SUB-PRIME TO SUBOPTIMAL: REALIZED EFFECTS OF THE FORECLOSURE CRISIS ON NEIGHBORHOOD QUALITY IN HILLSBOROUGH COUNTY, FLORIDA

By

CHARLES MYRON GIBBONS

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To my incredible parents, Jane and Gary Gibbons
Thank you for always believing in everything I've ever done.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ACS	American Community Survey
ARM	Adjustable Rate Mortgage
ESRI	Environmental Systems Research Institute
FGDL	Florida Geographic Data Library
GIS	Geographic Information System(s)
GWR	Geographically Weighted Regression
HOA	Home Owners Association
OLS	Ordinary Least Squares
REO	Real Estate Owned
SPSS	Statistical Package for the Social Sciences

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Cochair: Paul Zwick
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With its roots in risky subprime lending practices, the foreclosure crisis of the late 2000s gutted neighborhoods across the United States. As foreclosed properties sit vacant, they can begin to negatively affect the actual and perceived quality of a neighborhood. The State of Florida sits at the epicenter of this crisis, with many communities incurring thousands of home foreclosures.

This study looks to understand the local impacts of foreclosures on neighborhood quality in Hillsborough County, Florida. In utilizing home price as a proxy for neighborhood quality, small geography data allowed for analyses at a fine level of detail. Using both Ordinary Least Squares and Geographically Weighted Regression techniques, the impacts of foreclosure and vacancy on home value were modeled with spatial context. To measure physically tangible effects, the employment of cluster analysis allowed clusters of foreclosures and code violations to be compared.

The results of this study show that home foreclosures have had the greatest and most disproportionate effect on home values in high income neighborhoods. However,

these impacts have not yet translated to noticeable physical effects in wealthy neighborhoods. Low income neighborhoods have seen a lesser impact on home values, but seemed to have reached a tipping point of negative impacts; here physical deterioration is found to cluster near foreclosures. The results of this study highlight the need for planning practitioners and local officials to focus their community stabilization efforts on these low income neighborhoods racked by foreclosure.

CHAPTER 1
INTRODUCTION

Trying Economic Times

The economic crisis of the late 2000s has become a defining event for many American citizens. This so called Great Recession has been described as the "deepest downturn in the labor market in the postwar era" (Elsby et al., 2010). Starting in the United States in late 2007, the decline has hampered growth across most sectors of the economy. As of mid-2011, the national unemployment rate remains above 9%, while financial markets continue to be wildly volatile (BLS, 2011). One of the most telling economic indicators is continued stagnation in the United States housing market. Even as housing prices have fallen, a lack of available financing options has kept American houses from being sold. With its economy based heavily on real estate and growth, the State of Florida has been particularly hard hit by economic adversity since the burst of the housing bubble in 2007 and 2008. The dangerous combination of predatory lending, lax planning policy, intense land speculation, and rampant development created a housing catastrophe waiting to happen. Only in hindsight are policy makers beginning to see the error of their ways; the scars on the economic landscape apparent.

The Foreclosure Issue

A central impetus of the global economic downturn is rooted in the risky lending practices associated with the US housing bubble. Credit-worthiness became an unnecessary factor when applying for a home loan, as sub-prime and adjustable rate mortgages (ARMs) became popular means of home finance. Florida's overly exuberant construction and housing market fueled many lenders to offer these dangerous loans to homeowners who could not carry the financial burden. By 2005, approximately six out

of every 100 households in metropolitan areas of Florida were financed via subprime loans, nearly twice the national average (Mayer & Pence, 2008). When the housing bubble burst many Floridian homeowners were unprepared. Widespread job loss and rising payment rates on ARMs forced thousands of homeowners to default on their mortgage; most of these homes would eventually go in to foreclosure. Foreclosure rates have continued to remain at record highs since the crisis began in 2008. Major metropolitan areas in Florida have since been decimated by foreclosures.

Often cited are the negative effects of foreclosure on the overall housing market. Less understood is the impact of these foreclosures on the neighborhoods where they take place. These impacts on neighborhoods go beyond effects on housing sales. Foreclosures and resulting housing vacancies also have the potential to change the perception of a neighborhood and ultimately its quality. As city planners look to serve the public good, understanding the nature the relationship between foreclosure and neighborhood quality will be paramount in their success.

Research Questions

This research looks to explore and quantify the effects of foreclosure on neighborhood quality. Using a variety of Geographic Information Systems (GIS) techniques, this work will examine the foreclosure crisis in the context of Hillsborough County, Florida, a major county in the greater Tampa Bay area. This research will look to answer the following questions:

- Has the foreclosure crisis negatively affected neighborhood quality in Hillsborough County, FL? If so, to what extent?
- Are low income neighborhoods being disproportionately affected?
- Are local clusters of foreclosures compounding negative neighborhood effects?

Organization

This work will be divided into the following six chapters. Chapter 2 gives additional background detail as well as highlighting relevant literature. This includes an overview of foreclosure, the link between neighborhood quality and housing value, and the external effects of foreclosure on neighborhood quality. Chapter 3 explains the theory behind the spatial processes and analysis used. It also contains a detailed methodology used to conduct the research. Chapter 4 presents the results of the GIS analyses. Chapter 5 is a discussion of the results given the current knowledge and research reviewed in the literature review. Chapter 6 provides a conclusion with recommendations for further research.

CHAPTER 2
LITERATURE REVIEW

Foreclosure Background

Subprime Mortgages

At the root of foreclosure crisis is the subprime mortgage. Whereas a prime mortgage is a high quality loan offered to borrowers based on their ability to pay back the loan on time, subprime mortgages are offered to borrowers who have a "larger-than-average risk of defaulting on the loan"(Investopedia, 2010). Many of these borrowers had previously missed a mortgage payment, filed for bankruptcy, or had enough delinquent debts to warrant a low credit score. These mortgages typically feature higher interest rates that may be variable; subprime mortgages have been known to have low initial interest rates that are raised after their original teaser periods. These Adjustable-Rate Mortgages (ARM) have become known as some of the most notorious subprime loans (Foote et al., 2008)

A global excess in capital created an influx of financial investments in the early 2000s, allowing banks to offer mortgage loans in a greater quantity than the 1990s. (Taylor, 2009) Not only was there an availability of credit, but an increasing percentage of the associated loans were considered to be high risk or subprime, as seen in Figure 2-1. Many of these sub-prime loans were also sold to homeowners who bought other homes under speculation. Under normal circumstances, most banks would be unwilling to take on this kind of risk. During the housing boom, these subprime loans were sold in securities to investors, along with more stable loans that made them more palatable; this in turn allowed lenders to issue even more risky loans. The availability of credit allowed lifetime renters to become homeowners, typically beyond their means. Many

Floridians utilized these loans in two ways unique to the state: by using the equity in their houses to

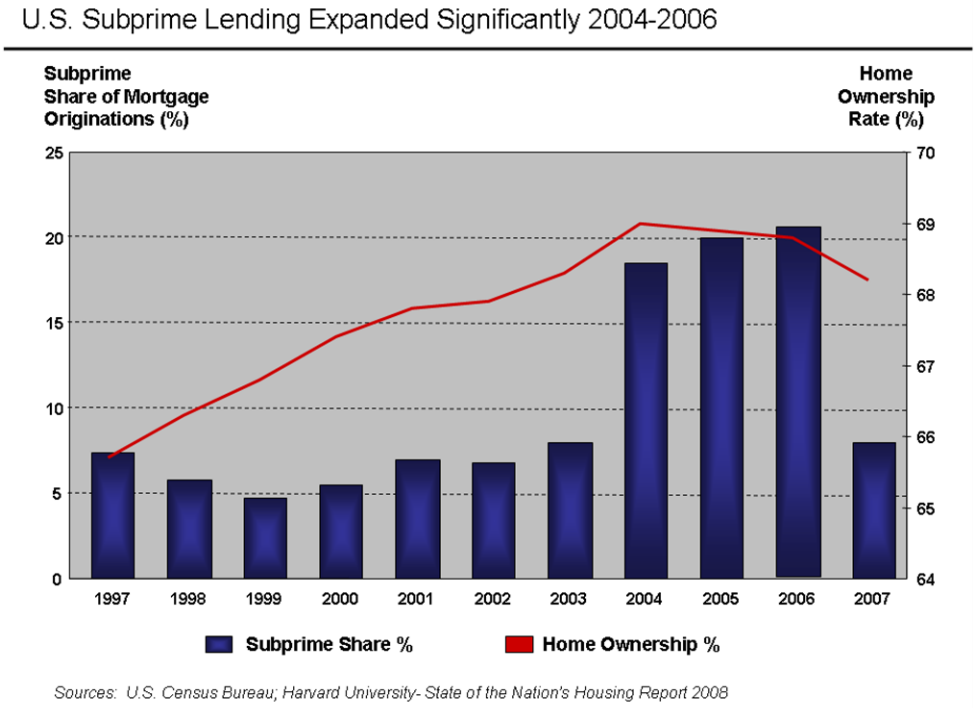


Figure 2-1. Subprime share of the mortgage market with home ownership rate. (Source: U.S. Census Bureau)

to access liquid funds and to buy, remodel, and subsequently resell or "flip" these properties. The vast majority of these were risky loans, with as many as 40% of currently foreclosed properties putting no money down on their homes. (Foote et al., 2008)

When interest rates on existing sub-prime mortgages exploded with a simultaneous plummet of housing prices in 2007 investors began to realize the toxicity of their assets. By 2008 these toxic debt assets in the United States had completely eroded away the stability of the global financial markets, beginning with the failure of Washington Mutual and Lehman Brothers banks. The government sponsored mortgage corporations Federal National Mortgage Association (Fannie Mae) and the Federal

Home Loan Mortgage Corporation (Freddie Mac) were only saved by a controversial government bailout, preventing a total global economic meltdown. (Glaeser et al., 2010). It was during this time that borrowers began to default on their payments; the wave of foreclosure was soon to follow.

Foreclosure Basics

When a property enters foreclosure, Merriam-Webster defines the process as "a legal proceeding that bars or extinguishes a mortgagor's right of redeeming a mortgaged estate" (2010). The process begins with a payment default, wherein the borrower misses one or more scheduled payments. At this point the lender seeks to rectify the default through loss mitigation methods, but if payment arrangements are not made within a 90 day period, a foreclosure suit is filed and the case winds its way through the Court system; this continues until a Final Judgment of Foreclosure is entered and the Court schedules a public auction of the property. In most instances, the property is purchased by the foreclosing lender who bids a credit bid for the property at the foreclosure sale. If the property goes unsold to a third party it becomes Real Estate Owned (REO), commonly referred to as "bank-owned" property. Once the property has either been sold or becomes bank owned its occupants are legally evicted. (Fogler, 2010)

Since the sharp decline in housing prices in 2007, foreclosures have dramatically increased as indicated in Figure 2-2. The Florida real estate market has experienced the foreclosure crisis in a unique way; the availability of land has fueled an ever growing housing market that felt the crash particularly hard. Borrowers with suspect credit used these available subprime loans to either buy houses which were out of their means or refinance their current home to gain liquid cash. There was excessive investing in real

estate as well during this time of rising prices, which in hindsight, were too good to be true.

The foreclosure rates in Central and South Florida have been astounding, with nearly one out of every 41 homes in some phase of the foreclosure process, versus one out of every 570 nationwide (Olorunnipa, 2010). With this staggering rate, many

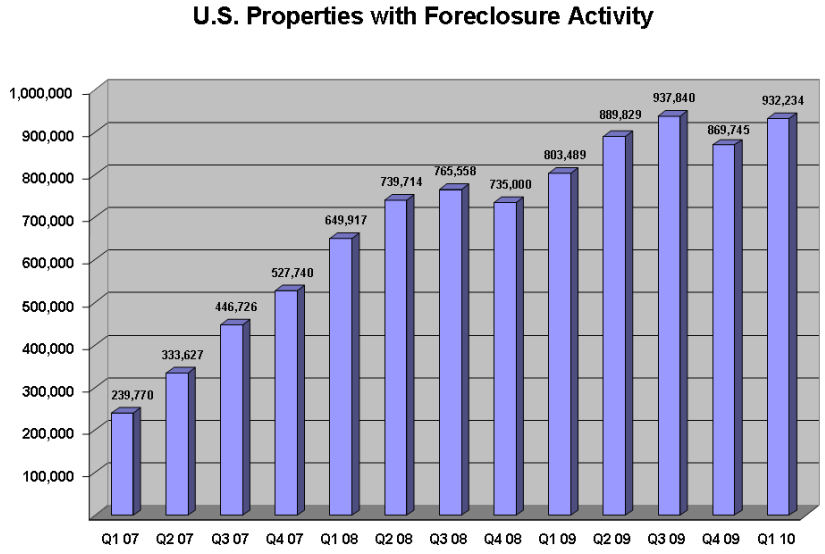


Figure 2-2. U.S. properties in foreclosure 2007-2010. (Source: U.S. Foreclosure Market Report)

neighborhoods have become inundated with pockets of foreclosed properties that lie vacant. Currently the lending market is much more stringent in terms of available credit, stricter than before the housing boom. The Federal Housing Administration has created a new set of guidelines that make it even more difficult for potential borrowers with bad credit to obtain a home loan. Increases in both minimum credit scores and monthly premiums will continue to keep credit tight and houses on the market (Browning, 2010). Without access to credit, potential homeowners have no way to purchase these foreclosed properties which remain vacant.

Housing and Neighborhood Quality

What Makes a Neighborhood?

Before accessing the quality of a neighborhood, the very concept of a neighborhood itself must be defined. Typically, individuals intuitively understand what a neighborhood feels like and they may very well be able to identify the neighborhood they are in. Beyond basic intuition, the concept of a neighborhood becomes murkier and more difficult to articulate. Many researchers have, in the past, focused on the idea neighborhood functionality; that is an area's ability to effectively perform economic, administrative control, political, and social functions (Hunter, 1979). This purely functional basis forced the examination of a neighborhood primarily on its actions. Besides being difficult measure, these categorical delineations could often come into conflict; such as when the economic identity of a neighborhood is in direct violation of its social identity e.g., an industrial area that is not viewed as such in its social context (Martin, 2003). These nebulous representations of neighborhoods have given way to more measureable means.

