Median Household Income

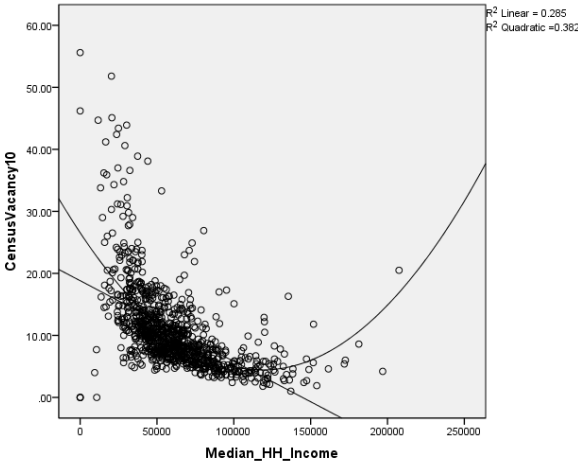

Figure 14. Median Housing Unit Value

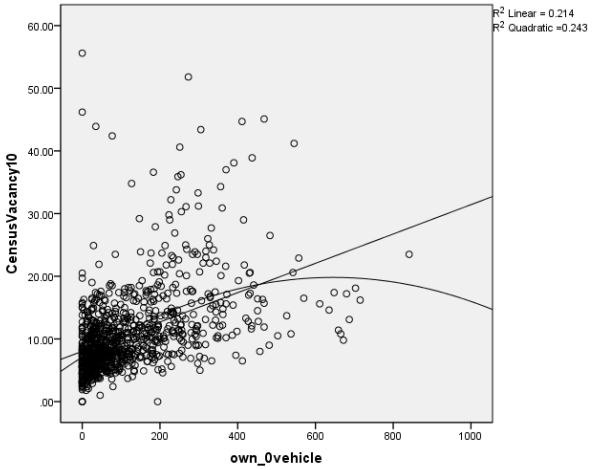

Figure 15. Number of Housing Units with No Vehicle

V. Results

1. Result of Model 1

11 neighborhood economic characteristics, four demographic characteristics, and foreclosure variables are used to estimate Model 1. Quadratic terms of foreclosure rate and housing units with no vehicle available enter the model but quadratic terms of median household income and median value of owner occupied housing units are dropped because of it causes severe multicollinearity problem. The regression model with 18 independent variables can explain 67% of the variation of vacancy rate in 2010 (R square = 0.670).

Table 6 shows six of 12 neighborhood characteristics are statistically significant at 95% level. These include vacancy rate from 2006 to 2010, housing units with no vehicle available and its quadratic term, median SMOC, percentage of people commute by driving alone, and percentage of people commute by public transit. Except the quadratic term of housing units with no vehicle, the other five are statistically significant at 99% level. 2010 vacancy rate increases with ACS 2006-2010 vacancy rate. If ACS vacancy rate increases by 1 percent, the 2010 vacancy rate will increase by 0.358 percent. Median selected monthly owner cost represents how much people spend in order to own the housing units. That is negatively correlated with vacancy rate, because keeping other variables constant, the more people willing to pay; the less possible they will leave their dwelling units vacant. The coefficient shows if households would pay 100 dollars more of owner cost, the vacancy rate will decrease by 0.2 percent. Two commuting mode variables are associated with household poverty. Neighborhood vacancy rate will decrease with the percentage of people in that tract driving alone to work and increase with the percentage of people taking public transit to work. It needs to be cautious to interpret the coefficients and signs of housing units with no vehicle available and its quadratic term. 2010 vacancy rate will increase with the number of housing units with no vehicle, but the effect becomes smaller when the number of housing units with no vehicle becomes larger. If there is one more housing unit that doesn't own a vehicle, the vacancy rate in 2010 will increase by almost 0.005 percent.

The other six economic characteristics are not statistically significant; however they are still important to control the differences among neighborhoods at various aspects. Generally, neighborhoods having higher median household income tend to have lower vacancy rate. However, because the model is measuring the difference of vacancy rate from 2008 to 2010, the median household income is not statistically significant, which means vacancies during that time period are not concentrated in poor neighborhood. Vacancy rate increases with the number of unemployed population. And if a neighborhood have a high owner occupied ratio, the vacancy rate tends to be low. Neighborhoods that have higher

median value of housing units will have a lower vacancy rate. Ratio of moving into units before 2005 to moving in after 2005 is negatively correlated with vacancy rate, which means neighborhoods with more households moving in before 2005 tend to be more stable and vibrant. This variable partially represents the effect of the 2003-2006 real estate bubble.

Among four neighborhood demographic variables, population density and average household size are statistically significant at 90% level, average household size is statistically significant at 99% level. Population density is negatively correlated with vacancy rate because populous neighborhoods tend to have less vacant or abandoned housing units. Keeping other variables constant, neighborhoods with bigger households tend to have lower vacancy rate. If on average, one neighborhood's average household has one more person than other identical neighborhoods, then the vacancy rate of that neighborhood could be expected 1.45 percent lower than others'.

The other two demographic variables are population density change from 2000 to 2010 and percentage of African Americans. If neighborhoods get more populous from 2000 to 2010, they tend to have lower vacancy in 2010. The percentage of African Americans reveals important information though it is not statistically significant. By controlling vacancy rate in 2008 and all other neighborhood characteristics, the percentage of African American is not positively correlated with vacancy rate, which means neighborhoods experiencing foreclosures since 2007 don't have a statistically significant difference between African Americans and other races.

Controlling neighborhood economic and demographic characteristics, foreclosure rate and its quadratic term are both statistically significant at 95% level. To interpret the effect of foreclosure rate, both the linear term and the quadratic term need to be considered. The coefficient of foreclosure rate is positive but the coefficient of its quadratic term is negative, which means vacancy rate increases with foreclosure rate, but increases at a slower rate at higher foreclosure rate levels. Holding all other independent variables constant, 1 more foreclosure filings per mortgageable property will increase the vacancy rate by about 2.2%.

Table 6. Regression of Vacancy Rate on Neighborhood, Demographic Characteristics and Foreclosure Rate

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	18.506	2.349		7.877	0.000
ForecolusreRate	2.936	1.228	0.114	2.390	0.017
SQforeclosureRate	-0.751	0.299	-0.106	-2.508	0.012
ACSvacancy0610	0.358	0.024	0.436	15.054	0.000
Median_HH_Income	7.905E-6	0.000	0.034	0.797	0.425
UnempRate	0.041	0.033	0.035	1.237	0.216
Per_OwnerOccupied	-0.194	1.089	-0.007	-0.178	0.859
LoanPeroccHU	-0.278	1.363	-0.005	-0.204	0.839
Own_0vehicle	0.005	0.003	0.110	2.064	0.039
SQown0vehicle	-9.340E-6	0.000	-0.116	-2.615	0.009
Median_HU_Value	-3.658E-6	0.000	-0.061	-1.372	0.170
Median_SMOC	-0.002	0.001	-0.123	-2.805	0.005
DriveAlone_per	-8.363	1.880	-0.139	-4.447	0.000
Transit_per	19.862	2.956	0.237	6.720	0.000
M05B_M05A	-0.156	0.130	-0.032	-1.199	0.231
PopDen10	0.000	0.000	-0.055	-1.878	0.061
Blackper10	-.814	0.733	-0.039	-1.110	0.267
PopDenCh	0.000	0.000	-0.016	-0.681	0.496
Avg_hhsize10	-1.451	0.392	-0.093	-3.705	0.000
R	0.818		R Square	0.670	

Diagnosing the regression model, the error term is normally distributed and there is no significant level of heteroskedasticity. By removing the quadratic term of median value of owner occupied housing unit value, multicollinearity is in a tolerable level. The VIFs of independent varialbes are all below 10. However, there might be some multicollinearity among the neighborhood economic characteristics. For example, median household income may correlate with median value of owner occupied housing units.

2. Result of Model 2

Within Atlanta 20-county area, Fulton, Cobb, DeKalb, Gwinnett and Clayton are the five core counties which are the most urbanized counties. The five core counties and the surrounding five counties, Cherokee, Douglas, Fayette, Henry and Rockdale are known as ARC 10-county area, which is also the metropolitan planning area (Figure 16).

