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Subsidized Housing and Neighborhood Change

By

Florence Louise Wilson

A dissertation submitted in partial satisfaction of the

Requirements for the degree of

Doctor of Philosophy

In

Social Welfare

In the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Michael J. Austin, Chair

Professor Julian C. Chow

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Abstract

Subsidized Housing and Neighborhood Change

By

Florence Louise Wilson

Doctor of Philosophy in Social Welfare

Professor Michael J. Austin, Chair

The purpose of this dissertation is to explore the relationship between low-income subsidized households/housing units and neighborhood quality while using a neighborhood change theoretical framework. Specific research questions that are addressed are: do low-income subsidized households/housing units impact neighborhood change or are low-income subsidized households/housing developers responding to changing neighborhood conditions? The research design is a case study of 16 US metropolitan areas. The two primary data sources are census data from the Neighborhood Change Database (NCDB) and Department of Housing and Urban Development (HUD) administrative data from the Picture of Subsidized Households (PSH) data file. Census tract median household income and median home value are the two neighborhood quality indicators used with the categorical outcome variable of large decline, stable/small change, and large gain. Predictor variables include neighborhood change variables: population, housing stock, and neighborhood characteristics. Multinomial logit regression, using base subsidized housing, neighborhood change, and PSH models, provides hypotheses testing of the impact of neighborhood indicators and PSH on how neighborhoods changed from 1990 to 2000 and impact of neighborhood ranking in 1990. The results indicate that subsidized households are more likely to be located in lower ranked neighborhoods based on income and home value, compared to general metropolitan trends. Second, PSH housing units significantly, though at an extremely small level, increased the likelihood that a neighborhood experienced a large decline and decreased the likelihood of a large gain from 1990 to 2000, compared to stable neighborhoods. Third, housing stock age and neighborhood characteristics are not primary indicators of neighborhood change. Fourth, neighborhoods with high levels of assisted households and total poor households may or may not experience neighborhood change compared to neighborhoods with no or low levels of assisted/poor households.

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Table of Contents

List of Tables

List of Figures

CHAPTER 1

INTRODUCTION

Problem statement

Recent housing policy research has concentrated on how neighborhoods impact the well being and opportunities for social and economic mobility of residents. However, these studies have shown that low-income households in high poverty areas are at a severe disadvantage compared to low poverty areas because they do not have geographic access to opportunity either in their immediate surroundings or in their metropolitan surroundings via transportation accessibility (Galster & Killien, 1995). Tenant-based approaches to low income rental policy have the goal of expanding the housing options of low income households to economically better neighborhoods and thus improving their economic and social outcomes. With an increased housing policy emphasis on the Housing Choice Voucher program, there is the concern in some metropolitan areas that voucher portability is re-concentrating poverty and minority households and associated problems in non-poor, low minority center city and suburban neighborhoods (Donovan, 2009; Landis & McClure, 2010). In addition, neighborhood residents of non-poor areas are concerned about the potential negative impact that subsidized housing and households may have on their neighborhood quality. Specifically, neighborhood residents of host communities and local policy makers are concerned about the potential impact of low-income housing and households on values of properties located nearby, overburdening public and private services, and increasing crime, other social negative problems and traffic congestion (Galster, et al, 2004; Nguyen, 2005).

The impact of subsidized housing and households on neighborhoods has been a concern of policy makers and others whether they are concentrating on revitalizing economically distressed communities or decreasing poverty (Khadurri, Burnett, & Rodda, 2003). First, one of the major concerns of national government policy makers and implementers of low-income rental housing programs is that they are continuing to inadvertently foster racial and economic segregation through housing policies. There is also a desire to correct negative outcomes from past policies (Donovan, 2009). Second, local governments that seek to revitalize deteriorated communities seek positive impacts on the housing quality submarkets in these neighborhoods (Galster, et al, 2004). Third, local governments, regional planning commissions, and urban analysts that seek to promote smart growth regional and state policies have recommended guidelines on the number of affordable housing units to be located within their communities (Downs, 2004; Orfield, 2000).

The three primary goals of recent low income rental housing policies are 1) to deconcentrate poor households living in high poverty neighborhoods, 2) to expand housing options for low-income households that would otherwise not be able to afford them, particularly in non-minority and low-poverty communities, and 3) to relieve the housing cost burdens of low-income households. Low-income rental housing policy is increasingly emphasizing a tenant-based approach that enables participants to access housing in the private rental market in communities with lower rates of poverty and lower percentages of minorities. However, there is rising concern with federal housing policies that seek to deconcentrate central city poverty may or could be a contributing factor (Puentes and Warren, 2006) to the recent trend in the suburbanization of poverty (Kneebone & Garr, 2010). The key policy concerns addressed in this study provides an attempt to disentangle the dynamics of neighborhood change of subsidized households. First, is the flow of low-income and subsidized households into and out of neighborhoods responding to changes within communities? That is, theories of neighborhood change provide some indication about where housing affordable for low-income households will be located. Thus, housing that is affordable to low-income households will tend to be located in neighborhoods that already have declining property values. Second, what impacts are low-income and subsidized households having on neighborhood quality? That is, how does the presence of subsidized households impact the trajectory of housing price appreciation or depreciation?

Purpose of the Study

Most studies on the relationship between neighborhoods and low-income households are concerned about the impact of neighborhood poverty on adult and adolescent social, economic, and health outcomes (Galster, 2001). Conversely, most studies on neighborhood outcomes of subsidized households are concerned with whether low-income housing policies have helped to improve neighborhood outcomes of recipient households in social and economic quality (Newman and Schnare, 1997; Olsen, 2001). In addition, there is a growing body of literature concerned with the impact of subsidized housing on neighborhood quality of receiving communities, primarily to address community and government concern about potential adverse effects. However, these studies are primarily concerned with explaining and determining the cause and effect of the presence of subsidized housing and households on host communities. These studies only recently have begun to consider understanding the types and trajectories of neighborhoods that subsidized households are selecting or in which subsidized housing units are being located.

This study is concentrated upon understanding the types of neighborhoods that low-income subsidized households are selecting and/or being located in and measuring the potential impact of this location on receiving communities. To address concerns about the impact of subsidized housing on neighborhood quality, this study seeks to 1) understand if subsidized households are self-selecting specific types of neighborhoods by studying the neighborhood quality change trajectory of communities selected by housing choice voucher recipients and 2) the impact of subsidized housing on neighborhood quality. Theories of neighborhood change will be used to study neighborhood quality level and the different trends in housing location choice of low-income households. Research methodology of impaction studies that investigate the impact of subsidized households on neighborhood quality (home values) will be used as a frame work for measuring impact to the extent of understanding the level and trajectory of neighborhood change.

Significance of the study

This study suggests the following specific contributions to various audiences including researchers, professionals, communities, and program recipients. First, this study is important to policy makers that are concerned with the negative impacts of low-income housing policy on neighborhood quality. However, there needs to be more research on neighborhood conditions of host communities in order to ascertain whether subsidized households are impacting neighborhoods or if changing neighborhoods are attracting low-income households. While this study does not focus on determining impact using impaction techniques, it is unique in that there are few impaction studies that attempt to explain changing neighborhood trends. It is important to fill this gap because federal low-income rental housing is increasingly emphasizing a tenant-based approach that will disperse poor households outside of high poverty areas and potentially may transform former poor areas into mixed income neighborhoods (Khadduri, 2004 response to Galster, 2004). Second, this study will make an important contribution to both theories of neighborhood change and impaction methodology literature. Galster, Cutsinger, and Malega (2008) begin to incorporate a neighborhood change theoretical framework into impaction studies. Galster, Cutsinger, and Malega (2008) model the relationship between neighborhood quality (property values), poverty rates (change in neighborhood poverty rates), property owner maintenance decision making, and social problems (crime) using a neighborhood change framework. Similarly, this study will build on the tradition of using property values to proxy for neighborhood quality outcome variable, but will use changes in neighborhood indicators derived from theories of neighborhood change to predict house value/rent price outcomes in terms of level and current and projected trends.

Research Questions

Research Question 1: Are subsidized households selecting neighborhoods that are declining in conditions/quality (as measured by change in metropolitan relative median home values, median gross rents, and median household income)? In the first research question, neighborhood change may be occurring as a result of aging housing stock (Life Cycle) and/or reduced housing services of the existing housing stock (Filtering). That is, more housing that is affordable to low-income households is available as a neighborhood's housing stock ages or services provided by the housing stock are not able to meet its current residents' needs (declining housing values). This research question addresses the impaction concern (i.e. Galster, Tatain, & Smith, 1999) of the types of neighborhoods that subsidized mobile households are selecting.

Research Question 2: Is the change in neighborhood conditions/quality (as measured by change in metropolitan relative median home values, median gross rents, and median household income) sensitive to the presence of subsidized households and percentage of the neighborhood that is low-income? In the second research question neighborhood change occurs as a result of an excess of the number of low-income in-movers over the number of higher-income out-movers (low-income households are replacing out-movers at a higher rate) (succession and Tipping). Is the increase of low-income households related to change in housing stock value?

Filtering

Hypothesis 1a: Subsidized households will more likely be located in neighborhoods that are filtering down or that are decreasing in income, rent, or housing value neighborhood quintile (level of and trend in outcome indicator of subsidized household's neighborhood).

Hypothesis 1b: Subsidized households are more likely to be located in lower quintile neighborhoods than in higher quintile neighborhoods compared to general metropolitan trends.

Life Cycle

Hypothesis 2: Housing stock age is an initial condition and aging and obsolescence are primary drivers in Filtering and Life Cycle perspectives. To the extent that the aging of housing stock is related to obsolescence, housing stock age is one of the primary physical and quality indicators of neighborhood change that is occurring in a neighborhood.

Succession and Tipping

Hypothesis 3a: Neighborhoods with high levels of assisted households and total low-income households will experience greater neighborhood change compared *to neighborhoods with no or low levels of assisted/poor households (estimating the impact of few versus many subsidized households on change in neighborhood outcome indicator).*

Hypothesis 3b: The rate of neighborhood change will be greater with higher levels of subsidized households compared to the rate of change with lower levels of subsidized households. Tipping postulates a non-linear relationship between presence and change in subsidized households over the study period and the neighborhood outcome indicator.

Preliminary Definitions of Key Terms

Subsidized housing: refers to public housing, Housing Choice Voucher, Section 8 Moderate Rehabilited, and other multifamily units as reported in the Picture of Subsidized Households (PSH) data file.

Housing Choice Voucher program: While most impaction studies have been concerned with place-based programs, the tenant based subsidy program 1) supports the fastest growing number of subsidized households of all the low-income housing assistance programs (Quigley, 2000), 2) receives the largest portion of low-income rental assistance program funding (Landis & McClure, 2010). 3) is more politically popular because it is more cost effective which results in serving more eligible households (Olsen, 2001) and 4) has similar impact concerns as place-based impacts primarily due to race/ethnic and economic differences between residents of host communities and the subsidized households (Freeman & Botein, 2002).

Neighborhood quality: median home values, median gross rent prices, and median household income will be the primary measures of neighborhood quality. Median home value is a primary outcome indicator because housing, locational attributes, neighborhood, and resident characteristics are capitalized into property values. Household median income is the second primary neighborhood quality measure.

Low-income families and households: those families and households with incomes below the absolute level of adequate subsistence as defined by federal definition and measurement of poverty. Similarly, this study will use percentage of a census tract population that is low-income to determine neighborhood poverty level. The alternative measure of poverty is the one used to determine housing subsidy eligibility by the Department of Housing and Urban Development (HUD) and is based on relative metropolitan area median income (Ruggles, 1990).

Limitations and delimitations. The scope of study is limited to case study areas. However, the sample selection, N = 16, represents a diverse set of metropolitan areas selected with the intention of expanding generalizability. Potential weaknesses: 1) Data sources (Neighorhood Change Database/Census data; PSH HUD administrative data). 2) Length of study period. 3) Potential bias due to omitted variables. This study will identify indicator variables from neighborhood change theoretical frameworks and empirical studies shown to be significantly correlated with outcome variables. 4) Reliance on decennial census data from year 2000 for neighborhood indicators, (2010 census has not been done and will not be available until summer 2011). 5) Inability to determine true causation because intervention variable is not under control of the investigator and nonrandom sampling. 6) Possible small sample size of subsidized households.

Research Organization

This dissertation consists of five chapters: Introduction, literature review, methods, analysis and results, and discussion. Chapter 1, the introduction, provides the problem statement, the purpose and goals of the study, its significance, and the audience to whom the study would be of interest. The research questions and related hypotheses are specified. Potential study weaknesses are considered. Chapter 2 provides a review of theoretical and empirical literature of Invasion and Succession, Tipping, Life Cycle, and Filtering neighborhood change frameworks. The summary of theories of neighborhood change focuses on their implications for low-income rental housing policy. Chapter 2 also provides a brief discussion of the evolution and current techniques of impaction methods in order to begin to connect it to the broader study of neighborhood change.

Chapter 3 is broken down into three general areas. The first section elaborates on the connection between theories of neighborhood change and impaction methodology in understanding the types (level and trends) of neighborhoods subsidized households are selecting and the potential impact of subsidized households on change in their neighborhoods. In addition, the research questions and hypotheses are stated. The second section lays out the selected case study research design including the sampling frame, sampling strategy, descriptions of case study 16 selected metropolitan areas, and discussion of data, data sources, and data limitations. Impaction studies are typically limited to small geographic areas, it is critical to obtain a broad range of metropolitan areas to enable generalizability. Thus, 16 metropolitan areas were selected based on population size, growth rate, and wealth across several indicators of geographic location and central city/suburban wealth distributions. The data set created includes census data from the NCDB and HUD administrative data from the Picture of Subsidized Households. The third section presents three multinomial logit regression models to test the hypotheses. These models help estimate the relationship between neighborhood change and subsidized housing-relevant indicator variables on the probability that a neighborhood would experience a large decrease or increase on primarily two outcome indicators of median home values and median household income. Large increases or decreases in neighborhood change are emphasized due to possible regression to the mean and change due to slight differences that result in placing a neighborhood in a different category (quintile). In addition, a description of the logit model terms and summary of the variables is provided.

Chapter 4 presents a summary of the analysis and results for individual metropolitan area transition matrices and hypotheses testing. After a brief metropolitan overview, the results for creating neighborhood quintiles by outcome indicator (median home value, median gross rent, and median household income) are presented. Neighborhoods (census tracts) that experience large changes on an outcome indicator from 1990 to 2000 of particular interest especially how they relate to the distribution of subsidized households. Second, results of the three multinomial logit regression models and their variations are presented and discussed. Chapter 5 summarizes the results particularly focusing on to the extent to which the analyses support or do not support the hypotheses. Policy implications and recommendations for future research are presented.

CHAPTER 2

LITERATURE REVIEW

INTRODUCTION

Theories of neighborhood change from a market perspective are in two categories: social and economic. Social models of theories of neighborhood change are Invasion and Succession, Tipping, and Life Cycle. Economic models of theories of neighborhood change are Filtering/thresholds and Bid Rent.

Social Models

Invasion and Succession was developed from ecological theories of communities from the work of Park, Burgess, and MacKenzie (1925). Primary contributors to this frame work are Burgess (1925) and Park (1952). Burgess (1925) provided the Concentric Zones framework for understanding neighborhood change within a macro-level urban system. From Burgess' Concentric Zones, other models of urban structure and change were developed including Sectoral (Hoyt, 1939) and Multiple Nuclei (Harris & Ullman, 1945). More recent versions of urban structure models evolved from this line of research including White's Late 20th Century Model and the Urban Realms Model (Carter & Polevychok, 2006). Park (1952), Duncan and Duncan (1957), and Taeuber and Taeuber (1967) provided the framework for understanding the dynamic process that occurred in neighborhood change within the urban structure, which is that of Invasion and Succession. Grodzins (1957) introduced the concept of Tipping to the neighborhood change process that contrasted earlier models of orderly, block by block change to that of different rates of change depending on the level of the invading group or land use.

The second social model of neighborhood change is that neighborhoods go through Life Cycles as the housing stock ages and change occurs through the process of Filtering. Life Cycle model of neighborhood change evolved from Homeowners' Loan Corporation (HOLC) real estate valuation appraisal maps. Two HOLC economists, Hoyt and Babcock (Hillier, 2005) further developed the appraisal model used in underwriting manuals. Hoyt (1939) furthered this work by using the ecological model of Park, Burgess, and MacKenzie (1925) as a guide. In addition, Hoyt built on Burgess' Concentric Zones Model in his Sectoral Model of urban structure and change. Hoover and Vernon (1959) further developed the model in their study of the New York metropolitan region that was requested by the Regional Planning Association of New York. The purpose of the study was to provide regional current and projected economic and demographic features for future planning studies and recommendations for government actions.

Economic Models

Filtering evolved from early economists to help explain neighborhood change within a housing market context. Early contributors to Filtering are Ratcliff (1949), Lowry (1960), and Fischer and Winnick (1952) (Grigsby, 1963). These models were different in that they modeled different aspects of the housing market that changed: price, household income, and housing quality. However, these models were similar in that they viewed housing as a simple commodity that provided housing services. Grigsby (1963) introduced sub-markets of housing quality through the concept of substitutability (Galster, 1996). Smith (1963) provided an initial empirical study and created typologies of housing quality sub-markets. However, Sweeny (1974) provided the first formal economic model of Filtering and Rothenberg, et al (1991) made substantial contributions (Galster, 1996).

The second economic model of neighborhood and urban structure is Bid Rent. Initially developed by Alonso (1964), bid rent is a static model of the resulting urban structure of individual household and business tradeoffs between transportation costs and housing/land size. The resulting urban structure is similar to that of Concentric Zones and others in that business, residential, and agricultural land uses are relative to location of and access to the central business district. Filtering is a process that describes the process of how neighborhoods change in a bid rent model. Bid Rent provides an economic model of urban structure resulting from residential and business locational choices. As such, it will not be used to study neighborhood change.

This chapter will review the following theories of neighborhood change: 1) Invasion and Succession; 2) Tipping/threshold; 3) Life Cycle; and 4) Filtering. The next section will discuss each theory individually and its' most important empirical studies. The conclusion present a brief discussion on impaction methodology and policy implications. Impaction methodology will be connected to these theories of neighborhood change and briefly reviewed. These elements will be used to formulate and test the research hypotheses that will address this study's research questions. The methodology will provide the basic structure of the hypotheses testing models.

INVASION AND SUCCESSION: THEORY

The origin of Invasion and Succession, as first put forth by Park (1952), is from ecological community theory. Park, Burgess, and MacKenzie (1925) based their ecological theory of community creation and growth on an analogy of human behavior to that of plant and animal ecology. Invasion and Succession is defined as competitive social actions by which individuals or groups come to actively occupy and dominate a territory formerly dominated by another group or activity (Scott & Marshall, 2009). Key concepts in Invasion and Succession are aggression, competition, natural areas, and inevitability of succession. There are three important aspects of Invasion and Succession: individual neighborhood change dynamics, the larger city/metropolitan context in which neighborhood change occurs, and the process within which the change occurs.

First, at the neighborhood level, an invading group starts the neighborhood change process because there is an increase in housing demand due to population and income growth. Proximally located areas to communities in which there is increased housing demand, are vulnerable to invasion or expansion and becomes the object of competition between the invading group and the existing residents. Neighborhoods may resist or succumb to change. Factors that render neighborhoods vulnerable to change are neighborhoods in which residents have weak social attachment, resident preferences for not living with invading group, and alternative opportunities for improved housing. However, once the invading group enters a community, change is typically uni-directional and succession is inevitable.

Second, neighborhood change occurs in a larger city/metropolitan context that determines urban structure and growth. One of the primary contributions of this frame work is that the change process occurs within an urban structure of a metropolitan area that is represented by a monocentric and/or polycentric structure. Burgess (1925) hypothesized that, based on competition between business and residential land use needs, urban structures of residential areas concentrically radiate out from a centralized core business district. While this model was based on a case study of Chicago, this structure was not new or unique to the early 20th century, but has early recordings from Biblical times. However, alternative modern models based on the ecological framework include Sectoral theory (Hoyt, 1939), Multiple Nuclei (Harris & Ullman, 1945), and White's 20th Century Model and the Urban Realms Model (Carter & Polevychok, 2006). These subsequent models offer some explanation of polycentric urban structure that is discussed in more detail below. These two aspects of ecologically-based Invasion and Succession neighborhood change theory highlight the neighborhood-level change process that occurs within a larger urban environment and results in macro-level structural changes.

Third, while there are no hard and fast rules for how neighborhoods change within the Invasion and Succession framework, some patterns have emerged. Duncan and Duncan (1957) specified the first model of Park's concept of the Invasion and Succession process. Neighborhoods are first penetrated by the invading group, followed by a time of piling up (increasing density) of the invading group until more housing units become available. Next is the consolidation stage that is broken down into three sub-stages of early consolidation, consolidation, and late consolidation. The final stage is invasion in which complete succession by the invading group is inevitable. Duncan and Duncan (1957) found that neighborhoods change in an orderly block by block process while Grodzins (1957) observed that neighborhoods change at different rates during the change process as further discussed the Tipping theory of neighborhood change section.

Primary criticisms of Invasion and Succession theoretical framework are restricted spatial and temporal specifications (Taub, et al 1984 and others as cited by Wood & Lee, 1991), inevitability of succession, uni-directional change process, and focus on ecological factors while ignoring other primary community actors (Taub, et al, 1984; Pitkin, 2001). First, the Invasion and Succession hypothesis was based on observations of two time periods of major population shifts and growth in the north-central region of the United States. Of particular interest and concern to policy makers, local government officials, and community residents were the population and growth and residential patterns of Black households. However, Invasion and Succession theory appears to be less capable of explaining neighborhood change during subsequent periods of time. That is, Invasion and Succession theory of how neighborhoods change appears to be restricted to growth patterns of a specific time and in a particular place. Thus, the current question is to what extent does Invasion and Succession explain neighborhood change under different residential patterns and population shifts? However, as Taub, et al (1984) noted, the urban spatial structure hypothesized in the model, has some resemblance to metropolitan-level concentric development from a dense urban core or from the core of a sub-center within a metropolitan area. Second, the inevitability of succession once invasion begins implies that integrated communities are not stable. However, as discussed below, there are cases of stable integrated neighborhoods that Invasion and Succession is not able to explain. Third, as with other ecological community theories Invasion and Succession ignores non-ecological factors that are critical to neighborhood change and growth. These factors include the stabilizing or destabilizing impact of institutional actors as their actions interact with residents' location decision making (Taub, et al 1984).

INVASION AND SUCCESSION: EMPIRICAL STUDIES

Early sociological studies using the Invasion and Succession framework provided a description of geographic patterns of Black and White residential patterns over time (Duncan & Duncan, 1957; Taeber & Taeber, 1965). Early sociological and economic empirical studies found evidence that supports the Invasion and Succession model of neighborhood change (Aldrich, 1978 review; Bruecker, 1977; Downs & Laruenti, 1960; Duncan & Duncan, 1957; Taeber & Taeber, 1965). However, later studies challenge the ability of the model to explain neighborhood change and the resulting monocentric urban structure. First, current studies challenge spatial and temporal applications (Taub, Taylor, & Dunham, 1984) of the model to periods of different immigration and migration patterns (Alba, et al, 1995; Logan & Zhang, 2010), the inevitability of complete Black succession, reverse Black to White succession occurring in gentrification and neighborhood revitalization (Fong & Shibuya, 2003), and increase in racial and ethnic diversity and racial tolerance among groups (Fong & Shibuya, 2003; Zhang, 2010). Second, since the Invasion and Succession models neighborhood change within the larger city and metropolitan context, the model's monocentric urban structure is challenged by the development of interconnected suburban subcenters.