Planning and neighborhood expert George Galster defines a neighborhood in quantifiable terms as a "bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses". (2001, p.2112) This definition covers an assortment of complex attributes ranging from structural, infrastructural, demographic, class, public service, environmental, proximal, political, social and sentimental characteristics that together, help to create a quantifiable portrait of a neighborhood. The key variable which unifies the relationship between variables is their proximity in space (Galster, 2001). In terms of being quantifiable, this definition excels at being able to put neighborhood characteristics into discrete units. Given their

spatial orientation, attributes within the Galster model of a neighborhood naturally lend themselves to analysis with a geospatial reference i.e., a Geographic Information System (GIS).

Hedonic Regressions

The concept of hedonic regression is usually associated with valuing housing and real estate markets. Its historic genesis actually comes from the work of Andrew Court in the 1930s, where these models were primarily used to develop price indices for early automobiles (Goodman, 1998). Since then, the central theory behind hedonic regression has changed little. According to Sopranzetti these models "deconstruct the price of an asset into the asset's component parts, and then use some form of ordinary least squares regression analysis to examine how each individual piece uniquely contributes to the item's overall value." (2010, p. 1201). In its simplest form, a hedonic regression model takes the form a simple linear regression.

$$Y = \sum_{i=1}^{n} \left(X_i \beta_i + \varepsilon_i \ldots X_n \beta_n + \varepsilon_n\right) \quad (2\text{-}1)$$

Where

- Y is the summed value of the asset in question (e.g. home value)
- X is a value of an attribute affecting the value of y (e.g. structural or neighborhood attributes)
- β is an empirically estimated coefficient
- ε is the residual error not accounted for in by the independent variables

These values are calculated for each independent variable, which when summed, affect the regression output (Franklin & Waddell, 2002). It is this division of an asset into separate utilities that makes housing prices so well suited to the hedonic regression methodology.

Using this theory the value of a home can be modeled by using descriptive characteristics that explain the variability in home prices. Common categories of dependent variables used to describe housing markets include:

- STRUCTURAL FEATURES. Physical makeup of the property including property size, total living area, number of rooms, structural type, building age, existence of garage, etc.
- NEIGHBORHOOD CHARACTERISTICS. Quality of the surrounding neighborhood measured by school quality, neighborhood demographics, income levels, crime levels, etc.
- SPATIAL LOCATION. Location within a housing market. Can also includes proximity measures to other features
- OTHER CONDITIONS. Miscellaneous conditions affecting value including unfinished housing, foreclosure/short sale, etc.

Proper model specification is achieved by choosing the variables which have strong theoretical links with housing quality (Sopranzetti, 2010). The ideal outcome of a hedonic regression model is to have a favorable coefficient of determination, or R^2 value. This measure of goodness of fit is one of the primary ways to account for how well the independent, explanatory variables explain differences in the dependent variable, in this case housing value (Amemiya, 1980). Further evaluation of hedonic models quickly becomes much more complex and unnecessary to explain at this juncture.

Linking Price with Quality

While they are not a perfect indication of neighborhood quality, housing prices can be a useful, readily available proxy for researchers to use in a variety of analyses. Following in the footsteps of Ellen & Turner, Ding and Knaap (2002) argue for neighborhood quality's effect on housing and the people living within them; that "neighborhoods can influence a variety of individual characteristics such as educational

attainment, criminal involvement, teen sexual activity, and employment, though the mechanisms of causation remain difficult to identify." (2002, p. 3) By the same token, housing price and quality are equally affected by these neighborhood characteristics. When all other things are held constant, housing price should be indicative of relative neighborhood quality alone. Goodman (1977) gives an example of comparing two houses within a geography whose physical assets are identical. If the descriptive social and economic characteristics of the geography are the same, the difference between housing units must not be accounted for somewhere in the variable. However, if we find that there are socioeconomic differences at a smaller geography, like that of a traditional neighborhood, then the price difference can be attributed to the quality of the neighborhood (Goodman, 1977, p. 486).

Ding and Knaap find that high quality neighborhoods are difficult to specifically define, but they are generally ones which "exhibit high or stable property values, low outmigration rates, high household incomes, racial cohesion, and high quality public services" (2002, p. 2). This is not to say that low income neighborhoods are necessarily "bad", but that higher income neighborhoods with higher priced homes tend to be decidedly correlated with high neighborhood quality rates. The argument is not made for the dogmatic approach of taking housing prices as a direct index of neighborhood quality; the opposite is true, as these values are better suited to identity patterns and relative relationships (Ding and Knaap, 2002). Home values are therefore seen to be a reasonable proxy by which one can estimate neighborhood quality. This can be especially useful for planners as low home values can indicate area of critical need and concern.

The selection of variables in a hedonic regression model of housing prices can be an important factor when tailoring a model. Choosing model variables more heavily focused towards the neighborhood characteristics will thereby increase the sensitivity to neighborhood factors (Can, 1990) Some physical characteristics of housing must be included, but a reliance on socioeconomic factors (e.g. percentage minority, female headed households with children and income), while shying away from the physical (number of bathrooms, size of garage, etc.) will skew a model towards a neighborhood quality bias. This is not an inherent flaw in the model, as long as these assumptions are being explicitly noted.

Foreclosure's Effect on Neighborhoods

The Vacancy Link

When a property completes the foreclosure process, its occupants are forced to leave when the title of the property is transferred. When a macro or micro market force causes the property to remain vacant, then a property becomes a risk to the overall quality of a neighborhood. In the wake of the foreclosure crisis, the lack of available credit has continued to keep potential homebuyers at all income levels from being able to purchase a new home (Browning, 2010). When a property stays vacant for an extended period of time it can become abandoned and even blighted; this can have a profound effect on the perception of a neighborhood (Immergluck & Smith, 2006).

Compounding the large scale market issues associated with vacancy is the added strain of income level. Foreclosures which take place in high income areas are much less likely to remain vacant than those in low income areas. As seen in Figure 2-3, low income neighborhoods are simply less desirable places for buyers to invest in a

home; thereby, fewer homes are sold in the initial phases following a foreclosure. Many will likely sit vacant for long periods, once again inducing blight (Immergluck &Smith, 2005). As vacancy rates climb a neighborhood runs the risk of falling into the broken windows trap.

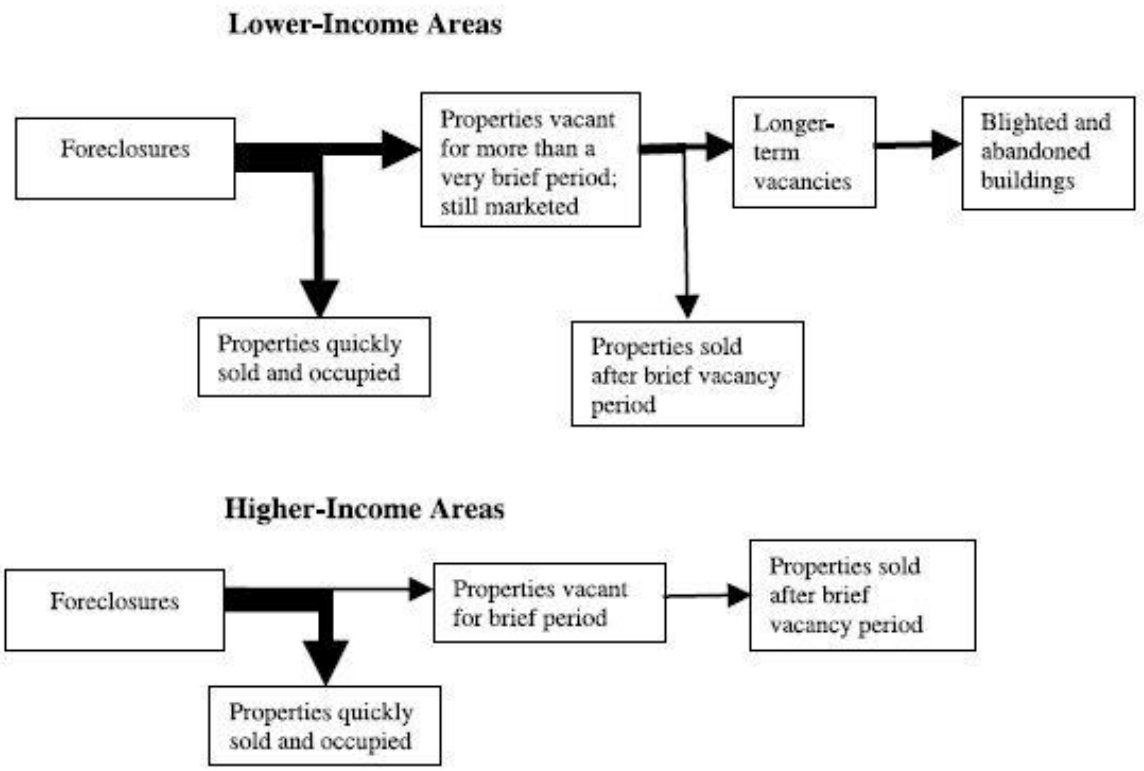


Figure 2-3. Foreclosure-vacancy trajectories by income. (Source: Adapted from Immergluck & Smith, 2005)

Broken Windows

The idea of the Broken Windows Theory was initially codified as a theoretical concept in Wilson and Kelling's (1982) landmark paper. While formally trained in criminology, Wilson and Kelling understand the universality in the link between the people and community. They introduce the concept with the example of an actual broken window:

> Social psychologists and police officers tend to agree that if a window in a building is broken and is left unrepaired, all the rest of the windows will soon

> be broken. This is as true in nice neighborhoods as in rundown ones. Window-breaking does not necessarily occur on a large scale because some areas are inhabited by determined window-breakers whereas others are populated by window-lovers; rather, one unrepaired broken window is a signal that no one cares, and so breaking more windows costs nothing. (It has always been fun.) (Wilson & Kelling, 1982, p. 2).

When a property incurs some sort of physical deterioration (be it damage, dilapidation, abandonment, etc.) it is crucial that the problem be quickly remedied; the Broken Windows cycle is said to affect both low income-high crime, as well as high income-low crime neighborhoods. The sociologic/criminological theory implies that the perceived safety and order of a neighborhood are crucially important to its actual quality (Wilson & Kelling, 1982). When neighbors, citizens, and passersby perceive a neighborhood to be safe and orderly their actions and demeanor are likely to reflect this; the same can be said for the negative relationship in poorly perceived neighborhoods. Relatively minor faults, a broken window; a wall with graffiti; shingles peeling off a house, can eventually snowball into full-blown neighborhood disorder, a "signal that no one cares" (Wilson and Kelling, 1982, p.3). As neighbors become disillusioned with the state of a neighborhood, they begin to become less active in its policing. In high quality neighborhoods, citizens have shown a sense of social responsibility and investment in their neighborhoods. The opposite is true in low quality, high crime neighborhoods; neighbors show a fend-for-themselves attitude towards crime and disorder (Wilson and Kelling, 1982). Further research has shown the link between the physical disorder in a neighborhood and the quality of life of its residents (Chappell, Monk-Turner, & Payne, 2011).

The vacancy associated with foreclosure leaves those properties open to the pitfalls of broken windows. In Accordino and Johnson's (2002) work with abandoned

properties, homeowners saw vacant and abandoned buildings as having “highly negative” impacts, with references to these buildings as “magnets for crime” (p. 303) Shilling (2009, p.110) draws the direct correlations between vacancy and broken windows:

- Direct increases in crime adjacent to vacant/abandoned properties
- Nearly $73 million in damage per year due to fires in abandoned properties
- High cost of demolition/cleaning leaves properties as they are
- Adjacent properties lose value
- Adjacent homeowners risk raises in insurance premiums/loss of coverage, further exacerbating negative effects

These neighborhoods with vacancies will often see these negative impacts after a certain critical mass of vacant and abandoned properties are reached. Each neighborhood has a sort of tipping point which will bring about widespread crime and neighborhood degradation. This model is presented in Galster’s (2000) model of neighborhood change, with regards to racial makeup. After a certain percentage of a neighborhood becomes African American, a tipping point is reached and the concept of white flight takes hold. This tipping point concept is further extended to vacancy and neighborhood decline. Beyond a point of critical mass, a neighborhood’s physically decline should greatly increase (Galster, 2000).

The longer a home sits vacant, the further said property will continue to degrade towards a point of disorder; at this point municipalities are then forced to issue code violation citations (Accordino & Johnson, 2002)

Code Violations

Local governments use the issuance of code violations to maintain the statues held in their housing and building codes. The Hillsborough County Code Enforcement Division defines themselves as being" responsible for the enforcement of the Minimum Housing Code, which defines standards for the maintenance of existing properties and structures, portions of the Land Development Code" (Hillsborough County, 2011). These issues are reported by either a code enforcement office on patrol duty or by the assessment of a property after it is reported by another party. Code enforcement hotlines exist for this in purpose in many jurisdictions (Hillsborough County, 2011). In this way a municipality can inform a property owner of their need for compliance and levy any penalties and fines against him/her.

Typical code violations associated with vacant and abandoned properties include: overgrowth of vegetation, graffiti, vandalism, improper pool maintenance, collection of trash/refuse, noticeable building degradation; these are typically commonplace amongst all violations. With that in mind, researchers have used the code violation as an indicator for neighborhood quality/stability. The overwhelming number of recent foreclosures has forced larger cities to act accordingly, insofar as creating vacant foreclosure registration systems to monitor code the enforcement issues associated foreclosed properties (Shilling, 2009).

Impact on Price

Given all the previously discussed negative impacts associated with foreclosure activity, the direct parallel between foreclosure and home value decreases has been well documented. Foreclosed properties, which convert to REOs, are generally offered on the market at a lower price to hasten the home off of a bank's ledger (Apgar & Duda,

2005). When properties in a neighborhood become foreclosed and vacant, market forces alone will drive down nearby prices. As vacancies increase, losses in home values diminish at the highest rates as seen in the housing market models of William Wheaton (1990). Beyond a given rate (unique for each neighborhood) further vacancy has less impact on housing values as most of the vacancy impacts are already absorbed into the market.