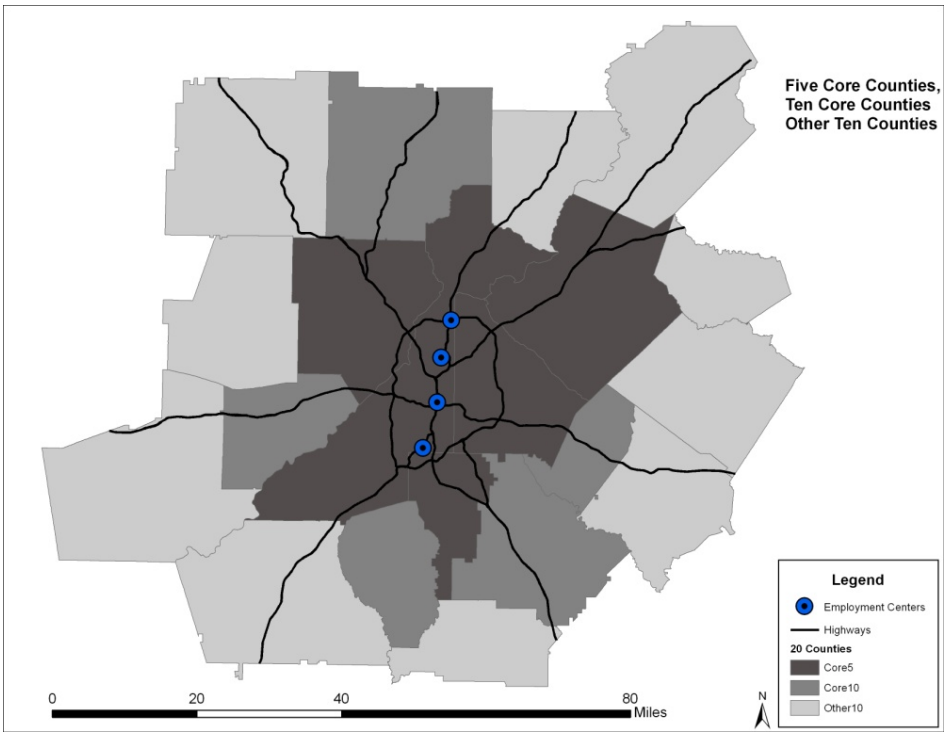

Figure 16. Five Core Counties, Ten Core Counties and Employment Centers

First, descriptive graphs are made to examine the difference on vacancy between five core counties and other 15 counties, and vacancy between ten core counties and other 10 counties (Figure 17 and Figure 18). The figures show that vacancy rate in either five or ten core counties have a larger standard deviation than suburb counties. To examine the effect of neighborhood location, both of them need to be included in the regression model.

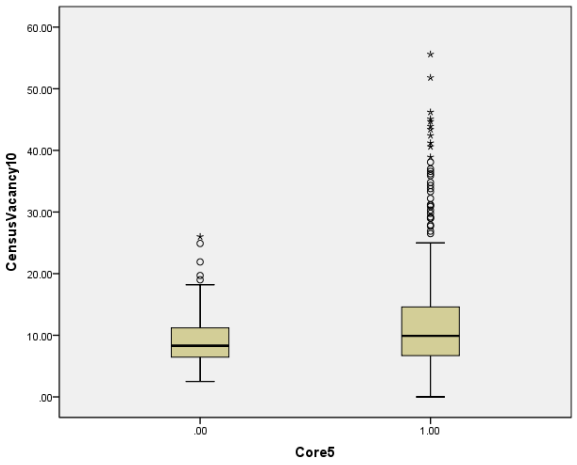

Figure 17. Five Core Counties and Others

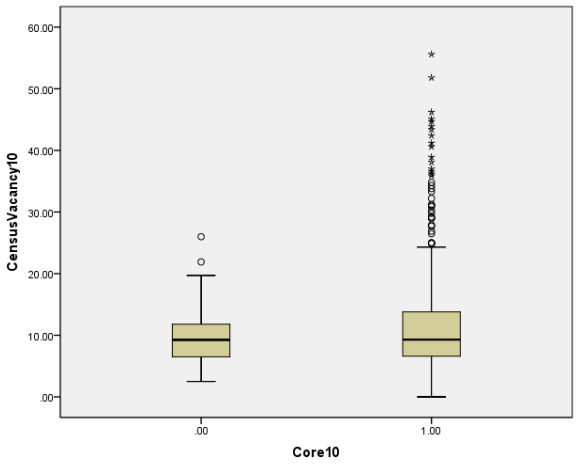

Figure 18. Ten Core Counties and Others

To measure whether there is a difference between effect of foreclosure on vacancy in central city and suburban neighborhoods, two dummy location variables are created based on whether the census tract is located within the five core counties and ten core counties or not. If a census tract is located inside the five-county area, the value of the core 5 dummy variable is 1; otherwise, the value is 0. If a census tract is located inside the 10-county area, the value of the core 10 dummy variable is 1; otherwise, the value is 0. These two dummy variables are added to model 1, which actually compares the vacancy rate of five core counties and ten core counties with the other outer ten counties.

Neighborhood economic characteristics, neighborhood demographic characteristics, foreclosure variables and dummy variables of location are used to estimate the second model. The regression model can explain 67.2% variance of vacancy rate (R square=0.672). The two dummy location variables increase the models' explanatory power by 0.2%.

Table 7 shows the regression result of model 2 with two dummy location variables. As in model 1, six of 12 neighborhood economic variables are statistically significant at 95% level. Average household size is the only statistically significant demographic variables at 99% level. The signs and magnitude of those variables are consistent with model 1. Foreclosure rate is positively correlated with vacancy rate, but its effect on vacancy rate is declining as foreclosure rate gets higher. Holding other variables constant, 1 more foreclosure filings per mortgageable property will increase vacancy rate by about 2%.

The dummy variables about whether the tract is located inside or outside the five-county area is not statistically significant, which means there is no statistically significant difference on vacancy rate between neighborhoods inside and outside the five core counties. However, the ten core county dummy variable is statistically significant at about 94% level, which is acceptable. It tells that holding other variables constant, neighborhoods inside ten core counties will have a vacancy rate 0.9 percent lower than neighborhoods of the outer ten-county area. Because vacancy rate during 2006 to 2010 is controlled, so the model is actually measuring the vacancy change from 2008 to 2010. And the result of model 2 shows suburban neighborhood has been experiencing higher vacancy than city neighborhood since 2008. Again, they may associate with the effect of the recent foreclosure crisis.

Table 7. Regression of Vacancy Rate on Neighborhood, Foreclosure Rate and Location Variables

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	19.039	2.356		8.081	0.000
ForeclusreRate	2.797	1.231	0.109	2.273	0.023
SQforeclosureRate	-0.713	0.300	-0.101	-2.376	0.018
ACSvacancy0610	0.351	0.024	0.429	14.730	0.000
Median_HH_Income	1.157E-5	0.000	0.049	1.153	0.249
UnempRate	0.037	0.033	0.031	1.104	0.270
Per_OwnerOccupied	-0.401	1.092	-0.015	-0.367	0.714
LoanPeroccHU	-0.158	1.362	-0.003	-0.116	0.908
Own_0vehicle	0.005	0.003	0.112	2.093	0.037
SQown0vehicle	-9.636E-6	0.000	-0.120	-2.700	0.007
Median_HU_Value	-3.865E-6	0.000	-0.065	-1.450	0.148
Median_SMOC	-0.001	0.001	-0.111	-2.529	0.012
DriveAlone_per	-8.788	1.885	-0.146	-4.662	0.000
Transit_per	19.557	2.954	0.234	6.621	0.000
M05B_M05A	-0.127	0.131	-0.026	-0.971	0.332
PopDen	0.000	0.000	-0.034	-1.097	0.273
Blackper	-0.100	0.800	-0.005	-0.125	0.901
PopDenCh	0.000	0.000	-0.021	-0.891	0.373
Avg_hhsize	-1.507	0.392	-0.097	-3.847	0.000
Core5	-0.006	0.442	0.000	-0.014	0.989
Core10	-0.911	0.469	-0.058	-1.943	0.052
R	0.820		R Square	0.672	

Except located inside the core counties or suburb counties, neighborhood's distance to its nearest employment center is also a critical spatial factor which may affect neighborhood vacancy. Based on the employment density of census tracts, four densest employment areas are identified as downtown, the airport, Buckhead, and Perimeter area (Figure 19). Distances to the four employment centers are measured for every census tracts, and a single variable is created based on the shortest distance of the four distances. In addition, the nearest employment center is coded as dummy variable. For example, if a census tract's distances to downtown, the airport, Buckhead and Perimeter are 10 miles, 11 miles, 9 miles and 12 miles respectively, then the variable "DistanceEmpCenter" is equal to 9 miles and the dummy variable of Buckhead is 1, dummy variables of downtown, the airport and Perimeter are all 0. To avoid

multicollinearity, the shortest distance variable and three dummy variables enter the model, except the dummy variable of whether the closest employment center is the airport or not. According to regression result of the model 2, whether a census tract is located inside the ten core counties have an effect on neighborhood vacancy rate, so the dummy variable of ten core counties is also used in this adjusted model 2.