The first overall conclusion of the studies reviewed is that Black to White invasion and succession occurred in the past (Duncan & Duncan, 1957; Taeber & Taeber, 1965) and continues (Wood & Lee, 1991), but changes in demographic, mobility, and immigration trends have altered this pattern and the rate of change (Alba, et al 1999; Wood & Lee, 1991). While Taub, Taylor, and Dunham (1984) effectively argue that housing market, changes in economic opportunities for Blacks, etc call the spatial and temporal applications into question, experiences of new visible minorities appears to follow some elements of Black to White succession even though Blacks may have more access to suburban housing markets and face less housing discrimination and other metropolitan level economic changes. Current immigration trends indicate that similar results were experienced by all visible minority groups and not just Blacks (Fong & Shibuya, 2003; Logan & Zhang, 2010) and whether current immigrant groups follow similar patterns is dependent upon their ability to speak English, socioeconomic status, and access to suburban immigrant enclaves with existing social networks and infrastructure (Alba, et al 1999).

The second overall conclusion is that newer versions of concentric zones and other geographic and sociological-based monocentric urban structure models (Carter & Polevychok, 2006) may provide some explanation for polycentricity. However, from urban economists' perspectives, polycentricity is explained by agglomeration of economic activity and not population and economic growth as postulated by Invasion and Succession (Anas, Arnott, & Small, 1998). This remainder of this section reviews key early and current studies that tested Invasion and Succession in understanding how neighborhoods changed, are changing, and will change.

Early Studies

Empirical studies have primarily tested the efficacy of Invasion and Succession to explain and predict primarily racial, and more recently, ethnic neighborhood change (Schwirian, 1983). Early quantitative studies on Invasion and Succession described the changes in the Black population during a time of significant migration of Blacks from the south. Two notable studies are Duncan and Duncan (1957) and Taeber and Taeber (1965). Duncan and Duncan (1957), notable because it developed stages of the Invasion and Succession process, studied changes in the Black population in Chicago from 1910 to 1950 and found that the most growth occurred during the 1940s. From their descriptive analysis, they provided a stage framework through which to examine invasion and succession. While Duncan and Duncan found Invasion and Succession useful in their analysis of residential patterns, they were not able to determine if Invasion and Succession were the cause of census tract changes from 1940 to 1950 because of data limitations and not controlling for metropolitan economic, social, and physical characteristics. In addition, their analysis was not generalizable to other cities that experienced substantial increases in the Black population during this time, because it was a case study of Chicago. Taeuber and Taeuber (1965) attempted to address these weaknesses by doing a multi-city comparative descriptive study and statistical analysis.

Taeuber and Taeuber described racial residential patterns for 207 US cities from 1910 to 1960 and calculated their seminal segregation index that was used to score and rank each city for 1960. Taeuber and Taeuber found that racial segregation was a pattern that has been increasing since 1910 and hypothesized that it would likely continue. Their overall conclusion was that racial residential segregation is universal in US cities. However, their models do not control for many metropolitan-wide economic factors that may provide higher levels of variance accounted for by multiple regression. The study falls short in estimating rates of change because while the authors acknowledge that tipping point is important to understanding racial residential change, it did not account for measures of different rates of succession as implied by tipping. Tipping point here is defined as the percentage of neighborhood composition that is Black at which the rate of departure of Whites is likely to change.

Two notable early empirical studies from economists' perspectives are Laurenti (1960) and Bruckner (1977). Downs and Laurenti (1960) evaluated the methodology and results of Laurenti (1960), a study sponsored by The Commission on Race and Housing concerning the impact of race upon sales prices of homes. The study by Laurenti (1960) estimated the impact of race on housing values of 20 neighborhoods in 7 cities employing the test control area comparison approach using sales data from multiple listing services and real estate directories. The study period was from 1949 to 1955. Criteria for selecting test neighborhoods was that they had non-White entry within the past 15 years and criteria for selecting comparison neighborhoods was based on their similarity to the test areas in size, reputation, type and quality of housing, and character of residents. The major conclusion of the Laurienti study was that non-Whites' entry into an all-White community had no impact: if no other changes in the neighborhood's characteristics occured (i.e. increased density), then there was no impact on housing values, which may even increase compared to other all White areas that did not have non-White entry. While the Laurenti study was the most widely quoted study on the impact of racial change on property values (Aldrich, 1975) and highlights Blacks' willingness to pay more for comparable housing (Downs & Laurenti, 1960), this study is seriously flawed because it uses the test control community comparison methodology. This methodology was used in early studies of the impact of subsidized housing on property values in which the results were subsequently dismissed because of the lack of formality in selecting comparable communities and controlling for metropolitan housing market conditions.

The study by Brueckner (1977) is notable because it compared and tested three major explanatory economic perspectives on the Invasion and Succession model of neighborhood change. First, Bailey's (Bailey, 1959; 1966) model of the growth of poor neighborhoods predicts that residential income succession will occur at the boundary of two contiguous areas with different income levels if the housing units area identical. Second, Muth's (Muth, 1973) vintage model of residential succession predicts that succession occurs when low income people occupy housing with the lowest levels of quality in higher income areas. Third, Filtering (Lowry, 1960) suggests that housing units are handed down through income distribution as they depreciate and no longer provide owners with the desired flow of housing services. Breuckner used census data for composite census tracts (N = 462) for eight US cities to build linear regression models of neighborhood income succession for 1950-1960 and 1960-1970. The dependent variable represented a ratio of the mean composite tract income for the beginning of the first decade divided by the mean composite tract income for the beginning of the second decade. The explanatory variables, drawn from the Bailey, Muth, and Filtering models were: distance (central business district to the center of the composite tract), comparative composite and adjacent tract income ratio; renter occupied units and owner occupied units ratio, average value for owner occupied dwellings, average rent for renter occupied dwellings, and year built (categorical variable). The results indicated that since the estimated coefficients on the comparative composite and adjacent tract income ratio variable were not statistically significant, there is little support for Bailey's model. The author qualified this finding because Bailey's model may need a finer grain of geographic scale. The results provide support for Muth's vintage model of succession andfiltering in that tracts with a large portion of houses providing low levels of housing services experienced a large decline in mean income where the low income population is growing.

Current studies

Current empirical studies' challenges are based on issues related to general theory construction and issues related to Invasion and Succession concepts. First, spatial and temporal specification modification based on social, economic, and population growth and settlement patterns: some of the concepts of Invasion and Succession appeared to be based on then current migration, urban development, racial attitudes and concerns; a decrease in housing market discrimination helped open more housing options for Blacks in central city and suburban areas not open to them previously. As mentioned previously, the theory/model has been criticized for being more relevant to the time period in which it was developed (Taub, Taylor, & Dunham, 1984). These challenges are believed to limit the usefulness of Invasion and Succession as a universal theory of neighborhood change. Challenges to concepts underlying Invasion and Succession theory are inevitability of neighborhood succession from all Black to all White and the monocentric urban structure. Challengers provided alternative explanations for these phenomena.

First, challenges to the universality of Invasion and Succession as a theory. Is Invasion and Succession applicable to neighborhood change regardless of geographic location and across time? A recent place-specific argument was made by Lee & Wood (1991). Lee & Wood argue that most previous studies on Invasion and Succession were case studies and/or focused on cities in the northeast and north central regions of the US. However, Fong & Shibuya (2003) found evidence of Invasion and Succession in Canadian cities but cautioned about the results due to differences in social, cultural, economic, political history and trends between Canada and the US.

A recent challenge to Invasion and Succession's temporal ability is due to change in population growth and settlement patterns over time. Specifically, changes in migration and immigration patterns refer to change in Black migration from southern rural areas to northern cities and to change in immigration populations and settlement patterns. As noted by Taub, Taylor, and Dunham (1984), there has been a significant reduction in the number of Blacks migrating. Most growth in minority population comes from increased migration and immigration of people Asian and Hispanic decent, who face similar challenges as to Blacks, but other factors mediated their initial settlement in poor inner urban areas. It has been noted that the increase in Asian and Hispanic immigrants alters dynamics of succession. That is, neighborhood racial change is no longer restricted to the change in proportion/number of Whites and Blacks. Neighborhood racial (ethnic) change is influenced by other groups as well (Logan & Zhang, 2010; Alba, Logan, Stults, Marzan & Zhang, 1999; Alba, et al, 1995). Alba, Logan, Stults, Marzan & Zhang 1999, used census data to study central city versus suburban settlement patterns of immigrants. The results provided mixed support for the inner city settlement pattern of immigrant hypothesis of the succession model. Socioeconomic status and ability to speak English were important to predicting inner city versus suburban settlement of immigrants. However, since settlement of prior generations established networks and infrastructure in suburbs, English speaking ability is losing its importance as predictor for inner city settlement.

Logan & Zhang (2010) investigated how Asians and Hispanics affect the paths of neighborhood change. This study proposed that there are two directions of neighborhood change: 1) Persistent White flight and White replacement by minorities and 2) new neighborhood diversity in multiethnic communities. Logan and Zhang argued for a modification of Invasion and Succession that incorporates buffering theory, given the growing Hispanic and Asian population and hypothesized that ethnic minorities are more likely to enter all-White neighborhoods, Blacks are more likely to enter mixed neighborhoods and Whites are more likely to desert areas with a lower-income, more transient population and other indicators of unattractiveness in the housing market. Current patterns of immigration are diluting residential segregation in the creation of multiethnic (global) neighborhoods. That is, this study finds some support that neighborhood racial transitions are not primarily going from White to Black because Hispanics and Asians are acting as a buffer in the neighborhood transition process whereby these groups enter communities and may subsequently be followed by Blacks.

However, the results of Fong & Shibuya (2003) find some support for the Invasion and Succession model in their study of Canadian cities from 1986 to 1991 in particular to that of all visible minority groups. Using census data for the 18 largest Canadian cities with visible minorities, they found that older immigrant groups (Western Europeans) were more likely to be in neighborhoods that experienced economic stability or increases within a five year period. They also found that all visible minority groups, including groups that were not Black, were likely to be located in neighborhoods that experienced economic decline within a five year period. In addition, recent immigrants were associated with neighborhood economic decline most likely due to having access to fewer socioeconomic resources. Fong and Shibuya concluded that even though cities are becoming more racially diverse and surveys indicate increased racial tolerance, visible minority status continues to be related to neighborhood economic decline.

The second challenge to the underlying concepts of Invasion and Succession is its postulated inevitability made by Wood and Lee (1991), Lee and Wood (1991), and Taub, Taylor, and Dunham (1984). The results are mixed in that there is some evidence where succession is inevitable and some evidence that succession is not inevitable and integrated neighborhoods are possible. Possible contributing factors to stable integrated neighborhoods are the reduction in segregation and reduction in racism (see Taub, Taylor, Dunham, 1984).

Wood and Lee (1991) conducted a more recent study on neighborhood racial succession inevitability. Wood and Lee is a descriptive study of racially mixed (10 to 89 percent Black) census tracts for 5 large US cities and regional comparisons for 34 metro areas. The time periods for the subsamples are 1940-50, 1950-60, 1960-70, and 1970-80. The time periods for the cohort subsamples (cohort definitions are displacement, stability, and succession) are tracts remaining geographically constant between two or more census dates (1940-80, 1950-80, and 1960-80). The results indicated that inevitability of succession was accurate for Chicago and Los Angeles and moderately so for Washington DC and Philadelphia in the 1940s. The data reflected a significant amount of variation in succession over time. Four of the cities experienced a decline in the likelihood of succession between 1940 and 1980. Overall, the 1940-1980 cohort city sample results indicate that succession had occurred by 1980 in 87%, 83%, 82%, 73%, and 52% of racially mixed tracts for Chicago, New Orleans, Philadelphia, Washington, DC, and Los Angeles, respectively. This provided some evidence that succession did occur in large percentages of racially mixed neighborhoods, but the rates were different for some cities. The cohort subsample results were similar for the regional study except that of Washington DC. The cohort analysis indicated that there were high rates of succession in racially mixed census tracts between 1940 and 1980 in the northeast, north central and southern regions and considerably lower rates for the west. The overall conclusion was that succession occurs in racially mixed neighborhoods, but its inevitability is not universal over time. Of the exceptions, patterns and changes in race relations and immigration/migration can be offered as time and place specific reasons.

Taub, Taylor, and Dunham (1984) studied neighborhood succession of 8 Chicago neighborhoods using a model that considered three neighborhood structural features, based on data from multiple sources. Sources of data were survey, participant (neighborhood) observation, informant interviews, windshield ratings of commercial and residential areas, crime statistics, and historical and archival materials. Supplemental data used for the study on neighborhood tipping was from telephone survey data from Omaha and from personal interviewing from the Detroit Area Study. Neighborhood structural features, measured at the aggregate level, were property value appreciation (Realty Sales Guide data), racial stability/change (Chicago Urban League report data), and crime (Chicago Police crime reports). Neighborhoods were classified as experiencing succession, resisting Invasion and Succession, and experiencing invasion without succession. There were several important findings, but the most important was that neighborhood succession was not inevitable or uni-directional. Other findings will be discussed because they provide support for Taub, Taylor and Dunham's development of an alternative approach to neighborhood change. First, employing mixed methods was important for understanding census tract housing and population dynamics and roles of individual and institutional actors in understanding neighborhood change. Second, community institutions play an important role in creating and maintaining neighborhood stability. Third, the collective actions of many individual decisions that impact succession is as important as housing stock deterioration in the neighborhood change process. Fourth, thresholds are important in succession. Declining neighborhoods need some households that have low thresholds (referred to as social pioneers) in order to encourage others with higher levels of thresholds to invest (maintain property) and so on, so that 100 percent investment is cumulated in this snowballing process. Fifth, after controlling for marital status, income, and housing stock age, both Blacks and Whites in racially mixed areas had higher thresholds. The most important contribution of this study was the alternative model of neighborhood change that was discussed above.

A third challenge to the underlying concepts of Invasion and Succession theory concerns its hypothesized urban structure. There are two dominant models of urban structure: monocentric and polycentric. Monocentric urban structure is defined as the concentration of economic activity in a core or CBD. Workers typically commuted inward from the surrounding residential area. This form was dominant until the early part of the twentieth century (O'Sullivan, 2003) but started to transform with the combination of employment decentralization as the urban area expanded, and economic activity disbursement to outer regional areas. Significant determinants of these processes were technological advances. The polycentric urban structure is defined as a region containing an urban core and a system of inter-related employment sub-centers located in different areas of a metropolitan/urban region. Urban structure is a major aspect of Invasion and Succession because neighborhood change impacts both the city and metropolitan context in which a neighbohrood is located as well as the individual neighborhood (Burgess, 1925).

Empirical studies on neighborhood change within a metropolitan context are typically estimated using population density measures for areas located progressively further away from the central business district. Empirical studies have found some support for hypothesized residential patterns; the foundational structure, a monocentric area or city of concentrated business activity surrounded by manufacturing, slums, working class housing, and increasingly higher-income residential areas, is considered a model of older cities during the early and mid 20th century. While Taub, Taylor, and Dunham (1984) found vestiges of the monocentric urban structure underlying current metropolitan structures, a polycentric urban system of interrelated suburban subcenters is considered a more realistic model of modern metropolitan areas (Anas, Arnott, & Small, 1998). While later urban structure theorists applied the monocentric pattern of urban growth to the development of metropolitan areas with multiple centers (Harris & Ullman, 1945; Carter & Polevychok, 2006 for review of White's 20th Century Model and the Urban Realms Model), Anas, Arnott, and Small (1998) found its agglomerative evolution to be more complex. This section will discuss specific empirical population density studies considered important for understanding and revaluation of the monocentric model applicability.

In a review of early Invasion and Succession empirical studies, Aldrich (1975) found the literature reveals the process of succession is not an isolated, random community-level occurrence, but is part of larger metropolitan-wide factors, forces, and change, as predicted by the model. The literature review finds that racial attitudes account for little of the motivations for leaving central cities, even though status and prestige are important factors when Whites consider and actually move. Aldrich is in direct conflict with sub-cultural neighborhood change theorists. Aldrich states that the study's findings imply that only national-level policy changes can impact neighborhood succession. The individual resident is not an influential agent in the process of neighborhood change and revitalization even though it is the cumulative actions of individual households that produce macro-level changes (Schelling, 1972).

The study by Guest (1972) appears to be one of the first that sought to understand the causes of spatial patterns of higher status households in metropolitan areas. Using the ecological framework of urban structural change and growth, Guest tested three different, but related variations as postulated by Alonso, Hawley, and Schnore. Guest showed the economic and sociological developments of the ecological perspective of urban structure and change. The economic ecological perspective was drawn from Alonso's bid rent theory. The sociological perspective was drawn from Hawley's push-pull perspective of higher status residential location (repulsion of problems associated with high density inner city areas and appeal of having larger housing in the periphery). Alonso and Hawley were built on the following premises: competition for land use between business/industry, high status residents, and low status residents; business/industry located in CBD because they are more willing to pay high rent; and trade-off decisions between commute time and house size of high and low status households. These two ecological perspectives were classified as synchronic (cross-sectional) because they emphasized the ongoing competition for central land within metropolitan areas. A third ecological perspective, which is the focus of this study, is historical which relates the changes in transportation technology (macro-level event) over time to the spatial patterns of higher income households and population density.

Guest evaluated a model of a distance and density gradient (higher status census tract location and density with respect to the CBD) for census tracts in 37 metropolitan areas from 1950 and 1960 using path analysis. The results provided support for the historical explanation of spatial patterns of high status households. First, large metropolitan areas before the advent of the street car were dense and had the spatial pattern of rapid increase in social status with distance. These metropolitan areas were more socially differentiated during the 1960s. Second, metropolitan areas with large population growth during the street car and automobile eras were less dense and the city/outskirts were socially differentiated. Thus, the author concluded that advances in transportation resulted in less pressure on CBD land uses which helped mitigate residential social status increases with distance from the CBD.

Guest (1973) used a similar historical ecological framework for a case study of the population spatial distribution in Cleveland, Ohio. Its findings provided some support for this theoretical framework in that census tracts developed before the development of the automobile and street car had the highest population concentration and congestion. Census tracts with population growth during the early period of the slow auto's diffusion and during the later part of the mass diffusion had high population congestion but led to a more dispersed metropolitan area. Similarly, as argued by Anas, Arnott, and Small (1998), along with most other current urban analysts, advances in transport and communications were major determinants of urban growth as economic activity caused urban areas to spread out and decentralize and subsequently form sub-centers.

Anas, Arnott, and Small (1998) reviewed studies that sought to determine how well the monocentric model performed in explaining post WWII urban structure changes due to suburbanization. Studies reviewed calculated an index of population centralization (density gradient) for cities to determine two things. In the first test, the density gradient was the proportional rate at which population density falls with distance (p. 1436). The results of density gradient analysis on various U.S., European, and Australian metropolitan areas indicated that these conditions have been consistently met. A second test looked more closely at specific factors that impacted the density gradient (index) and their magnitudes. The authors concluded that studies reviewed indicated that population density function estimated for the typical urban economist explanation for decentralization is rising incomes and declining transport costs, held up when compared to a gradient based on actual data on income and transport costs. Thus, the research appears to conclude that the monocentric model performed well in explaining urban structure changes of deconcentration.

However, Anas, Arnott, and Small (1998) discussed criticisms of these studies and in giving the monocentric model too much credit for explaining decentrailization (suburbanization) (p. 1436-1439). From an economic perspective, economies of agglomeration, defined as "the decline in average cost as more production occurs within a specific geographic area," is mainly responsible for urban structure and growth" (Anas, Arnott, & Small, 1998, p. 1427). Agglomeration of employment activity occurs in both monocentric and polycentric urban area structures. While the monocentric model was able to explain urban structure of most cities at the beginning the 20th century (adjusting for variation in topology per Anas, Arnott, and Small, 1997), the polycentric model is more representative of modern urban forms, with the exception of some smaller-sized cities (O'Sullivan, 2003). The polycentric model applies to a metropolitan region that contains a center city and an interrelated system of employment sub-centers (Anas, Arnott, & Small, 1998). Sub-centers represent the tendency of economic activity to cluster. Various descriptions were found in studies reviewed by Anas, Arnott, and Small (1998). For example, sub-centers are prominent in both new and old cities, but they have not eliminated the importance of the main center. Sub-centers are sometimes arrayed in corridors and they help explain surrounding employment and population trends. While most jobs were found located outside sub-centers, commuting is not well explained by either the monocentric or polycentric models.

Summary

The Invasion and Succession model has two components: the neighborhood level changes and metropolitan patterns of these changes for all its city and suburban communities. The first component is the process of neighborhood change. Park (1952) provided the first specification for Invasion and Succession, Duncan and Duncan (1957) proposed stages of Invasion and Succession and Taeber and Taeber (1965) provided a segregation index calculation. Early empirical studies were descriptive by providing a picture of neighborhood racial change during a time of significant population growth and restricted housing access. Causal empirical studies provided some evidence that neighborhoods change as a result of population growth through Invasion and Succession of different racial and ethnic groups. However, Invasion and Succession is less able to explain neighborhood change across time and geographic space such as different population growth trends, alternatives provided by increased suburban housing development, and decreased housing market discrimination (Taub, Taylor, & Dunham, 1984) and within a changing economic structure and economy and globalization of business activity and financing as postulated by structural theory of urban poverty (Wilson, 1987). Thus, spatial and temporal specification modifications indicate that invasion is less likely to occur but there is some evidence of neighborhood succession in race and ethnic population. Current research continues to use the Invasion and Succession model to help understand neighborhood racial and ethnic change due to a growing multiethnic population (Logan & Zhang, 2010).

The second component of Invasion and Succession is a model of metropolitan level patterns of urban structure and change. Models of urban structure are monocentric and/or polycentric. Empirical tests consist of density gradient methodology that provides evidence for early residential growth and development patterns and to some degree suburban sub-center growth within regions of multiple central areas. However an alternative view is that polycentrism is more representative of mid to late 20th and early 21st century urban structures. Polycentricism is viewed more of an agglomeration of economic activity and response in labor pool residential patterns than simply a repetition of monocentricism within the same regional area. However, even polycentricism does little to address the overall impact of national and regional economic shifts on urban structural change. Thus, the Invasion and Succession model provides a foundational understanding of urban structural change but critically ignores understanding the impact of economic structural changes on neighborhood change, especially decline.