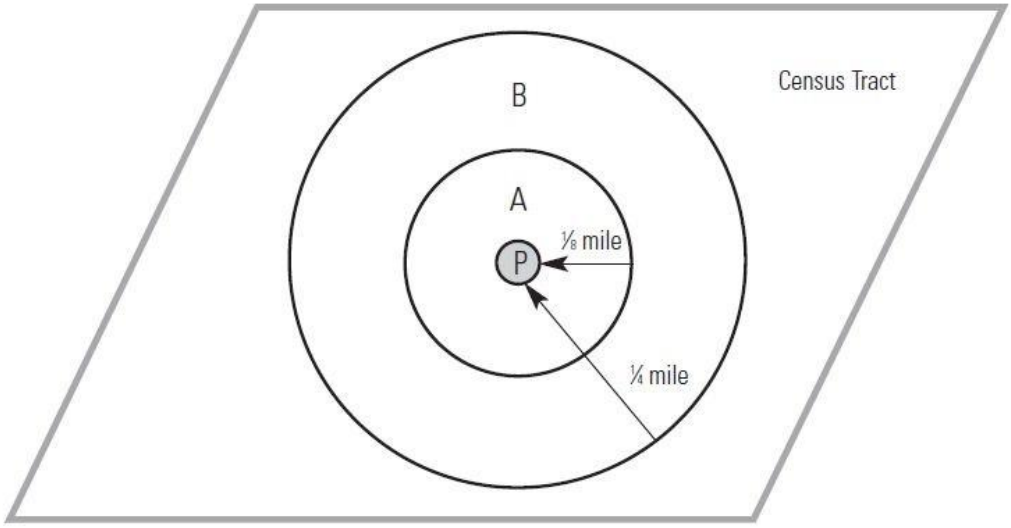


Figure 2-4. Model of foreclosure impact proximity on property values (Source: Adapted from Immergluck & Smith, 2006)

Immergluck and Smith have led the majority of research studies in the past decade. Their recent (2006) piece highlights the early effects of the foreclosure crisis on housing price. Both direct (i.e., lower valued homes for sale) and indirect (i.e., lowering of neighborhood quality) effects of foreclosure tend to be related to the proximity of the event. The closer a property is to a foreclosure, the greater the effect on home value. As evidenced in Figure 2-4, buffer rings around a property can

approximate a zone of influence from a foreclosure activity. Significant impacts are seen within one quarter of a mile in Zone B, but the greatest impacts occur within one eighth of a mile in zone A. Using small scale hedonic regression, the Immergluck study suggests in an average Census Tract, that each foreclosure within Zone A would decrease property values at a rate of 1.136% per year (Immergluck & Smith, 2006, p. 69).

In low median income tracts, the Immergluck & Smith (2006) model showed even greater impacts on disadvantages households with a 1.80% per year loss in Zone A. This has been attributed to the negative neighborhood externalities which are further depressing low income neighborhoods. The current debate amongst academics is to whether or not these negative impacts on home value and neighborhood quality are worsening in both low and high income neighborhoods. In the past, most high income areas remained immune to the brunt of foreclosure's negative effects. The following research will look to shed light on the ways in which the current foreclosure crisis is impacting both high and low income neighborhoods.

CHAPTER 3
METHODOLOGY

Methodology Overview

To answer the questions posed in the introduction of this work, the methodology uses a variety of geospatial techniques to investigate the impacts of foreclosure in Hillsborough County, Florida. There are two general types of analysis used to answer these questions: One is the use of regression techniques to investigate the relationship between foreclosure and home value/neighborhood quality at the block group level; both an Ordinary Least Squares (OLS) Regression and Geographically Weighted Regressions (GWR) are used. Two is the use of the Getis-Ord Gi* cluster analysis at a neighborhood level to investigate the relationship between foreclosure and code violations; non-parametric statistical techniques will be used to evaluate significant results. All geospatial processes were completed using ESRI's ArcGIS 10.2 platform, unless otherwise noted. The findings of this study demonstrate how the Foreclosure Crisis of the late 2000s has significantly impacted neighborhood quality in communities in Florida. By investigating neighborhoods of both high and low socioeconomic statuses, this work is designed to help planners and elected officials make the best use of limited resources to combat foreclosures and stabilize at-risk neighborhoods.

Datasets

Foreclosure Data

An initial challenge in undertaking research of this nature was locating accurate and useable foreclosure data. In coordination with the Shimberg Center for Housing Studies at the University of Florida the foreclosure data was acquired from ForeclosuresDaily.com. Although this data is primarily used by real estate

professionals, care was taken by the research staff at the Shimberg Center to validate the data against court records. Additional small sample sources of foreclosure data were acquired at high cost and compared against the ForeclosuresDaily data. It was found that approximately 70-80% of the actual foreclosures taking place are represented in the ForeclosuresDaily data; it should be noted that there was no discernable selective bias by which foreclosed properties were omitted. Given the monetary and opportunity costs associated with acquiring more accurate data, the ForeclosuresDaily data was deemed to be accurate enough for research purposes (personal communication, August 4, 2011)

The foreclosure dataset selected for the analyses in this paper was the "Closed Foreclosures"; that is, those which had completed the foreclosure process, with a change in the certificate of title. It was decided that the years 2006 through 2009 would be aggregated to create a dataset encompassing the cumulative foreclosures since the onset of the foreclosure crisis. These closed foreclosures are then joined to a GIS shapefile of all parcels in Hillsborough County based on a common Parcel Tax Folio number. Hillsborough County was chosen as the study area primarily on the basis of join effectiveness; over 95% of the foreclosures joined to the property parcel shapefile without any issue.

In a final quality control step, foreclosure parcels are filtered to only include those parcels which could be considered an owned home. For this study, an owned home falls into either Single Family Residential or Condominium land use categories. These were the two primary land uses in which an average property owner could take out a home mortgage based on equity. Condominiums were included under the assumption

that foreclosures and vacancies affect the intake of Condo Association fees, which then impacts the upkeep of the property; thus the Broken Windows theory still applies. To achieve this end, the previously joined Closed Foreclosure shapefile has a Select by Attribute function performed so that only Single Family Homes (Land Use Code 001) and Condominia (Land Use Code 004). See Appendix A for a full listing of Land Use Codes. Using the Feature to Point tool, these selected parcels are then converted to a point shapefile based on the parcel centroids, resulting in a 2006-2009 Foreclosure Point shapefile.

Code Violation Data

The other unique data source used in this research was code violation data for Hillsborough County. Code enforcement in Hillsborough County is undertaken by individual municipalities, including City of Tampa, City of Plant City, Temple Terrace, and Unincorporated Hillsborough County. Plant City and Temple Terrace were unable to provide usable data for this project; fortunately, their relative sizes within the county are small.

A Code Violation dataset was created by combining the violations for the City of Tampa and Unincorporated Hillsborough County for the year 2009. This year was chosen to reflect code violations (and thereby negative neighborhood effects) in a time period following extended foreclosure activity. These code violations were then joined to a GIS shapefile of all parcels in Hillsborough County based on a common Parcel Tax Folio number. Due to variations in the reporting of violations, the type of violation was not considered in any analysis. Each incident is valued equally as a negative influence on the neighborhood.

Dataset Master List

The following is a list of all of the datasets used in the analyses to follow. It should be noted that some datasets comprise many variables, while others have a single variable.

- 2006-2009 Closed Foreclosure Shapefile- Acquired from ForeclosuesDaily.com
- 2009 City of Tampa & Hillsborough County Code Violations Shapefile- Acquired from the City of Tampa and Hillsborough County's Code Enforcement Divisions respectively
- 2010 Hillsborough Parcels Shapefile- Acquired from the Florida Geographic Database Library (FGDL)
- 2010 SF1 Hillsborough County Census Shapefile- Acquired from the US. Census Bureau

Regression Analyses

Model Basics

To evaluate the impact of foreclosure on neighborhood quality, a hedonic style regression model was chosen. While based on a real estate focused hedonic regression, the model chosen focuses less on the physical particulars of each property and more on the surrounding neighborhood characteristics. In this way the model attempts to predict housing price, primarily with neighborhood quality indicators. Since this paper has established the theoretical relationship between housing price and neighborhood quality, these regressions are created to further understand the impact that foreclosure has on neighborhoods.

The following Table 3-1 lists the variable names, types, expected relationship (to increase in Just Value), data sources, and geographies chosen for regression analysis. The causal relationships between these variables can be seen in Figure 3-1, a conceptual model for the regression analyses.

Table 3-1. Regression variable specifications

Variable	Time Period	Variable Type	Expected Relationship	Source	Original Geography
Just Value of Home	2010	Dependent	-	Parcel Data	Parcel
Home Foreclosure Rate	2006-2009	Explanatory	Negative	Foreclosures Daily	Parcel
Percent Vacant	2010	Explanatory	Negative	Census	Block Group
Population Density	2010	Explanatory	Variable	Census	Block Group
Percentage of Female Headed Households	2010	Explanatory	Negative	Census	Block Group
Percent Minority	2010	Explanatory	Negative	Census	Block Group
Total Living Area of Home	2010	Explanatory	Positive	Parcel Data	Parcel

The Just Value of a Home represents a fair market value for a piece of property as determined by the local property appraiser. In this regression the Home foreclosure Rate is a measure of the cumulative percentage of homes within a block group which have experienced a foreclosure between 2006 and 2009; it is expected to have a negative relationship with the dependent variable. As previously described in the literature review, high foreclosure rates are associated with lowered home values.

Percent Vacant is a traditional measure of vacancy based on the number of occupied housing units divided by the total number of housing units; it too is expected to have a negative relationship as described in the literature review. Population Density is the measure of persons per square mile. The relationship for this value can vary based on the type of neighborhood encountered; e.g. high valued homes can exist in both high density, mixed-use areas as well as traditional low density subdivisions. Percentage of Female Headed Households with Children represents the rate of households which are headed by a single mother; this was best available proxy for income level based on data available. This is expected to have a negative value as low income neighborhoods demand low housing values as the poor cannot afford high rents/home values. Percent minority measures the percentage of non-white persons. Relevant literature has consistently shown that high minority areas have low values. Total living area is the measureable living area, measured in square feet, in which a family can live. Larger living areas are consistently positively related to home value; potential buyers value having additional space.

As an indicator area median income is strongly correlated with other measurements of neighborhood quality (Immergluck & Smith, 2006). Unfortunately, the US Census Bureau will not be releasing socioeconomic data, including median income, with the 2010 Census. It will instead be included in the 2010 release of the American Community Survey (ACS); this data was unfortunately not available at the time of publication. The 2009 ACS data was also unusable for the regression analyses as it was in the incongruent 2000 Census geographies.

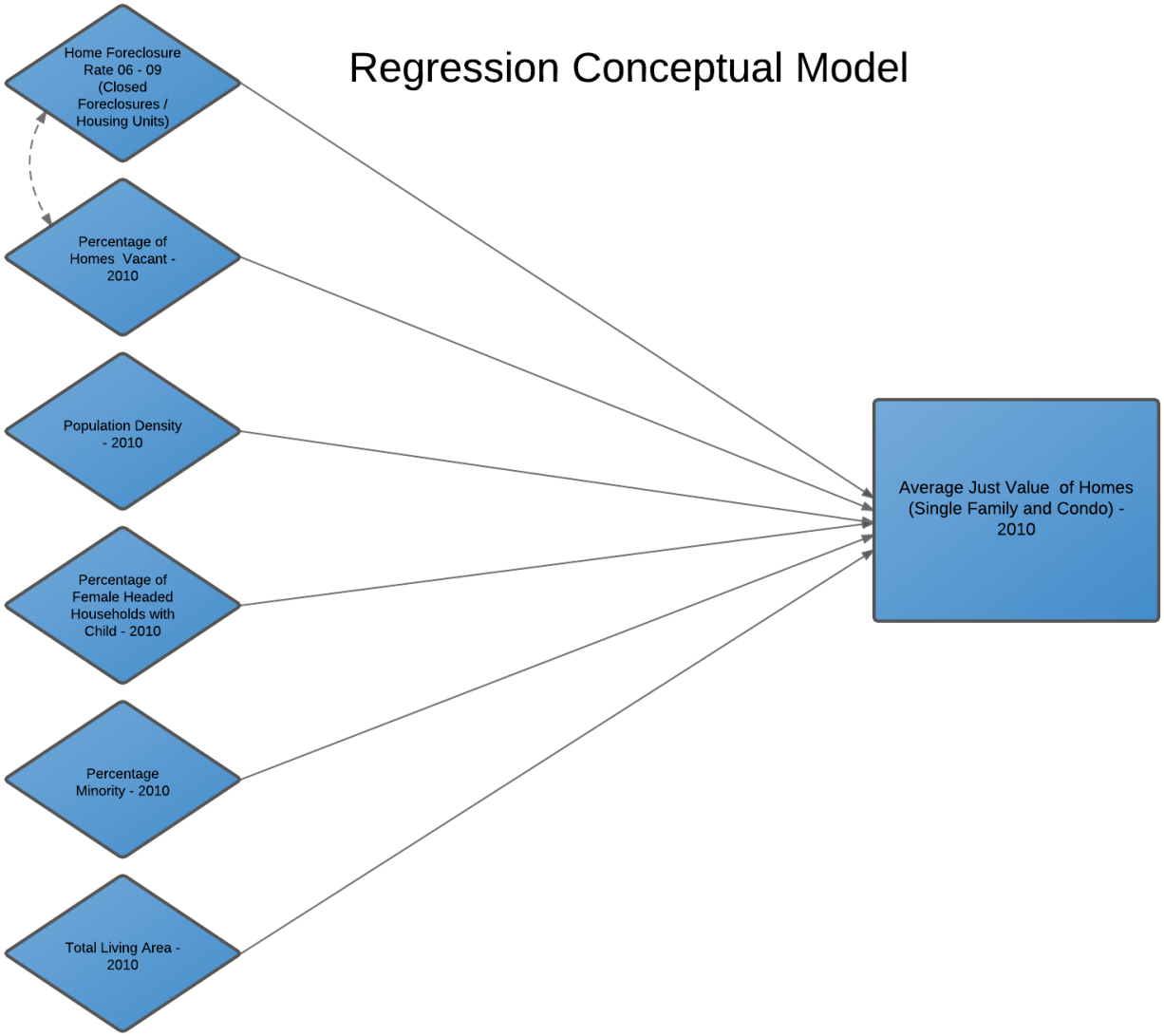


Figure 3-1. Regression Conceptual Model. (Source: Charles Gibbons, 2011)

Data Preparation

In order to perform regression analyses in an ArcGIS environment, all of the variables must exist within a single shapefile. In many instances, this requires the manipulation of variables so that they have matching geographies. In this study, Just Value, Home Foreclosures, and Total Living Area all exist at the parcel level; to ameliorate this problem, the parcel level data must be aggregated to the US Census Block Group geographies.