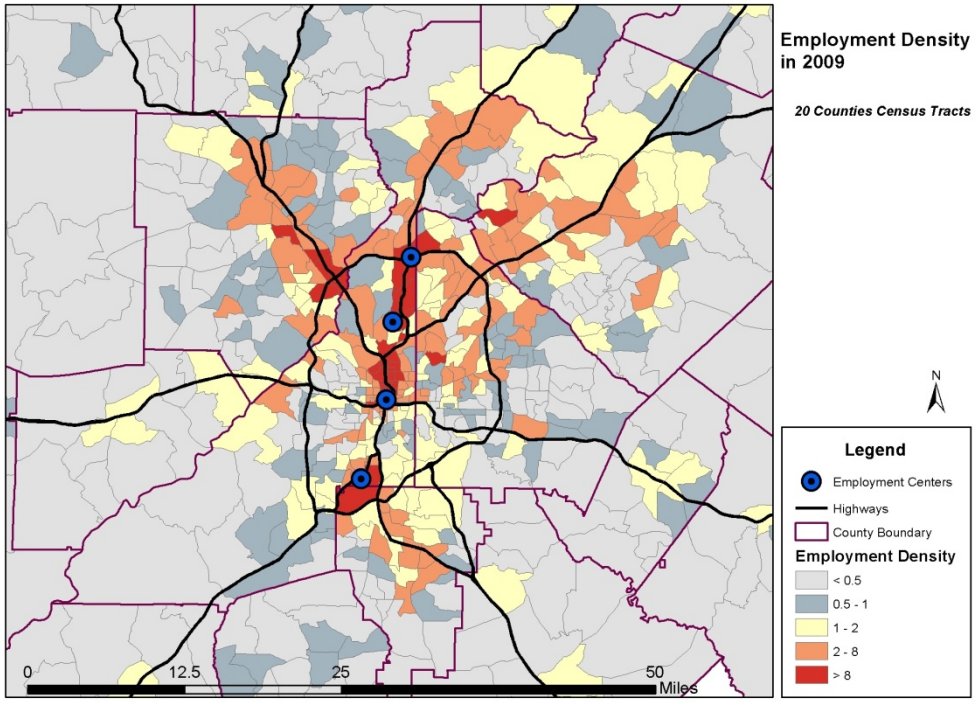

Figure 19. Employment Density in 2009 and Four Employment Centers

Source: Employment Data from Atlanta Regional Commission

Neighborhood economic characteristics, neighborhood demographic characteristics, foreclosure variables and location variables of distance to the closest employment center, three dummy variables of closest employment center and dummy variable of ten core counties are used to estimate the adjusted model 2. The regression model can explain 67.8% variance of vacancy rate (R square=0.678). The added location variables of shortest distance to the closest employment center and three dummy variables of employment centers increase the models' explanatory power by 0.6%, comparing with the original model 2.

Table 8 shows the regression result of adjusted model 2. Five of 12 economic variables are statistically significant at 95% level. Housing units with no vehicle is statistically significant at about 94% level. Average household size is the only statistically significant demographic variable at 95% level. The signs

and magnitude of those variables are consistent with model 1 and the original model 2. Foreclosure rate and its quadratic term are statistically significant at 95% level. Holding other variables constant, 1 more foreclosure filings per mortgageable property will increase vacancy rate by about 2.3%.

Table 8. Regression of Vacancy Rate on Neighborhood, Foreclosure Rate and Location Variables (2)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	19.293	2.394		8.060	0.000
ForeclusreRate	3.086	1.239	0.120	2.491	0.013
SQforeclosureRate	-0.793	0.301	-0.112	-2.634	0.009
ACSvacancy0610	0.355	0.024	0.433	14.854	0.000
Median_HH_Income	0.000	0.000	0.046	1.052	0.293
UnempRate	0.031	0.033	0.027	0.950	0.342
Per_OwnerOccupied	-0.774	1.116	-0.029	-0.693	0.488
LoanPeroccHU	0.158	1.360	0.003	0.116	0.907
Own_0vehicle	0.005	0.003	0.101	1.908	0.057
SQown0vehicle	0.000	0.000	-0.110	-2.483	0.013
Median_HU_Value	0.000	0.000	-0.078	-1.751	0.080
Median_SMOC	-0.001	0.001	-0.110	-2.525	0.012
DriveAlone_per	-8.486	1.937	-0.141	-4.380	0.000
Transit_per	19.245	2.987	0.230	6.444	0.000
M05B_M05A	-0.118	0.130	-0.024	-0.912	0.362
PopDen	0.000	0.000	-0.054	-1.644	0.101
Blackper	-1.305	0.900	-0.062	-1.449	0.148
PopDenCh	0.000	0.000	-0.016	-0.664	0.507
Avg_hhsize	-1.032	0.427	-0.066	-2.417	0.016
Core10	-1.212	0.494	-0.078	-2.454	0.014
TractClosetoDowntown	0.061	0.454	0.004	0.134	0.894
TractClosetoBuckhead	0.445	0.472	0.023	0.942	0.346
TractClosetoPerimeter	-0.959	0.380	-0.073	-2.522	0.012
DistanceEmpCenter	-0.029	0.025	-0.049	-1.171	0.242
R	0.823		R Square	0.678	

Ten core counties dummy variable is statistically significant at 95% level. It means vacancy rate of census tracts located inside the ten core counties is 1.2 percent lower than census tracts located outside the ten core counties. That is consistent with the original model 2, both of which shows suburb neighborhoods have a higher vacancy than central city neighborhoods during the period of 2006 to 2010.

Comparing to census tracts whose closest employment center is the airport, census tracts closest to Perimeter employment center have almost 1 percent lower vacancy rate and the dummy variable is statistically significant at 95% level. Though the other two dummy variables are not statistically significant, the signs show that vacancy rate of census tracts closest to downtown or Buckhead are higher than census tracts closest to the airport. The variable of shortest distance from every tract to its closest employment center is statistically significant at 75% level. It is negatively correlated with vacancy rate, which means giving all others constant, the closer the neighborhood to its employment center, the higher its vacancy rate. It also shows suburb neighborhoods have a higher vacancy rate than inner city neighborhoods in that period.

Figure 20 shows that all census tracts are classified into four groups according to which employment centers they are closest to. The northern part (blue area) has the lowest vacancy rate, followed by the southern part (dark green area). The two inner areas (purple and light green) have the highest vacancy rate. Besides, the outer ten counties (Bartow, Forsyth, Hall, Barrow, Walton, Newton, Spalding, Coweta, Carroll, and Paulding) have a higher vacancy rate than the core ten counties.

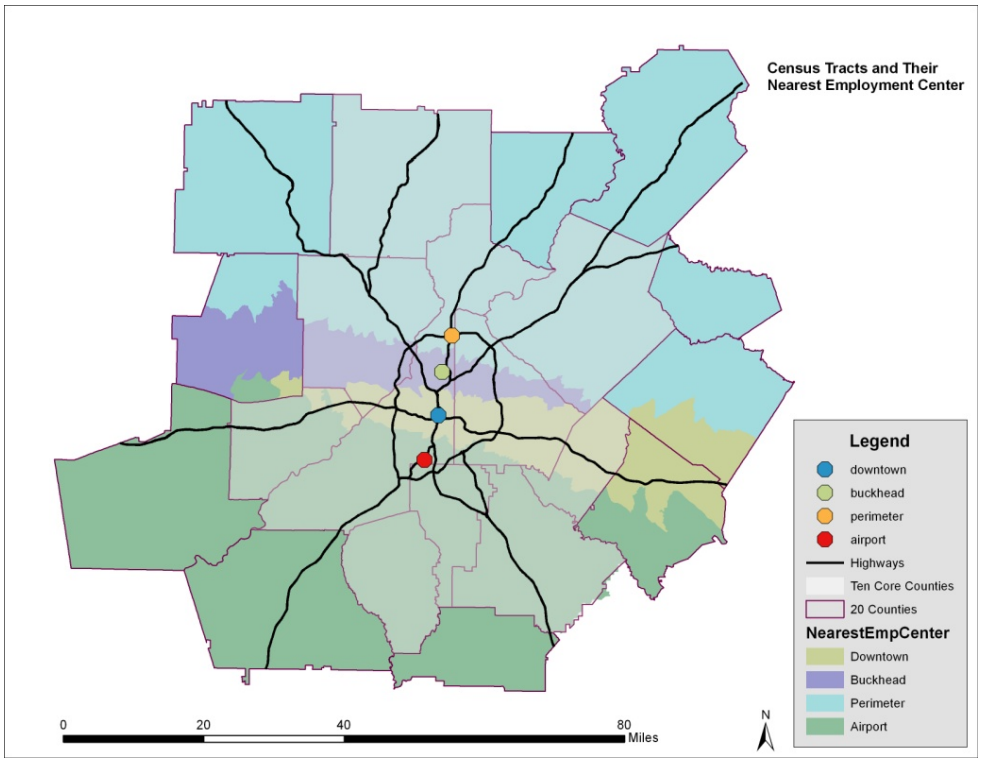

Figure 20. Four Census Tract Groups Based on Closest Employment Centers

The adjusted model 2 doesn't have significant non-normality or heteroskedasticity problem. And there is no severe multicollinearity. But as in the first model, there is some multicollinearity between median household income and median housing unit value. In addition, some neighborhood variables may be correlated with the location variables. For example, there are significant differences of demographic variables inside and outside five core counties (Table 8). Equal variance hypothesis and equal mean hypothesis are rejected of all four demographic variables so the means of those four variables are statistically different between five core counties and other 15 counties. Besides, the two commuting mode variables may also correlate with the core five counties, because public transit system is concentrated within the urban area (Figure 21). However, the VIFs of all the variables are below 10, so the multicollinearity is at a tolerable level.