Table 2-1 Invasion and Succession Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicators of interest	Predictor Variables	Analysis	Results
Downs & Laruenti, 1960 evaluation of Laruenti 1960	20 neighborhoods in 7 cities	MLS & real estate directories	1949-1955	Housing values	Race	Test control comparison area approach	Non-White entry into all White neighborhood had no impact if no other factors in neighborhood change
Duncan & Duncan, 1957	Chicago	Census	1910-1950; 1940-1950	Level & growth in Black population	N/A	Created typology of each census tract of Invasion & Succession stage for 1940 & 50	Stages of Invasion & Succession: penetration, piling up, consolidation, invasion; did not determine causality; no control for metro characteristics
Taeuber & Taeuber, 1965	207 US cities	Census	1910-1960; 1960	Racial Segration	Level of race composition	Multiple regression	Developed segregation index; all us cities are segregated; segregation will increase
Guest, 1972	37 metro areas. Census tract	Census	1880, 1930, 1950, 1960	Population density & social status	Distance from CBD; population density	Path analysis	1) Large population pre-street car→urban spatial pattern was rapid increase in social status with distance. 2) Large population post initial street car, auto→less pressure on CBD land uses→less diffused density patterns and social status distinction with distande from CBD
Guest, 1973	Cleveland & inner suburbs, N = 221 census tracts	Census	1910-1970	Population density, social status	Distance from CBD; population density	Path analysis; density & components for age cohorts of census tracts; distance from CBD; regression	Density patterns within & across metro area supportts thesis of the impact of historical transportation trends
Guest & Weed, 1976	Cleveland; Boston; Seattle. Census tract	Census	1930, 1960, 1970	Ethnic race segregation & social status	NA	Dissimilarity Index (from Tauber & Tauber, 1965).	Some relat ionship between ethnic segregation & social status, but not mutually exclusive
Brueckner, 1977	8 US cities N = 468 composite census tracts	Census	1950, 1960	Income: Y'50/Y'60 & Y'60/Y'70	Distance, Y1 initial/Y2 initial year, #renter occupied units/#owner occupied units initial year, average home value initial year, average rent initial year,	Linear regression	No support for Baily: non-signif icant coeffficient on composite & adjacent tract increase ratio. Support for Muth: tracts with low quality housing had large decrease in average income and increase in low income households

Table 2-1 Invasion and Succession Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicators of interest	Predictor Variables	Analysis	Results
					various years for proportion of housing stock built.		
Vandell, 1981	Houston & St. Louis census tracts	Census	1960 1970	Income	Housing stock (initial); residents (initial); distance; racial composition.	Pooled & stratified regression.	Transitional & non-White tracts had faster rates of succession than similar White tracts for a variety of types of housing markets
Taub, Taylor, & Dunham, 1984	Chicago	Mixed methods	8 areas	Neighborhood racial change	Structural features = appreciation, racial stability, crime	Focused on survey data analysis	Ecological facts do not uni-directionally determine neighborhood outcomes
Taub, Taylor, & Dunham, 1984	Omaha metro study & Detroit Area Study	Phone & personal surveys	Omaha 1978 (N = 300 White, 300 Blacks Detroit 1976 (N = 1100)	Racial tolerance	NA	Empirically based & translated tolerance and preference schedules; tolerance/preference curves	Omaha—Blacks willing to live in neighborhoods with any racial combination; Whites—as the level of Blacks increased, level of tol erance increased; Detroit—progressive decrease in tolerance with increase in Blacks, Whites less tolerant ;no White would tolerate more than 9:6 Black-White ratio. Overall: no neighborhood in either city will tip to all Black
Wood & Lee, 1991	5 US cities (Philadelphia, Chicago, New Orleans, Los Angeles, & DC); census tracts; 38 regional area comparison	Census	1940-1980	Neighborhood racial composition	NA	Cohort analysis of census tracts classified by succession status: displacement; stability; and succession	Mixed results. All cities except New Orleans had large succession cohorts that declined each period from 1940 to 1980. There were some stable tracts that ranged between 4.8% in LA during the 40s to 70.6% for New Orleans during the 40s. LA had the largest decrease in succion census tracts
Alba, Logan, Stults, Marzan & Zhang 1999		Census	1980 1990	Household resides in suburb		Logistic regression	Mixed results: SES & ability to speak English were important to predict inner city vs sububurban immigrant settlement; settlement of prior generations established networks &

Table 2-1 Invasion and Succession Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicators of interest	Predictor Variables	Analysis	Results
							infrastruture in suburbs so that English speaking ability is losing its importance as predictor of inner city settlement.
Fong & Shibuya, 2003	18 largest Canadian metro areas with large visible minority population	Canadian census data; census tract	1986-1991	neighborhood poverty rate	Changes in neighborhood SES; instrumental variable	2-stage least squares regression: 3 models: 1) Life Cycle, 2) Invasion & Succession, 3) Life Cycle, Invasion & Succession, & spatial effects	Results of 2nd model: neighborhoods with older immigrants (West European) are less likely to experience economic deterioration; Higher proportion of visible minorities related to higher neighborhoodd poverty rates 5 years later; recency of immigr ation increases likelihood of neighborhood economic decline
Logan & Zhang, 2010	24 US metro areas; census tract	NCDB	1980-2000	Race/ ethnicity combinations	Minority presence, foreign born, median family income, % homeowner, % female headship, % over 65, % < 5years, population growth rate, location within metro area, region	Transition matrices; transition probabilities; multinomial logit regression & logistic regression	Minority entry or White exit are not associated with market weaknesses (no support for Invasion & Succession); Blacks enter communites following Asian & Hispanic entry is slightly supported (buffering)

TIPPING: THEORY

In this study, Tipping is considered to be an extension of Invasion and Succession even though there are different theorists and empirical studies involved. Tipping refers to two constructs. First, tipping "occurs when a recognizable new minority enters a neighborhood in sufficient numbers to cause the earlier resident to begin evacuating" (Schelling, 1971, p. 181). Grodzins (1957) observed that in general Whites will begin to leave when a community reaches the 20 percent level of Blacks. Schelling (1971) points out that this "tolerance level" will occur for any group that begins to increase its presence to the point of the original group leaving.

Tipping also refers to the percentage level of the minority group (invading group) at which the change process in a transitioning neighborhood begins to accelerate. That is, a second construct of Tipping reflects whether the neighborhood change process and patterns are linear versus non-linear. The foundational Invasion and Succession theory models a linear pattern of the process and rate of neighborhood change. As observed by Duncan and Duncan (1957), neighborhood racial change from White to Black in Chicago occurred in an orderly block by block pattern once a neighborhood allowed Blacks to enter. An alternative observation is that of different rates of transition patterns and processes as a neighborhood changes (Downs, 1981). Specifically, Tipping refers to a specific point or range of percentage of invading group (Blacks) at which the rate of the original group (Whites) accelerates (Grodzins, 1957; Wolf, 1963). Two Tipping models will be discussed briefly: Schelling's (1972) model and a general model.

Schelling's model of segregation and tipping offers specific factors to consider in this basic process. One important factor in Schelling's model is individual Black and White household residential decision making as a response to what other households are doing or expected to do result in collective behavior. Other factors include neighborhood characteristics (well-defined neighborhood boundaries); new entrants clearly recognizable as separate group (Freeman & Botein, 2003 Impaction model), normal turnover rate, number potential entrants compared to size of neighborhood and rate of increase, alternative housing for out-movers, alternative housing options for in-movers (181-182), and speculation (White expectations of neighborhood change).

Schelling believed this model can be applied to multiple phenomena: different ethnic groups or gender within neighborhoods, occupations, clubs, schools, etc. This discussion will be restricted to racial neighborhood change because most of the studies in neighborhood change that use tipping focus on race and ethnicity. Schelling recognized that the tipping point is a level at which Whites will move and points at which Blacks will move in at different rates. Tipping is hypothesized to occur in a neighborhood with well-defined boundaries as in the Bounded Neighborhood Model.

The proposed hypotheses of this model are that each household makes independent residential location decisions (no concerted effort on the part of households) and that neighborhoods will experience normal turnover but this will be impacted by change in residents' characteristics of in-movers versus out-movers. Unlike other models of Tipping (Grodzins, 1957), neighborhood stability is possible when neighborhoods are all White or all Black and when there are a small number of Whites remaining and there are not enough Blacks to fill up all the available units. Because Schelling's model is an abstract formulation that is based on individual household residential decisions based on initial residents and new residents and neighborhood change expectations, different scenarios of neighborhood change processes and outcomes are hypothesized.

The assumptions of Schelling's model include fixed capacity of the neighborhood (does not model new development within neighborhood); entry limited to normal turnover or by rate at which initial residents evacuate; initial role of White population that already exists in neighborhood; Whites will be more tolerant to outsiders relative to their preferences to living outside the area because it is more difficult to move out than to make a household decide not to move in (182). The Black population may be small or large relative to the neighborhood. Or it could be small in the short run but cumulatively large with passage of time (182). A weakness of this model is fixed housing stock within subject neighborhood (fixed capacity of neighborhood).

A general model of the tipping process highlights neighborhood change (outcome indicator) as a function of entry by a new group in a neighborhood, the rate of entry of the new group, and the level at which there is a discontinuity of the change rate. While both Shelling and the general model hypothesized that stability is possible in an integrated neighborhood, the concept of predominantly unstable integrated neighborhoods has come under attack. Ottensmann (1995) and others (Smith, 1998) challenge the premise that integrated neighborhoods are unstable and succession is inevitable. Ottensmann (1995) notes that there were other opinions (i.e. Duncan & Duncan, 1957) to this same effect but these were crowded out by the overwhelming numbers that claimed the existence of inevitable succession. Ottensmann's (1995) argument is supported by three lines of recent research using various primary and secondary sources of data: 1) Racial segregation modestly decreased since 1970; 2) Actual neighborhood observations provide evidence of stable integrated neighborhoods. 3) More Whites are moving into racially mixed neighborhoods than expected and an overall decline in the growth of the Black population that was experienced by large in-migration from the south to northern industrial cities.

An important current insight by Zhang (2010) can be considered in light of Ottensmann's arguments. Zhang pointed out incongruence between recent research on neighborhood racial composition preferences that showed an indication that Whites' tolerance levels are increasing, and persistent (though slightly declining) segregation. This will be discussed further below. A second insight preceding Ottensmann's argument can be drawn from Goering. Goering (1978) reviewed social science research on the existence and thresholds of neighborhood racial Tipping. Goering concluded that while Tipping may exist in certain areas under certain conditions, neighborhoods are too variable to unequivocally conclude that it does indeed occur. Goering discussed several macro-metropolitan (population growth; employment), neighborhood (real estate activity, local associations, housing type and costs, proximity to transitioning areas, service quality), and household (satisfaction, financial status, and prejudice) level factors that influence who moves and why they move. Thus, there are numerous factors that can contribute to why some integrated neighborhoods may be stable and others not. Ottensmann and others are pointing out that there should not be an iron clad rule that integrated neighborhoods are not stable because stable integrated neighborhoods do in fact exist.

While Goering's review found that Tipping may be explained by factors that contribute to normal turnover (Goering, 1974), Vandell (1981) found that rates of neighborhood income transition are faster in minority and transitional segmented housing markets compared to similar White housing markets in the two different types of housing markets in St. Louis and Houston. Thus, Vandell provides some indication that normal neighborhood turnover is not enough to explain Tipping.

EMPIRICAL STUDIES: TIPPING

There are two sets of empirical studies on Tipping: those that specifically test Schelling's thesis and those as applied to Invasion and Succession theory of neighborhood change. Studies on Schelling's thesis will be discussed first followed by studies on Tipping that occurs in Invasion and Succession. Overall, both qualitative and quantitative studies provide mixed support for Schelling's Tipping hypothesis. More recent tests use larger data sets, but fail to incorporate important demographic and population growth trends into their analyses. Second, studies on Tipping in Invasion and Succession outside of normal housing turnover, provides support that there are levels at which neighborhood change will occur and at which the rate of neighborhood change will accelerate.

Studies on Schelling's Tipping thesis have taken the form of collecting data on people's neighborhood racial composition preferences in the form of surveys or in experiments in which participants are shown various neighborhood racial compositions (Clark, 1991; Taub, Taylor, & Dunham, 1984); use of large data sets (Card & Rothstein, 2008; Easterly, 2009); and computer simulations of Schelling's spatial proximity model and bounded neighborhood model (Zhang, 2010).

Since Schelling's model focused on people's preferences, most studies that test Schelling's hypothesis use data based on people's reactions to and preferences for neighborhood racial combinations, patterns, and levels (Easterly, 2009). These studies attempt to ascertain how people will react to certain racial combinations in a neighborhood obtained through surveys or experimental designs that present hypothetical situations to participants then use this information to create empirical and translated tolerance/preference schedules. Two notable examples of preference studies are Taub, Taylor, and Dunham (1984) and Clark (1991).

Taub, Taylor, and Dunham (1984) used survey data, obtained as part of a larger city of Chicago research study, from Omaha and Detroit to examine, discuss, and test Schelling's Tipping model and develop a modified model. The surveys were designed to estimate parameters for the bounded neighborhood model. Preference measures were the presentations of various scenarios of neighborhoods with different levels of Blacks and Whites to participants. Estimated White and Black tolerance schedules revealed that in Omaha and Detroit, there was a decreasing level of Whites that would tolerate increasing levels of Blacks. It was surprising that while in Detroit there were no Whites that would tolerate neighborhoods with a ratio of more than 9 Blacks to 6 Whites, but in Omaha 28 percent of Whites surveyed would live in all Black neighborhoods. Even more striking, the results of the same question asked of Omaha (not Detroit) Blacks indicated that at least 95 percent of respondents would live in any combination of neighborhood racial mix (including all White and all Black). Translated tolerance schedules for each population were calculated from empirically estimated preference and tolerance schedules. Taub, Taylor, and Dunham note that this reflects the lower level of Whites' tolerance for Blacks in Detroit. In both cities there were some Whites that would tolerate no level of Blacks. They also note that the finding that Blacks would live in any neighborhood regardless of race indicates their pent up demand for housing and would occupy units as soon as vacated by Whites was hypothesized in one of Schelling's scenarios.

Using translated tolerance/preference schedules, Taub, Taylor, and Dunham (1984) modified the parameters of the Bounded Neighborhood Model for conditions of the housing market. These modifications included level of demand, supply of housing units, and type of neighborhood (older White, benchmark, high competition, and gentrifying) to estimate that equilibrium could be attained with all White and all Black outcomes as well as with integrated outcomes. These modifications hypothesize that residential location and stability are motivated by housing market conditions in addition to racial preferences. Housing market conditions are implied in Schelling's model in scenarios of what will occur if there is not enough Black demand (alternative housing options exist) for vacating White housing units; Whites are leaving neighborhoods because of more attractive alternatives and not solely because of racial issues.

Clark (1991) tested Schelling's thesis for White and Black residential preferences on data collected in telephone interviews in Omaha, Kansas City, Milwaukee, Cincinnati, and Los Angeles. The data was used to create preference/tolerance distributions and schedules in which Clark had two important results. First, Clark's results generally supported Schelling's description of preferences, but empirical curves are less regular than Schelling's theoretical ones. Second, Clark found gaps between Blacks' and Whites' preferences where Blacks preferred neighborhood racial compositions of 50/50 while Whites preferred combinations of 80/20. While this finding was similar to results in other studies such as Massey and Denton (1993), more recent studies show that Whites are becoming more tolerant with preferred neighborhood racial combinations of 70/30 (Zhang, 2010).

Zhang (2010) noted that while preference studies indicate an increasing level of willingness of Whites to live in integrated neighborhoods and an increase in the level of the portion of Blacks in a neighborhood, segregation persists. Zhang buillt on Schelling's segregation and Tipping theses to explore why there is discordance between preferences and actual segregation. In a mathematically-based computer simulation, Zhang combined the spatial proximity and bounded neighborhood models in a multi (2)-neighborhood context and incorporates specifications and limitations into the simulation. Zhang's results provided theoretical support for Schelling's segregation and Tipping point theses and a potential explanation as to why segregation persists regardless of changes in people's preferences. The model showed that regardless of initial neighborhood racial distribution patterns and equal preferences of both Blacks and Whites, neighborhoods will not be stable in an integrated state, even though this may be the preferred state of all residents, because it only takes a small change, whether unintentionally decreasing a household's utility, to start the process of segregation. Thus, integration is, at best, only tenuously and temporarily stable, but true stability is only achieved when a community is segregated. In addition, segregation persists even though most people prefer integrated neighborhoods. However, Zhang suffered from many of the same criticisms as Schelling's sophisticated, but stylized abstract model, some of which the author acknowledged. Zhang offered polished computer simulations but like Schelling's manual scenarios, they did not use actual data, which may account for the gap in understanding discordance between the actual persistence of segregation and sampled preferences of people.

Card, Mas, and Rothstein (2008) and Easterly (2009) attempted to address this gap earlier and tested Schelling's thesis by using large data sets of census data that are used to study segregation patterns. Both study percentage change in race/ethnic in census tracts in multiple metropolitan areas for 1970 to 2000 with data from the Neighborhood Change Data Base. It should be noted that the authors do not test if there are significant differences in the spatial distributions by race in standardized tract boundaries from their original tract definitions, which may or may not impact their study. Card, Mas, and Rothstein use regression discontinuity methods to examine the change in White, minority, and total population 1970 to 2000 as a function of 1970-1980, 1980-1990, and 1990-2000 candidate Tipping points, controls for demographic and household characteristics. Their results produced mixed results in support of Schelling's Tipping hypothesis. The data and analysis provided evidence that White population flows exhibit tipping-like behavior in most cities with tipping points ranging from five to twenty percent minority, with city tipping points being higher than those of the suburbs. Tipping mostly occurred in the suburbs and near existing minority enclaves. However, there was little evidence of non-linearity in rents and housing values around the Tipping point. While these findings are interesting, the models only accounted for very small level of observed variances (ranging from 0.14 to 0.30), which may be an acceptable level for social science empirical studies.

Easterly (2009) studied change in census tract share of Whites from 1970 to 2000 for 202 metropolitan areas using basic regression. The change in White population was a function of fourth order polynomial of the initial White share. Easterly did a series of cumulative distribution function analyses and found that ten percent of the sample census tracts changed from White to Black from 1970 to 2000, but the changes did not occur as suggested by the Tipping hypothesis. Given the trends in urban spatial dynamics, it was not surprising that Easterly found that the main factor in change was the movement of Whites from center cities and inner suburbs to outer suburbs. In addition, the relationship between change in White share and the level of Whites does not fit the Tipping model because neighborhoods that changed were not in transition (i.e. unstable integration).

In summary, survey studies provide support for the concept that households have preferences for neighborhood composition at which they would feel comfortable entering into or continuing to reside in and racial compositions at which they would feel uncomfortable and thus leave. It is also possible, contrary to criticisms that the Schelling model hypothesizes unstable integrated neighborhoods, to introduce housing market conditions and constraints into the model to estimate multiple points of equilibrium. Modifications also highlight 1) other motivations for Whites leaving communities (i.e. alternative housing options) 2) strong motivations of Whites to enter into Black communities (i.e. gentrification), and 3) multiple points of equilibrium. Recent analytical studies find mixed support. Zhang (2010) noted incongruence between increasing tolerance and persistence segregation. However, there are other empirical studies that do not test Schelling's version of the tipping phenomena. Notable empirical studies that test Tipping are: Grodzins (1957), Mayer (1960), Steinnes (1977), Schwab and Marsh (1980), and more recently Galster, Cutsinger, and Malega (2008).

The second set of empirical studies is applied to studying racial succession of neighborhoods, particularly during a time of significant growth in the Black population in urban areas, but as Schelling pointed out Tipping can be applied to multiple phenomena related to how people sort themselves under many circumstances. There are four primary concepts of Tipping: Tipping is part of the Invasion and Succession neighborhood change theory which postulates that there is a level at which the population will start to change (Grodzins, 1957; Mayer, 1960), there is a level of the invading group at which the rate of those leaving will accelerate and neighborhood stability is only achieved when the population is all one group or all the other (Schelling, 1971), normal turnover rates need to be considered when estimating tipping (Vandelll, 1981), and neighborhoods that are transitioning are unstable and total succession is inevitable (Duncan & Duncan, 1957; Grodzins, 1957; Schelling, 1971). Later studies indicate that tipping points exist but are defined as a threshold at which an indicator will negatively impact a neighborhood outcome measure (i.e. Galster, Cutsinger, & Malega, 2008).

Building on the work of contemporaries Duncan and Duncan (1957), Grodzins (1957) provided an early discussion for the general public to understand the patterns of Black and White metropolitan settlement patterns and its problems, implications, and consequences. While cities have had migrant settlement and assimilation issues with Europeans, Black population growth and restricted residential patterns has contributed significantly to racial and ethnic residential location decisions. Grodzins used the succession and tipping point ecological framework for discussing residential racial change due to large in-migration of southern Blacks in the 14 largest US cities. In-migration and barriers to housing, metropolitan areas can be described as having a Black urban core surrounded by White suburbs. Most neighborhoods that are predisposed to racial changes are those located adjacent to Black areas. In addition, Whites begin to vacate neighborhoods for various reasons such as economic improvement, supply of better housing in the suburbs, etc. The presence of Blacks only accounts for a small portion of why Whites leave (Aldrich, 1977). The initial Blacks to enter communities are those whose economic and social characteristics are similar to those of White residents. As the percentage of Blacks increases it reaches a tolerance threshold for Whites and their rate of moving increases until the area becomes all Black. Piling up—the significant increase in residential density—occurs at the later stages of neighborhood transition. The social consequences of city suburban schism are decreased property values, decreased business activity. An early case study observation of tipping was Mayer (1960).

Mayer (1960) provided evidence that tipping occurred in a well defined neighborhood of 700 square foot homes surrounded by racially mixed neighborhoods. The selling of a third house in the White area convinced everyone that the neighborhood was destined to become mixed. A year later 40 houses had been sold to Blacks and everyone defined the neighborhood as mixed although opinion varied on whether the neighborhood would become completely Black. In another two years, the neighborhood was 50% Black and the end result was no longer questioned. Similar phenomenon has been occasionally observed for ethnic groups other than Blacks, also for clubs, schools, occupations, and apartment buildings. Later Tipping studies use more sophisticated methodology, as in Steinnes (1977).

Steinnes (1977) developed a twin linear specification of neighborhood racial change with Tipping. A tipping point used: 10 percent of an area (census tract) is occupied by Black households. The first model uses distance as the only predictor and the second model adds indicators of economic (median household income, median education level, and percent of houses owner occupied) and social mobility (% foreign born, % population under 18 years, and % of housing stock in good condition). The sample included census tracts in the city of Chicago (N = 62) located in the northeast and northwest White fringe areas using census data for 1960 and 1970. Sixteen census tracts to the north of the first sample areas are added for part of the analysis. The results indicate that distance alone is insufficient to explain whether an area tips or not. Economic and social mobility variables are significant for predicting whether an area tips or not, but are not able to determine the rate of neighborhood change once an area has tipped.

Schwab and Marsh (1980) replicate Steinnes (1977) using the twin linear model specification of neighborhood racial change using census data. The city of Cleveland, Ohio and its contiguous suburban census tracts for 1940 to 1970 were used for the case study. It differs from Steinnes in that it uses 100 percent of the area’s census tracts instead of a sample and spans three decades instead of one decade. The results were similar to Steinnes in that distance from a Black community alone is not sufficient to predict whether a neighborhood tips or not. However, this study found that tipping point does not operate uniformly across geographic area and across time.

Similar to the practical perspective of Ottensmann (1996), Goering (1978) provided a review of social science research, policy and political issues, and residential mobility trends. Goering believes that research had not been effective in identifying and disentangling the various past and current macro and micro (neighborhood and households) level factors that contribute to explaining why and in which particular way (i.e. linear or non-linear rates) neighborhoods change. Thus, neighborhood tipping in residential succession could occur but given other influences on neighborhood change and lack of rigorous scientific research and available data, Goering concluded that no iron-clad theory could capture all these elements effectively. That is, given the data and research methods and analysis used thus far, it is difficult to predict under what circumstances tipping will occur.

Summary

Tipping refers to the level of a new group at which the original group will leave and the rate at which they leave a neighborhood. Invasion and Succession perspective change largely models a consistent rate at which neighborhoods will change (Duncan & Duncan, 1957). An alternative perspective is that neighborhoods will change at different rates. Thus, the general model of the tipping process highlights that neighborhood change (outcome indicator) is a function of entry by a new group in a neighborhood, the rate of entry of the new group, and the level at which there is a discontinuity of the change rate.

Studies on Tipping in Invasion and Succession outside of normal housing turnover provided support that there are levels at which neighborhood change will occur and levels at which the rate of neighborhood change will accelerate. However, data and research methods do not sufficiently disentangle the effects of multiple factors that contribute to tipping to permit predicting the time and degree of tipping. The major criticisms of this model are inevitability of succession and unstable integrated neighborhoods. In addition, qualitative and quantitative studies provided mixed support for Schelling's Tipping hypothesis. The most recent studies used larger data sets, but fail to incorporate important demographic and population growth trends into their analyses. The major criticisms of Schelling's model concerns neighborhood stability and oversimplification of two dimensional model of race/ethnicity in the United States.