Aggregation to the 2010 US Census Block Group geography is achieved via the following steps:

1. Using Select by Attributes on the Hillsborough County Parcels layer to select out only Owned Home land uses, 001 and 003 (in the same way this was achieved for Home foreclosures).
2. Using the Feature to Point tool, these selected parcels are then converted to a point shapefile based on the parcel centroids. This step assures that large parcels, which straddle multiple clock groups, are not counted more than once.
3. Using a Spatial Join. The 2010 US Census Blocks should be the target layer and the 2010 Homes Parcels as the join layer. Parcel data should be summarized as averages. This will give an average Just Value and Total Living Area for each block group

The resulting file only requires a join with the foreclosure data to be complete. This is achieved using another spatial join with the 2010 US Census Blocks as the target layer and the 2006-2009 Foreclosure Points as the join layer. Foreclosure points should be summarized using basic summation. The resulting Regression Master shapefile contains all of the pertinent regression data at a Block Group geography.

Ordinary Least Squares Regression

An Ordinary Least Squares (OLS) Regression is first used to explore and define the relationships between the explanatory variables and home value. This initial regression is a global model which is evaluated aspatially.

Theory

The OLS regression takes its shape from a simple linear regression (see Equation 2-1 in Chapter 2). It uses known values to calculate an equation which best fits as a model for a dependant variable, as seen in Figure 3-2. What makes an OLS more powerful than a traditional linear model is the use of statistical checks to minimize the residuals or squared deviations (ESRI, 2009). The OLS performs the following calculation on the β values in order to minimize these squares (Burt & Barber, 1996):

$$\beta = \frac{n\sum_{i=1}^{n} X_i Y_i - \sum_{i=1}^{n} X_i \sum_{i=1}^{n} Y_i}{n\sum_{i=1}^{n} {X_i}^2 - (\sum_{i=1}^{n} X_i)^2} \quad (3\text{-}1)$$

This equation effectively minimizes the squared residuals by creating optimized β values. The use of statistical software packages and GIS applications has made these calculations more manageable.

Care should be taken in choosing the specifications of a model. Improperly specified models will yield results which may not be trustworthy. Beyond the value of R^2 (measure of goodness of fit), the OLS tool in ArcGIS gives a report which includes a variety of measurements used to evaluate and calibrate a model. The user should also take additional steps to check for spatial autocorrelation (Using Moran's I) in the residuals. Clustered residuals are indicative of a misspecified specified model which is missing one or more key explanatory variables (Zwick, 2010).

Method

In ArcGIS the Ordinary Least Squares (OLS) Tool is opened via ArcToolbox. The Regression Master shapefile will act as the Input Feature Class, as it contains all of the relevant spatial data. Dependent and Explanatory Variables (as defined in Table 3-1) are entered into the appropriate portion of the UI. After the model is run, it will return an OLS output shapefile as well as a report which displays the model results.

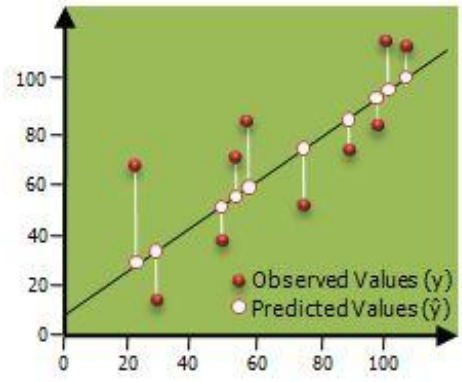


Figure 3-2. Representation of ordinary least squares model. (Source: ESRI, 2011)

To check for clustered residuals the Spatial Autocorrelation (Global Moran's i) is used. The OLS output shapefile acts as the Input Feature class; the Residuals field as the Input Field. Default settings are employed, except that Row Standardization is necessary to avoid the inherent bias associated with Census Block Groups (Zwick, 2010). These geographies are controlled to have equal population which requires the use of Row Standardization. This function will also generate a report for evaluation.

Geographically Weighted Regression

A Geographically Weighted Regression (GWR) is used to further explore relationships between the explanatory variables and home value in a spatial context. This type of regression is a local model which takes spatial variation into account.

Theory

One of the criticisms of the OLS model is that it only gives one set of coefficients; it is in fact a global model which shows the relationships between variable across an entire study area. In practice, homogeneity is often not encountered across a study area. Problems in the real world are often complex and have varying relationships which change in space, a concept known as spatial non-stationarity. The development of GWR in the last 15 years has allowed researchers to produce regression models which more accurately represent changes over space (Fotheringham, 2002).

In practice, a GWR differs from an OLS by running the regression locally. The term Geographically Weighted Regression can almost be considered a misnomer. It is not just one regression model, but actually the summary of *many* regressions in space. A GWR runs an OLS type model at every data point within a dataset. In the case of Hillsborough County, this amounts to 876 regressions; one for each block group. This is achieved by only using nearby neighbors in the calculation of each individual regression model. To make this possible nearby datapoints are weighted based on their distance away from the regression point; this concept, refered to as a Spatial Kernel, is shown in Figure 3-3. Fotheringham (2002) describes the Spatial Kernel:

> For a given regression point, the weight of a data point is at a maximum when it shares the same location as the regression point. This weight decreases continuously as the distance between the two points increases. In this way, a regression model is calibrated locally simply by moving the regression point across the region. (p. 44)

This method helps to account for Tobler's (1970) First Law of geography; that everything is related in space, but near things are more related than others.

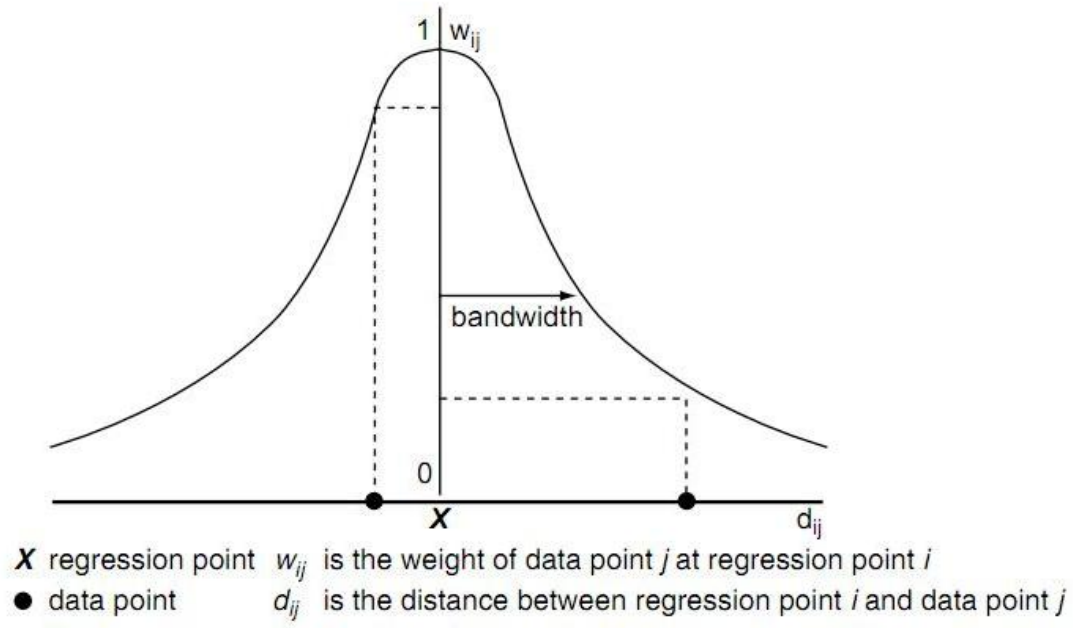


Figure 3-3. Model of a spatial kernel. (Source: Fotheringham, 2002)

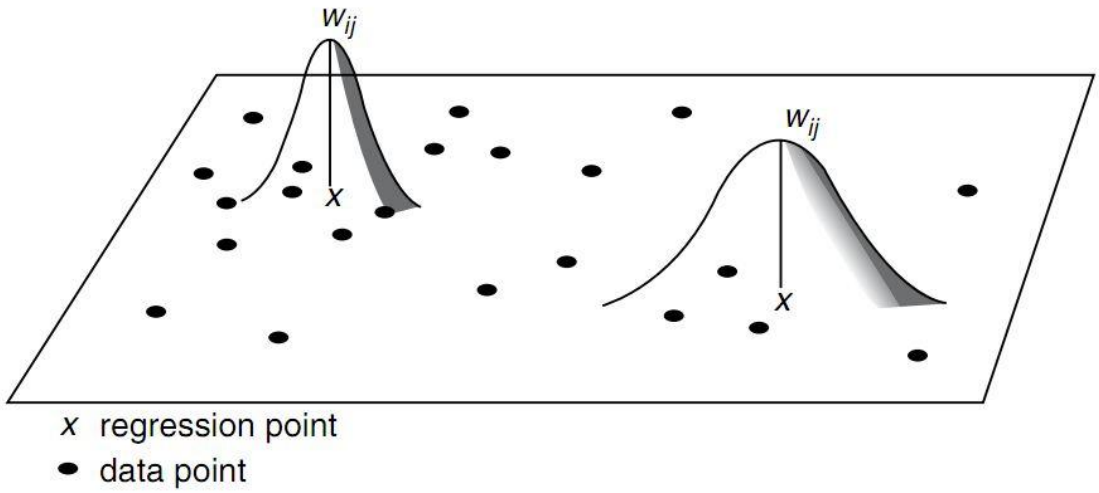


Figure 3-4. Adaptive spatial kernels in GWR. (Source: Fotheringham, 2002)

Choosing the size of the kernel can have a large impact on the performance of a GWR. Use of an adaptive spatial kernel helps to account for varying distances between regression points. Seen in Figure 3-4, the Adaptive Spatial Kernel changes the size of

the kernel's bandwidth to encompass the optimal number of neighboring data points. Without this feature, more sparsely located data points would lack the critical number of points to create an effective and significant model (Fotheringham, 2002).

Given its inherent spatial constructs, the GWR has quickly become a popular tool amongst researchers. Like any model, it can only act as a representation of the real world. The GWR's ability to take spatial non- stationarity into account makes it more robust than an OLS when trying to understand how models vary in space.

Method

In ArcGIS the Geographically Weighted Regression (GWR) Tool is opened via ArcToolbox. The Regression Master shapefile will act as the Input Feature Class, as it again contains all of the relevant spatial data. Dependent and Explanatory Variables (as defined in Table 3-1) are entered into the appropriate portion of the UI. Bandwidth Method should be left at the default, AICc. Kernel type should be set to ADAPTIVE; this will account for the variable size and locations of the block groups. After the model is run, it will return a GWR output shapefile as well as a dbf file which displays the model results.

The same method will be used to evaluate clustering of residuals as in the OLS. The Spatial Autocorrelation (Global Moran's i) tool is used. The GWR output shapefile acts as the Input Feature class; the Residuals field as the Input Field. Default settings are employed, except that Row Standardization should be used.

To properly interpret the coefficients or β values, standardized β should be calculated manually using the following formula (Bring, 1994):

$$B_i = \widehat{\beta_i}\left({}^{s_i}/_{s_y}\right) \tag{3-2}$$

Here the beta values, β, are multiplied by the ratio of the explanatory variable's standard deviation to that of the dependent variable's standard deviation. This standardized beta uses the changes in standard deviations to show the relative importance of the independent variables. Standardized betas should be calculated for each coefficient directly in the ArcGIS field calculator.

Cluster Analysis

The regression models used in the primary analysis are intended to explore the relationship between foreclosure rates and the just value of homes. Given the link between home value and neighborhood quality, the regressions model the negative effects of foreclosure on neighborhood quality by proxy only. To measure the physical effects on neighborhoods directly, a secondary cluster analysis will be employed at the neighborhood level. Using Getis-Ord Gi* Hotspot analysis, clusters of foreclosure incidents will be compared against clusters of land development code violations. The object is to determine if foreclosure clusters are indicative of code violation clusters. This degree of clustering will then be evaluated using traditional non-parametric statistical methods.

Using the results from the GWR analysis, two neighborhoods were chosen for the cluster analysis; one low income and one high income (based on 2009 ACS income data) neighborhood were selected. This will allow for the study of foreclosure's affect on neighborhoods of different income levels.

Data Preparation

The process of selecting neighborhoods is undertaken using the coefficient surfaces created in the GWR. To find areas in which foreclosures had the greatest effect on home value, block groups with extremely negative Home Foreclosure Rate

coefficient values are deemed favorable candidates for selection. From this subset, one low income and one high income neighborhood were chosen with a high foreclosure and vacancy rates. This effectively selects neighborhoods which have high foreclosure and vacancy rates, where foreclosures have an large impact on housing value

Based on this rationale, the following criteria were used in determining the neighborhoods of choice:

- Bottom 50% of negative Home Foreclosure Rate Coefficients
- Home Foreclosure rate greater than 2.5%
- Vacancy rate greater than 14%

The two neighborhoods which best fit these specifications were Old West Tampa (low income) and the southeast quadrant of Westchase (high income).

To prepare the data for analysis the parcels within the two neighborhoods were selected out based on their described locations as census designated places. The quadrant subsection of the entire Westchase community was selected to make the neighborhood sizes more even. The selected parcels are then spatially joined to the foreclosure point and code violation point shapefiles. The final shapefile for each neighborhood contains a count of both foreclosure activities and code violations for each parcel.