Table 9. T-test of Demographic Variables in and out of 5 Core Counties

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
PopDen	Equal variances assumed	114.92	0.000	18.428	946	0.000	2454.669	133.202
	Equal variances not assumed			24.949	775.52	0.000	2454.669	98.389
Blackper	Equal variances assumed	212.23	0.000	11.959	942	0.000	0.237	0.020
	Equal variances not assumed			14.230	931.15	0.000	0.237	0.017
PopDenCh	Equal variances assumed	19.74	0.000	-0.956	946	0.339	-105.570	110.446
	Equal variances not assumed			-1.334	676.02	0.183	-105.570	79.127
Avg_hhsize	Equal variances assumed	99.06	0.000	-8.931	946	0.000	-0.268	0.030
	Equal variances not assumed			-10.850	944.80	0.000	-0.268	0.025

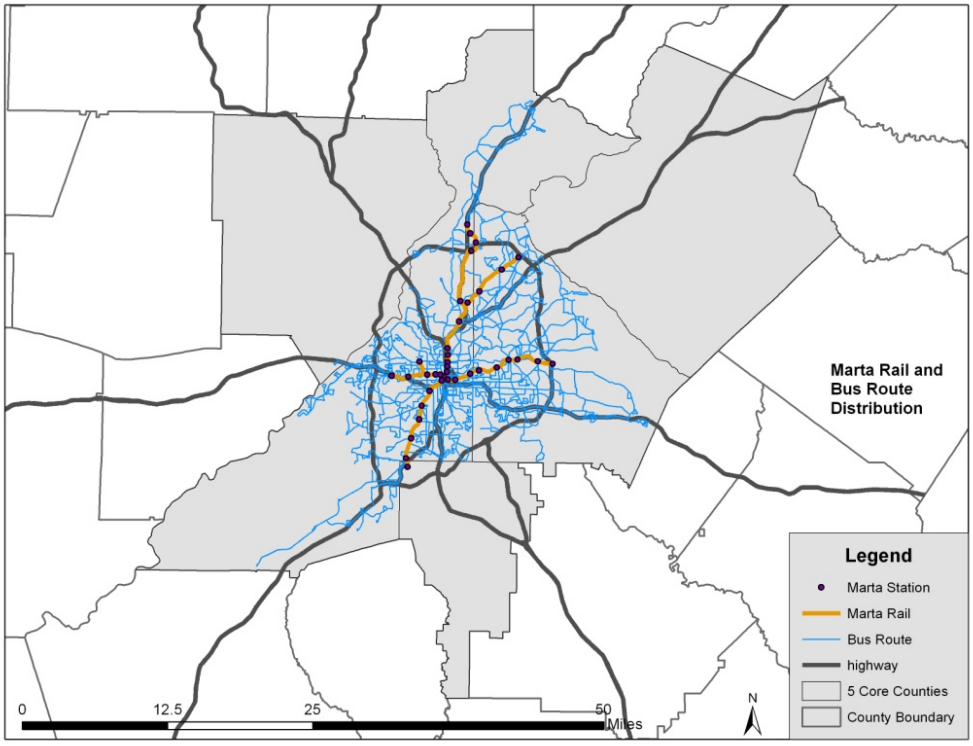

Figure 21. Marta Rail and Marta Bus Route Distribution

3. Result of Model 3

To understand the temporal effect of foreclosure rate on vacancy, foreclosure rates of four individual years are used instead of using total foreclosure filings per mortgageable property from 2007 to 2010. However, the four foreclosure rate variables have caused severe multicollinearity problem. VIFs of the four foreclosure rates are great than 50. So instead of using foreclosure rates of four individual years, total foreclosure rate and its quadratic term, and percentage of foreclosure filings in a certain year are used to measure the temporal effect. Two foreclosure filings percentage variables enter model 3, one is percentage of foreclosure filings in 2007 and 2008, and the other is percentage of foreclosure filings in 2009. Percentage of foreclosure filings in 2007 and 2008 are used as a proxy of the subprime foreclosure crisis.

Neighborhood economic variables, demographic variables, location variables and foreclosure variables (include percentage of foreclosure filings in 2007, 2008 and percentage of foreclosure flings in 2009) are used to estimate model 3. This model can explain 68.2% of variation of vacancy rate (R square

= 0.682). The two foreclosure filings percentage variables help to improve the model's explanatory power by 0.4%.

As in the adjusted model 2, table 10 shows the regression result of model 3: five economic variables, one demographic variable, two location variables and two foreclosure variables are statistically significant at 95% level. However, looking into the foreclosure variables, percentage of foreclosure filings in 2007 and 2008 are not as significant as expected. Noticing that ACS vacancy rate from 2006 to 2010 is one of the independent variable, which means the model is actually measuring the vacancy rate change from 2008 to 2010. So the foreclosure filings in 2007 and 2008 help explain the vacancy rate before 2008, not from 2008 to 2010. The other reason might be the temporal lag effect of subprime crisis, which means foreclosure filings in 2009 are still affected by the crisis.

Table 10. Regression of Vacancy Rate on Neighborhood, Foreclosure Rate and Percentage of foreclosure filings

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	14.926	2.796		5.338	0.000
ForeclusreRate	2.181	1.257	0.085	1.734	0.083
SQforeclosureRate	-.619	0.303	-0.088	-2.041	0.042
ForeclosurePer0708	2.283	2.452	0.031	0.931	0.352
ForeclosurePer2009	12.810	3.670	0.091	3.490	0.001
ACSvacancy0610	0.354	.024	0.432	14.740	0.000
Median_HH_Income	9.972E-6	0.000	0.043	0.983	0.326
UnempRate	0.035	0.033	0.030	1.059	0.290
Per_OwnerOccupied	-0.771	1.118	-0.029	-0.690	0.490
LoanPeroccHU	-0.129	1.362	-0.002	-0.095	0.925
Own_0vehicle	0.005	0.003	0.096	1.807	0.071
SQown0vehicle	-8.609E-6	0.000	-0.107	-2.428	0.015
Median_HU_Value	-5.044E-6	0.000	-0.085	-1.903	0.057
Median_SMOC	-0.001	0.001	-0.112	-2.585	0.010
DriveAlone_per	-8.688	1.929	-0.144	-4.505	0.000
Transit_per	18.621	3.087	0.223	6.033	0.000
M05B_M05A	-0.107	0.129	-0.022	-0.829	0.407
PopDen	0.000	0.000	-0.037	-1.108	0.268
Blackper	-1.023	0.916	-0.048	-1.117	0.264
PopDenCh	0.000	0.000	-0.025	-1.071	0.285
Avg_hhsize	-0.958	0.426	-0.061	-2.249	0.025

Core10	-1.039	0.494	-0.067	-2.101	0.036
TractClosetoDowntown	0.191	0.454	0.011	0.422	0.673
TractClosetoBuckhead	0.491	0.470	0.026	1.044	0.297
TractClosetoPerimeter	-1.008	0.382	-0.077	-2.636	0.009
DistanceEmpCenter	-5.970E-6	0.000	-0.054	-1.279	0.201
R	0.826		R Square	0.682	

One possible solution to estimate the effect of percentage of foreclosure filings in 2007 and 2008 or the effect of the subprime crisis is to drop the ACS vacancy rate from 2006 to 2010, so that the model will estimate the vacancy rate in 2010 instead of vacancy rate change from 2008 to 2010. Table 11 shows the regression result of adjusted model 3. Dropping the ACS vacancy rate from 2006 to 2010 makes all other variables statistically significant at a higher level. However, the explanatory power of the model decreased to about 60%.

Six out of 12 neighborhood economics variables are statistically significant at 95% level, five of which are the same as the first two models (except the ACS vacancy from 2006 to 2010), and the sixth one is percentage of owner occupied housing units. Three economic variables become statistically significant at 90% level, which are unemployment rate, median value of owner occupied housing units, and ratio of moving into housing units before 2005 to moving in after 2005. Keeping others constant, 1 more percent of owner occupied housing units will decrease vacancy rate by almost 3.5 percent; neighborhoods with 10,000 dollars higher median housing value will have a 0.05 percent lower vacancy rate; if the neighborhoods' housing units moving in before 2005 to after 2005 ratio increases by 1, the vacancy rate will decrease by 0.25 percent.

Population density change from 2000 to 2010 and average household size are statistically significant at 95% level. The magnitude of population density change is tiny; if neighborhoods' household size is one person larger, the vacancy rate will be 1.9 percent lower, keeping others constant.

Core ten-county dummy variable, Perimeter employment center dummy variable and the shortest distance to employment center are statistically significant at 95% level. However, after dropping the ACS vacancy rate from 2006 to 2010, the vacancy distribution pattern changes. All three employment center dummy variables are now negatively correlated with vacancy rate, which means the southern part (neighborhoods' closest employment center is the airport) of metro Atlanta has the highest vacancy rate, comparing with the northern part and the inner areas. Comparing this result with adjusted model 2, it tells that there is more vacancy occurred in two inner areas during 2008 to 2010.

All four foreclosure variables are statistically significant at 99% level. Keeping others constant, one more foreclosure filings per mortgageable will increase vacancy by 4.6 percent, which is higher than the first two models; one more percent of foreclosure filings in 2007 and 2008 will increase vacancy rate by 7.7 percent. And the regression result confirms the hypothesis that the effect of subprime crisis may last until 2009.