Table 2-2 Tipping Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicator of interest	Predictor Variables	Analysis	Results
Wolf, 1963	2 Detroit case studies	Housing development-Russell Woods & Lafayette Park; survey data	1950s	% housing units occupied by Blacks & Whites	NA	Descriptive only	Various tipping defintions; Black & White housing demand; alternatives to housing options (supply) impact tipping & succession
Grodzins, 1957	14 largest US cities; all metro areas	Various-mostly census	1920-1950	% Black in neighborhood	NA—proximity	Descriptive only	Tipping point = increase in exodus of Whites; succession inevitable
Steinnes, 1977	Chicago-sample census tracts	Census	1960, 1970	Racial turnover (% Black)	Distance, econ omic & social mobility	Twin linear regression	Economic & social mobility variables signifigant predictors of whether area tips; does not determine rate of change once area tips
Schwab & Marsh, 1980	Cleveland & contiguous suburbs	Census	1940 1950 1960 1970	% Black in neighborhood	Distance; mobility; attachment; housing	Twin linear regression	Tipping occurs but it is not uniform across space & time
Vandell, 1981	Houston & St. Louis census tracts	Census	1960 1970	Median neighborhood income	Housing stock; residents; distance; racial composition	Pooled & stratified regression	Transitional & non-White tracts had faster rates of succession than similar White tracts for a variety of types of housing markets
Taub, Taylor, & Dunham, 1984	Omaha & Detroit	Omaha 1978 Phone survey data: N = 300 Blacks, N = 300 White residents; Detroit 1976 Area Study personal interviews: N = 1100 residents	1978 1976	Subjects asked if would they move into or out of neighborhoods with varying racial combinations	NA	Tolerance /preference schedules & graphs; Translated tolerance/preference graphs	% Whites tolerance decreased as ratio of Blacks to Whites increases; Blacks in Omaha would live in neighborhoods with any racial combination
Clark, 1991	Omaha, Kansas City, Milwaukee, Cincinnati & Los Angeles	Telephone surveys	Not given	Racial combination	NA	Preference distribution graphs; Tolerance preference schedules; translated tolerance preference schedule by city	Gaps between Blacks' & Whites preferences (Blacks prefer 50/50, Whites prefer 80/20); generally supports Schelling's description of preferences, but empircal curves are less regular than those

Table 2-2 Tipping Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicator of interest	Predictor Variables	Analysis	Results
							postulated by Schelling
Galster, Cutsinger, & Lim 2007	5 large cities (Cleveland, Denver, Detroit, Oakland, Seattle); census tract	Local administrative data	1988-2003	Threshold level: stability, multistate stability, instability, & threshold instability for each indicator variables regressed on its lagged linear & quadratic value.	Property crime rate; violent crime rate; rate of low birth weight babies; rate of birth to teen moms; median home values; property tax delinqency rate; home sales rates	Linear & quadratic coeffients were estimated for neighborhood indicators: if coefficient of lagged indicator is significantly different from its original state then the variable did not return to its original state	Not all indicators show same speed or patterns of adjustment, but most results suggest stable, endogenous neighborhood adjustment process. Neighborhoods with poverty rates > 20% did not adjust as quickly, especially to crime shocks
Card, Mas, & Rothstein 2008	1970--104 MSAs & 35,725 census tracts; 1980--113 MSAs & 39,283 census tracts; 1990--114 MSAs & 40,187 census tracts	NCDB	1970-2000	Change in White population; change in minority population; change in total population	1970-1980 beyond candidate 1970 tipping point; demographic and household controls;1980-1990 beyond candidate 1980 tipping point; 1990-2000 beyond candidate 1990 tipping point	Regression discontinuity methods	Provides evidence that White population flows exhibit tipping-like behavior in most cities with tipping points ranging from 5% - 20% share minority; tipping occurs mostly in suburbs & near existing minority enclaves; little evidence of non-linearity in rents or house prices around the tipping point; tipping points much higher in cities where Whites have more tolerate racial attitudes
Galster, Cutsinger, & Malega, 2008	Case study: Cleveland N = 200 census tracts; Metro study N = 100 largest metros	Case study: home sales data from property tax rolls & NNIP data; Metro study: NCDB & Factfinder	1990-2000	Change in property values and rent	Change in crime, poverty, condition, structure, and metro effects	Case: hedonic regression; Metro: econometric model with regression	Case: in low spatial concentrated areas, neighborhood poverty changes have no noticeable impact on prop erty values; Metro: 1) significant correlation between decadal change in pov rate2) highly nonlinear changes in Ln (property value/rent) in census tracts
Easterly, 2009	202 US metro areas	NCDB	1970-2000	Change in share White from 1970-2000	1970 White share of population ; log of 1970 population density; log of	Basic regression with dependent variable as a function of 4^{th}-order polynomial of initial White share; CDF analysis	10% of sample changed from White to Black during 1970-2000; changes did not occur as suggested by tipping hypothesis; Main factor of change was White movement from center city & inner

Table 2-2 Tipping Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicator of interest	Predictor Variables	Analysis	Results
					1970 median family income in 1970		suburbs to outer suburbs; related between change in White share & initial White share does not fit tipping model—no unstable neighborhoods

LIFECYCLE: THEORY

The Life Cycle ecological perspective is an application of the Filtering model (Pitkin, 2001; Temkin & Rohe, 1996) that has mostly been used for neighborhood public and private investment valuations (i.e. real estate appraisals) and assessment (Metzger, 2000). The theoretical argument underlying this model is that neighborhoods have a natural life cycle. This life cycle involves occupancy by a succession of demographic groups and income levels that fall steadily as a neighborhood ages. Thus, the relationship between resident socioeconomic status and housing age is important. The first argument in Life Cycle theory is that housing age reduces the benefits produced by a housing unit. The second argument is that demand for housing is a positive function of income. Thus, aging housing stock leads to lower-income occupancy. One of the primary assumptions is homogeneity of the housing stock. That is, most housing in neighborhoods is developed during the same time period, and consequently the population in the entire neighborhood will change—depending on various factors such as alternative housing options, rate of new construction, price and desirability of new housing, household preferences, etc. (Grigsby, et al 1987).

Overall the Life Cycle model of neighborhood change is most closely associated with Burgess, an early human ecologist, and Hoover and Vernon, early land economists (Schwab, 1987). The specific historical evolution of the Life Cycle model of neighborhood change started with Homeowners' Loan Corporation (HOLC) real estate valuation appraisal maps. Two HOLC economists, Hoyt and Babcock (Hillier, 2005) further developed the appraisal model that was used in underwriting manuals. Hoyt (1939) furthered this work by using the ecological model of Park, Burgess, and MacKenzie (1925) as a guide. In addition, Hoyt built on Burgess' Concentric Zones Model in his Sectoral Model of urban structure and change. HOLC later developed a five-stage neighborhood model that went from new construction to low valued housing (slum conditions). Hoover and Vernon (1959) further developed the Life Cycle model in their study of the New York metropolitan region that was requested by the Regional Planning Association of New York to be used for regional projections and planning. Hoover and Vernon's informally specified five-stage neighborhood model went from low density single family homes to high density in a strong housing markets to downgrading and thinning out in declining markets ending in renewal with development of multifamily housing. A more current theory of Life Cycle is provided by Birch (1971), Real Estate Research Corporation (1975), and Downs (1981) is presented in Table 2-3.

Table 2-3 Currently Used Versions of the Life Cycle Model

Stage Theory (Birch, 1971)	Real Estate Research Corporation (1975)	Revised Model of Downs (1981) based on multiple sources (Metzger, 2000)
Stage 1: Rural	Healthy	Stage 1: Stable and Viable—relatively new or relatively old and thriving; rising property values; no signs of decay.
Stage 2: First Wave of Development	Incipient Decline	Stage 2: Minor Decline—older areas with some functional obsolescence; young families with few resources; visible minor housing deficiencies; density higher than when first developed; property values are stable or slowly rising; some FHA insured mortgages; level of public services and social status of neighborhood lower than stage 1
Stage 3: Fully Developed	Clearly Declining	Stage 3: Clear Decline—renters are dominant; absentee landlords; lower social status than stage 1 or 2 because more lower SES groups predominate; a lot of visible minor housing deficiencies; residential conversions increases density; weak confidence in neighborhood's future; some abandoned houses.
Stage 4: Packing	Accelerating Decline	Stage 4: Heavily Deteriorated
Stage 5: Thinning	Abandonment	Stage 5: Unhealthy and Non-viable
Stage 6: Recapture		
Stage 7: Decay of Recaptured Area (recycle back through Life Cycle)		

The general thrust of the model is that as a neighborhood ages, there are associated changes in physical aging, population density, intensity and type of land use, resident characteristics, and availability and usage of public and private services. Based on the current status of and trend in these characteristics, an assessment of a neighborhood's current life cycle stage can be determined and tentative determinations can be made about its trajectory. Key concepts in the Life Cycle model are homogeneity, rate of change, and direction of neighborhood change. First, even though housing is considered multi-dimensional, neighborhood housing stock is fairly homogenous. That is, the dominate number of homes is constructed about the same time (Grigbsby, et al, 1987; Downs, 1981). This fact is important because as housing in a community ages entire neighborhoods and not just individual units change. Second, rates of change vary within and between stages. However, Downs (1981) hypothesized that the rate of change increases at the 3rd and 4th stages. Third, the direction of neighborhood change is both uni and bi-directional. Neighborhoods move back and forth between the early stages, but, once a neighborhood reaches the 3rd and 4th stages, it is more difficult to arrest or reverse decline. However, Life Cycle is a theory of the stage of the progression of a neighborhood as it ages. There is not an explicit formal process specified by the theory. The implied process is that of an aging housing stock as indicated by obsolescence and depreciation and related housing market and social changes. In addition, neighborhoods are viewed as constantly changing but the model does not explain neighborhood stability.

Measurement of stages: Birch (1971) developed the “Stage Intensity Score,” a method for estimating the Life Cycle stage of a neighborhood: Rural, Developed, Fully Developed (Stable), Packing (Decline), Thinning, Recapture (Renewal) (used by Schwab, 1987). Rural stage index is characterized by low density and the absence of multi-unit buildings. Developed stage index measures the first wave of development which is indicated by the presence of new single family housing units and absence of multifamily unit buildings. Fully developed, high quality residential stage index is characterized by high rents and moderate densities (Stable stage index measures the characteristics of well-developed high quality tracts with high housing values and low population densities.). Packing stage (Decline stage) index measures the characteristics of an area that is first becoming a slum characterized by declining property values/rents and low population densities. The thinning stage index measures the level of population decline. Finally, the Recapture stage (renewal stage) index measures the revitalization of a tract and is characterized by new housing with higher densities than newly developed areas and with high renter-occupied units. Factors that move neighborhoods from one stage to another are explained in empirical studies section.

While there are some general strengths and weaknesses of ecological neighborhood change models (Pitkin, 2001), there are several strengths, especially in its complementary use with other models, and weaknesses, some of which have been overcome, specific to the Life Cycle model. First, Life Cycle/stage theory grew out of practice (real estate appraisal) making it a good example of practice informing theory. In turn, as theory progressed it was able to inform practice. Second, it continues to be influential in current and trajectory neighborhood data gathering framework by providing information for appraisals (incorporated into the professional language, licensing requirements) and community planning and development (used by neighborhoods and planners, alike). Third, Life Cycle has universal appeal in that it can be used regardless of neighborhood type. Life Cycle or “stage theory” offers a general theory of the Life Cycle that all neighborhoods go through regardless of type (Babcock, 1932 did a life stages study of five neighborhood types per Metzger, 2000). It focuses on the past, current, and projected status of a neighborhood to provide investors and residents with information for investment purposes or planning/program needs. Fourth, the Life Cycle has concepts that are readily implemented, especially through the use of neighborhood indicators, to measure status of and changes in neighborhood characteristics (Sawicki & Flynn, 1996). Since this model focuses on neighborhood changes at the neighborhood geographic scale, the neighborhood unit can be defined as the census tract or individually determined by the city or sub-community. There are national and local sources of data (decadal and annual) at this level. Fifth, the recent strong development of neighborhood information systems makes using indicators, to measure and track neighborhood changes through its life cycle, relatively inexpensive. Neighborhood information systems provide data at the neighborhood (census tract defined or neighborhood defined) that is easy to use, though it may be less so for larger geographical areas.

However attractive the professional and practical applications may be, the Life Cycle model has weaknesses. First, the Life Cycle model is associated with public and private lending and abusive practices in the past, such as redlining, act as systematically strategic barriers to certain households and neighborhoods (minority) to accessing same resources at other households and neighborhoods (White). Second, Down’s (RERC) Life Cycle was designed to be analogous to the human life cycle, but these two areas are different lines of research. Third, the Life Cycle model has been criticized for modeling uni-directional neighborhood decline whose ultimate end will be deterioration and abandonment. However, other models have informally incorporated various regeneration/revitalization/gentrification stages into its framework (i.e. Birch, 1971 as well as more recent neighborhood gentrification research). Fourth, Life Cycle has been given an arguably disproportionate amount of credit for influencing public and private lending policies (Metzger, 2000 and three responses from Downs, 2000; Galster, 2000; and Temkin, 2000). The negative side of this hegemony in policy impact is that the theory, in its true essence causes neighborhood decline because of the effect it has on private and public maintenance and investment decisions (Metzger, 2000). Fifth, the Life Cycle thesis does not frame the current and projected neighborhood status within a metropolitan system or relative to broader metropolitan trends or other neighborhoods. However, some regional researchers and scholars estimate the Life Cycle for each neighborhood in a metropolitan area to understand the patterns of decline and growth at the regional level. In turn, the metropolitan area is studied with in its regional context and then the region within the national context. For example, neighborhoods in metropolitan areas in the Northeast have been impacted differently and more unevenly than neighborhoods in metropolitan areas in the Southwest because of national changes in the economy and economic structure. Sixth, the Life Cycle model only explains neighborhood stability to the extent that neighborhoods may remain at one stage for a period of time before moving either up or down. However, neighborhoods are not modeled in an equilibrium state but are constantly changing. Seventh, spatial and temporal specifications may be needed because the theory was primarily built on the observance of neighborhoods during the 20th century. Specifically, the original observed patterns of change may be less applicable to how newer outer suburban communities will age compared to central cities and its aging first suburban communities.

EMPIRICAL STUDIES

Early empirical studies of the Life Cycle model were descriptive (Hoyt, 1939), framed in an urban structure framework (Sectoral theory), and attempted to provide modified versions especially for application in mortgage lending (Metzger, 2000) and planning (Hoover & Vernon, 1959). Subsequent studies tested the ability of the Life Cycle model to explain or predict neighborhood change (Birch, 1971; Guest, 1974; Fong & Shibuya, 2003; Schwab, 1987; 1989). These studies investigated the factors that move a neighborhood through the Life Cycle (Schwirian, 1983), analyzed one particular stage of the Life Cycle (Cohen, 2001), or examined its applicability to other contexts and time periods (Choldin & Hanson, 1981; Fong & Shibuya, 2003; Mehta, 1968). The Life Cycle model was found to describe and explain neighborhood change, from an aging housing stock perspective, fairly well in most studies. In reviewing more current studies, this conclusion appears to hold across time and space. However, the Life Cycle model has two primary criticisms. First, the urban structure models (i.e. Concentric Zones, Sectoral) are more reflective of older and, at the time, newly developing monocentric cities (Taub. Taylor, & Dunham, 1984) and a new model of non-growing urban structure is needed (Lee, 2005; Schwab, 1989). Second, the Life Cycle thesis does not model the impact of macro-level events/variables on neighborhood change. This section will discuss empirical explanatory and predictive studies on these aspects and criticisms of the model.

Schwirian (1977) discussed several factors, identified in other approaches or studies, influential on the movement of neighborhoods through the Life Cycle. First, as indicated in the bid rent model, alternative housing options or rates of new housing construction provide incentives for households to move if they can afford to do so. In addition, population growth impacts demand and thus the rate of new housing construction. Second, the changing accessibility of the neighborhood to the metropolitan area's employment opportunities and growth will impact its' desirability.

While housing stock age is less of an indicator of the life cycle stage of a neighborhood in this case, housing located in areas that are less accessible to employment will be demanded less by higher income households and may impact property values and thus become more affordable to lower-income households. Third, Schwirian also cited the extent to which public agencies pursue redevelopment projects or attempt to frame regulations controlling growth and change will impact a neighborhood's movement between stages. There are internal forces that may impact neighborhood stability rather than change. For example, some residents of aging neighborhoods may not want to relocate and thus take advantage of having the same home and neighborhood characteristics at lower housing costs (Schwirian, 1983). Thus, the extent to which residents mobilize resources to resist change will impact movement of a neighborhood into the next Life Cycle stage.

Older empirical research also tested the ability of the Life Cycle thesis to predict neighborhood outcome in change in status (Farley, 1964; Guest, 1974), residential population density (Guest, 1973), and neighborhood population size (Schwirian, 1983). The general findings provided varying degrees of support that neighborhoods display some of the characteristics as hypothesized by the Life Cycle model. In addition, some empirical studies focus on one stage of the process/cycle, such as abandonment (Schwirian, 1983 for example Feathermann, 1977-1978). A more recent examination on housing abandonment was done by Cohen (2001) in a case study of three Baltimore neighborhoods. This study acknowledged that neighborhoods with large amounts of abandoned housing may be based on its stage in the Life Cycle model. However, Cohen believes that most Life Cycle models that are currently being used pre-date the large scale abandonment being experienced by some metropolitan areas. As such, the Life Cycle model does not account for the complex confluence of recent macro-level structural changes on neighborhood change.

Since the 1980s, Life Cycle-related research in the United States shifted its focus to revitalization and gentrification (Schwab, 1989) which will not be addressed in this study. As noted previously, revitalization and gentrification may or may not be considered as a stage in a neighborhood's Life Cycle. Arguments for not considering it as a Life Cycle stage because more complex factors influence whether public and private investment exists and to what degree it is available beyond the specifications in the Life Cycle model.

Important to the Life Cycle theory is its applicability across different time periods and geographic areas such as cities versus suburbs and US versus non-US metropolitan areas. The ability of neighborhood Succession and Life Cycle models to explain city and suburban neighborhood change (Choldin & Hanson, 1981). Life Cycle was used as well to understand changes in non-US metropolitan areas (Mehta,1968; Fong & Shibuya; 2003).

Given the growing size and importance of suburbanization, Choldin and Hanson (1981) tested the Life Cycle and Invasion and Succession models in cities and suburbs of metropolitan Chicago from 1940 to 1970. In general, their analysis of growth patterns of older suburbs confirmed Life Cycle model outside city limits. The most important findings were that cohort (determined by year that the suburb or community area reached 1200 in population density) was a strong predictor of growth and loss for cities and suburbs and that all suburbs grew early in the period studied, but older suburbs stabilized in the 1960s. Among city areas and suburbs, family group was a strong predictor of growth. However, their study was based on suburb and community area designation which may not be small enough geographic scale. In addition, their definition of cohort was defined as the year in which a certain population level/density is attained. Current inner city and first and outer suburb studies classify census tracts based on the decade in which the predominant housing stock was developed. Census tracts in case study metropolitan areas were classified by predominant housing stock and find patterns of development and differentials between these designations (Lee & Leigh, 2005; Lee, 2004). Similarly, in a multi-metropolitan level study these areas were classified these areas by dominant housing stock age and analyzed different median income and housing value trends over time in them (Hudnut, 2006).

There is still some interest in using the Life Cycle neighborhood change model in other non-US metropolitan areas. Mehta (1968) study on segregation in India from the1800s to 1950 provided an indication of metropolitan level residential trends. Mehta concluded trends in centralization or decentralization (of poor and/or wealthy households) and the impacts of different macro-level changes such as advances in technology on urban structure, yield universal patterns across time as well as space. Mehta did not specifically focus on Life Cycle neighborhood change but rather the resulting urban structure and growth that can be related to Burgess's Concentric Zones Model. In a more recent study on the applicability of neighborhood change models to other countries, the ability of Life Cycle, Invasion and Succession, and Spatial Effect models to explain neighborhood change (measured by poverty rate) in census tracts in 18 Canadian metropolitan areas (Fong & Shibuya, 2003). While there was some support for the Life Cycle thesis, caution was taken about using these models to explain neighborhood change in Canadian neighborhoods because of the economic, social, and political differences from the US (Fong & Shibuya, 2003).

Summary

Analogous to human life development cycle, the Life Cycle perspective postulates that neighborhoods go through different stages as their housing stock ages. Thus, neighborhood change (observed outcome) is a function of the predominant age of the housing stock to meet current residents' needs. Indicators of Life Cycle stages consist of physical, economic, and social factors. Changes in Life Cycle indicators both contribute to neighborhood change and are impacted by it. These indicators include housing type (single family versus multifamily buildings), population density, housing tenure, housing values/rents, household income/poverty rate, neighborhood income/poverty rate, type and availability of housing financing, resident racial/ethnic composition, and public and private service quality (Real Estate Research Corporation, 1975). The stage intensity score, a method to measure a neighborhood's stage, was developed and tested by Birch (1971).

Early empirical studies of the Life Cycle model were descriptive (Hoyt, 1939), framed in an urban structure framework (Sectoral theory), and attempted to provide modified versions especially for application in mortgage lending (Metzger, 2000) and planning (Hoover & Vernon, 1959). Subsequent studies tested the ability of the Life Cycle model to explain or predict neighborhood change (Birch, 1971; Fong & Shibuya, 2003; Guest, 1974; Schwab, 1987; 1989). These studies investigated the factors that move a neighborhood through the Life Cycle (Schwirian, 1983), analyzed one particular stage of the Life Cycle (Cohen, 2001), or examined its applicability to other contexts and time periods (Choldin & Hanson, 1981; Fong & Shibuya, 2003; Mehta, 1968). In most studies, the Life Cycle was found to describe neighborhood change fairly well from an aging housing stock perspective. However, the Life Cycle model has two primary limitations. First, the urban structure models (i.e. Concentric Zones, Sectoral) are more reflective of older and, at the time, newly developing monocentric cities (Taub, Taylor, & Dunham, 1984). Thus, a new model of non-growing urban structure is needed (Lee, 2005; Schwab, 1989). Second, the Life Cycle thesis does not model macro-level event impacts on neighborhood change.

Table 2-4 Life Cycle Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicator s of interest	Predictor Variables	Analysis	Results
Birch (1971)	New Haven SMSA	1960 census; 1967 census pretest	1960-1967	Housing stock age	Predominant age of housing in 1960 & 1967; household income; education achievement; family size	Developed “stage intensity score”	Support for Hoover & Vernon & Birch’s stage theory: high income families buy larger houses in low density areas with good schools & more privacy; poor cannot afford new housing— inherit older housing abandoned by high income households; poor with large families will push outward for lower density & better schools
Guest, 1974	13 US metro areas	Case study: real property inventory; Census data	1940-1970	Social status: occupation & education; center city versus suburban location; distance to CBD	NA	Cohort analysis	Cohort analysis provides some suppt for Life Cycle, but it is not strong. Cleveland passed through its’ life cycle rapidly
Choldin & Hanson, 1981	Community areas in Chicago (N = 75) & its suburbs (N = 57, N = 147)	Local fact book; census	1940-1970	Population growth	Cohort, family status, racial composition, SES,	Cohort analysis & multiple regression on small area data	Cohort & family status are strong predictors of growth in city & suburbs; Succession model no longer accounts for changes at neighborhood level; support for Life Cycle; but in regards to Concentric Zones model- need new macro model of non-growing metro areas
Schwab, 1987	Cincinnati, OH; census tracts N = 99	Census data	1970 & 1980	Change in median census tract housing value compared to change in median city housing value	Life Cycle- develop, stable, decline, thinning, renewal. Arbitrage- income, Black, adjacent, renters. Composition- distance, quadrant, renovate, level of	Linear discriminant. For Life Cycle used “Stage Intensity Score” method developed by Birch, 1971 for variable categories	1)Coefficient was strongest on composite model; unclear results for Life Cycle 2)Life Cycle had highest predictive value for correctly classifying tracts into their

Table 2-4 Life Cycle Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicator s of interest	Predictor Variables	Analysis	Results
					Blacks		respective groups
Fong & Shibuya, 2003	18 largest Canadian metro areas with large visible minority populations	Canadian census data; census tract	1986-1991	1991 neighborhood poverty rate	Change in neighborhood SES; Invasion & Succession = 9 major racial & ethnic groups; Spatial Effects model = Instrumental variable for percent poor; neighborhood poverty potential	Two-stage least square regresssiion	No variation in life cycle for housing stock age
Rosenthal, 2007	35 US MSAs, Chicago, Philadelphia case studies	NCDB & other various historical data sources	1950-2000, 1900-2000	Percent change in neighborhood economic status	Predominant housing stock age, home ownership, minorities, college edcuated	1)Transition probabilities; 2) Absolute value percent change in census tract relative income; 3a)Time series analysis – panel unit root analysis; 3b)Serial correl; 4) Regression to analyze impact of aging housing & local externalities arising from social status	1)2/3rd of census trcts that were low income in 1950 climbed to higher quintile by 2000; 2) Neighborhoods cycle over many decades 3) Filtering & social dynamics affect neighborhood status through different channels & temporal patterns and are independent; SES factors & distribution of housing stock age effect change in neighborhood economic status in different ways
Ellen & O'Regan, 2008	226 US metro areas; N = 18252 central city census tracts	NCDB	1970-2000	Percent change in neighborhood economic status)	Neighborhood Income quintile at start of decade; main and interactive effects of tract-level demographic & housing characteristics	Correlation analysis & Logit regression	Neighborhood relative income at Initial quintile impacted likelihood of gaining; race, SES & housing characteristics effect likelihood of gain; neighborhood demographics & SES have different effects in low-income areas than in other areas

FILTERING: THEORY

Filtering theory of neighborhood change is an abstract construct of the process of how neighborhoods change in a market context. Neighborhood change is the result of resident mobility, aging housing stock, and new construction of housing in excess of household formation. As housing stock ages it becomes less attractive for higher income households who then seek newer housing. New housing construction in excess of household formation offer housing to these households. Since there is little variation in age of the housing stock in a given neighborhood (whereas there is much variation in housing stock age metropolitan wide), as homes within higher income neighborhood age, entire neighborhoods filter down to the next lower income group (Grigsby, et al 1987).