Theory

The Getis-Ord Gi* Hotspot analysis tool is a common method of determining clustered values. It evaluates the weighted values in a dataset in space to determine where like values are clustered. The result of this process is the Gi* statistic, actually a Z score. This Z score indicates where statistically significant clusters of hot/high values

(positive Z scores) and cold/low values (negative Z scores) exist in space (ESRI, 2011). These Z scores are included in the output shapefile.

Method

The Getis Ord Gi* statistic can be calculated using the Hot Spot Analysis (Getis-Ord Gi*) toolset in ArcGIS. The entire process must be completed for both neighborhoods, with iterations of foreclosures and code violations as the input field. Choosing a Conceptualization of Spatial Relationships is an important step in specifying the model. For this analysis the Inverse Distance relationship was chosen; the spatial impacts from foreclosures and code violations should decrease drastically as distance increases. The distance band should be set to 1/8 of a mile. This is the distance supported by Immergluck & Smith (2006) in which a foreclosure has having the greatest impact on the surrounding neighborhood. Row Standardization should also be employed to account for the imposed aggregation scheme associated with parcel data.

Non-Parametric Statistics

Beyond a simple visual interpretation of the Z scores associated with foreclosure and code violation clustering, a Pearson's r correlation coefficient will be calculated for each neighborhood. This will effectively measure the correlation between clusters of foreclosures and clusters of code violations.

Theory

Because the Z Scores returned by the Hotspot analysis are in the form of ratio data, the Pearson's Product-Moment Correlation Coefficient (Pearson's r) can be used to quantify a correlation between foreclosure and code violations. Pearson's r uses paired values, in this case Z scores for foreclosure and code violation clustering, to

measure the linear dependence between two variables (Burt & Barber, 1996). The calculation of Pearson's r is seen below in Equation 3-3.

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}} \quad (3\text{-}3)$$

The value of r can range from -1 to 1. The following guide (Quinnipiac, 2011) indicates the strength of a relationship based on the value of r:

- +.70 or higher Very strong positive relationship
- +.40 to +.69 Strong positive relationship
- +.30 to +.39 Moderate positive relationship
- +.20 to +.29 weak positive relationship
- +.01 to +.19 No or negligible relationship
- -.01 to -.19 No or negligible relationship
- -.20 to -.29 weak negative relationship
- -.30 to -.39 Moderate negative relationship
- -.40 to -.69 Strong negative relationship
- -.70 or higher Very strong negative relationship

For the r value to be statically significant, further significance tests must also be undertaken.

Method

The calculation of the Pearson's r statistic is easily obtained using the software suite SPSS. Before loading the Z Scores directly into SPSS, the Z scores for foreclosure and code violations clusters must first be matched together Microsoft Excel based on a common parcel ID; they are then loaded into SPSS. The Bivariate Correlation Tool is selected and the Pearson's Correlation option should be checked. Upon completion, a report is generated with the requisite r statistic and significance value.

CHAPTER 4
FINDINGS AND RESULTS

OLS Results

Model Reliability

As a global model, an Ordinary Least Squares regression looks at the strength of a model to predict an outcome across an entire dataset. As per the results in Table 4-2, in this study the OLS performed reasonably well. With an Adjusted R^2 of 0.70, on a scale of 0-1, the chosen explanatory variables are seen to be good indicators of home value overall. With p-values of nearly zero, the Joint F and Wald statistics in Table 4-2 indicate that the model is in fact significant. However, the significant Koenker (BP) Statistic is indicative of nonstationarity amongst the model's relationships. Such a value provides an indication that this model should be evaluated in the context of a GWR, once the global coefficients are understood (ESRI, 2011).

Residuals

The residuals in a regression model represent that which cannot be explained by the explanatory variables chosen in the model. Careful examination of model residuals can help determine the overall quality of the model's construction. While all models contain residual values, it is their relationships in space which are deemed important. The Jarque-Bera Statistic, evaluated in Table 4-2, indicates whether or not the residuals are normally distributed. In this case, the nearly zero p-value indicates non-normal residuals and therefore, model bias.

Further testing of this principal was employed with the use of the Moran's I Spatial Autocorrelation tool. If high or low residuals are clustered in space then a model

Table 4-1. Adapted OLS regression coefficient table

Variable	Coefficient	StdError	t Statistic	Probability	Robust StdError	Robust t	Robust Prob
Intercept	-77239.8839	10615.6200	-7.2761	0.0000	18154.1868	-4.2547	0.0000
Vacancy Rate	637.7891	293.0880	2.1761	0.0298	251.9920	2.5310	0.0115
Density	2555.2891	373.6703	6.8384	0.0000	455.2410	5.6130	0.0000
Percent Minority	-835.9340	115.1266	-7.2610	0.0000	86.8348	-9.6267	0.0000
Total Living Area	120.5626	3.5797	33.6794	0.0000	8.1648	14.7661	0.0000
Home Foreclosure Rate	-386164.4201	144842.1339	-2.6661	0.0078	81606.6001	-4.7320	0.0000
Female Headed Households	43763.0049	28689.9333	1.5254	0.1275	22646.6851	1.9324	0.0536

Table 4-2. Adapted OLS regression diagnostic table

Diag_Name	Diag_Value	Definition
AIC	21609.68	Akaike's Information Criterion: A relative measure of performance used to compare models; the smaller AIC indicates the superior model.
AICc	21609.85	Corrected Akaike's Information Criterion: second order correction for small sample sizes.
R2	0.7011	R-Squared, Coefficient of Determination: The proportion of variation in the dependent variable that is explained by the model.
AdjR2	0.6991	Adjusted R-Squared: R-Squared adjusted for model complexity (number of variables) as it relates to the data.
F-Stat	339.79	Joint F-Statistic Value: Used to assess overall model significance.
F-Prob	0	Joint F-Statistic Probability (p-value): The probability that none of the explanatory variables have an effect on the dependent variable.
Wald	614.93	Wald Statistic: Used to assess overall robust model significance.
Wald-Prob	0	Wald Statistic Probability (p-value): The computed probability, using robust standard errors, that none of the explanatory variables have an effect on the dependent variable.
K(BP)	99.03	Koenker's studentized Breusch-Pagan Statistic: Used to test the reliability of standard error values when heteroskedasticity (non-constant variance) is present.
K(BP)-Prob	0	Koenker (BP) Statistic Probability (p-value): The probability that heteroskedasticity (non-constant variance) has not made standard errors unreliable.
JB	22682.67	Jarque-Bera Statistic: Used to determine whether the residuals deviate from a normal distribution.
JB-Prob	0	Jarque-Bera Probability (p-value): The probability that the residuals are normally distributed.
Sigma2	2995763352.11	Sigma-Squared: OLS estimate of the variance of the error term.

is seen to be misspecified; there are likely some key explanatory variables which are missing from the model itself (Zwick, 2010). The Moran's I Spatial Autocorrelation tool returned a Z score of 60.60 (2.58 being the 99th percentile threshold), indicating clustering with an infinitesimally small chance of this value being caused by random chance. This is also visually evident in Figure 4-3; the map indicates severe clustering of both high and low values in space. This indication of misspecification can also be aided by the used of GWR to remove nonstationarity and decrease the clustering of residuals (ESRI, 2011). The variable which could have helped to reduce the clustering of residuals is median income. As when compared against the American Community Survey (ACS) Median Income map in Figure 4-2, the OLS residuals correlate in a visual inspection. Unfortunately, Median income data was not released in the 2010 Census. The 2009 ACS data remains in the 2000 Census Block geographies, therefore it was unusable in the regression. Geographies must be identical to be used in a GIS based regression model.

Coefficients

The OLS regression coefficients returned results that were mostly expected from a theoretical perspective. Based on the expected coefficients in Table 3-1, most of the actual coefficients found in the model match their theoretical counterparts accordingly. To check these coefficients for significance, calculated p-values are consulted. Based on the significant Koenker (BP) Statistic, the Robust-p values are used instead of the version calculated from a traditional Student's t statistic (ESRI, 2011). Almost all of the variables have p values below that of the 0.05, meaning they are significant at the 95th percentile. At this level there is statistically only less than a 5% chance that the coefficients are due to random chance. Only Female Headed Households had a higher

value of 0.0536, making it significant at 94.6th percentile. This is deemed acceptable for this research, but these coefficients are viewed within the light of their borderline p-values.

The two coefficients of greatest interest, Home Foreclosure and Vacancy Rate, returned differing values. The coefficient for Home Foreclosure Rate was highly negative as was expected; home foreclosures are indicative of lower home values. However, vacancy rates were found to be positive; this is in direct disagreement with the concept that high vacancy rates are indicative of lower home values. This unexpected result could be a response to other market forces not accounted for in the initial conceptual model. These possible influences will be discussed further in Chapter 5.

GWR Results

Model Improvements

The use of Geographically Weighed Regression (GWR) improved upon the results found in the OLS. As seen in Table 4-3, the Adjusted R^2 value was increased substantially, to 0.91, while the AICc was lowered; both of these indicators show a model framework that is better suited to answering the questions asked. The local R^2 surface in Figure 4-4 shows the majority of the study area has values above 0.85, showing good overall performance. Spatial Autocorrelation of the GWR residuals were still clustered, but to a much lesser extent as seen in Figure 4-4. The resulting Z score of 3.41 still indicates clustering, but this is much closer to an acceptable level than the OLS model.

Table 4-3. Adapted GWR supplementary results table

Variable Name	Value	Definition
Neighbors	245	-
Residual Squares	705027831911	-
Effective Number	78.47	-
Sigma	29732.41	-
AICc	20578.74	-
R2	0.9191	-
R2Adjusted	0.9112	-
Dependent Field	0	Home Just Value
Explanatory Field	1	Home Foreclosure Rate
Explanatory Field	2	Vacancy Rate
Explanatory Field	3	Female Headed Households
Explanatory Field	4	Density
Explanatory Field	5	Total Living Area
Explanatory Field	6	Percent Minority

Coefficients in Space

The defining feature of a GWR is the creation of coefficient surfaces; these allow researchers to look at how coefficients vary over space. As in the OLS, the two variables of greatest importance are the coefficients for Home Foreclosure Rate and Home Vacancy Rate. These coefficients are pictured in Figure 4-5.

Home Foreclosure Rate produced negative coefficients across the entire study area. The most negative coefficients appear to be in coastal areas with high incomes, when compared against 2009 ACS data. Even low income areas with these highly negative coefficients are bordering high income neighborhoods.

Vacancy Rate showed unexpected variation over space. While the global model produced a positive coefficient, the GWR produced a range of values from -8.51 to

86.86. It was expected that vacancy would produce negative coefficients, as higher vacancies would result in lower home prices. This was only true within a few areas in the county. The lowest negative values are clustered in the red shaded portions of the map in Figure 4-5. This area represents primarily low income residents, along with a high level of transient college students associated with the University of South Florida. There is also a swath of slightly negative coefficients to the south and east, including the higher income developments of Fishhawk and Lithia.

Foreclosure & Code Violation Clusters

Old West Tampa

Old West Tampa is an older, ethnically diverse neighborhood which has a relatively low median income; approximately $22,000 based on overlaying 2009 ACS data (average for Hillsborough County was approximately $40,000). The combination of high Home Foreclosure Rates and low income put the neighborhood of Old West Tampa at a high risk for negative neighborhood effects and code violations. Seen in terms of incidents in Figure 4-6, foreclosures and code violations do tend to coincide visually. After running the Hotspot analysis, the maps in Figure 4-7 returned the following hotspot clusters, with red signifying clusters of high values and blue signifying clusters of low values.

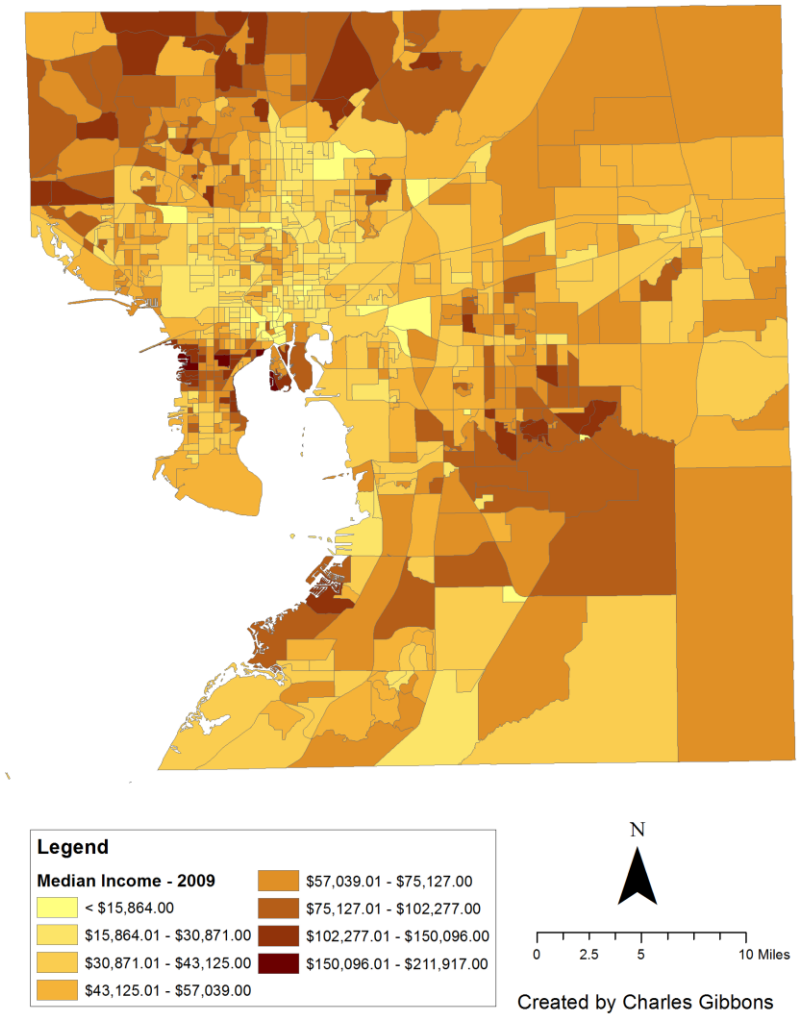
When compared using the Pearson's r correlation statistic, the hotspot Z scores revealed a correlation value of 0.354 at a 99% confidence interval. This indicates a moderately positive correlation between the clustering of foreclosure incidents and land development code violations in the neighborhood of Old West Tampa.