Table 11. Regression of Vacancy Rate on Neighborhood, Foreclosure Rate and Percentage of foreclosure filings (2)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	24.818	3.019		8.221	0.000
ForeclusreRate	5.943	1.369	0.232	4.341	0.000
SQforeclosureRate	-1.380	0.332	-0.196	-4.155	0.000
ForeclosurePer0708	7.728	2.695	0.106	2.867	0.004
ForeclosurePer09	14.977	4.078	0.106	3.673	0.000
Median_HH_Income	8.867E-6	0.000	0.038	0.786	0.432
UnempRate	0.071	0.037	0.060	1.950	0.052
Per_OwnerOccupied	-3.474	1.226	-0.130	-2.833	0.005
LoanPeroccHU	-2.342	1.505	-0.040	-1.556	0.120
Own_0vehicle	0.006	0.003	0.131	2.236	0.026
SQown0vehicle	-1.515E-5	0.000	-0.189	-3.873	0.000
Median_HU_Value	-5.053E-6	0.000	-0.085	-1.715	0.087
Median_SMOC	-0.001	0.001	-0.100	-2.070	0.039
DriveAlone_per	-11.904	2.131	-0.198	-5.586	0.000
Transit_per	23.858	3.410	0.285	6.997	0.000
M05B_M05A	-0.248	0.143	-0.050	-1.730	0.084
PopDen	-8.858E-5	0.000	-0.030	-0.810	0.418
Blackper	-0.149	1.016	-0.007	-0.146	0.884
PopDenCh	0.000	0.000	-0.060	-2.264	0.024
Avg_hhsize	-1.874	0.469	-0.120	-3.997	0.000
Core10	-2.044	0.544	-0.131	-3.754	0.000
TractClosetoDowntown	-0.286	0.504	-0.017	-0.568	0.570
TractClosetoBuckhead	-0.067	0.521	-.003	-0.129	0.898
TractClosetoPerimeter	-0.951	0.425	-0.073	-2.237	0.026
DistanceEmpCenter	-1.061E-5	0.000	-0.095	-2.049	0.041
R	0.779		R Sqaure	0.596	

4. Spatial Autocorrelation Problem

The three models are susceptible to spatial autocorrelation, because census tract with high vacancy neighbor tracts tends to have higher vacancy rate. To measure the spatial autocorrelation, global Moran's I is calculated (Figure 22). There is a significant positive spatial autocorrelation, which means census tracts with high vacancy rate are concentrated, and census tracts with low vacancy rate are concentrated as well. Global Morans' I is calculated based on the rook contiguity weight matrix. Figure 23 shows the connectivity distribution of all the census tracts, which describes the distribution of locations by number of neighbors (shown in the legend). Noticing that there are no islands, which mean census tracts correspond to zero neighbors. And most census tracts are identified with five or six neighbor tracts.

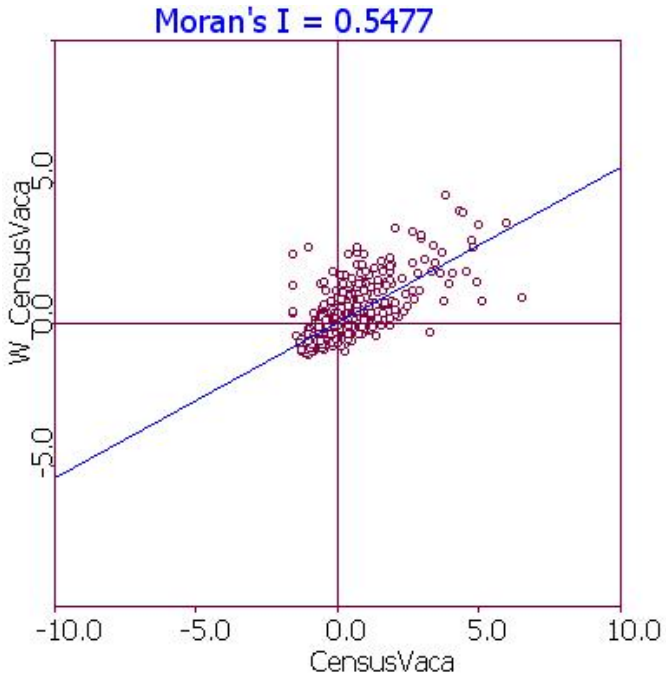

Figure 22. Global Moran's I of Vacancy Rate, Calculated by Geoda

Note: Weight Matrix Created Using Rook Contiguity Method

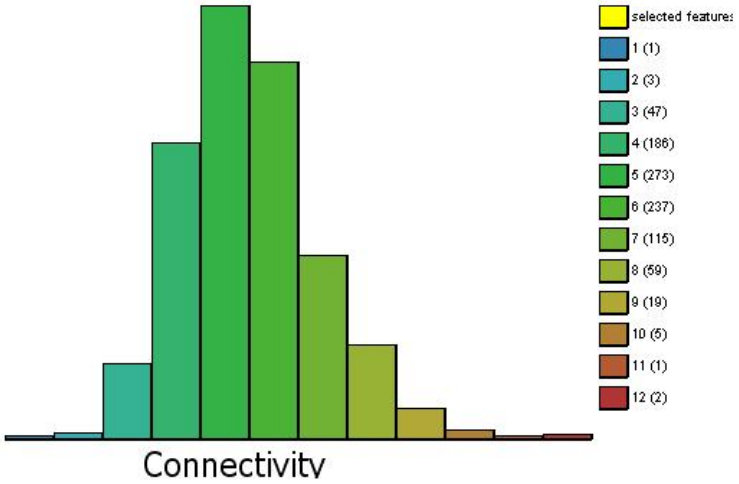

Figure 23. Connectivity of Census Tracts, Calculated by Geoda

To examine where the high vacancy concentrated and low vacancy concentrated neighborhoods are, clusters and outliers analysis as well as hot spot analysis are conducted. Figure 24 shows all clusters of vacancy rate calculated based on tracts' spatial relationship. Black area is the high vacancy clusters; blue area is the low vacancy clusters. There are a few outliers, where high vacancy tracts have low vacancy neighbors or low vacancy tracts have high vacancy neighbors (orange and white areas). By looking into the clusters, a single high vacancy cluster is identified which locates at City of Atlanta, and a band of low vacancy cluster is located at the north suburb of Metro Atlanta and the other low vacancy cluster is at the south edge of the Metro area (Figure 25.).