The current Filtering model of neighborhood change is based on economic theory applied to the basic concepts of the Invasion and Succession. Both Filtering and Invasion and Succession are market concepts of neighborhood change but Filtering focuses on market components of change while Invasion and Succession focus on resident, neighborhood economic, and social status aspects of change. Change occurs in Filtering neighborhood economic and social status change due to residential mobility, declining property values, and new construction excess over household formation while change occurs in Invasion and Succession because of pressures due to population and economic growth.

Early concepts of Filtering viewed the housing market as a single commodity that offers various levels of quality at various levels of cost. Debate focused on which particular variable defines how houses filter: dwelling price, dwelling quality, and/or household income (Grigsby, 1963). Post WWII theories of Filtering use housing quality submarkets as a foundational concept.

There are several key concepts of Filtering. First, housing is viewed as a commodity that can be valued and exchanged in the market. There are characteristics that make housing a unique commodity: highly durable, very large in size, expensive investment, spatially immobility, and multidimensionally heterogeneous (Galster & Rothenberg, 1991). Fundamental to current Filtering theory, as noted above, is that there are submarkets of housing quality based on the concept of substitutability. Housing submarkets are measured by an overall quality index and then classified in quality categories such as low, medium, and high quality submarkets. Housing units are then arrayed along a continuum from low to high quality. Based on this array, submarkets are determined where there is close substitutability among the housing units for households seeking to maximize their utility. Each submarket is independent of and interrelated with other submarkets within a given housing market. That is, changes in one submarket reverberate and impact conditions in other submarkets. The housing market has two main groups: individual consumers (renters, owners) and aggregate consumers and individual suppliers (developers, landlords, owner-occupiers) and aggregate suppliers.

Filtering is viewed as both a static model consisting of housing submarkets and a process by which the housing market operates. For the most part neighborhood change in Filtering is non-linear and bi-directional (Rothenberg, et al, 1991). The process of Filtering is initiated with new housing construction that is in excess of the number of households forming for appropriate income-qualifying households. These households move to new units thus increasing the number of units available at their previous submarket quality level. The price of this housing drops in the medium-run and is now available for the next lower-income households to occupy.

EMPIRICAL STUDIES: FILTERING

Baer and Williamson (1988) provided a broad study of the evolution of Filtering as an implied housing policy strategy, test of its effectiveness at meeting the needs of low-income households, and development of a formal theory of housing economics. Prior to the 1930s there was no federal housing policy. The housing market was mostly unregulated except for very few local housing policies. Filtering evolved as an implicit strategy for pre-federal housing policy market perspective on how the market would provide for the needs of low-income households. Early post WWII housing policy debates focused on whether and the extent of government intervention in the housing market was needed. However, due to lack of large data sets to study the process and results of Filtering, there were little empirical research studies. Early empirical studies used matrix analysis that was subsequently used in conjunction with vacancy chains. Since vacancy chains were clumsy to develop, another method, vacancy transfers of units from one household to another was employed. A second approach was to use the matrix approach to analyze turnover through Markov chains or matrices that examined the probability that a household will move to a different housing submarket. After larger federal government data sets were developed and the concept of housing submarkets was specified, empirical studies and methodology became more sophisticated. The analysis in this dissertation will focus on the major empirical studies on Filtering are Grigsby (1963), Smith (1963), Coulson and Bond (1990), and Rothenberg, et al (1991). To the extent possible, studies that follow these major studies will be included.

Some scholars believe that prior to Grigsby (1963) housing was considered one market of an array of units of progressively higher quality. However, some speculate that the concept of housing submarkets originated in the early 1900s by an economist Richard T. Ely (Watkins, 2008). Grigsby (1963) was the first study to introduce the concept of interrelated housing submarkets through substitution (Galster, 1996) and empirically tested whether the housing market behaved as theorized in matrix analyses with data from the National Housing Survey. Grigsby identified and measured housing submarkets in the Philadelphia SMSA for 1955 and 1956. Housing submarkets were based on location and value of single family homes, employment location, household income, age of head of household, families with and without children, income and place of employment, and previous tenure by value of present residence for single family home purchasers. The resulting matrix was a table that followed the movement of households within Philadelphia SMSA submarkets. A second matrix provided a picture of net migration from and to the submarkets. Accompanying the matrices were figures that theorized the source of housing demand for center city and for suburbs and source of supply for center city and for suburbs. Demand consisted of population growth from migration and new household formation, former renters, and former owners. Housing supply consisted of new and used homes. Policy implications from author's perspective: to have an evaluation of the extent to which the private market will meet the goals of better housing for low income households. Overall, Grigsby found that Filtering based on home values, family income, and family social status (occupation) does occur within Philadelphia, between center city, and between suburban areas. However, because the author only provided partial results, it was difficult to identify filtering trends and magnitude in household movement between geographic areas based on the three indicators.

Grigsby (1963) and the availability of large data sets from the Annual (American) Housing Survey were considered watershed events for the study and ultimate development of formal housing economic theory of Filtering. However, Sweeney (1974) was one of the first to develop a formal model of Filtering as a theory (Bond & Coulson; Galster, 1996; Rothenberg, 2008). Sweeny (1974) was not an empirical study but provided hypothetical policy intervention scenarios through which the model was used to predict how different housing submarket demand and supply will respond. While this helped to establish Filtering as a housing economics theory, its applicability to housing policy was limited due to model constraints (Baer & Williamson, 1988) but it does provide a valuable indication of how housing submarkets will respond during housing interventions such as urban renewal with and without one for one replacement in different housing submarkets. It also provides a more solid case for arguing against using Filtering as a housing policy intervention since new construction at the high end will not only remove low quality housing from the market, but it will cause prices to increase the highest in the lowest housing submarket. It also can be applied to begin understanding the impact of voucher usage in various quality housing submarkets.

An earlier work using census data to help build knowledge of Filtering was Smith (1963). Smith used a frequency distribution of proportion non-White, owner-occupied, and housing values to study neighborhood change for 76 Oakland, California neighborhoods. From this descriptive analysis, Smith developed three principles governing neighborhood change: persistence in neighborhood socio-economic characteristics, accommodation represented by a shift in neighborhood housing demand resulting in change in social economic characteristics, and gradual transition of selective factors change in aggregate housing demand. In general, the most important findings of Smith were that overall increase in the proportion of minority households during the 1936 to 1960 study period, neighborhoods that were originally all White tended to persist during this period, and neighborhoods that changed tended to have a high proportion of minorities in the beginning period.

In a subsequent study, Smith (1964) attempted to study the Filtering process through housing submarkets from another approach and created five typologies of housing quality submarkets. Households were assigned to house submarket based only on its income level. New construction was predicted to occur whenever the economic value function exceeded the cost function and at the quality level where such excess occurred. That is, Smith used basic microeconomic analysis and posited, that similar to the production of other commodities, new housing construction will occur in the sub-market where it is profitable for developers to do so—the incremental increase in revenue is greater than the incremental increase in construction costs for each additional unit constructed. Deterioration was seen as progressively lowering the cost function until eventual replacement occurred while increase in either population or incomes augmented the value function, thereby generating new construction and leaving the lowest-quality existing units vacant. Smith also did not present a formal model of Filtering however and only used a single variable in which to define submarkets using community typology.

Coulson and Bond (1990) was the first to use hedonic modeling to determine the impact of neighborhood change of the succession of household income levels and housing stock age on housing prices. They distinguished neighborhood succession from one income group to another through Filtering or through externalities models. Coulson & Bond (1990) tested the roles of changes in housing stock age and resident characteristics (race) in a hedonic structural model impact on housing prices. The hedonic structural model developed by the authors in a previous study, combines Filtering and externality effects. They hypothesized that Filtering models the result of the passage of time on the level of services that housing decreasingly provides. As a result, lower income households and minority households will outbid higher income households since the latter are less willing to pay for housing that is declining. They also hypothesized that externalities are the result of lower income households and/or minorities increasing their numbers in a neighborhood lower the quality of the neighborhood and resident bids. Over time low-income and/or minority households will outbid higher income households.

Using data from Federal Housing Administration applications for FHA insurance on new mortgage loan and the Census of Housing, Coulson and Bond examined six cities in 1970 and 1980. The results provided strong support for externalities in that neighborhood income and race have a significant impact on property values (high income households are willing to pay more to live in high income neighborhoods). There was little evidence of an effect of income on demand for racial composition of the neighborhoods, but race of household head was significant. The results provided some support for Filtering in that higher income households are more willing to pay for bigger houses, but little support for Filtering of housing as the housing unit ages (depreciation rates are low; demand function is not consistent with Filtering model with respect to age). In sum, Coulson and Bond found support for housing quality Filtering, since newer housing is typically larger than older housing but little support for housing stock age Filtering.

Ellen and O'Regan (2008) was a recent empirical study using the Filtering and social externalities model developed by Coulson and Bond (1990). Ellen and O'Regan addressed current concerns about the degree to which neighborhood economic change occurred in US central cities during the 1990s with a specific focus on high poverty and minority areas. The unit of analysis was the census tract and the primary measure of neighborhood economic status was the census tract's average household income relative to that of the MSA. Following Rosenthal (2008), Ellen and O'Regan created five quintiles of neighborhood types that are based on the relative ratio of average census tract income to average MSA income. The research design is a quantitative analysis that uses the NCDB with a sample frame of 266 metropolitan areas or N = 38,552 census tracts. The sample consisted of 18,252 central city census tracts representing 47 percent of the sample frame. This study defined the measure of economic gain/improvement as being equal to the percentage point change in a neighborhood's relative income where any positive increase is considered and economic gain and an increase of 10 percentage points or higher is considered a large economic gain.

The overall results from three logit regression models related to initial income level (Filtering), tract level factors (social externalities), and interaction effects of these two sets of indicators. First, the results indicated that initial neighborhood relative income is important to how it fared during the following decade in the base model. Except for the next lowest neighborhood income quintile, the coefficients were positive. This finding provided some support that upward filtering occurred. However, initial neighborhood economic quintile became less important by the 1990-2000 time period and as resident and neighborhood factors were included in the model. This finding makes sense since neighborhood income was correlated to tract level factors including race/ethnicity, education, etc. From a Filtering perspective, it would be expected that tract level factors play a role in the process, but their contribution relative to initial income is not assessed. Second, some tract level factors played a role in explaining the observed increase in the probability of upgrading of very low income census tracts. Third, the overall results of the full model that included initial neighborhood income quintile, tract level factors, and interaction variables provided some support for Filtering and social externalities. However, these three ranges of attributes often have different and at times, unclear effects on the probability of economic gain (filtering upward).

Rothenberg, et al (1991) further developed the submarket concept within the Filtering perspective of how neighborhoods change. Most importantly, Rothenberg, et al (1991) was the first study to employ a hedonic index strategy to identify housing submarkets in contrast to spatial submarket approaches. Rothenberg used homes sales data from property tax assessor records for a case study of Des Moines, Iowa and Annual Housing Survey and Bureau of Census data for the cross-metropolitan study. Rothenberg found that housing submarkets could be estimated without serious confounds and in adequate quality array of housing by using the hedonic index technique.

Rothenberg, et al then used their submarkets to study short- and medium-run submarket demand and supply responses and inter-submarket interactions. Housing submarket demand responses to different prices that were studied included prices within given tenure/quality sub-market; other quality submarkets in the same tenure; other tenure submarkets, non-housing commodities. Within their study of housing supply, they considered new construction, conversions of existing stock, and existing stock. In addition, they studied the supply of new construction for the aggregate amount of construction (by tenure and quality). They emphasize the role of conversion in the overall supply response. For the existing housing stock they incorporated revenue possibilities that vary in a non-linear fashion across submarkets, transformation possibilities in individual units vary by structure type, age, and initial quality level (optimal transformation is indicated for each unit). Rothenberg et al also studied how demanders and suppliers will respond to exogenous market shocks over the short and long run.

As summarized by Rothenberg, et al, the overall results indicated that there are important systematic variations in several dimensions across different submarkets. There were several striking results in the cross SMSA study. First, housing prices and their rates of change varied within submarkets thus bolstering the notion that though interconnected, housing quality submarkets function independently. Second, supply responses varied but most new construction was in the upper two quintiles and conversions occurred in the lowest quintiles for both owner and renter occupied units. Third, elasticities varied across different submarkets. The responsiveness of demand with respect to price became increasing inelastic at lower sub-markets. This reflects fewer housing options for residents in lower submarkets than in other submarkets. The elasticity of demand with respect to market valuations in substitute submarkets of higher quality is greatest in the lowest quality rental submarket, but is not significant in other renter submarkets and is large across all owner submarkets. Market period elasticity of stock supply is less in owner than renter submarkets, but in all except one is extremely small. Medium-run supply function in all owner submarkets appears to be perfectly elastic over a three year period, while higher quality renter submarkets are less elastic. No consistencies in medium-run supply elasticities in the lowest quality renter submarkets could be observed. The most interesting result of the single market SMSA study is that the submarket in which a housing unit originated affected the probability that improvements would be made to it.

Rothenberg, et al concluded in the overall model that the strength of inter-submarket repercussions appears to be inversely related to the quality differences between any two given submarkets. This is due to implicit degree of substitutability perceived by both demanders and suppliers. Observed non-uniformities are superimposed on this systematic observance. Owner price and cross price elasticities of demand varied depending on the submarket. Also the speed and extent of medium-run supply adjustment vary by submarket, especially if the age or quality distribution of the exiting stock is also varied.

Summary

Filtering describes neighborhood change as the result of resident mobility, aging housing stock, and new construction of housing in excess of household formation. As housing stock ages it becomes less attractive to higher income households who then seek newer housing. New housing construction in excess of household formation offer housing to higher income households. Since there is little variation in age of the housing stock in a given neighborhood (whereas there is much variation in housing stock age metropolitan wide), as homes within higher income neighborhood ages, entire neighborhoods filter down to the next lower income group (Grigsby, et al 1987).

Empirical studies on Filtering attempted to determine if housing submarkets exist, provided methods to define submarkets, and used defined submarkets for further analysis of individual and aggregate behavior patterns and interrelatedness in metropolitan housing markets. Studies provided evidence of the existence of submarkets and utilized hedonic regression to define them (Rothenberg, et al, 1991). Other studies uses simpler methods such that of Smith (1963) in creating neighborhood typologies based on factors such as household income. Overall, most studies provided support for various types of Filtering i.e. income (Ellen & ’Regan, 2008), housing value (Rothenberg, et al, 1991), and housing quality (Coulson & Bond, 1990).

Table 2-5 Filtering Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicators of interest	Predictor Variables	Analysis	Results
Smith, 1963	Oakland, CA N = 76 neighborhoods	1936 Oakland Real Property Survey; 1950 & 1960 Census of Housing	1936-1960	Proportion non-White; owner occupied units; home values	NA	Distrib analysis for 1936, 1950, 1960	Deveveloped 3 principles governing neighborhood change: Persistence, Accommodation, Gradual Transition
Grigsby, 1963	Philadelphia SMSA	National Housing Inventory (Census)	1955 & 1956	Housing unit location, tenure, & value; household race	Population, income, & employment location	Developed matrix of housing submarkets based on hh employ, residence, & mobility patterns	Matrix based on actual & potential household moves between submarkets provide some housing submarket identification & measurement; Sources of housing supply (new/existing) & demand (tenure); Household income movement between center city & suburbs
Vandell, 1981 (Succession & Filtering)	Houston & St. Louis census tracts	Census	1960 & 1970	Income	Housing stock; residents; distance; & racial composition.	Pooled & stratified regression	Transitional & nonWhite tracts-faster succession than similar White tracts for a variety of housing market types
Coulson & Bond, 1990	6 cities (Atlanta, Baltimore, Chicago, Houston, Philadelphia, Seattle); census tract	FHA applications for FHA insurance on new mortage loans; Census of Housing	1970 & 1980	Housing prices	Housing stock age; neighborhood income, & race	Structural hedonic modeling	Support for externalities -high income households willing to pay more to live in high income neighborhoods; Support for housing quality filtering, little support for housing age filtering

Table 2-5 Filtering Most Important Empirical Studies

Author/Year	Sample size/location	Data & Source	Time Frame	Indicators of interest	Predictor Variables	Analysis	Results
Ellen & O'Regan, 2008	226 US metro areas; census tract	NCDB	1970-2000	Average household income	Income quintile; demographic & housing characteristics ; interaction variable between these variables	Logit regression	Initial quintile-important; racial, SES, & housing factors significantly affect likelihood of gain, share Black population is negatively correlated with economic gains during 1980s; neighborhood SES & demographics have different effects in lower income areas than in other areas during 1980s
Rothenberg, et al, 1991	Cross study: multiple metro areas (1960 N = 36 SMSAs; 1975-76 N = 38 SMSAs); case study-DesMoines, IA; census tract	Cross: 1960 census; 1975-1976 Annual Housing Survey; Single: property tax assessment records	1960 & 1975-1976	Housng values	Cross:housing characteristics & location attributes, SMSA dummy; Case: structural & location attributes, market condition at time of sale	Cross: hedonic index for both samples for owners & renters; quality submarket partitioning. Case: hedonic index, quality submarket partitioning	Both: produced reasonable housing quality arrays based on estiamted hedonic index; used submarkets for examination of 1) market period (short-run) housng submarket supply & demand; 2) medium-run changes in housing stock in submarkets
Rothenberg, et al, 1991	Quality submarkets estimated for cross metro & case study markets	Same as above	Same as above	Probility that a randomly selected household in given SMSA market will occupy housing in a given submarket	Short term demand and supply	Multinomial logit regression; Ordinary least squares regression	Short- term supply decisions determined by size of existing housing stock; Distribution in short-term market across different quality submarkets depend on household income, metro area race distribution, & array of submarket prices

IMPACTION METHODOLOGY AND POLICY IMPLICATIONS

The purpose of this dissertation is to disentangle the effects of normal neighborhood change and relationship between subsidized households and neighborhood quality. Theories of neighborhood change provide a framework through which to observe the type and change trends of assisted households in low-income housing mobility program. Impaction studies, primarily based on economic theory of housing capitalization, assess the impact of these assisted households on neighborhood quality as measured by housing values. This study focuses on four major social and market-oriented theories of the former and impaction methodology of the latter. The remainder of this section will provide a brief discussion of impaction methodology. The following section will provide the low-income rental housing program and program evaluation context for this study and discuss how this study will address the need to disentangle effects of subsidized households on neighborhood quality and the response of subsidized households to changing neighborhoods.

Impaction Methodology

Property values have been a common outcome indicator estimated in impaction studies (Freeman & Botein, 2002). Methods to estimate property value impacts are test/control area comparison, cross sectional hedonic regression, pre/post hedonic regression and cross sectional time series, and hybrids of test/control area comparison and time series hedonic regression. First, the test control comparison method resembles a quasi-experimental design. This method compares communities that received the intervention of subsidized housing to those that have none. While the logic of comparing similar communities is acceptable, with the exception of the dependent variable is acceptable, test/control area comparison method has serious flaws. Studies employing this approach have not used formal and systematic approaches to selecting neighborhoods that are truly comparable except for the presence of subsidized housing. In addition these studies provide no controls for area wide conditions that may vary with the condition of the smaller neighborhood.

The second impaction method is cross-sectional hedonic regression. This method estimates sales price (or assessed value) levels of impacted communities while controlling for neighborhood context, location, housing structure, and site characteristics. While this approach was a significant improvement over test/control area comparison, it fails to estimate trends in sales prices thus providing no indication of whether the neighborhood is decline or growing. The third impaction method, pre/post hedonic regression and cross-sectional time series, are similar to cross-sectional hedonic regression, but they estimate both sales price levels and trends before and after subsidized households (or estimating home value changes multiple times over the study period). The hedonic regression provides some control for neighborhood context, location, housing structure, and site characteristics.

The fourth approach to estimating impaction is a hybrid of test/control area comparison and time series hedonic regression. Overall, the approach estimates and compares pre, during introduction, and post sales price levels and trends for non-impacted and impacted communities. It combines the research designs of test control comparison and time series with the analytical technique of hedonic regression. The first method of this approach is the Adjusted Interrupted Time Series (AITS) that is currently believed to be the most comprehensive (Lee, 2008). AITS was developed by Galster, Tatian, and Smith (1999) case study of the impact of Section 8 Certificate and Vouchers on property values in Baltimore County. “AITS method compares the differences in the levels and trends of an outcome indicator between target and control neighborhoods before and after the intervention, while controlling for coincident citywide changes in trends (Galster, Tatian & Accordino, 2006, 458).”

The second method of the hybrid technique is Difference in Differences (DID). The theoretical difference between AITS and DID is that the former estimates level of, and trends in, property values, while the latter only estimates the level of property values (even though estimates and comparisons can be made for multiple time periods). Schwartz, Ellen, Voicu, and Schill (2006) and Ellen (2007) built on Galster, Tatian, and Smith (1999) to develop and use DID to explore factors that affect the size and magnitude of the impact of subsidized housing on neighborhoods. “DID method compares differences in the levels of an outcome indicator between target and control neighborhoods before and after the intervention “(Galster, Tatian & Accordino, 2006, 458). Specific to impaction, DID estimates the impact of subsidized housing on neighborhood quality as measured by single family housing prices or appreciation of being located proximally to subsidized housing development/units. DID method compares the differences in single family housing price levels before and after the presence of subsidized housing for intervention and control neighborhoods. Using New York City (NYC) as a case study, Schwartz, Ellen, Voicu, and Schill (2006) and Ellen (2007) estimated hedonic regression and repeat sales models with a geocoded administrative data set of 294,000 residential property sales in NYC from 1980 and 1999 and administrative data on the development of 66,000 subsidized housing units (for homeownership) from 1987 to 2000. These two studies were able to factor in trends in appreciation prior to development and again after development.