Westchase

Built in the late 1990s, Westchase is a newer more affluent community with a much higher median income than Old West Tampa; approximately $85,000 based on overlaying 2009 ACS data. The neighborhood experienced a large number of completed foreclosures, but there very few code violations; this can be seen in Figure 4-8. Running the cluster analysis on this neighborhood, seen in Figure 4-9, shows the same red-to-blue patterns as the previously done.

The Pearson's r correlation statistic showed a Z score of -0.291 at a 99% confidence interval. This is indicative of a weak negative relationship between the two variables. In short, there was barely any discernable relationship between foreclosure incidents and land development code violations in the neighborhood of Westchase. The few code violations which did occur had seemingly no connection to the pockets of foreclosure activity in the area.

Figure 4-1. 2010 block group geographies, Hillsborough County, FL. (Source: Charles Gibbons)



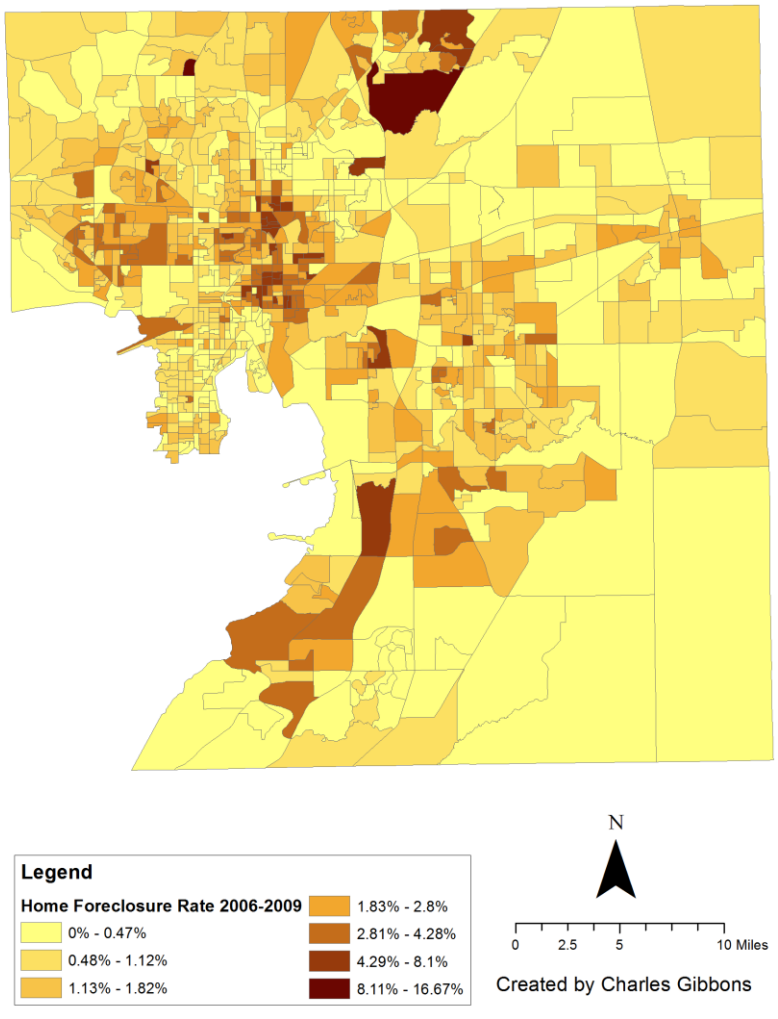


Figure 4-2. Hillsborough County – 2009 ACS median income and 2006-2009 home foreclosure rate. (Source: Charles Gibbons)

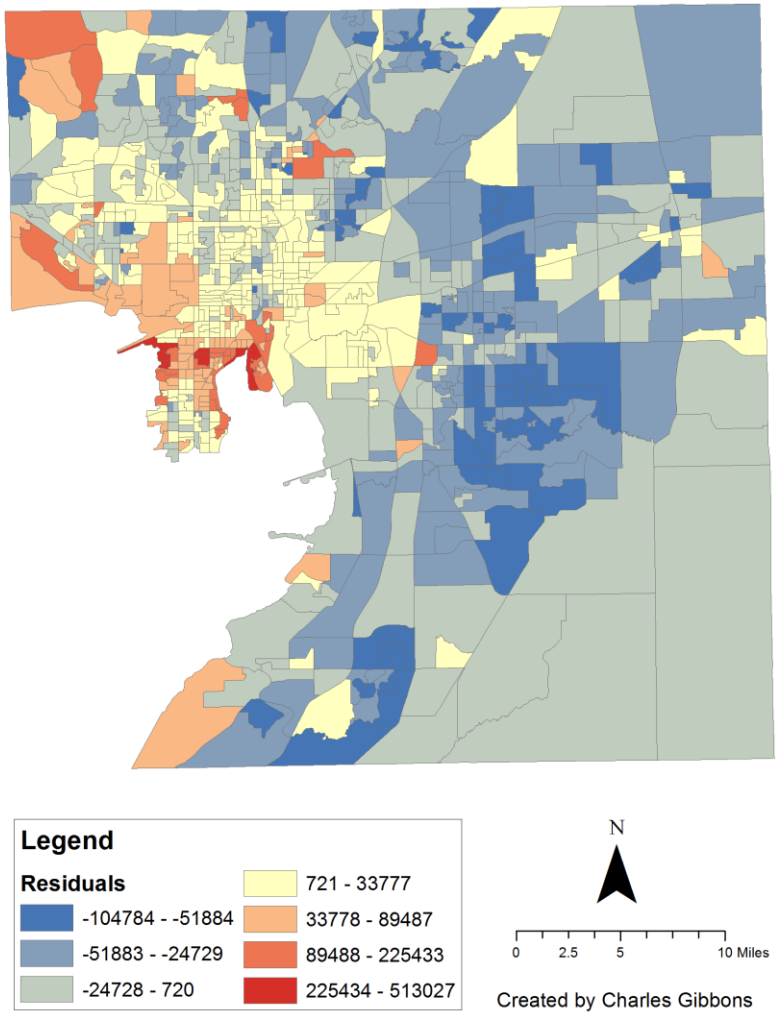


Figure 4-3. Hillsborough County – OLS residuals. (Source: Charles Gibbons)

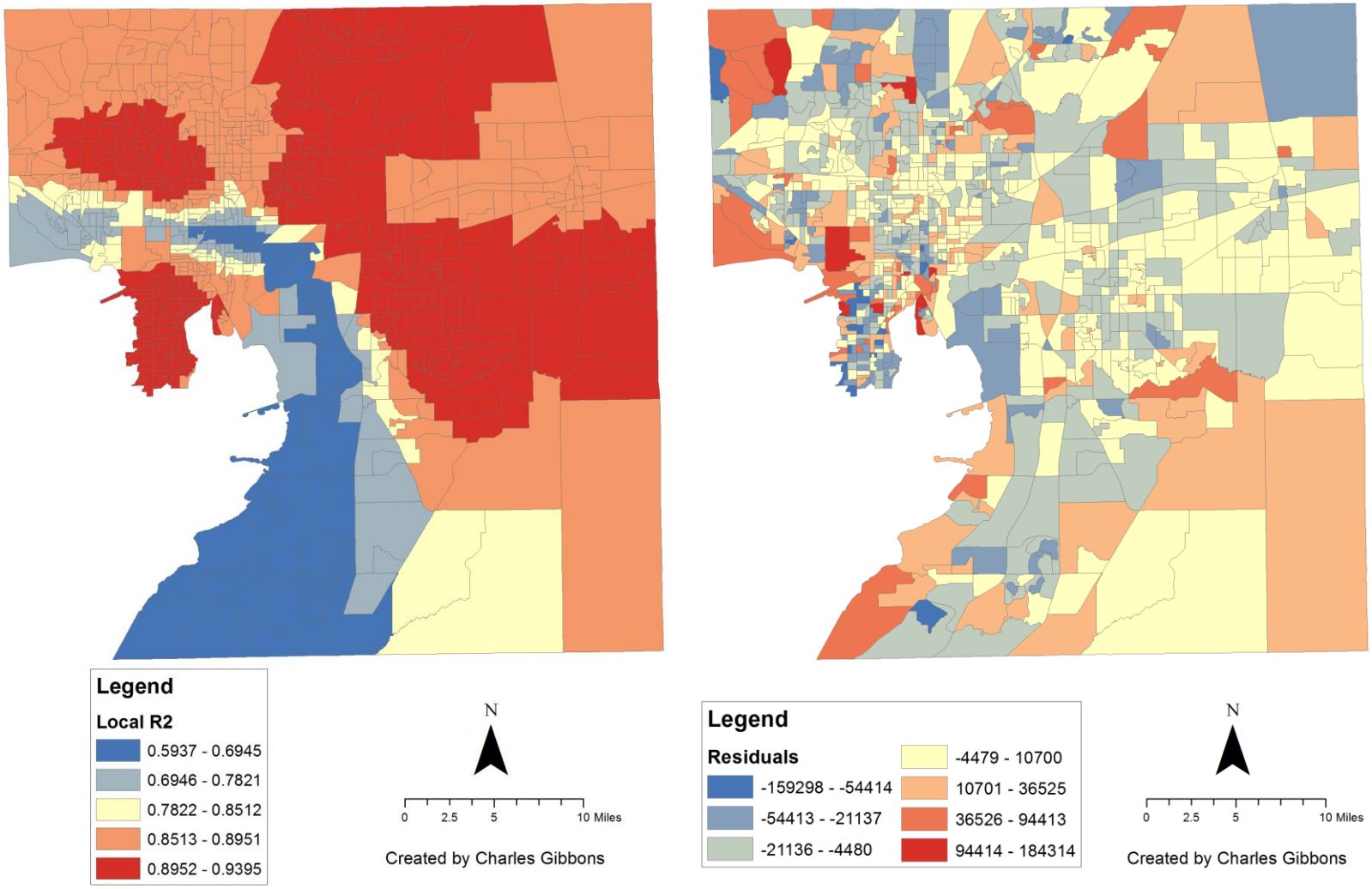


Figure 4-4. Hillsborough County - GWR local R^2 and GWR residuals. (Source: Charles Gibbons)

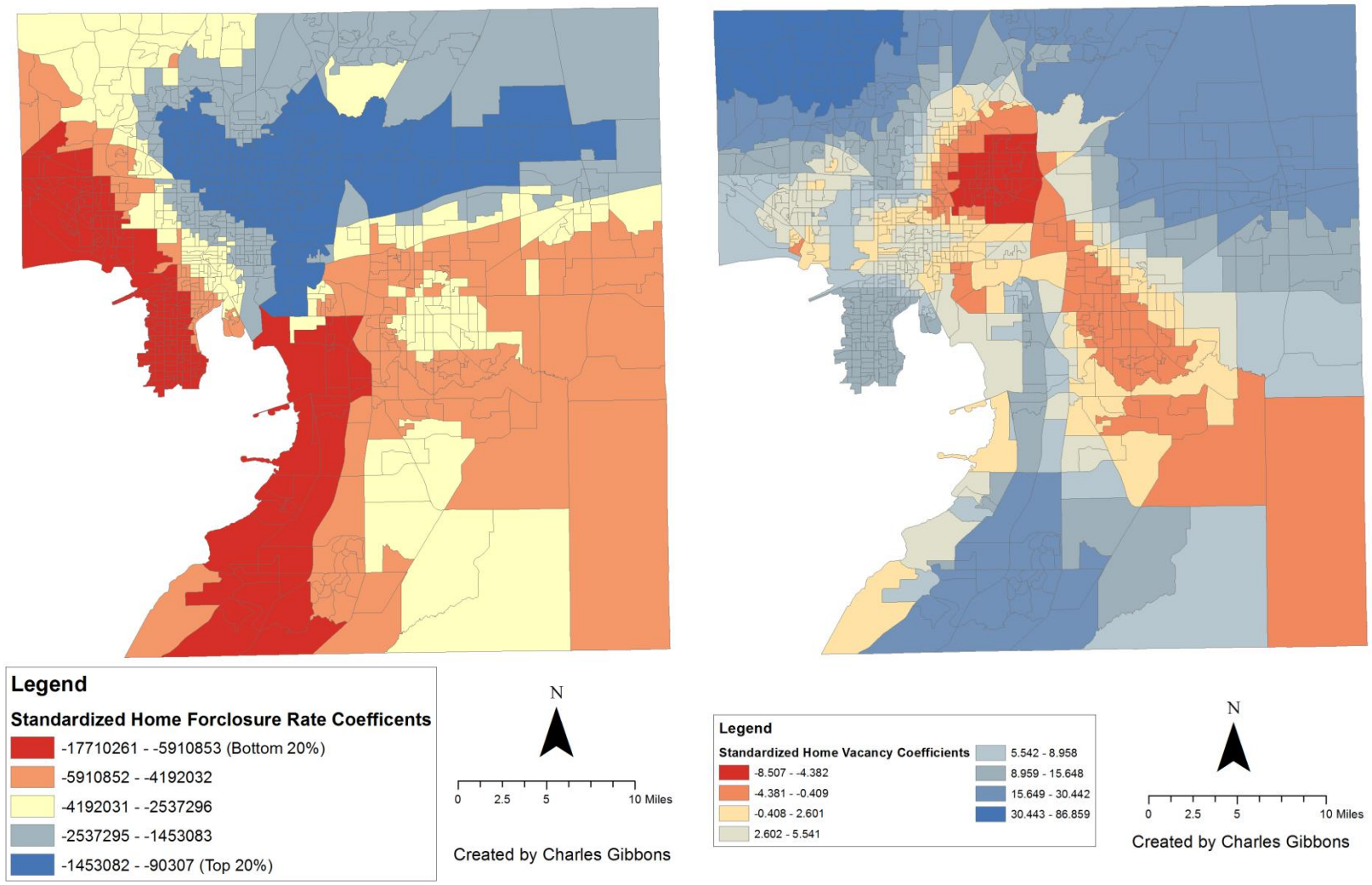


Figure 4-5. Hillsborough County – GWR standardized foreclosure coefficient surface and vacancy coefficient surface. (Source: Charles Gibbons)