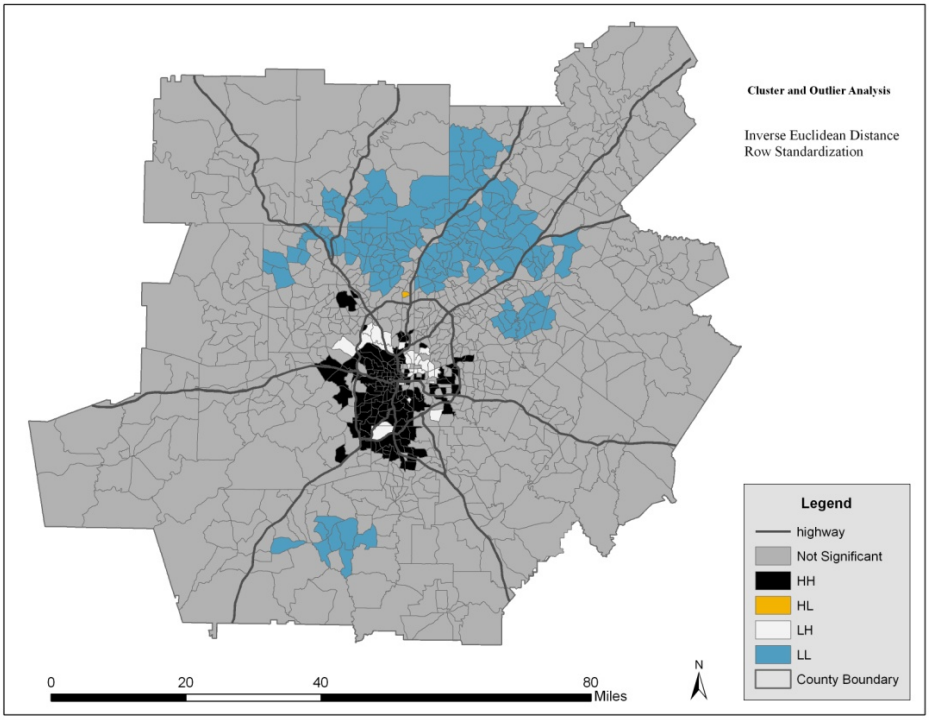

Figure 24. Clusters and Outliers Analysis

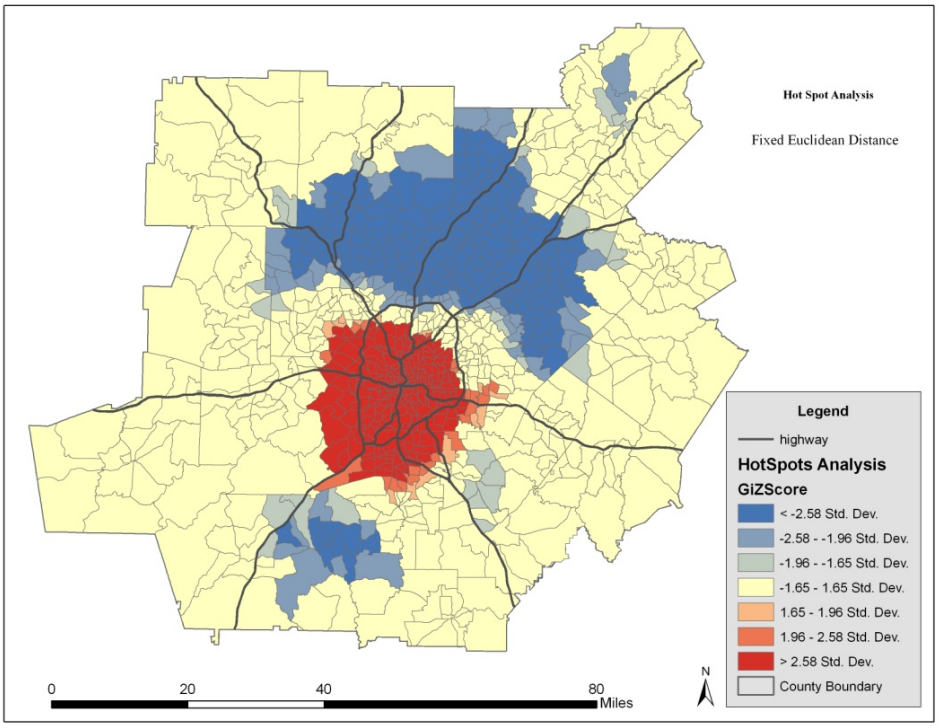

Figure 25. Hot Spot Analysis

Those clusters' distribution pattern help to understand the current vacancy distribution, however, it doesn't include the effect of independent variables, such as neighborhood economic, demographic characteristics, location features and foreclosure variables. Mapping the regression result helps to understand the severity of spatial autocorrelation. Figure 26 shows the Global Moran's I of residual term of the classic regression of adjusted model 2. It shows that the unexplained vacancy rate of adjusted model 2 still have slight positive spatial autocorrelation, though the regression model succeeds explaining major spatial autocorrelation by including neighborhood economics, demographic characteristics and location features of neighborhoods.

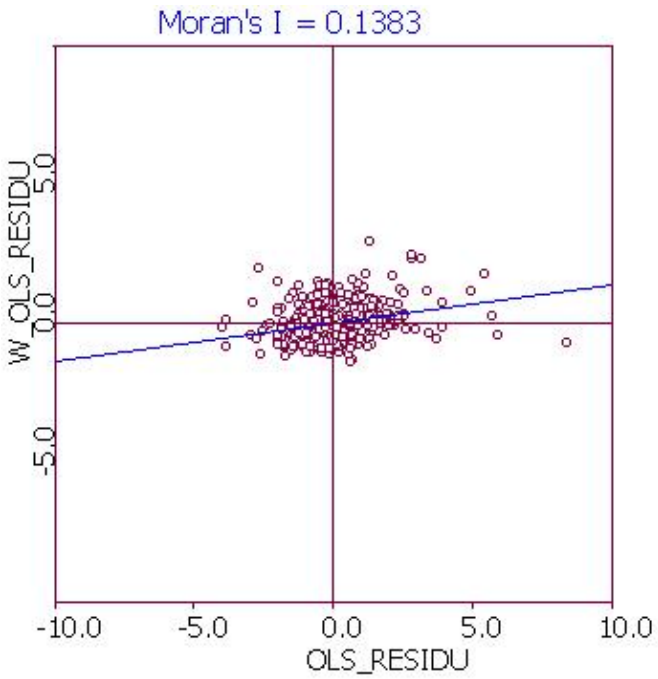

Figure 26. Global Moran's I of Regression Residual of Adjusted Model 2, Calculated by Geoda

By doing LM test, the LM-error test doesn't reject the null hypothesis, however the LM-lag test rejects the null hypothesis (Table 12), which means one approach to further improve the regression result is to conduct a spatial lag regression in Geoda. Spatial lag term is the average vacancy rate of every tract's neighbors, and a tract's neighbors are defined by the rook contiguity matrix (Figure 23 shows the distribution of number of neighbors). Then the spatial lag term enters the model as independent variable.

Table 12. LM Test

TEST	MI/DF	VALUE	PROB
Moran's I (error)	0.138253	7.5659716	0.0000000
Lagrange Multiplier (lag)	1	75.4420079	0.0000000
Robust LM (lag)	1	27.3107169	0.0000002
Lagrange Multiplier (error)	1	48.1425793	0.0000000
Robust LM (error)	1	0.0112883	0.9153869
Lagrange Multiplier (SARMA)	2	75.4532962	0.0000000

A geographically weighted regression (spatial lag model) is estimated by including spatial lag term of the dependent variable as an independent variable to the adjusted model 2, which reduces the significance of all other explanatory variables. Figure 27, Figure 28, and Figure 29 show the spatial lag regression result of adjusted model 2 with spatial lag term of vacancy rate. Figure 28 shows that the residual of the geographically weighted regression are now scattered instead of clustered. The Global Moran's I of residual term of the spatial lag regression of adjusted model 2 is almost equal to zero, which means there is no statistically significant spatial autocorrelation (Figure 27).

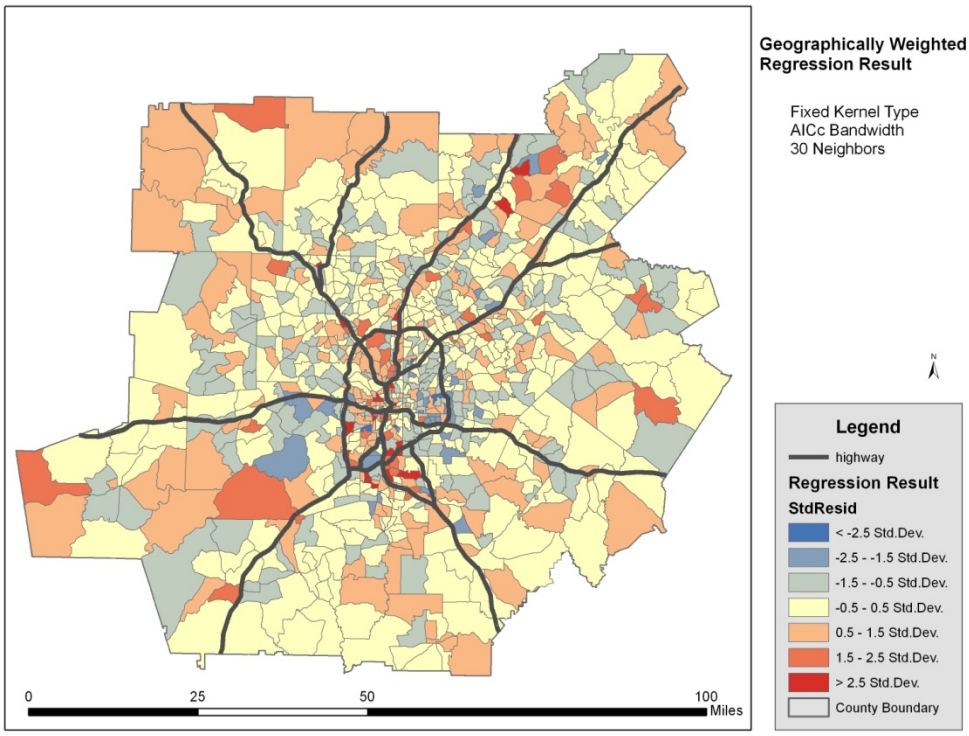

Figure 27. Regression Residuals of Geographically Weighted Regression Result

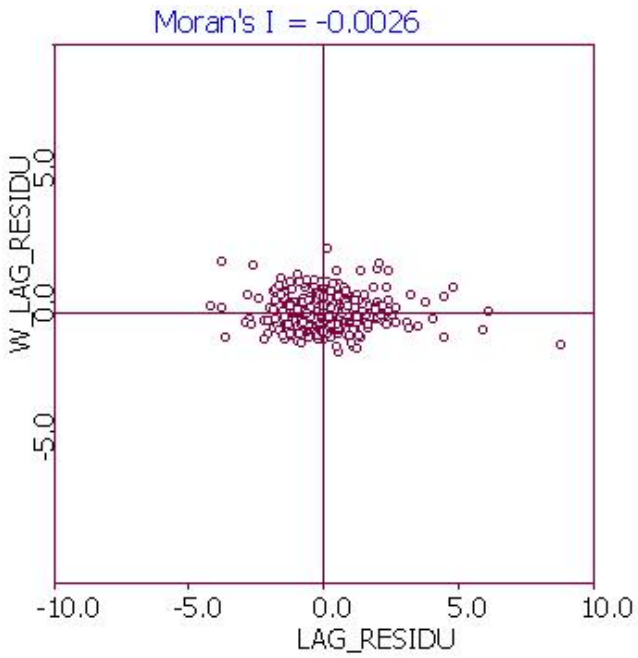

Figure 28. Global Moran's I of Regression Residual of Geographically Weighted Regression, Calculated by Geoda

Figure 29 is the predicted vacancy rate distribution of the spatial lag regression of adjusted model 2. Just as the model regression result, between 2008 and 2010, vacancy happened mainly in the suburb neighborhoods. And census tracts, whose closest employment center is perimeter, have a lower vacancy rate than the other areas. Comparing to Figure 20, census tracts close to the airport employment center has a higher vacancy than tracts close to the Perimeter employment center, but lower vacancy than tracts close to downtown and Buckhead employment centers. And also, census tracts closer to the employment centers have a higher vacancy rate.