Application of Impaction Methodology to the Present Study

Impaction methodology is useful for addressing this dissertation’s research questions concerning neighborhood location of subsidized households (level of and trend in neighborhood outcome indicator) and its potential impact on those outcome indicators. It would be ideal to estimate selected neighborhood's outcome indicator change trajectory (trend) before, at the time of initial entry, and after established residency of subsidized households at the micro-level as done in Galster, Tatian, and Smith (1999) and other studies (Ellen, 2007; Lee, 2008). However, due to census and subsidized housing administrative data limitations and covering multiple metropolitan areas, it is not possible to study household level changes over an extensive time period. In addition, this study will not break down geographic scale at the micro-neighborhood level (Lyons & Loveridge, 1993), but will follow the approach of Galster, Cutsinger, and Malega's (2008) exploratory study on multiple metropolitan areas using census data and census tract-defined neighborhoods. However, unlike Galster, Cutsinger, and Malega (2008), this study will examine each metropolitan area and will control for metropolitan-level factors by creating neighborhood quintiles based on selected outcome indicators (i.e. income, rent, home values) for each metropolitan region.

This study will not estimate the impact of subsidized housing on property values and income, but rather on the likelihood of a neighborhood changing on an outcome indicator given the presence of subsidized households. This provides a better overall indication of the types of neighborhoods that subsidized households are located. Although the reasons that subsidized households are located in certain neighborhoods are not determined, but anticipated reasons will be discussed in the conclusions section (selection may be based on limitations of housing options, discrimination, preferences, etc.). What the present study will do is examine the neighborhood type and change trends of neighborhoods in which subsidized housing is located while defining this change within a neighborhood change theoretical framework. It is important to disentangle the impact of low-income subsidized housing programs on neighborhood quality. The next section will provide a brief discussion of low-income housing policy goals, related programs, and the program evaluation area that this dissertation attempts to address by examining neighborhoods through a neighborhood change theoretical framework and concepts of impaction methodology.

Policy Implications

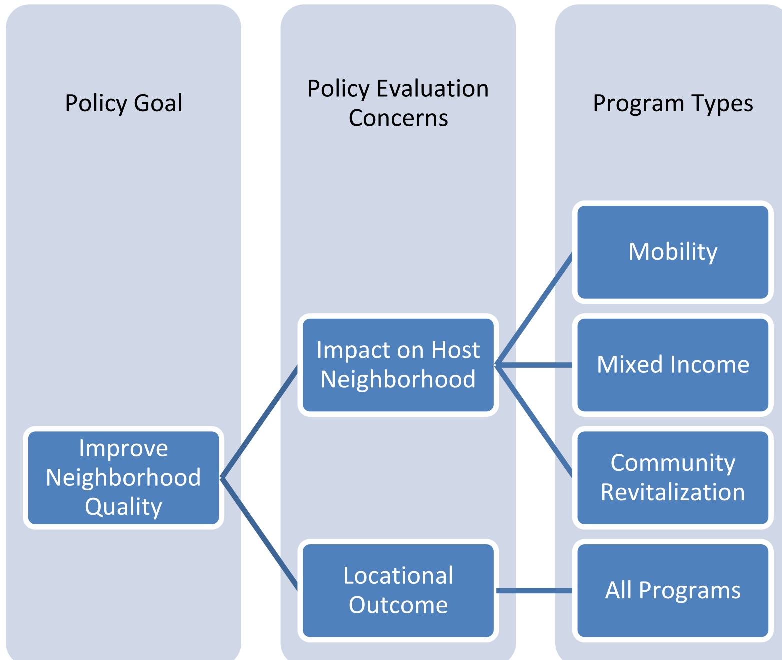

Figure 2-1 Policy Implications: Relationship between Subsidized Households and Neighborhood Quality

The overall goals of low-income housing policy are to increase housing consumption and quality and improve neighborhood outcomes (quality) of poor households (Olsen, 2001; 2006). Types of housing programs to achieve the goal of improved neighborhood outcomes are revitalization of poor neighborhoods, development of mixed income communities, and enabling low-income households to access non-poor and non-minority communities through mobility programs.

For policies that seek to revitalize communities and to create mixed income communities, the goal is to have a positive impact on neighborhoods. For policies that enable poor households to access low-income and non-minority communities through a mobility program, impact is not necessarily a goal, unless there is a need to demonstrate that assisted housing can have a positive impact. The concern of this dissertation is assessing neighborhood outcomes that are measured by the physical, social, and economic characteristics of subsidized households' neighborhood environments. A second measure of neighborhood outcome is to assess the impact of subsidized households on host communities, i.e. negative externalities (Olsen, 2001; 2006). It is the second neighborhood outcome measure that is the concern of this dissertation.

In mobility and place-based programs, policy makers want to make sure that assisted housing is not contributing to problems of racial and income segregation and neighborhood decline, especially that of first suburban communities (Puentes & Warren, 2006). What these policy analysts are overlooking is that subsidized households tend to be located in declining neighborhoods (Freeman & Botein, 2002). What is less clear, however, is whether subsidized households are responding to or causing neighborhood change. The goal of this dissertation is to estimate the relationship between subsidized housing and indicators of neighborhood change based on theories of neighborhood change with the primary focus on the likelihood of subsidized households to be located in declining neighborhoods.

CHAPTER 3

METHODS

Approach

The purposes of the present study are to get a better understanding of the types of neighborhoods in which subsidized housing and households are located and of the potential impact that these households may have on their neighborhoods. Theories of neighborhood change can provide an indication of subsidized households' neighborhood types and their past, current, and anticipated changes. Current impaction methodology attempts to estimate neighborhood type and change by measuring levels of and trends in property values in micro-neighborhoods in which subsidized housing and households are located. Two current impaction methods, Adjusted Interrupted Time Series (AITS) and Difference in Differences (DID), evolved over a period of almost 50 years from initial methods of test control area comparison to various forms of multiple and hedonic regression techniques.

Application of Impaction Methodology to the Present Study. Impaction methodology is useful for addressing this dissertation's research questions concerning neighborhood selection of subsidized households (level of and trend in outcome indicator) and its potential impact on those outcome indicators. It would be ideal to estimate selected neighborhood's outcome indicator change trajectory (trend) before, at the time of initial entry, and after established residency of subsidized households at the micro-level as done in Galster, Tatian, and Smith (1999) and other studies (Ellen, 2007; Lee, 2008). However, due to census and subsidized housing administrative data limitations and covering multiple metropolitan areas, it is not possible to study household level changes over an extensive time period. In addition, this study will not break down geographic scale to the micro-neighborhood level (Lyons & Loveridge, 1993), but will follow the approach of Galster, Cutsinger, and Malega's (2008) exploratory study on multiple metropolitan areas using census data and census tract-defined neighborhoods. However, unlike Galster, Cutsinger, and Malega (2008), this study will examine each metropolitan area and will control for metropolitan-level factors by creating neighborhood quintiles based on selected outcome indicators (i.e. income, rent, home values) for each metropolitan region.

This study will not estimate the impact of subsidized housing on property values, but rather on the likelihood of a neighborhood changing on an outcome indicator given the presence of subsidized households. This provides a better overall indication of the level and trends in a neighborhood's outcome indicator as well as a clearer picture as to the extent that subsidized households are contributing to neighborhood change while identifying other important change indicators. This also provides an indication of the types of neighborhoods that subsidized households are selecting, as measured by the neighborhood outcome indicator level in 1990 and trends in change from 1990 to 2000. While the reasons subsidized households are selecting certain neighborhoods are not determined, anticipated reasons will be discussed in the conclusions section (selection may be based on limitations of housing options, discrimination, preferences, etc.). What the present study will do is examine the neighborhood type and change trends of neighborhoods in which subsidized housing (with an emphasis on Picture of Subsidized Households programs) is located while defining this change within a neighborhood change theoretical framework. The next two sections will lay out the research questions and frame research hypotheses within Filtering, Life Cycle, Succession, and Tipping neighborhood change theories.

Research Questions

> Research Question 1: Are subsidized households selecting neighborhoods that are declining in conditions/quality (as measured by change in metropolitan relative median home values, median gross rents, and median household income)? In the first research question, neighborhood change may be occurring as a result of aging housing stock (Life Cycle) and/or reduced housing services of the existing housing stock (Filtering). That is, more housing that is affordable to low-income households is available as a neighborhood's housing stock ages or services provided by the housing stock are not able to meet its current residents' needs (declining housing values). This research question addresses the impaction concern (i.e. Galster, Tatain, & Smith, 1999) of the types of neighborhoods that subsidized mobile households are selecting.

> Research Question 2: Is the change in neighborhood conditions/quality (as measured by change in metropolitan relative median home values, median gross rents, and median household income) sensitive to the presence of subsidized households and percentage of the neighborhood that is low-income? In the second research question neighborhood change occurs as a result of an excess of the number of low-income in-movers over the number of higher-income out-movers (low-income households are replacing out-movers at a higher rate) (Succession and Tipping).

Assisted Housing Policy Implications: Neighborhood Selection and Neighborhood Change

Galster, Cutsinger, and Malega (2008) speak to the accessibility of opportunity to higher quality neighborhoods and related amenities that foster upward economic and social mobility. "In the absence of subsidies, the only way a poor household can move into a neighborhood is if the rents and property values have declined to the point that they are affordable (p. 115)." There are two concerns with low-income housing policies that encourage resident mobility as well as those that encourage affordable housing development in non-poor areas: residential location choice and neighborhood impact. Locational outcome refers to the types of neighborhoods assisted households are selecting as measured by their levels and trends on selected quality indicators. Neighborhood impact refers to the impact of assisted households and housing units on neighborhood quality. Theories of neighborhood change are frameworks through which to understand both neighborhood selection and neighborhood impact. Filtering and Life Cycle theories of neighborhood change offer insight into the underlying neighborhood change dynamics of neighborhoods selected by assisted households: how physically changing neighborhoods impact housing demand, public and private services, etc. Residential Succession and Tipping theories of neighborhood change provide an opportunity to examine the potential impact of subsidized households and housing units on their new neighborhoods: the impact of individual and aggregate residential location decisions on change in resident characteristics. Further discussion on these themes and hypotheses are developed as follows.

In the Filtering perspective, neighborhood change process is the "net out-migration of the households in the income range typically represented in the neighborhood in the previous period and the corresponding net in-migration of households with a somewhat lower income (Galster, et al, 2008, p. 103)." Out and in-migration is driven by changing housing stock quality, changing resident housing preferences, and alternative housing options. Filtering postulates the existence of housing quality submarkets within the larger metropolitan housing market based on housing quality, household income, and/or home value. These indicators determine the quality of the submarket available to low-income households. Assisted poor households (through tenant-based mobility programs, i.e. HCV or place-based programs in higher quality neighborhoods i.e. LIHTC) are capable of accessing higher-quality neighborhoods because the rent that households are capable of paying is supplemented by subsidies. In contrast, unsubsidized poor households are restricted to neighborhoods where there is housing that is affordable to them typically in neighborhoods that are Filtering downward and, for the most part, declining in rents and property values (Logan & Zhang, 2010). For purposes of this study, according to Filtering neighborhood change theory, subsidized households will most likely be located in declining neighborhoods because that is where affordable housing is located.

Hypothesis 1a: Subsidized households will more likely be located in neighborhoods that are filtering down (quintile decline) or that are decreasing in income or housing value neighborhood quintile. Note: impaction methodology refers to the level and trends of impact/change. That is, the level of change is estimated by a 2000 quintile outcome variable with a 1990 quintile predictor *variable. In addition, the trend of change is estimated by a quintile change category outcome variable with a 1990 quintile predictor variable.*

Hypothesis 1b: Subsidized households are more likely to be located in lower quintile neighborhoods than in higher quintile neighborhoods compared to general metropolitan trends.

In the Life Cycle perspective, neighborhood change refers to neighborhoods that may decline in housing value as services of the aging housing stock are not able to meet the needs of its current residents. Current residents obtain housing that provides the level of housing services they desire in alternative neighborhoods and new residents, typically lower income, move in as this housing stock becomes more affordable to them. Similar to housing quality Filtering, Life Cycle perspective hypothesizes that neighborhoods with aging housing stock will be more affordable to poor households with the poorest of households located in the most deteriorated neighborhoods. Subsidized households will be able to access neighborhoods in the early stages of its Life Cycle to the extent that their combined subsidy and tenant payments will cover rent prices. Unsubsidized poor households will be restricted to neighborhoods in the later stages of the Life Cycle, since this is where most affordable housing typically will be located.

Hypothesis 2: Housing stock age is an initial condition and aging and obsolescence are primary drivers in Filtering and Life Cycle perspectives. To the extent that aging of housing stock is related to obsolescence, housing stock age is one of the primary physical and quality indicators of neighborhood change that occurs in the neighborhood regardless of changes in resident characteristics, and regional and national macro-level changes (economy).[1],[2]

Full Model One Neighborhood Outcome versus Neighborhood Change and PSH HUD Indicators, where all independent variables are treated as predictor variables.

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[1] Variables for change in housing stock age, structure, and neighborhood characteristics are added to the base subsidized housing model to determine their contribution to change on neighborhood quality (quintile change of outcome indicators). Full model one estimates the relationship between neighborhood outcome and select neighborhood change and PSH reported HUD units. After creating a general model to be estimated for all metropolitan areas (for purposes of comparison), neighborhood change variables that have high tolerance levels (above 0.40) and have coefficients with high standard errors (above 2.0) are eliminated from the model.

[2] In addition, full model one will be stratified by two levels of PSH reported HUD units: census tracts with 0 to 8 units of PSH households and census tracts with 9 or more units of PSH households.

The combined housing subsidy and tenant payment may not be sufficient for subsidized mobility households to access neighborhoods in the first stage (unless there are local housing development incentives that require developers of higher income housing to set aside units to be leased at lower rates to lower income households). Subsidized mobility households may be one of the indicators that a neighborhood is shifting to the next lower stage in its Life Cycle (or possibly higher stage if a community is revitalizing—however this study does not focus on revitalizing communities) as its housing stock ages and becomes more affordable to subsidized households. Neighborhood change in the Life Cycle perspective for subsidized mobility households may occur to the extent that the presence and possible increase in subsidized households are part of the Life Cycle change process.

As noted previously, while Filtering and Life Cycle perspectives offer insight into the underlying neighborhood change dynamics of neighborhoods selected by assisted households, Succession and Tipping perspectives provide an opportunity to examine the extent to which subsidized households and housing units may be impacting their neighborhoods. Succession and Tipping perspectives postulate neighborhood change resulting from change in residents. In Succession and Tipping perspectives, neighborhood change is typically associated with racial change. However, this could apply to economic status and the housing market, especially if the majority of the poor households are minorities. Poor household entry into a higher quality neighborhood may be possible due to the beginning of rent or housing value decline, increased economic ability, housing subsidization of these households to afford higher rents, or developer set aside incentives. This may result in a decline in demand from higher income households as the number of subsidized households increase. In turn, the original (higher income) residents may move because of preference to live in neighborhoods containing households with higher socioeconomic status (to the extent that household income is related to social status) (Guest, 1974). In addition, subsidized households may act as a “buffer” (Logan & Zhang, 2010) which enables subsequent entry of more subsidized households and ultimately unsubsidized poor households as postulated by the Invasion and Succession framework (Freeman & Botein, 2002). However, the key concern here is that succession or change in resident characteristics is associated with a weakening housing market (Logan & Zhang, 2010). Tipping refers to the level of new households in the neighborhood at which original residents leave and to the rate at which original residents leave. Subsidized households using tenant-based mobility subsidies may impact change in socioeconomic status to the extent that they are concentrated (Galster, Tatian, & Smith, 1999) or to the extent to which they are perceived as being different from the original residents (Freeman & Botein, 2003).

Hypothesis 3a: Neighborhoods with high levels of assisted households and total low-income households will experience greater neighborhood change compared *to neighborhoods with low levels of assisted households and total low-income households.*[3]

Hypothesis 3b: The rate of neighborhood change will be greater with higher levels of subsidized households compared to the rate of change at lower levels of subsidized households (estimating the contribution of subsidized housing on the neighborhood outcome indicator). Tipping postulates a non-linear relationship between presence and change in subsidized households over study period and the neighborhood outcome indicator.[4]

Research Design

A case study of 16 US metropolitan areas will be used to test the hypotheses. The sampling frame consists of metropolitan areas that have a 1990 population size of at least 500,000 and is within the contiguous 48 states (N = 88). The sampling procedures used to select metropolitan areas for study involved creating a 3X3X3 matrix based on population size, population growth, and metropolitan wealth. A) Population size categories: 1 = 500k to 999,999. 2 = 1m to 3,999,999. 3 = > 4m. B) Rate of population change from 1990 to 2000. Each metropolitan area was assigned one of six categories: Population loss = negative population change (N = 6); Stagnated to slow population growth = 0.0% to 10.0% (N = 29); Slow to moderate population growth = 10.01% to 20.0% (N = 29); Moderate to medium paced population growth = 20.01% to 30.0% (N = 15); Medium paced to fast population growth = 30.01% to 40.0% (N = 6); Population explosion = greater than 40.01% (N = 3). C) Indicator of metropolitan wealth that was used is median household income. Each metropolitan area was classified into Low, Moderate, and High level of wealth categories. Other factors considered in selecting a sample included central city/suburban income differences and location of metropolitan area in the country. D) Central City/Suburban Income Differences by calculating the ratio of city/suburban median household differences versus outside central city household median income. Categories were Strong CC; CC/SUB little difference; CC/SUB difference moderate; CC/SUB difference strong; CC/SUB difference very strong; CC/SUB difference extreme; CC/SUB difference

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[3] Full model two estimates the relationship between neighborhood outcome and PSH reported HUD units. The general model that is estimated for all metropolitan areas (for the purpose of comparison) is used with only variables that have high tolerance levels (above 0.40) are eliminated from the model. The results are only interpreted for PSH reported HUD unit impact on the likelihood of neighborhood outcome.

[4] Full model two is stratified by poverty level. Two levels of high poverty neighborhoods are tested: census tracts with 1990 poverty rates less than 30 percent.

off the charts; and No Central City in metro area. E) Census region (4) and division (9) location.

Sample summary: The metropolitan areas selected (N = 16) represent a large amount of diversity across all the parameters of population size, growth rate, city and suburban household income differences, median household income, and division/regional location. Metropolitan areas selected are presented in Table 3-1.

Table 3-1 Sample Metropolitan Areas Summarized by Selection Criteria

Metropolitan Region	Population Size: 1990	Population Growth 1990-2000	Metropolitan Wealth 1990: Median Household Income	Central City/ Suburban Wealth Differences	State	National Division	Regional Division
Atlanta MSA	Moderate	Fast	Moderate	Extreme	GA	3	5
Austin-San Marcos MSA	Small	Explosion	Low	Strong	TX	3	7
Chicago PMSA	Large	Moderate	Moderate	Very Strong	IL	2	3
Dayton-Springfield MSA	Small	Loss	Moderate	Very Strong	OH	2	3
Denver PMSA	Moderate	Fast	Moderate	Very Strong	CO	4	8
Detroit PMSA	Large	Stable/Slow	Moderate	Extreme	MI	2	3
Houston PMSA	Large	Medium	Moderate	Very Strong	TX	3	7
Jacksonville MSA	Small	Medium	Low	Moderate	FL	3	5
Memphis MSA	Moderate	Moderate	Low	Very Strong	TN-AR-MS	3-3-3	6-7-6
Miami PMSA	Moderate	Moderate	Low	Extreme	FL	3	5
Minneapolis MSA	Moderate	Moderate	Moderate	Very Strong	MN-WI	2-2	4-3
Philadelphia PMSA	Large	Stable/Slow	Moderate	Extreme	PA-NJ	1-1	2-2
Pittsburgh MSA	Moderate	Loss	Low	Strong	PA	1	2
Sacramento PMSA	Moderate	Medium	Moderate	Strong	CA	4	9
San Francisco PMSA	Moderate	Stable/Slow	High	Strong	CA	4	9
Oakland PMSA	Moderate	Moderate	High	Very Strong	CA	4	9
Washington PMSA	Large	Moderate	High	Very Strong	DC-MD-VA-WV	3-3-3-3	5-5-5-5

The time period for this study is 1990 to 2000. However, while neighborhood change occurs, it does so over a long period of time (Rosenthal, 2008). Many previous studies did not capture nor document long term change cycle of neighborhoods because they are usually for a shorter time period than necessary to identify how and the extent to which neighborhoods change. In the short run, neighborhoods tend to change but their change appears to be around a stable mean (Rosenthal, 2008). However, this study will focus on the time period from 1990 to 2000 primarily due to data limitations: HUD section 8 programs only existed since the 1970s and its true impact may not be discernible for a longer period of time. In addition, a longer period of time is not possible given the availability of Picture of Subsidized Housing data.

Data/Data Sources

The three sources of data are the Neighborhood Change Database (NCDB), Online Demographic Database, Long Form Release (accessed 4/7/2010; various dates in 7/2010) and American Factfinder for census data and Picture of Subsidized Households 2000 (PSH) for subsidized housing administrative data. First, the NCDB builds on the Urban Institute's Under Class Data Base (UDB) created in 1989 by Isabel Sawhill and Erol Ricketts that initially contained data for 1980 and was expanded to include 1970 and 1990. The NCDB combines data from the UDB with 2000 census data. NCDB was developed by the Urban Institute and GeoLytics, Inc. (a private firm that specializes in the development of demographic and geographic data products). Data from 1970, 1980, and 1990 were remapped to 2000 census tract designations. The NCDB is provided in short form release and long form release. The short form provides data from variables from 1970, 1980, 1990, and 2000 Census short form survey and the long form provides data from the full set of variables from the Census long form survey. The long form release is from the 1990 Summary Tape Fine 3A (STF3A) and 2000 Summary File 3 (SF3) and Summary File 1 (SF1).

NCDB variables are categorized into three areas: geographic identifiers, population, and housing. Geographic identifier variables include state, county, tract, region/division, metropolitan area (MSA/CMSA/PMSA), central cities, and place spatial scale. Population variables include general population characteristics, age distribution, family structure/marriage, mobility and transportation, education, employment/labor market, income and earnings, and language ability. Housing variables include tenure/occupancy, characteristics/utilities, costs/affordability for owners, and costs/affordability for renters. This study uses variables from all three areas with an emphasis on geographic identifiers and housing variables.

NCDB census tract standardization (normalization). Census tract boundary changes are made every 10 years. For comparability across 1970 through 2000 decennial census, the NCDB provides census data for each decennial year based on the respective year's census tract definitions and for each decennial year based on 2000 census tract definitions. The standardization (or "normalization") process involved overlaying 2000 census tract map over the year, for example 1990, by using ArcGIS and estimating population weights to apply to variables for recalculation (Tatian, 2003). Tract changes can be identified with the tract change code variables (TCH90_00 for tract changes made between 1990 and 2000 decennial census) which provides a one digit number corresponding to the type of change made. Table 3-2 provides census tract changes for the study sample.

Table 3-2 Census Tract Changes for Study Sample Metropolitan Areas (Sample N = 11,010)

		Type of Census Tract Change from 1990 to 2000					
MSA/PMSA	Total Census Tracts	Not Designated	0) No change	1) 1 to 1 (rename)	2) Many to 1 (combined)	3) 1 to many (split)	4) Many to many
Total Sample	11,010	0	5,241	595	168	1,319	3,687
Atlanta MSA	647	0	247	8	3	186	203
Austin-San Marcos MSA	249	0	122	0	1	49	77
Chicago PMSA	1,753	0	1,325	4	6	138	280
Dayton-Springfield MSA	239	0	160	0	3	4	72
Denver PMSA	496	0	211	2	20	107	156
Detroit PMSA	1,242	0	782	1	17	126	316
Houston PMSA	749	0	1	388	20	127	213
Jacksonville, FL MSA	194	0	98	2	5	45	44
Memphis MSA	258	0	123	1	2	62	70
Miami MSA	332	0	0	143	1	79	109
Minneapolis MSA	731	0	268	2	5	88	368
Philadelphia PMSA	1,261	0	690	7	18	105	441
Pittsburgh MSA	689	0	225	2	31	6	425
Sacramento PMSA	343	0	135	0	1	66	141
San Francisco /Oakland PMSA	829	0	352	6	7	47	417
Washington DC PMSA	998	0	502	29	28	84	355

Source: Author's calculations of NCDB data for study sample.