Figure 4-6. Old West Tampa – Home foreclosure and code violations. (Source: Charles Gibbons)

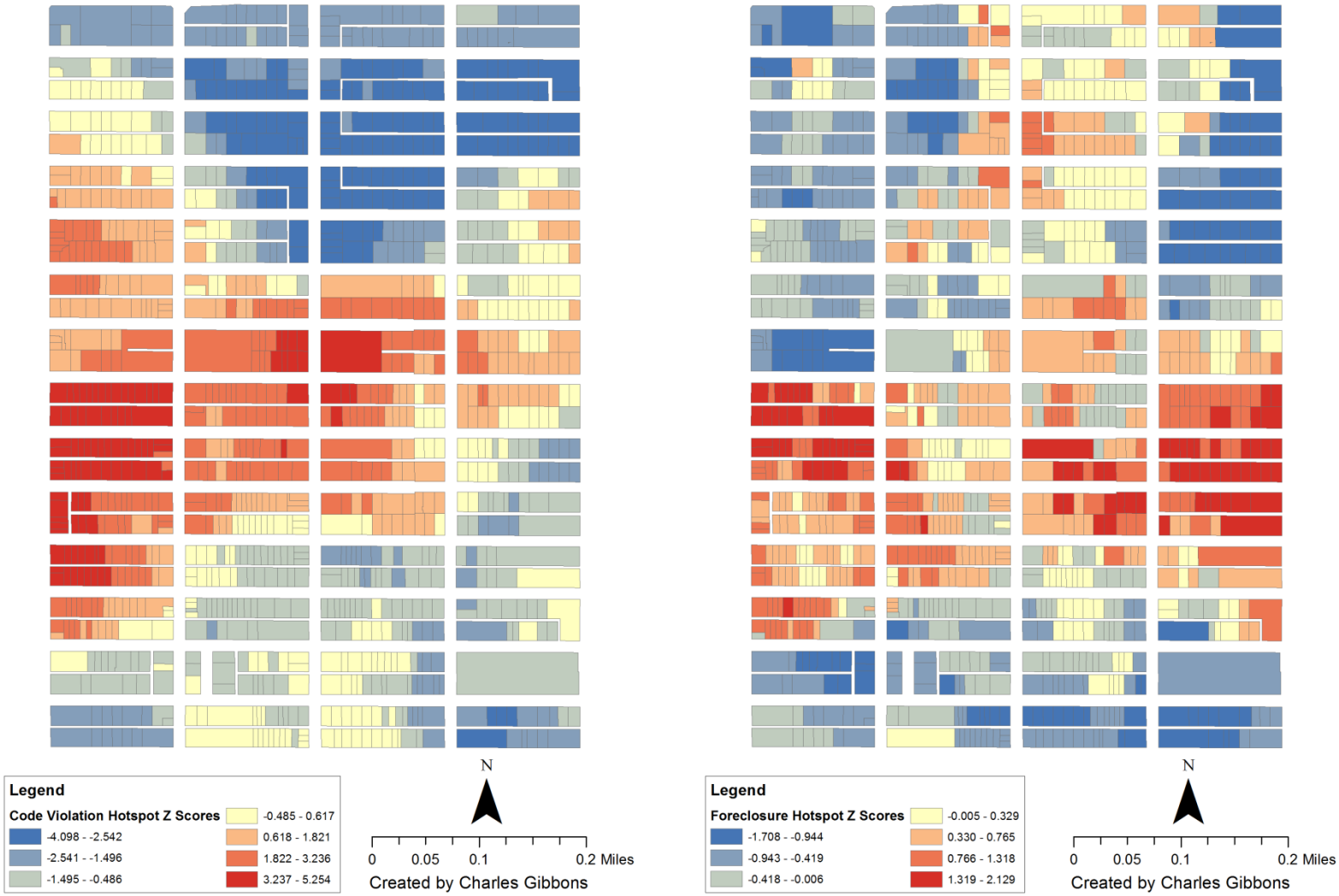


Figure 4-7. Old West Tampa – Code violations Getis-Ord Gi* Z scores and foreclosure Getis-Ord Gi* Z scores. (Source: Charles Gibbons)

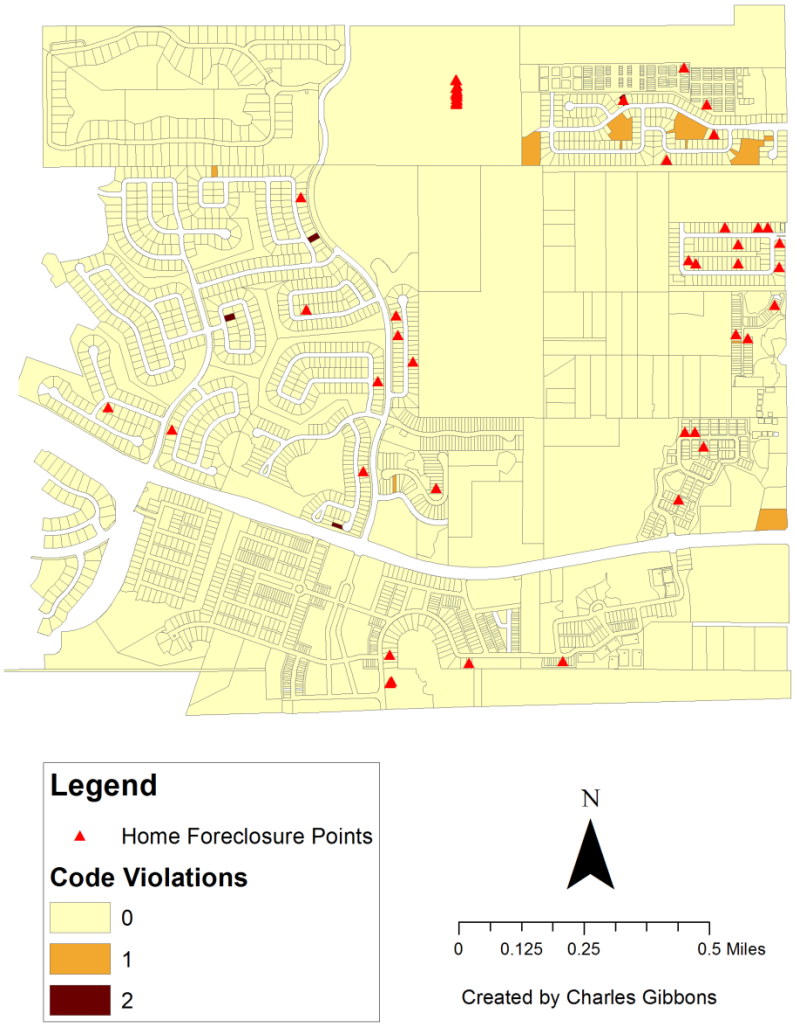


Figure 4-8. Westchase – Home foreclosure and code violations. (Source: Charles Gibbons)

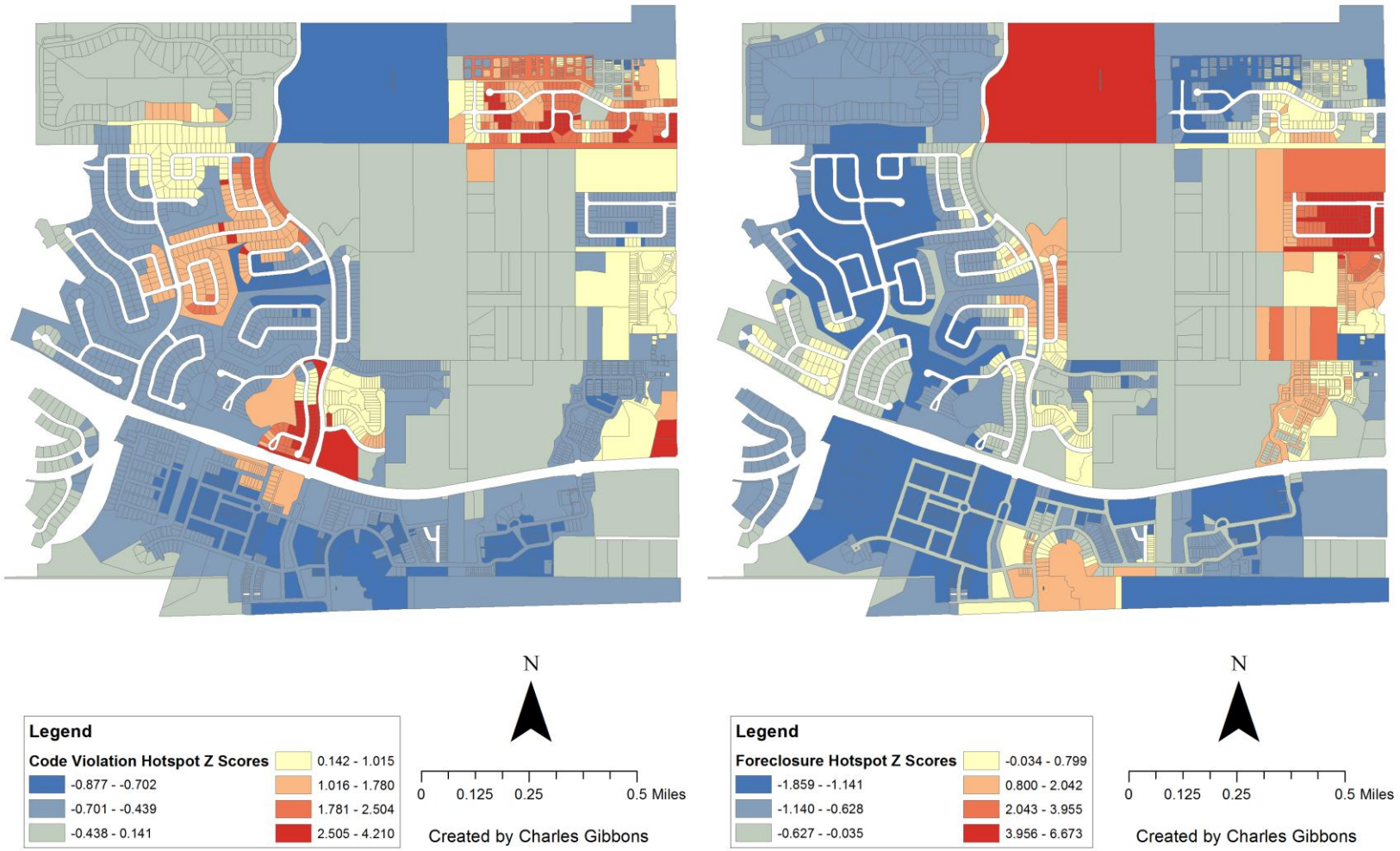


Figure 4-9. Westchase – Code violations Getis-Ord Gi* Z scores and foreclosure Getis-Ord Gi* Z scores. (Source: Charles Gibbons)

CHAPTER 5
DISCUSSION

This work was originally intended to examine foreclosures and factors of neighborhood change since the burst of the housing bubble. The initial plan was to do a short longitudinal/cross sectional analysis from 2006 through 2010. The lack of available data for such a short time period forced a change in direction, along with a change in scope. By combining in-depth regression analyses with local clustering, this research design was able to triangulate on the actual effects of foreclosure on neighborhoods in a meaningful way. The following discussion highlights the results and findings of this research in light of the existing literature on foreclosure's effects on neighborhood quality.

Plunging Home Values

Since the onset of The Great Recession, the US housing market has taken a major downturn. While much of the loss of home value is associated with stagnations in the markets, a great deal of degradation can be attributed to nearby home foreclosures. The results of both regression analyses proved the incredible impact that the percentage of foreclosed homes can have on an area. The OLS model returned a coefficient value of -386164.4201. Based on this global model, a mere 1% increase in the number of homes being foreclosed upon would lower the average home price by nearly $3,900 within a block group.

The GWR provided several key insights into the relationship between foreclosures and home values. The largest negative coefficients exist in block groups which are predominately high income; including greater Westchase, Town and Country, greater South Tampa, and continuing towards the wealthy retirement communities in

Apollo Beach/Sun City Center. In these neighborhoods a one percent increase in the foreclosure rate could decrease the average home price from anywhere between $60,000 and $177,000 on the high end. While the extremely high coefficients represent losses in property value to the extremely wealthy, huge losses in value are possible in moderate and even low income housing. Areas which seem most susceptible to these losses are low income neighborhoods which border higher income neighborhoods. Evidence has previously shown that high home prices can often spill over into adjacent low quality/income neighborhoods (Immergluck & Smith, 2006). This effect has been seen in terms of loss of home value due to foreclosure. Low income neighborhoods which abut high income neighborhoods, like Carver City and Old West Tampa, are seeing largely negative Home Foreclosure coefficients. Other traditionally poor neighborhoods which are situated further from high income areas are seeing much smaller negative Home Foreclosure coefficients.

It seems as though higher income neighborhoods have more home value to lose from nearby foreclosures and they are losing it disproportionately. Extremely poor neighborhoods often had high rates of foreclosure, but there was already so little actual home value to lose that the effects of foreclosure have had little impact on them.

A Broken Link?

The link between foreclosure and vacancy rates has been well documented in economic and planning literature. This case was actually not different from theory in terms of the actual foreclosure and vacancy rates. Where there was a high rate of foreclosure there was often a high rate of vacancy, especially in low income neighborhoods as evidenced in Figure 5-1.