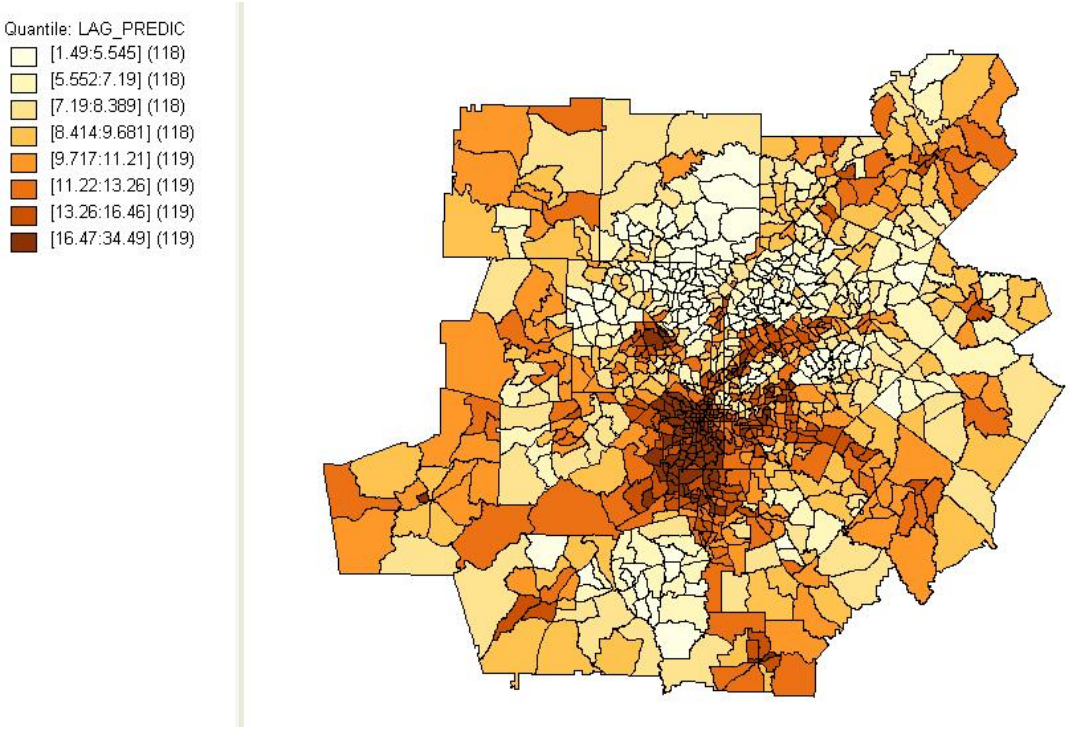

Figure 29. The Predicted Vacancy Rate from Geographically Weighted Regression Result

Comparing Figure 26 and Figure 28, though the adjusted model 2 still have some spatial autocorrelation (Global Moran's I = 0.14), the result is acceptable because its regression generates similar vacancy distribution pattern as the spatial lag model does, because the independent variables together are able to explain most of the spatial concentration. Therefore, though the basic model, adjusted model 2 and model 3 have slight spatial autocorrelation issue, the regression results are still reliable. The spatial concentration of high vacancy and low vacancy tracts are explained by the demographic, household income, housing unit characteristics and location features. Besides, the spatial concentration is part of the nature of neighborhood characteristics. Neighborhoods are blended into, not isolated with its surrounding area.

VI. Summary and Conclusions

1. Conclusions

This study examines the effect of foreclosures on neighborhood vacancy change from 2006 to 2010 at the census tract level. First, total foreclosure filings per mortgageable property, together with neighborhood economic and demographic characteristics are used to estimate the vacancy rate. The model can explain 67% variation of the vacancy rate. The model shows that vacancy rate increases with foreclosure rate, but increases at a slower rate at higher foreclosure rate levels. Holding other variables constant, 1 more foreclosure filings per mortgageable property will increase vacancy rate by about 2.2%. Among all other independent variables, ACS vacancy rate from 2006 to 2010, housing units with no vehicle available and its quadratic term, median SMOC, percentage of people commute by driving alone, percentage of people commute by public transit, population density and average household size are statistically significant at 95% level. In addition, the regression result suggests that neighborhoods with more households moving in before 2005 tend to be more stable and vibrant. This variable partially represents the effect of the 2003-2006 real estate bubble and reveals the effect of recent foreclosure crisis on neighborhood. Median household income is not negatively correlated with vacancy rate as significantly as expected, which means vacancies during the period of 2008 to 2010 (or 2006 to 2010) are not concentrated in low income neighborhoods, but involve some median or high income neighborhoods.

To examine whether there is a difference in vacancy rate between inner city and suburban neighborhoods, two dummy location variables are used to estimate model 2. And the regression result shows that there is no statistically significant difference on vacancy rate between neighborhoods inside and outside the five core counties. However, ten core counties do have a lower vacancy rate than the ten outer counties. Holding other variables constant, neighborhoods inside ten core counties have a vacancy rate 0.9 percent lower than neighborhoods of the outer ten-county area. The result of model 2 shows suburban neighborhood has been experiencing higher vacancy than city neighborhood since 2008. Again, they may associate with the effect of the recent foreclosure crisis. Adding location variables of distance to employment center and dummy variables of employment centers in model 2, the adjusted model 2 shows if neighborhoods' nearest employment center is Perimeter area, they will have the lowest vacancy rate; vacancy rate of census tracts closest to downtown or Buckhead are higher than census tracts closest to the airport. This result is consistent with the original model 2 that suburb neighborhoods have a higher vacancy rate than inner city neighborhoods during that period.

It is important to not only understand the magnitude of effect of foreclosure on neighborhood vacancy, but also to know how long this effect will last. Percentage of foreclosure filings in 2007 and 2008 is used as a proxy of the subprime foreclosure crisis and is added to adjusted model 2 together with percentage of foreclosure filings in 2009. Because the model is actually measuring the vacancy rate change from 2008 to 2010. But the foreclosure filings in 2007 and 2008 help explain the vacancy rate before 2008, not from 2008 to 2010. So model 3 is re-estimated by dropping ACS vacancy rate from to 2006 to 2010 so that it measures the vacancy rate in 2010. Different from models predicting vacancy rate from 2008 to 2010, this models shows southern part (neighborhoods' closest employment center is the airport) of metro Atlanta has the highest vacancy rate, comparing with the northern part and the inner areas. And it helps to explain vacancy between 2008 and 2010 concentrated in inner city areas. And the regression result confirms the hypothesis that the effect of subprime crisis may last until 2009.

Global Moran's I is calculated to measure the spatial autocorrelation, clusters and outliers analysis as well as hot spot analysis are conducted to map the spatial distribution of vacancy rate. The adjusted model 2 can reduce Global Moran's I from 0.5477 to 0.1383. And a spatial lag regression (geographically weighted regression) model can further reduce it to -0.0026. Though there is still some positive spatial autocorrelation in the adjusted model 2, 0.1383 is tolerable. So regression results of the three regression models are reliable.

2. Innovation and Limitation

Instead of using a hedonic model to estimate the effect of foreclosure on housing price, and explain the negative externality of lowered housing price on the neighborhood stability, this study focused on measuring the effect of foreclosures on neighborhood vacancy directly. Variables about neighborhood economic characteristics, such as income, employment status, vehicle availability, owner occupied rate, monthly owner cost, commute mode are included as control variable to minimize neighborhood bias. Besides, demographic characteristics, such as population density, racial composition, household size, median age, are included to minimized bias as well.

Except the basic model measuring the effect of total foreclosure on vacancy rate, two more models are estimated to measure the spatial and temporal factors, which give a more comprehensive description of the relationship between foreclosure and neighborhood vacancy. Considering spatial autocorrelation, a geographically weighted regression improves the models.

However, data are extracted from both Census and American Community Survey, which may introduce some error because of different measurement methods those two datasets use. And because the geography of tracts change from 2000 to 2010, to bridge the two geographies into one, minimum of

percentage data, and variables changes from 2000 to 2010 are used. That may cause some variables affecting the vacancy can't be included in the models.

Model 2 and 3 are measuring the spatial and temporal relationship between foreclosure and vacancy rate. Model 2 can be improved by introducing more location variables to stimulate the real situation. And there are only four years of foreclosure filings data, which is not long enough to estimate the long-term effect of foreclosure. Models 3 can be improved by adding foreclosure data in at least recent 10 years and model needs to be specified carefully to reduce multicollinearity.

Bibliography

Adelino, M., Gerardi, K., et al. (2010). "What Explains Differences in Foreclosure Rates? A Response to Piskorski, Seru and Vig." *Federal Reserve Bank of Atlanta, Working Paper Series*: 2010-8.