Limitations of NCDB. The NCDB limitations are primarily of three types: Census Bureau-based limitations, NCDB development-based, and appropriateness of using NCDB for the current study. Since the NCDB is a reconfiguration of census data, it has the same sampling and non-sampling weaknesses and limitations as census survey data (Bennefield, 2003). Sampling errors includes undercounting households and differences between 100 percent survey and sample survey. Non-sampling errors can occur primarily during data collection and data processing. Errors during data collection include undercounting households or people, failing to obtain all required information from respondents and obtaining incorrect or inconsistent information from respondents. Errors during data processing include clerical handling errors by field interviewers and electronic processing of questionnaires. Non-sampling errors may affect the data by increasing variability and bias. The Census Bureau has taken steps to reduce sampling and non-sampling errors (Bennefield, 2003).

Three NCDB-development-based limitations are variable selection and possible incomparability of normalized census tract boundaries across time. First, the NCDB contains information on a select group of variables based on the authors' determination of variables that were most comparable across census years and were of strong interest to policymakers and communities (Tatian, 2003). A third NDCB development limitation is related to contemporaneous comparability. Census tract standardization is based on estimating population weights that are applied to all variables for areas that had census tract changes. While the weights may be appropriately estimated and applied to the data, metropolitan areas may have been redefined based on the inclusion or exclusion of counties. Metropolitan areas are defined based on the size of its core and the work flow between counties. The core and work flow trends may have change between decadal census periods thus it may make more sense to compare metropolitan areas and intra-metropolitan dynamics as they were defined for that period to more accurately reflect the metropolitan dynamics.

The final area of limitation to this study is the selection of census data to address the research questions. Census data is typically used to describe and analyze neighborhood change (Galster & Tatian, 2009). Most of the indicators of neighborhood change studies typically change at a slow pace (i.e. household income, social status, race/ethnicity) (Rosenthal, 2008). However, in attempting to estimate the impact of subsidized housing on neighborhood quality using census data at the census tract level is problematic. First, even though the original intention of defining census tracts was to group homogenous areas, using the current census tract to proxy for neighborhood is typically not a true representation of neighborhoods (Coulton, Chan, & Mikelbank, 2010) or housing submarkets (Grigsby, et al, 1987). Second, the census tract is considered too large to capture the micro-neighborhood impact of subsidized housing on neighborhood quality (Galster & Tatian, 2009). Third, decennial census data reveals little information about intervening years. This is problematic for variables such as home values in certain submarkets that change cyclically and/or rapidly (Galster & Tatian, 2009). Fourth, impaction studies that use census data for property values and rent prices have been wrought with problems such as ecological fallacy (census-based property values do not distinguish between subsidized and unsubsidized units) and artificially low rent values due to inclusion of subsidized household rents included in census rent values (Freeman & Botein, 2002).

Picture of Subsidized Households

Department of Housing and Urban Development (HUD) collects information on assisted housing participants in Public Housing, Housing Choice Voucher Program (HCV), Moderate Rehabilitation (Mod Rehab), Project-based Section 8—New Construction and Substantial Rehabilitation, Section 236, Below Market Interest Rate, Section 202 Supportive Housing for the Elderly, and Section 811 Supportive Housing for Persons with Disabilities (Taghvi, 2008). Public housing authorities (PHA) collect household information for participants in Public Housing, Housing Choice Voucher, multifamily housing, and Section 8 Moderate Rehabilitation programs through Form HUD-50058 Family Report for new, existing, and recent households. The PHA electronically submits data to the Public and Indian Housing (PIH) Information Center (PIC) that is maintained by HUD. The systems used for recording participant information from Form HUD-50058 are the Multifamily Tenant Characteristics System (MTCS) and Tenant Rental Certification System (TRACS). Data from MTCS, TRACS, and Census Bureau are used to develop the Picture of Subsidized Households (PSH) for rental units (Taghavi, 2008). The PSH provides information at various geographic scales except for the household level (to protect confidentially of program participants). PSH were created for the 1970s, 1996, 1997, 1998, 2000, and 2008.

For purposes of this dissertation, the number of units per census tract is needed. However, if a census tract contains less than 11 assisted housing units, household information is suppressed. To estimate the number of subsidized households in a census tract including those with less than 11 units, the number reported will be used (Taghavi, 2008). The number reported refers to the number of households (units) for which 50058 information was collected and represents about 92 percent of assisted households for which information is required.

Limitations of Picture of Subsidized Household Data. There are some limitations to using PSH that need to be noted. First, the PSH does not provide household level data unless special access is requested for and granted to use the underlying MCTS and TRACS data systems and data files. Since this study will use publicly available information, this study's research questions were modified to reflect availability of tract level information in the PSH. Second, PSH data file is generated on an ad hoc basis depending on the availability of resources at HUD. While HUD encourages researchers to evaluate program efficacy, inconsistent data reporting makes it extremely difficult to do so, especially prior to 1996. However, this concern was highlighted by the report of the National Research Council's Committee to Evaluate the Research Plan of the Department of Housing and Urban Development (National Research Council, 2008). As a result of its recommendations it is expected that more resources will be available to meet this need of the public and research community. Third, as noted by HUD, some of the data records do not provide sufficient information to determine census tract location with confidence (Taghavi, 2008). Thus for those units, no census tract is specified which results in each unidentified unit with its own census tract designation. However this amount does not appear to be large: the number of PSH 2000 units for which there were unidentified units appear to be in excess of an estimated 2,700 or 3.9 percent of all PSH units recorded (Taghavi, 2008). While all administrative and survey data, collection, and procession are subject to clerical error, HUD has attempted to enforce strict reporting and submission guidelines for the PHA through updating form HUD-50058 and information guide and providing online and in-person training. In addition the PIC cleans the data before its inclusion in microdata files.

The primary advantage of using PSH 2000 for this dissertation is its availability and inexpensive cost. PSH 2000 is available for online query and data downloading thus making it easy to access and inexpensive to use. Data can be downloaded into statistical software programs, Excel, and ArcGIS relatively easily. Second, the PSH 2000 provides household data at multiple geographic scales. Important for this dissertation, is data at the census tract level. Third, census tracts are based on 2000 definitions which match with the NCDB normalized 2000 census tracts which facilitates joining the data sources with the use of a common identifier. Fourth, while information on census tracts with less than 11 units is suppressed, using the number reported appears to be an adequate proxy (Taghavi, 2008). However, the percent of households lost using this process for estimating census tract composition cannot be calculated. Fifth, assisted household data from the PSH 2008 (released in early 2010) can be used to track census tract growth and decline of subsidized households after the study period date of 2000.

Dependent Variable Definitions for the Preliminary Analyses

Two primary variables are used in this study: median home value and median household income. First, median home value refers the middle value of the distribution of home values for a geographic unit, i.e. census tract (US Census Bureau, 2007). Median values are specified owner-occupied, single-family housing units on less than 10 acres, without a business or medical office on the property. Value is the homeowner's estimate of what the house and lot would sell for if it were on the market. Median home value data is available for 1990 and 2000 from STF3. As needed, median home value adjustments for 1990 to 2000 dollars are made with CPI-U-RS factor 1.277636 (Bennefield, 2003). Housing cost not used as an dependent variable, but is related to trends in median home values, is median gross rent. Median gross rent refers to the middle value of the distribution of gross rent for a geographic unit. Renter occupied units refers to units rented for cash payments plus those occupied by someone other than the owner without payment of cash for rent (Bonnette, 2003). Gross rent refers to the monthly amount of contract rent plus estimated average monthly cost of utilities and fuels. Contract rent includes payments made to the landlord by the tenant or by another entity on behalf of the tenant. Rentals contract for HCV participants are between the tenant, the PHA, and the landlord (Olsen, 2001). For each HCV household, the contract rent includes payments made by the PHA for the HCV household (US Census Bureau, 2007). Census data sources for gross rent can be obtained from STF1 for 1950 to 2000 gross rent comparisons and STF3 for all rent descriptive analysis. As needed, median rent adjustments for 1990 to 2000 dollars are made with CPI-U-RS factor 1.277636. Second, median household income refers to the middle income level of the range of household income values for a geographic unit (US Census Bureau, 2007). Median household income data is available for 1990 and 2000 from STF3. As needed, median household income adjustments for 1990 to 2000 dollars are made with CPI-U-RS factor 1.277636. In addition, median metropolitan area income and home values are available from the Census Bureau website's (American Factfinder) list of tables. The median metropolitan values are not the same as the median of the median census tract values (metro median values per census bureau website area different than the median of the median census tract values given in ArcGIS).

Preliminary Data Analyses

The purpose of preliminary data analysis is to investigate neighborhood change across outcome indicators using a transition matrix (Logan & Zhang, 2010) by creating an index of neighborhood quality assigned to each census tract for 1990 and 2000. Logan and Zhang study neighborhood racial transition according to methods of prior studies by creating transition matrix. They classify census tracts by percentage of race/ethnic composition into W, B, H, A various combinations of these categories. They create a transition matrix for the two decade period of 1980-2000. For every tract in 2000, the matrix reveals the category that the tract fell into 20 years before (1079).

The present study will create three matrices that compare 1990 quintiles to 2000 quintiles for median household income and median home values. To create neighborhood quintiles for each metropolitan area by census year for each outcome indicator, the simple following procedure is used: 1) Census tracts are sorted from low to high on an outcome variable. 2) Quintiles are formed at the 20th, 40th, 60th, and 80th percentile cut-off points on each outcome variable. 3) Each variable is assigned to 1st, 2nd, 3rd, 4th, and 5th quintiles (Ellen & O'Regan, 2008; Rosenthal, 2008). This method allows for standardization of quintiles for each variable and can be used comparatively between study years and within and between metropolitan areas. Since this is a relative measure, there is no need to convert 1990 dollar values into 2000 dollar values. Each outcome indicator variable for each metropolitan area is mapped out to determine the proportion of each MSA/PMSA that increased/decreased in quality from 1990 to 2000. 4) A neighborhood transition matrix for each variable for each metropolitan area is created using cross tabulation and analyzed. For the primary analysis, the level of decline or gain from 1990 to 2000, the number of census tract quintiles that a census tract experienced was calculated based on neighborhood quintile ranking in 1990 and in 2000. The number of neighborhood quintile changes that a census tract experienced is the outcome variables either measured by median household income or median home value. The distribution of neighborhood quintile change for median household income and median home value outcome variables are mapped for each metropolitan area and provided in Figures 3-1a through 3-16b. These maps show the distribution of how census tracts/neighborhoods changed from 1990 to 2000 by quintile change categories: census tract decreased -4 to -2 neighborhood quintiles from 1990 to 2000; census tract remained stable or experienced small neighborhood quintile loss or gain from 1990 to 2000; and census tracts increased 2 to 4 quintiles from 1990 to 2000. The relationship between the level of neighborhood quintile change and select predictor variables is tested for significance.

Primary Analyses

The purpose of this study is to build a testable model of the relationship between neighborhood change and subsidized housing using succession, Tipping, Life Cycle, and Filtering theoretical frameworks. Preliminary NCDB data cleaned, checked, and transformed in Excel and ArcGIS is used to eliminate census tracts not meeting inclusion requirements, map metropolitan areas, and create neighborhood outcome quintile variables that are exported to SPSS for further data cleaning, review, transformation, and statistical analysis. Since neighborhood quintile change variables are ordered categorical variables, cumulative ordered logit regression is the preferred model to estimate the relationship and its significance between housing, neighborhood, and subsidized indicator variables on the probability that a neighborhood experienced a large change from 1990 to 2000. However, for this data file, the ordinal regression model does not meet the assumption that the relationships between the predictor variables and the logits are the same for all the logits. If this assumption was met then the cumulative probabilities of the logits are parallel. Recommended alternative regression analyses are multinomial logit regression (Norusis, 2010) and ordered Generalized Linear Model (Liao, 1994). The disadvantage of using the multinomial logit is that it ignores the ordered nature of the logits. However, comparing neighborhood outcomes to a reference category is appealing because the reference provides a base from which to understand neighborhood decline or growth. Thus, this study uses the multinomial logit model with stable/small change as the reference category of the dependent variable. Models for two outcome variables (median household income and median home value) will be estimated.

Results of the logit models will be interpreted based on: 1) Significance of overall logit model (compared to the intercept only model). 2) Pseudo R^2 for explanatory power of the logit model. 3) Significance of individual parameters in the overall logit model (Chi-Square maximum likelihood tests). 4) Positive/negative sign on parameters. A discussion of the progressive development from a base model to a full model follows. In addition, model variable definitions are provided in the section immediately following the section on model specification.

Base Model

The base model establishes the fundamental condition and driver that impacts neighborhood change: initial level of a neighborhood of the outcome variable at time t (1990) and census tract population change from 1990 to 2000. The initial neighborhood quintile indicator N at time t (1990) is a census tract level metropolitan-relative classification of the census tract median value. Like the change in neighborhood quintile outcome indicator, N at time t+1 (2000) minus N at time t (1990), is an ordinal variable. Neighborhood quintile change will be grouped as follows: large decline, stable/small change, and large gain which are described in the model variable definitions section below. Population change (census tract population at time t+1 minus census tract population at time t relative to metropolitan population change at time t+1) is a continuous variable. The null hypothesis is that individual predictor variables (initial neighborhood quintile and relative population change) have no impact on the likelihood that a neighborhood will change and the sign on the subsidized housing indicator will not impact whether it contributes to the probability of the neighborhood increasing or decreasing in its quintile ranking/classification, holding the other predictor constant.

Base Model: Pr Δ quintile [median home value] = initial quintile (1990) + Census Tract Population Change (1990 to 2000). *[Pr (N t+1 – Nt) = N(t) +* Δ*POP]*

Subsidized Housing Base Model

The subsidized housing base model addresses all the hypotheses, but in particular it addresses hypothesis 1, test the likelihood that subsidized households will be located in neighborhoods that are filtering up (increasing in median household income and median home value) or are filtering down (decreasing in median household income or median home value). Specifically, the hypotheses investigate the relationship between the presence of subsidized households and the probability that a neighborhood gained, declined, or remained stable from 1990 to 2000 on the outcome variable. The subsidized housing base model consists of the base model plus an estimate of the number of subsidized households in a census tract. Subsidized housing indicator is a continuous variable that is based on the number reported for all PSH housing units (public housing units, HCV, Section 8 Moderate Rehabilitation, and multifamily housing units as of 12/2000) at time t+1 (2000). The number of reported units is less than the actual units (total reported represents approximately 92 percent of all units per Taghavi, 2008) and is a continuous variable. Since census data includes subsidized household rents in gross rent median values, only median values for specified owner-occupied housing units and median household income will be estimated for this model. The null hypothesis is that the presence and level of subsidized housing units has no impact on the likelihood that a neighborhood will change and that the sign on the subsidized housing indicator will not impact whether it contributes to the probability of the neighborhood increasing or decreasing in its quintile ranking/classification, holding all other predictors constant.

Subsidized housing base model: Pr ∆quintile [median home value or median household income] experienced large decline or large gain = initial quintile + population change + AllHUD PSH subsidized housing units. *Pr [(N t+1 – Nt) decline or gain] = N(t) + ∆POP + AllHUD(2000).*

Model 2

To test neighborhood indicators as postulated by Filtering and Life Cycle perspectives in hypothesis 2, housing and neighborhood variables will be added to the model. Specifically, this model tests that housing stock age and structure and neighborhood conditions have no impact on the probability that a census tract will change from 1990 to 2000. Similar to the subsidized housing base model, only median values for specified owner-occupied housing units and median household income will be estimated for this model because census data includes gross rents for subsidized housing units in the median gross rent variable. The null hypothesis is that the presence and level of individual variables have no impact on the likelihood that a neighborhood will change, holding all other predictors constant, and that the sign on the subsidized housing indicator will not impact whether it contributes to the probability of the neighborhood increasing or decreasing in its quintile ranking/classification compared to the reference category.

Model 2: Pr large decline or large increase in quintile ∆ [median household income or median home value] = initial quintile + population change + Number/proportion Subsidized Housing (t+1) + Housing Age (t) + ∆Structural Conditions + ∆ Neighborhood Characteristics. *Pr [(N t+1 – Nt) decline or gain] = N(t) + ∆POP + AllHUD(2000) + ∆Housing Stock AGE + ∆STRUCT + NEIGH (1990)*

To further examine different levels and rates of neighborhood change as postulated by Tipping theory, model two will be stratified by groupings of number of the number of AllHUD units by creating dummy variables for groupings of number of subsidized households, i.e. subsidized housing < = 8 HCV units, subsidized housing > = 8 HCV units.

Model Variable Definitions:

<u>Quintile (median home value or median household income) change</u>—median quintile change from 1990 to 2000. This is a crude estimate of housing submarkets solely based on home values and on household income. While home value quintiles are based on all census tracts within a metropolitan area, how an individual census tract relates to its metropolitan median home value cannot be estimated. The neighborhood quintile change categories are: large negative change = -4 to -2; small negative change = -1; no change = 0; small positive change = 1; and large positive change 2 to 4. Note: to account for possible regression to the mean, small negative and small positive change categories are considered no or minimal change and will not be analyzed further. This study is primarily interested in those census tracts with large positive or large negative changes.

<u>Initial quintile</u> is defined as median home value quintile in time t (1990) and median household income quintile in time t (1990). The appropriate indicator is distinguished by the estimated outcome indicator.

Note: Initial Neighborhood Predictor Variables. Including initial median household income and initial median home value neighborhood quintiles in the model resulted in quasi-complete separation in the sample when maximum likelihood was being estimated. This occurs when there is a violation of the requirement that there is no predictor variable capable of perfectly predicting the outcome variable (Allison, 1999; Menard, 2002 p. 80). Initial neighborhood indicators were considered perfect predictors on some cases thus causing incomplete maximum likelihood estimation (lack of convergence). This problem is found when models contain dummy predictor variables. Since perfect prediction of one variable prohibits analyzing the impact of other variables on the outcome variable, initial neighborhood quintile for both indicator variables were excluded from the median household income model and the median home value model. However, when the initial quintile variables are excluded from the model, the pseudo R^2 values decline significantly even though the models are significantly different than the intercept only model and some individual variables are significant in the resulting models. An alternative is to use the continuous variable form of the dummy variables that will include initial household income and initial median home values in the model. However, it will not permit direct interpretation of the relationship between initial neighborhood quintile and neighborhood quintile change experienced during the 1990s.

Thus, a proxy for initial neighborhood quintile in the hypotheses testing is a relative measure as follows: census tract median household income compared to metropolitan median household income and census tract median home values compared to metropolitan median home values.

Population change is the percent change in census tract population from 1990 to 2000.

Housing age categories: Categories are determined by change in the proportion of the total housing stock age built between 1990 and 2000; 1980 and 1989; 1970 and 1979; 1960 and 1969; 1950 and 1959; 1940 and 1949; and 1939 or earlier (Lee, 2005). Following Galster, Cutsinger, and Malega (2008), this study is interested in the change of the proportion of housing stock age at 1990 and at 2000 for the following categories: Change in the proportion of occupied/total housing units built 10 years ago or less; 11 to 20 years ago; 21 to 30 years ago; 31 to 40 years ago; 41 to 50 years; and more than 50 years ago. Since these variables measure the same factor (housing stock age) the sum will equal 1.00. Thus, the largest group (i.e. change in the proportion built 10 years ago or less) is determined and used in the general model.

Change in Housing Structure and Conditions: variables included in this category are 1) change in the proportion of total units based on type and number of units in the residential structure, 2) change in proportion of total units based on number of bedrooms, 3) change in the proportion of total units without complete kitchen facilities, and 4) change in the proportion of total units without complete plumbing facilities (Galster, Cutsinger, & Malega, 2008). However, initial analyses indicate that the variables measuring housing type/number of units and housing size based on the number of bedrooms are highly correlated with housing stock age and yield tolerance levels below 0.4 (0.4 tolerance level cut off is recommended by Allison and 0.2 is recommended by Liao).

Housing structure: refers to its number and type of units. For the number of units, the following Census Bureau categories (used by Galster, et al, 2008) housing structure categories are: Change in the proportion of occupied/total housing units that are 1 unit, attached; 1 unit, detached; 2 units; 3 or 4 units; 5 or more units; mobile homes; and other types of housing units. Since the number of total and occupied structure type and number of units sum to the total and occupied housing units, respectively, the largest group (i.e. 1 unit detached) is determined and selected for the general model.

Number of bedroom categories: Change in the proportion of occupied/total housing units with no bedrooms; with 1 bedroom; 2 bedrooms; 3 bedrooms; 4 bedrooms; and 5 or more bedrooms. The largest group (i.e. units with 3 bedrooms) is determined and selected for the general model.

Note to Housing Stock Variables. There are highly correlated relationships between and within groups of housing stock indicators that resulted in identifying and selecting one or two levels within the change in the proportion of housing stock age, change in the proportion of type, and change in the proportion of number of bedroom variables. For example, the 6 categories of age of the housing stock at the beginning of the study period (1990) and during the 1990 to 2000 time period are highly correlated. Individual regression analysis provides an indication that housing less than 10 years old adequately explains the variance observed in change in median home values even though its contribution is small (but significant) in an ordinal model of the relationship between home value change and housing stock age. This is surprising since the Life Cycle and Filtering models specify that housing stock age will drive neighborhood change. However, the strong relationship between new housing and the older housing indicates a complex relationship. For, example, the preliminary regression analysis indicates that the percent or rate of newer housing is related to decreases in the percent of a neighborhood that has older housing (especially that of housing older than 50 years).

<u>Kitchen and plumbing facilities</u>: Because of how the census and the NCDB present variables related to kitchen and plumbing facilities, clarification of these definitions is required. First, complete plumbing facilities for 1990 and 2000 census were recorded for occupied and vacant housing units. Complete plumbing facilities include 1) hot and cold piped water, 2) a flush toilet, and 3) a bathtub or shower located inside the house, apartment, or mobile home, but not necessarily in the same room (US Census Bureau, 2007). Housing units lacking in any one of the three facilities were identified as incomplete. Second, complete kitchen facilities for 1990 and 2000 census were recorded for occupied and vacant housing units. Complete kitchen facilities include 1) a sink with piped water, 2) a range, or cook top and oven, and 3) a refrigerator located inside the house, apartment, or mobile home, but not necessarily in the same room (US Census Bureau, 2007). Housing units lacking in any one of the three facilities were identified as incomplete. The number of 1990 lack of adequate kitchen units and 1990 lack of adequate plumbing units are used instead of proportion of total housing units that have inadequate kitchen or plumbing facilities. Number of units is used because the number of units classified as such is so small (range from 0.29% to 1.75% in 1990 DP-5 Table) that interpreting the model as a one unit increase appears to be more realistic than a one percent increase.

In contrast to Galster, Cutsinger, and Malega, this study does not define housing stock and housing structure and conditions as only those units that are owner-occupied versus renter occupied. First, this study’s focus on the Life Cycle and Filtering perspectives on neighborhood change necessitates using total housing units to study the housing stock. This approach is in line with Lee (2005) and Lucy and Phillips (2006) approach to defining census tracts as downtown, inner city, inner suburban, and outer suburban as determined by the predominant housing stock age of a census tract. In addition, the change in vacancy rate and initial year housing tenure variables assist in capturing the effect of these variables on neighborhood outcome variables. Second, this study does not stratify the models by tenure because, as discussed above, the median gross rent variable includes below market rents of subsidized households.

Change in neighborhood conditions—refers to a neighborhood's physical; social; economic characteristics: 1) change in race/ethnicity of residents (proportion of census tract that is White, Black, Asian, and Hispanic/Latino); 2) change in age of residents (proportion of census tract that are persons under 5 years of age; proportion of persons 65+ years); 3) change in family structure (proportion of families and subfamilies with own children that are female headed); Economic conditions (change in poverty rate—Galster, et al used change in county poverty rate as an instrumental variable for change in census tract poverty rate). The largest group (i.e. Share non-Hispanic/Latino White percent change) was selected for the general model.