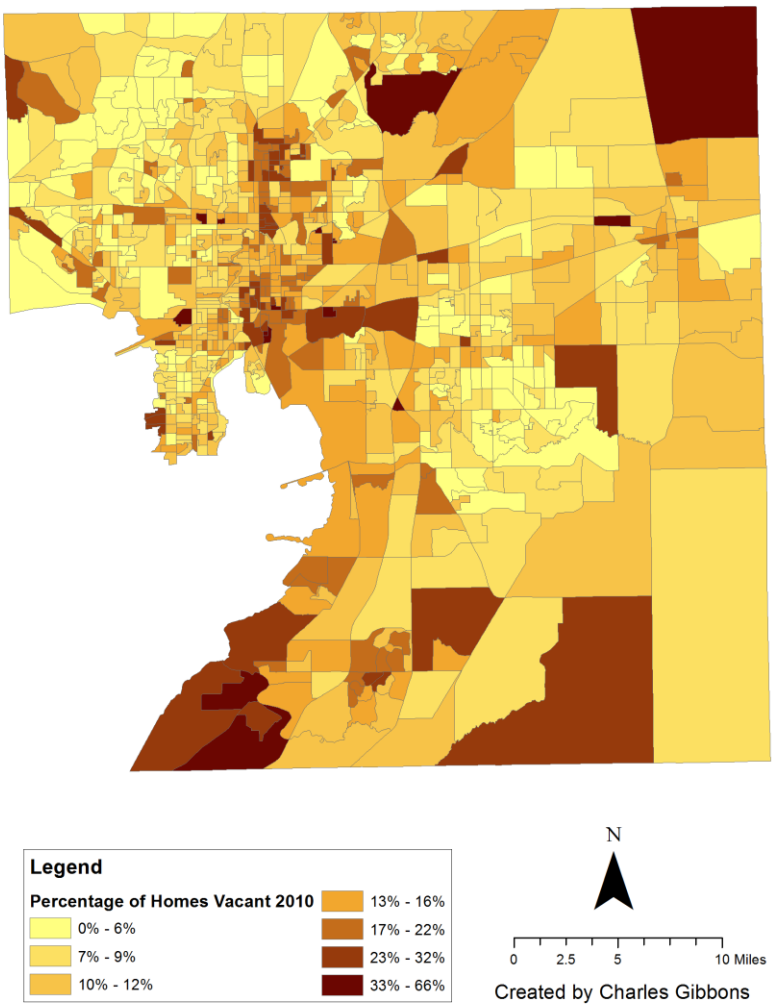


Figure 5-1. Hillsborough County - Percentage of homes vacant in 2010. (Source: Charles Gibbons)

Strangely there seemed to be a disconnect between Vacancy Rate coefficients and Home Foreclosure Rate coefficients. In the OLS regression, vacancy coefficients were positive while foreclosure coefficients were highly negative. This pattern was repeated in the GWR; except in some low income areas, like those with negative vacancy coefficients near the University of South Florida (see Figure 4-5). Aside from these locations, negative foreclosure coefficients are associated with positive vacancy coefficients. The combination of high foreclosure rates with high vacancy in low

income neighborhoods seems to have a synergistic effect in creating negative coefficient values.

Poor neighborhoods seem to be closer to a tipping point of neighborhood quality. Already physically and socially troubled, the rash of foreclosures following the bubble burst pushed low income neighborhoods into disrepair; this allows the broken windows cycle to take hold. High and middle income neighborhoods have not seen these effects for a variety of possible reasons. In many high/middle income neighborhoods, Homeowners Associations (HOA) exist to maintain a uniform character within a community and more vigilant enforcement of community maintenance standards. The fees associated with membership may be used towards the physical upkeep of properties, which may not exist in neighborhoods without mandatory HOA's (Nelson, 2011). If homes become foreclosed and vacant, HOAs can temporarily maintain a property's physical appearance; this curbs the onset of broken windows before it starts. Problems can arise for HOAs if enough properties are foreclosed upon, and budget shortfalls are created due to lack of paid fees; this represents another tipping point which many communities are on the verge of reaching (Perkins, 2010).

If a neighborhood does not reach a point of deterioration, most of the loss in housing value is caused purely by market forces. Foreclosed homes go on the market at a lower rate and therefore, they have the effect of lowering housing prices in the immediate area. The higher the quality of a neighborhood, the more resistant it is to the effects of foreclosure.

Realized Effects on Neighborhood Quality

The local cluster analyses confirmed the idea that low income areas have a greater chance of seeing the physical deterioration of a neighborhood. Old West

Tampa sits in close proximity to wealthier neighborhoods to the south; its largely negative foreclosure coefficient is likely caused by a spillover effect. The cluster analysis revealed that foreclosures clusters are correlated with code violation clusters. In low income neighborhoods, the influx of foreclosures has caused the broken windows cycle to manifest itself in the form of code violations. These physical symptoms are a direct sign of foreclosure's effect on the street.

Unlike Old West Tampa, the neighborhood of Westchase saw the opposite effect. The Westchase area saw a high rate of foreclosure and vacancy, but these indicators did not manifest many code violations. The few code violations which did exist did not seem to be related to the foreclosures in the neighborhood; this was reflected in the correlation statistic. There was effectively no correlation between the foreclosures and code violations in this high income neighborhood. This supports the previous claims made about high quality neighborhoods, while also bolstering the argument that HOAs decrease physical effects of foreclosure upon neighborhoods.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

As the United States remains in the throes of a deep economic downturn, understanding how to deal with the issues created by foreclosures will be a key to the recovery of neighborhoods and the housing market as a whole. Planners and community officials should work to understand the impacts that foreclosure activities have had on neighborhoods of all varieties. Given the limited resources of local governments, every dollar should be specifically targeted to help neighborhoods which have suffered most from the foreclosure crisis.

Conclusions

The effects of foreclosures on neighborhood quality have been felt across the entire nation. This study has shown that in Hillsborough County, Florida, the burden has not been equally shared. Home values have been dramatically slashed since the onset of the foreclosure crisis in 2007. Still, high income neighborhoods have seen the greatest proportional decline in home value. Each foreclosure incident has a greater impact on home values in a high income neighborhood than one in low income neighborhood. These results, contrary to traditional literature, could likely be due to the rampant investor speculation taking place in the early 2000s. High income neighborhoods had highly inflated home values which were acting under abnormal market forces.

These losses in home value never translated into measurable physical decline within high income neighborhoods. Here, land development code violations were not very prevalent, even with high incidents of foreclosure. In lower income neighborhoods the incidents of code violations created a noticeable impact on the community. Given

the overall quality of the neighborhood, a greater number of code violations are to be expected in a lower income neighborhood. The location of these code violations gives a link of causality between them and the foreclosure incidents. The 1/8th mile clusters of foreclosures and code violations produced a statistically significant correlation between the two.

Planning Policy

This research primarily focused on the identification of areas which are vulnerable to the impacts of foreclosure. Ideally, local agencies should use this type of analysis to guide their actions in their jurisdictions. Programs and policies should be enacted by local government to not only curb foreclosure, but also to manage existing foreclosed properties. One such device is the use of land banking, which are "governmental or nongovernmental nonprofit entities that focus on the conversion of vacant, abandoned properties into productive use" (HUD, 2011). The City of Cleveland, Ohio has recently set up a land bank by which they have acquired nearly 1000 properties. Striking a deal with lenders, the land bank offers to buy off unwanted foreclosed properties as long as the lender pays for demolition (Saito, 2011). Typically, these extremely distressed houses cost more in terms of maintenance than their actual worth. By acting in this way, a local government-owned land bank can acquire and hold a property to stabilize a neighborhood for future redevelopment. These programs are not only good planning for foreclosures, but they act as a show of good faith on the part of a local government entity.

Study Limitations

This study was primary limited by data availability. Income data at the 2010 Census Block Group geography will not become available until 2012. The most

accurate foreclosure data is only available at a high price premium; therefore the cheaper, less accurate ForeclosuresDaily.com data was used. Sales data for these years was spotty in terms of availability and quality. In using Just Value, an inherent error is associated with property appraiser data. An appraisal is just an approximation for the home's value, not the actual market/sales price of a home. Use of actual sales data would be a better approximation of real value, especially in a poor housing market. Crime data would have been a great indicator of neighborhood quality, but it too was unavailable at a small geography. With more time and greater resources, these regression models could be improved by using better indicators of neighborhood quality. Also, given the small study area only six explanatory variables could be used in the GWR. With a larger study area, more descriptive variables could be used to strengthen the model in space.

Further Research

At the conclusion of this study, the avenues for future research in foreclosure are abundant. As previously expressed, this research was initially intended to be a time series. Given the lack of available small geography data for the period of 2006-2011, this was not possible. To better understand the ways in which the foreclosure crisis has created neighborhood change, high quality small area data could be used. The full extent of damage from the foreclosure crisis will not truly be known until the United States reaches a full economic recovery.

APPENDIX: DOR LAND USE CODES

USE CODE

Residential Property

000	Vacant Residential
001	Single Family
002	Mobile Homes
003	Multi-family - 10 units or more
004	Condominia
005	Cooperatives
006	Retirement Homes not eligible for exemption. Others shall be given an Institutional classification
007	Miscellaneous Residential (migrant camps, boarding homes, etc.)
008	Multi-family - less than 10 units
009	Undefined - Reserved for Use by Department of Revenue

Commercial Property

010	Vacant Commercial
011	Stores, one story
012	Mixed use - store and office or store and residential or residential combination
013	Department Stores
014	Supermarkets
015	Regional Shopping Centers
016	Community Shopping Centers
017	Office buildings, non-professional service buildings, one story
018	Office buildings, non-professional service buildings, multi-story
019	Professional service buildings
020	Airports (private or commercial), bus terminals, marine terminals, piers, marinas.
021	Restaurants, cafeterias
022	Drive-in Restaurants
023	Financial institutions (banks, saving and loan companies, mortgage companies, credit services)
024	Insurance company offices
025	Repair service shops (excluding automotive), radio and T.V. repair, refrigeration service, electric repair, laundries, laundromats
026	Service stations
027	Auto sales, auto repair and storage, auto service shops, body and fender shops, commercial garages, farm and machinery sales and services, auto rental, marine equipment, trailers and related equipment, mobile home sales, motorcycles, construction vehicle sales
028	Parking lots (commercial or patron) mobile home parks
029	Wholesale outlets, produce houses, manufacturing outlets
030	Florist, greenhouses

031 Drive-in theaters, open stadiums
032 Enclosed theaters, enclosed auditoriums
033 Nightclubs, cocktail lounges, bars
034 Bowling alleys, skating rinks, pool halls, enclosed arenas 2009 NAL-SDF-NAP User Guide 13
035 Tourist attractions, permanent exhibits, other entertainment facilities, fairgrounds (privately owned).
036 Camps
037 Race tracks; horse, auto or dog
038 Golf courses, driving ranges
039 Hotels, motels

Industrial Property
040 Vacant Industrial
041 Light manufacturing, small equipment manufacturing plants, small machine shops, instrument manufacturing printing plants
042 Heavy industrial, heavy equipment manufacturing, large machine shops, foundries, steel fabricating plants, auto or aircraft plants
043 Lumber yards, sawmills, planing mills
044 Packing plants, fruit and vegetable packing plants, meat packing plants
045 Canneries, fruit and vegetable, bottlers and brewers distilleries, wineries
046 Other food processing, candy factories, bakeries, potato chip factories
047 Mineral processing, phosphate processing, cement plants, refineries, clay plants, rock and gravel plants.
048 Warehousing, distribution terminals, trucking terminals, van and storage warehousing
049 Open storage, new and used building supplies, junk yards, auto wrecking, fuel storage, equipment and material storage

Agricultural Property

050 Improved agricultural
051 Cropland soil capability Class I
052 Cropland soil capability Class II
053 Cropland soil capability Class III
054 Timberland - site index 90 and above
055 Timberland - site index 80 to 89
056 Timberland - site index 70 to 79
057 Timberland - site index 60 to 69
058 Timberland - site index 50 to 59
059 Timberland not classified by site index to Pines
060 Grazing land soil capability Class I

061 Grazing land soil capability Class II
062 Grazing land soil capability Class III
063 Grazing land soil capability Class IV
064 Grazing land soil capability Class V
065 Grazing land soil capability Class VI
066 Orchard Groves, Citrus, etc.
067 Poultry, bees, tropical fish, rabbits, etc.
068 Dairies, feed lots
069 Ornamentals, miscellaneous agricultural 2009 NAL-SDF-NAP User Guide 14

Institutional Property

070 Vacant
071 Churches
072 Private schools and colleges
073 Privately owned hospitals
074 Homes for the aged
075 Orphanages, other non-profit or charitable services
076 Mortuaries, cemeteries, crematoriums
077 Clubs, lodges, union halls
078 Sanitariums, convalescent and rest homes
079 Cultural organizations, facilities

Government Property

080 Undefined - Reserved for future use
081 Military
082 Forest, parks, recreational areas
083 Public county schools - include all property of Board of Public Instruction
084 Colleges
085 Hospitals
086 Counties (other than public schools, colleges, hospitals) including non-municipal government.
087 State, other than military, forests, parks, recreational areas, colleges, hospitals
088 Federal, other than military, forests, parks, recreational areas, hospitals, colleges
089 Municipal, other than parks, recreational areas, colleges, hospitals

Miscellaneous Property

090 Leasehold interests (government owned property leased by a non-governmental lessee)
091 Utility, gas and electricity, telephone and telegraph, locally assessed railroads, water and sewer service, pipelines, canals, radio/television communication
092 Mining lands, petroleum lands, or gas lands
093 Subsurface rights
094 Right-of-way, streets, roads, irrigation channel, ditch, etc.
095 Rivers and lakes, submerged lands
096 Sewage disposal, solid waste, borrow pits, drainage reservoirs,

waste land, marsh, sand dunes, swamps

097 Outdoor recreational or parkland, or high-water recharge subject to classified use assessment.

Centrally Assessed Property

098 Centrally assessed

Non-Agricultural Acreage Property

099 Acreage not zoned agricultural

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BIOGRAPHICAL SKETCH

Charles Gibbons was born in 1987 in Tampa, Florida. He is the son of Jane and Gary Gibbons. He has one sister, Kristie. Charles studied at H.B. Plant High school before attending the University of Florida, where he earned his Bachelor of Science in geography in 2009. During his tenure, he would support his Florida Gator football team by playing alto saxophone in The Pride of the Sunshine, The University of Florida Fightin' Gator Marching Band.

In the fall of 2009, Charles began his studies in Urban and Regional Planning at the University of Florida. As a graduate assistant, Charles began to work as a GIS Analyst at the Shimberg Center for Housing Studies at UF. Here he provided valuable assistance in creating and maintaining spatial datasets related to the study of affordable and special needs housing in Florida. Charles will graduate with his Master of Arts in Urban and Regional Planning in December 2011. Charles hopes to continue his work with geospatial technologies and planning in the future. Outside of his academic career, Charles' love for maps and exploration has kept him infected by the travel bug. He also enjoys playing home-chef and considers himself a "foodie".