Allen, R. (2011). "The Relationship between Residential Foreclosures, Race, Ethnicity, and Nativity Status." *Journal of Planning Education and Research* 31(2): 125-142

Baxter, V. and Lauria, M., (2000). "Residential Mortgage Foreclosure and Neighborhood Change." *Housing Policy Debate* 11(3): 675-699.

Been, V., Ellen, I. G., et al. (2011). "Does Losing Your Home Mean Losing Your School?: Effects of Foreclosures on the School Mobility of Children." *Regional Science and Urban Economics* 41(4): 407-414.

Burnett, K., Herbert, C., and Kaul, B. (2002). "Subprime Originations And Foreclosures in New York State: A Case Study of Nassau, Suffolk, and Westchester Counties". Retrieved on November 19 2011, from Abt Associates Website, http://www.abtassociates.com/reports/Suburban_NY_Foreclosures_study_final.pdf.

Carroll, T. M., Clauretie, T.M., and Neil, H. R. (1997). "Effect of Foreclosure

Case, K. E. (2008). "The Central Role of Home Prices in the Current Financial Crisis: How Will the Market Clear?" *Brookings Papers on Economics Activity* 2008: 161-193.

Couch, K. A. and Nelson A. A. (2011). "The Foreclosure Frisis: Causes and Consequences." *Journal of Policy Analysis and Management* 30(2): 381-382.

Fogel, K., Kali, R., et al. (2011). "Have Community Banks Reduced Home Foreclosure Rates?" *Journal of Banking & Finance* 35(9): 2498-2509.

Foote, C. and Gerardi, K., (2009). "Reducing Foreclosures: No Easy Answers." *Federal Reserve Bank of Atlanta, Working Paper Series*: 2009-15.

Foote, C., Gerardi, K., et al. (2008). "Just the facts: An Initial Analysis of Subprime's Role in the Housing Crisis." *Journal of Housing Economics* 17(4): 291-305.

Foote, C., Gerardi, K., et al. (2008). "Negative Equity and Foreclosure: Theory and evidenc." *Journal of Urban Economics* 64(2): 234-245.

Forgey, F. A., Rutherford, R. C., and VanBuskirk, M. L. (1994). “Effect

Frame, W. S. (2010). "Estimating the Effect of Mortgage Foreclosures on Nearby Property Values: A Critical Review of the Literature." *Federal Reserve Bank of Atlanta, Economics Review*: 95(3).

Galster, G. and Tatian P. (2009). "Modeling Housing Appreciation Dynamics in Disadvantaged Neighborhoods." *Journal of Planning Education and Research* 29(1): 7-22.

Gerardi, K. and Willen P. (2009). "Subprime Mortgages, Foreclosures, and Urban Neighborhoods." *The B.E. Journal of Economics Analysis & Policy* 9(3).

Gerardi, K., L. G., and Meier, S., (2010). "Financial Literacy and Subprime Mortgage Delinquency: Evidence from a Survey Matched to Administrative Data." *Federal Reserve Bank of Atlanta, Working Paper Series*: 2010-10.

Gerardi, K.,Willen P. (2009). "Decomposing the Foreclosure Crisis: House Price Depreciation versus Bad Underwriting." *Federal Reserve Bank of Atlanta, Working Paper Series*: 2009-25.

Gruenstein, D., and Herbert, C. (2000). “Analyzing Trends in Subprime Originations And Foreclosures: A Case Study of the Atlanta Metro Area”. Retrieved on Novermber 19 2011, from Ablt Associates Website, http://www.abtassociates.com/reports/es-20006470781991.pdf.

Immergluck, D. (2005). "Measuring the Effect of Subprime Lending on Neighborhood Foreclosures: Evidence from Chicago." *Urban Affairs Review* 40(3): 362-389.

Immergluck, D. (2008). "From the Subprime to the Exotic: Excessive Mortgage Market Risk and Foreclosures." *Journal of the American Planning Association* 74(1): 59-76.

Immergluck, D. (2009). *Foreclosed: High-risk Lending, Deregulation, and the Undermining of America’s Mortgage Market.* Ithaca, New York: Cornell University Press.

Immergluck, D. (2009). "The Foreclosure Crisis, Foreclosed Properties, and Federal Policy: Some Implications for Housing and Community Development Planning." *Journal of the American Planning Association* 75(4): 406-423.

Immergluck, D. (2010). "Neighborhoods in the Wake of the Debacle: Intrametropolitan Patterns of Foreclosed Properties." *Urban Affairs Review* 46(1): 3-36.

Immergluck, D. (2011). "The Local Wreckage of Global Capital: The Subprime Crisis, Federal Policy and High-Foreclosure Neighborhoods in the US." *International Journal of Urban and Regional Research* 35(1): 130-146.

Immergluck, D. and Smith G. (2006). "The Impact of Single-family Mortgage Foreclosures on Neighborhood Crime." *Housing Studies* 21(6): 851-866.

Immergluck, D., Smith, G., (2006). "The External Costs of Foreclosure: The Impact of Single-family Mortgage Foreclosures on Property Values." *Housing Policy Debate* 17(1): 57-79.

Kaplan, D. H., Sommers G. G. (2009). "An Analysis of the Relationship Between Housing Foreclosures, Lending Practices, and Neighborhood Ecology: Evidence from a Distressed County." *Professional Geographer* 61(1): 101-120.

Kobie, T. F., Lee, S., (2010). "The Spatial-Temporal Impact of Residential Foreclosures on Single-Family Residential Property Values." *Urban Affairs Review* 47(1): 3-30.

Lauria, M. and Baxter, V., (1999). "Residential Mortgage Foreclosure and Racial Transition in New Orleans." *Urban Affairs Review* 34(6): 757-786.

Leonard, T. and Murdoch, J. C., (2009). "The Neighborhood Effects of Foreclosure." *Journal of Geographical Systems* 11(4): 317-332.

Leonard, T., and Murdoch, J. (2009). “The Neighborhood Effects of Foreclosure”. *Journal of Geographical Systems* 11, no. 4:317–32.

Lin, Z., Rosenblatt, E., et al. (2007). "Spillover Effects of Foreclosures on Neighborhood Property Values." *The Journal of Real Estate Finance and Economics* 38(4): 387-407.

Of Foreclosure Status on Residential Selling Price. *Journal of Real Estate Research.* 9, no.3: 313–8.

Pennington-Cross, Anthony. (2006). “The Value of Foreclosed Property”. *Journal of Real Estate Research.* 28, no. 2: 193 ‑ 214.

Pollack, C. E., Kurd, S. K., et al., (2011). "A Case-control Study of Home Foreclosure, Health Conditions, and Health Care Utilization." *Urban Health* 88(3): 469-478.

Rhreat to Low-income Homeowners”. Retrieved on November 19 2011 from New Jersey Institute for Social Justice Website, http://www.njisj.org/reports/predatory_lending.html.

Robertson, C.T., Egelhof, R., Hoke, M. (2008). “Get Sick, Get Out: The Medical Cause of Home Mortgage Foreclosures”. *Health Matrix.* 2008(18): 65–105.

Rogers, W. H., (2010). "Declining Foreclosure Neighborhood Effects Over Time." *Housing Policy Debate* 20(4): 687-706.

Rugh, J. S. and Massey, D. S., (2010). "Racial Segregation and the American Foreclosure Crisis." *American Sociological Review* 75(5): 629-651.

Saegert, S., Fields, D., et al., (2011). "Mortgage Foreclosure and Health Disparities: Serial Displacement as Asset Extraction in African American Populations." *Urban Health* 88(3): 390-402.

Schuetz, J., Been,V., et al., (2008). "Neighborhood Effects of Concentrated Mortgage Foreclosures." *Journal of Housing Economics* 17(4): 306-319.

Shilling, J.D., Benjamin, J.D., and Sirmans, C.F. (1990). “Estimating Net Realizable Value for Distressed Real Estate”. *Journal of Real Estate Research.* 5, no. 1: 129 – 40.

Shlay, Anne B., and Gordon Whitman. (2004). “Research for Democracy: Linking Community Organizing and Research to Leverage Blight Policy”. Retrieved on November 18th 2011, from World Wide Web page: http://comm-org.wisc.edu/papers2004/shlay/shlay.htm.

Status on Residential Selling Price: Comment”. *Journal of Real Estate Research* 13, no. 1: 95–102.

Terrence M. Clauretie and Nasser Daneshvary (2009). "Estimating the House Foreclosure Discount Corrected for Spatial Price Interdependence and Endogeneity of Marketing Time." *Real Estate Economics* 37: 43-67.

Wassmer, R. W. (2011). "The Recent Pervasive External Effects of Residential Home Foreclosure." *Housing Policy Debate* 21(2): 247-265.

Whinston, M. D. (1990). "Tying, Foreclosure, and Exclusion." *The American Economic Review* 80(4): 837-859.

Yanmei, L. and Morrow-Jones, H. A. (2010). "The Impact of Residential Mortgage Foreclosure on Neighborhood Change and Succession." *Journal of Planning Education and Research* 30(1): 22-39.

Zimmerman, K., Wyly, E. and Botein, H. (2002). “Predatory Lending in New Jersey: The Rising