Note to Neighborhood Characteristic Variables. Similar to groups of housing stock variables is same highly correlated relationship between proportion of the neighborhood that is White, Black, Asian, and Hispanic. In an individual regression analysis of proportion of a neighborhood that is White on proportion Black, Asian, and Hispanic indicates a negative relationship between each minority group and the proportion that is White. As expected, standardized beta coefficients indicate that proportion Black has the highest inverse impact on the change in the proportion that is White.

Locational variables: location of census tract in center city versus suburbs as identified by the NCDB geographic identifier variable PCMACC for 1999 (Ellen & O'Regan, 2008). PCMACC identifies the proportion of the census tract population that resides in metropolitan area central city in 1999. Most values are located at two extremes and this study defines a census tract as center city if PCMACC99 is more than 50 percent. However, due to multicolinearity, this variable was not used in the general model developed in Chapter 4.

Subsidized housing variables: Consists of assisted housing units as reported in the PSH that are part of Housing Choice Voucher, public housing, Section 8 Moderate Rehabilitation and multifamily housing programs. As noted in the PSH limitations section, PSH will not provide information for census tracts containing fewer than 11 assisted units (by program type). However, the "Number Reported" represents about 92 percent of all required reported units (Taghavi, 2008) is used as a proxy. This method can be used as done so by Taghavi (2008), but the exact number of units lost in the census tracts by metropolitan area cannot be calculated. The PSH 2000 data file is used since its census tract boundaries are consistent with the NCDB normalized boundaries (PSH 2000 is the first PSH with web based query and download tool, Taghavi, 2008). PSH HUD variable is the number of units per census tract instead of proportion of the census tract that contains PSH HUD assisted units. Following Rosenthal (2008), number of units is used because there are notable changes in the impact of concentration of subsidized housing on property values (i.e. Galster, et al 1999). Thus, number of PSH HUD units as provided by HUD is used for further analyses of the difference in neighborhood outcome and concentration of PSH HUD units.

Table 3-3 provides a summary and brief description of variables used in this study.

Table 3-3 Neighborhood Outcome and Indicator Variables

Variable Category	Short Name	Description	Year(s)
Outcome Variables	∆NQuintVal	∆Neighborhood median home value quintile 1990-2000	2000
	∆NQunitRen	∆Neighborhood median gross rent quintile 1990-2000	2000
	∆NQuitInc	∆Neighborhood median household income quintile 1990-2000	2000
Indicator Variables			
Initial Quintile	NQuintVal	Neighborhood median value quintile	1990
	NQunitRen	Neighborhood median gross rent quintile	1990
	NQuitInc	Neighborhood median household income quintile	1990
Central City versus Suburban Neighborhood	PCMACC99	Percent of metropolitan designated census tract that is located in central city in 1999	1999 (2000)
∆Population	∆POP	Census tract population change from 1990-2000	1990, 2000
Assisted Housing	HCVSUB	Number Housing Choice Voucher subsidized housing units	2000
	Other Assisted Housing	Number other assisted housing units, excluding HCV, reported in PSH (public housing, multifamily housing, Section 8 Moderate Rehabilitation units)	2000
	AllHUD	Total number subsidized housing units as recorded by PSH (All HUD = public housing, HCV, multifamily, Section 8 Moderate Rehab)	2000
Housing Age	BLTYRxxyN	Total housing units built xxxx to xxxx	1990, 2000
	BLTYRxxy	Proportion of the total housing units that contains housing built from year xxxx to xxx for	1990, 2000

Table 3-3 Neighborhood Outcome and Indicator Variables

Variable Category	Short Name	Description	Year(s)
		y year.	
	∆BLYRxxy	Change in the proportion of total housing units built during this time period	1990, 2000
Housing Structure	BDTOTxyN	Total housing structures that contain x number of bedrooms as of y time period.	1990, 2000
	BDTOTxy	Proportion of the total housing structures that contain x bedrooms as of y study year	1990, 2000
	∆BDTOTxy	Change in the proportion of total housing units with x number of bedrooms between 1990 and 2000	1990, 2000
	BDOCCxyN	Total occupied housing units that contain x number of bedrooms as of y time period	1990, 2000
	BDOCCxy	Proportion of the total occupied housing units that contain x bedrooms as of y study year	1990, 2000
	∆BDOCCxy	Change in the proportion of occupied housing units with x bedrooms from 1990 to 2000	1990, 2000
	TTUNITxyN	Total housing structures that contain x number of units as of y time study period	1990, 2000
	TTUNITxy	Proportion of the total housing structures that contain x number of units as of y study year	1990, 2000
	∆TTUNITxy	Change in the proportion of total housing units consisting of x units	1990, 2000
	OCUNITxyN	Total occupied housing structures that contain x number of units as of y time period	1990, 2000

Table 3-3 Neighborhood Outcome and Indicator Variables

Variable Category	Short Name	Description	Year(s)
	OCUNITxy	Proportion of the total occupied housing structures that contain x bedrooms as of y study year	1990, 2000
	∆OCUNITxy	Change in the proportion of occupied housing units consisting of x units from 1990 to 2000	1990, 2000
Total Housing Units	TOTHSUNy	Total housing units in census tract	1990, 2000
	∆KITNOy	Change in the proportion of occupied housing units without complete kitchen facilities	1990, 2000
	∆PLMBNOy	Change in the proportion of occupied housing units without all plumbing facilities	1990, 2000
Neighborhood			
∆Occupancy	∆OCCHUyc	Percent change in total occupied housing units from 1990 to 2000	1990, 2000
	∆VACHUyc	Percent change in total vacant housing units from 1990 to 2000	1990, 2000
Tenure	RNTOCCy	Proportion of occupied units that is renter occupied at x study year	1990, 2000
	∆RNTOCCy	Percent change in the proportion of total renter-occupied housing units	1990, 2000
	OWNOCCy	Proportion of occupied units that is owner occupied at x study year	1990, 2000
	∆OWNOCCy	Percent change in the proportion of owner-occupied housing units	1990, 2000
Race/Ethnicity	SHRNHWy	Proportion of census tract that is non-Hispanic/Latino White for x study year	1990, 2000
	∆SHRNHWy	Percent change in the proportion non	1990, 2000

Table 3-3 Neighborhood Outcome and Indicator Variables

Variable Category	Short Name	Description	Year(s)
		Hispanic/Latino White from 1990 to 2000	
	SHRNHBy	Proportion of census tract that is non-Hispanic/Latino Black for x study year	1990, 2000
	ΔSHRNHBy	Percent change in the proportion non Hispanic/Latino Black/African American population from 1990 to 2000	1990, 2000
	SHRNHAy	Proportion of census tract that is non-Hispanic/Latino Asian or Native Hawaiian and other Pacific Islander for x study year	1990, 2000
	ΔSHRNHAy	Percent change in the proportion non-Hispanic/Latino Asian or Native Hawaiian and other Pacific Islander population from 1990 to 2000	1990, 2000
	SHRHSPy	Proportion of census tract that is Hispanic/Lation for x study year	1990, 2000
	ΔSHRHSPy	Percent change in the proportion Hispanic/Latino from 1990 to 2000	1990, 2000
Economic	UNEMPRTy	Unemployment rate of census tract as of x study year	1990, 2000
	ΔUNEMPRTy	Change in the proportion of persons 16+ years old who are in the civilian labor force and unemployed from 1990 to 2000	1990, 2000
	POVRATy	Poverty rate of census tract for x study year	1990, 2000
	ΔPOVRATy	Change in the proportion of total persons below the	1990, 2000

Table 3-3 Neighborhood Outcome and Indicator Variables

Variable Category	Short Name	Description	Year(s)
		poverty level last year from 1990 to 2000	
Age	CHILDy	Proportion of persons who are children under 18 years old	1990, 2000
	KIDSy	Proportion of persons who are under 5 years old	1990, 2000
	OLDy	Proportion of persons who are 65+ years old	1990, 2000
Family structure	FHHy	Proportion of families and subfamilies that are female headed	1990, 2000

Elimination of Observations: Census Tract Eliminations

From the original 11,478 census tracts that were classified in the NCDB in the study sample, tracts were eliminated due to NCDB errors and study inclusion criteria. NCDB errors were due to non-existent census tracts in 6 areas (per email correspondence with GeoLytics in July, 2010). Following other studies, this study will include those census tracts meeting the following criteria:

1) Census tracts have at least 200 total people for both time periods (Galster, Cutsinger, & Malega, 2008; Lee & Wood, 1991 use 500 census tract population cut off and Ellen & O'Regan, 2008 use 200 census tract population cut off).
2) Group quarters (institutional and non-institutional) make up less than 50 percent (.50) of the total census tract population for either 1990 or 2000 (Ellen & O'Regan, 2008; Galster, Cutsinger, & Malega, 2008; Lee & Wood, 1991). The census does not consider residents in group quarters to have established households.
3) Census tracts with reported median household income (Ellen & O'Regan. 2008; Galster, Cutsinger, & Malega, 2008).

As a result of census tracts not meeting these criteria (N = 460), the final study sample will consist of 11,010 neighborhoods in the 16 metropolitan areas.

Picture of Subsidized Household Data

Households for which it is difficult to determine exact geographic location due to information collection errors, omissions, etc, the unit is reported in "Name of County—no census tract" category by HUD. Prior to eliminating tracts in the 11,470 census tracts sample, 22,665 units out of 636,272 All HUD Program reported units (all HUD programs consists of public housing, HCV, Section 8 Moderate Rehabilitation, and multifamily units) or 3.56 percent had no or unreliable census tract identifiers. In addition, 10,774 units out of 238,479 reported HCV units or 4.52 percent had no or unreliable census tract identifiers. HUD studies that utilize MTCS and TRACS combined with other data sources eliminate the units for which there are no census tract identifiers since the percentage is no more than six percent of the total units (per 8/3/2010 email correspondence with Lydia B. Taghavi, primary staff person responsible for the production of PSH at HUD Office of Policy Research and Development, Division of Program Monitoring and Evaluation).

Chapter 4 will provide descriptions of the general model used for all metropolitan areas and a summary of the overall results.

Atlanta, GA MSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

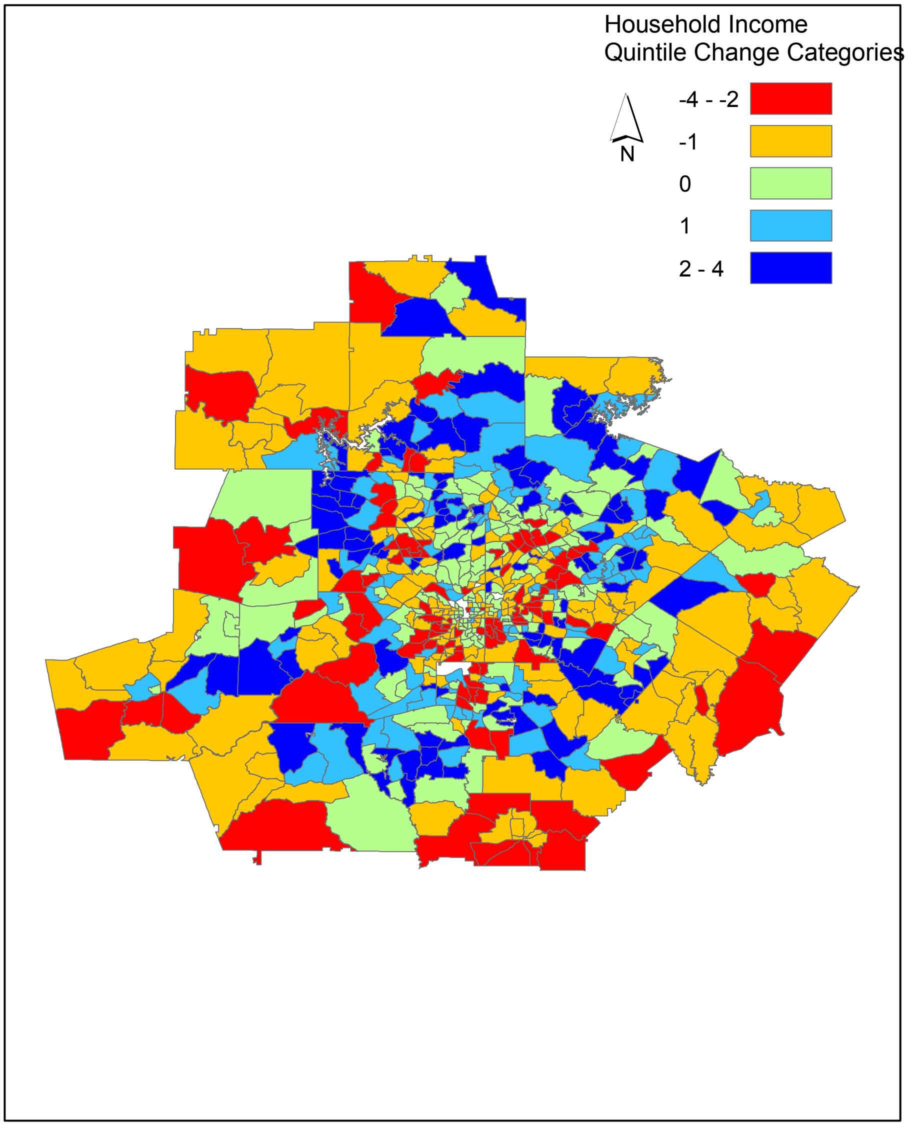

Figure 3-1a Atlanta GA, MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Atlanta, GA MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

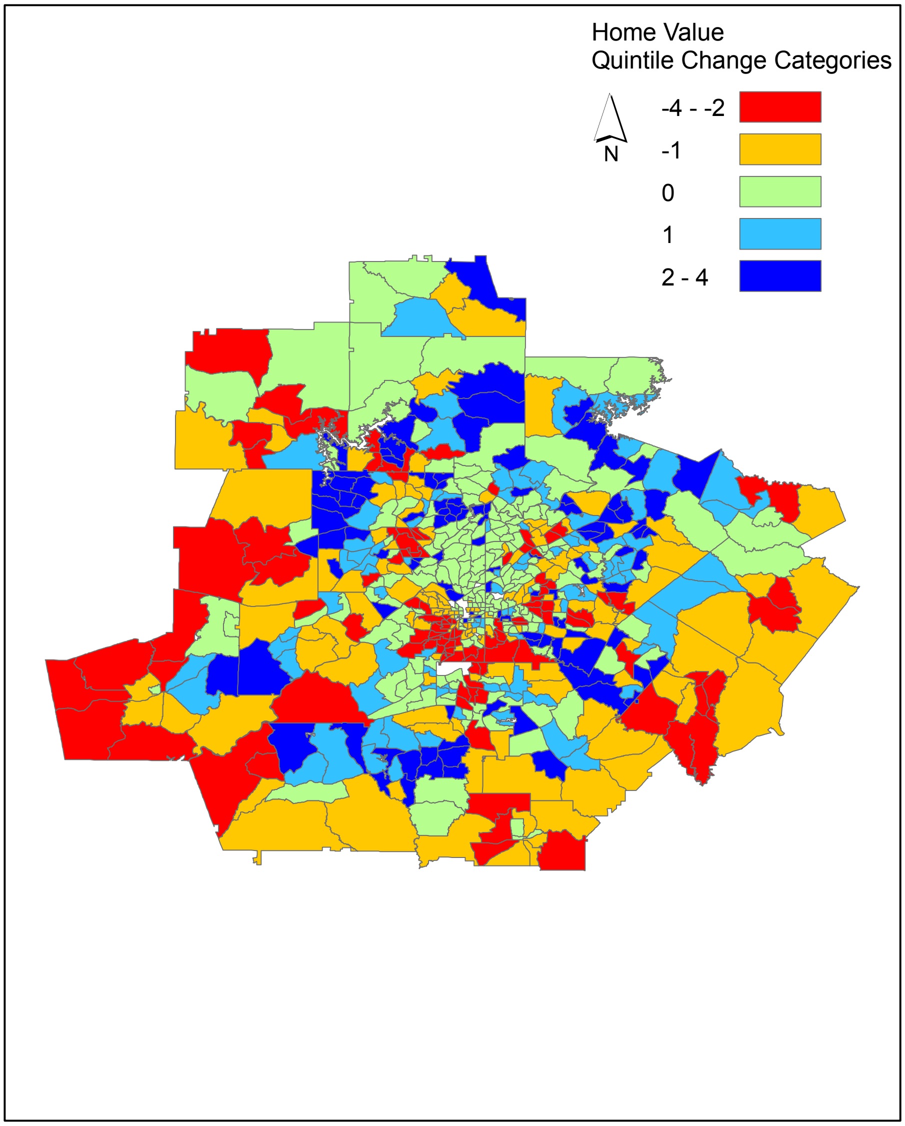

Figure 3-1b Atlanta GA, MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Austin-San Marcos, TX MSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

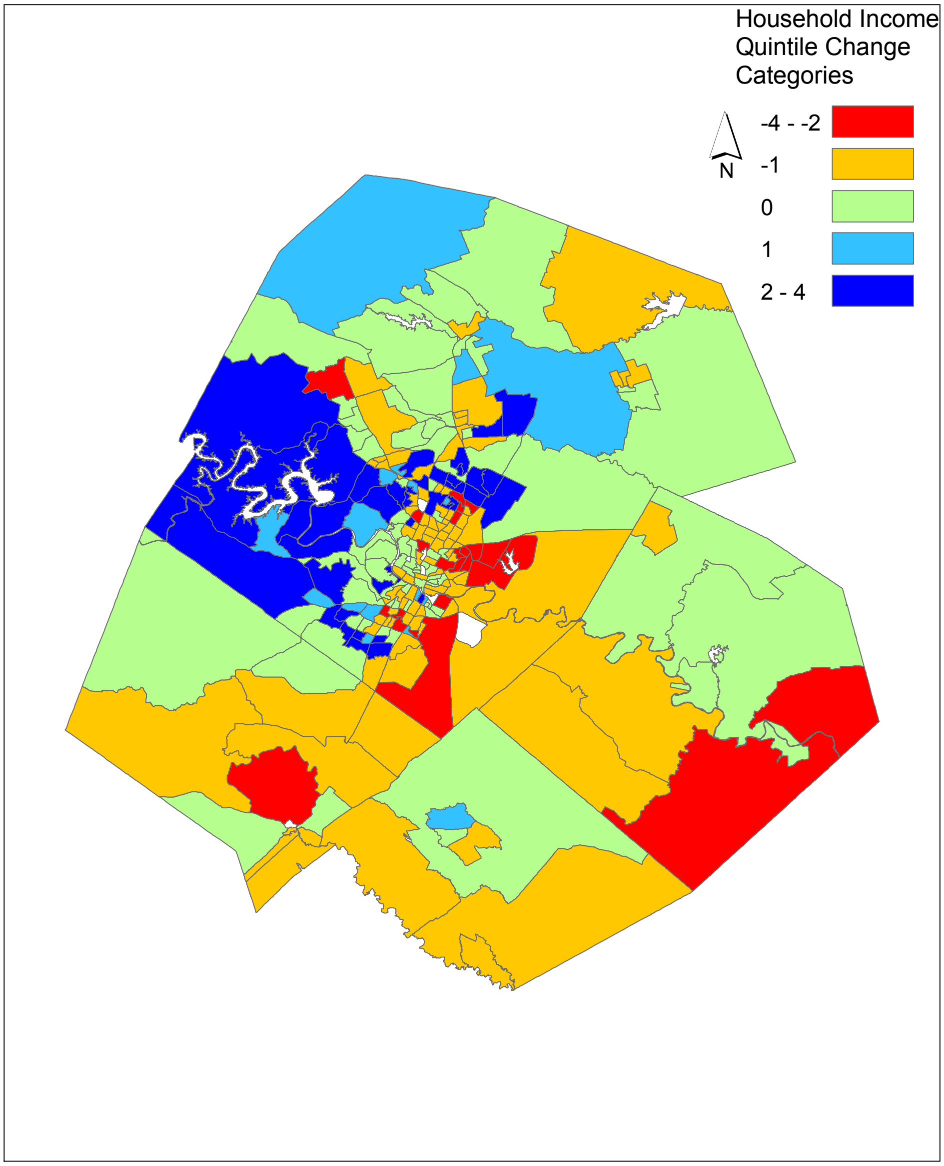

Figure 3-2a Austin-San Marcos, TX, MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Austin-San Marcos, TX MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

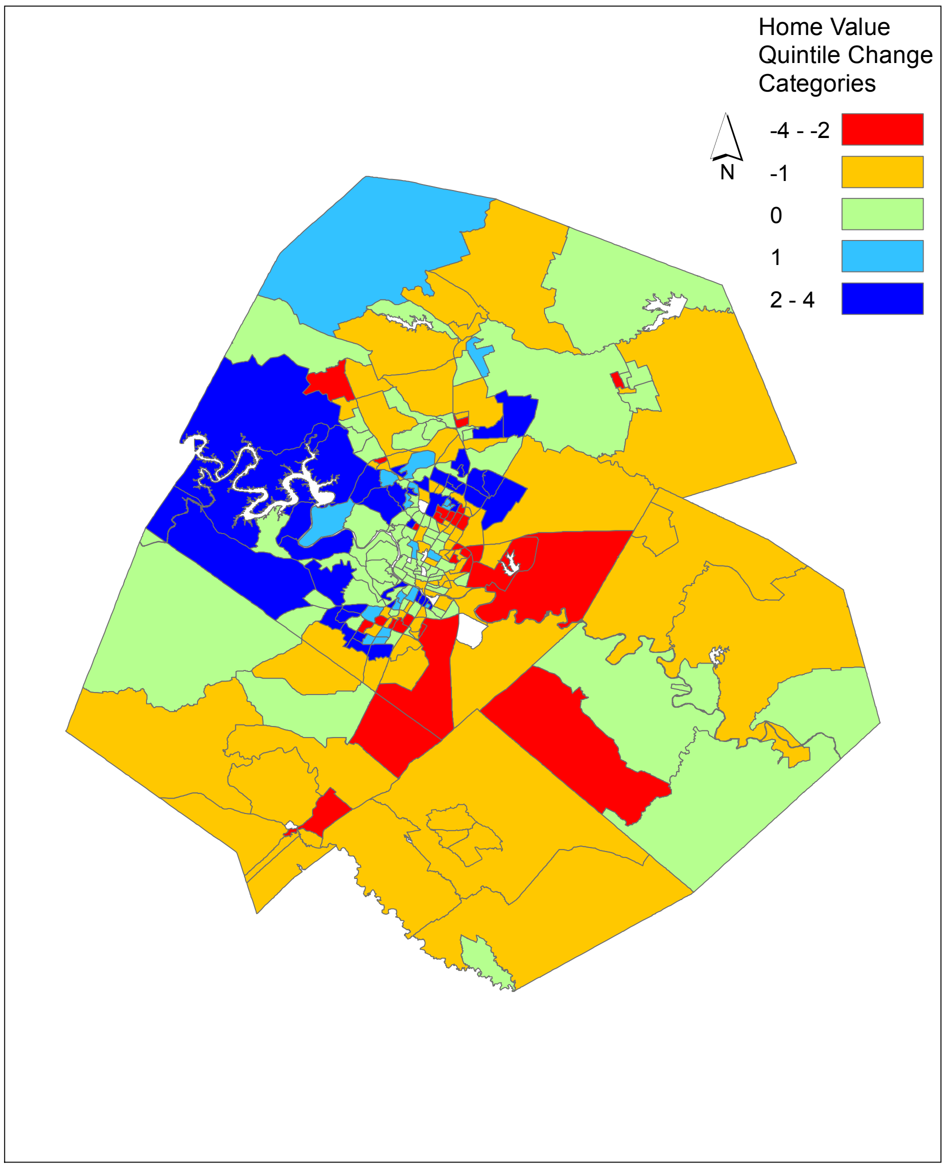

Figure 3-2b Austin-San Marcos, TX, MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Chicago, IL PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

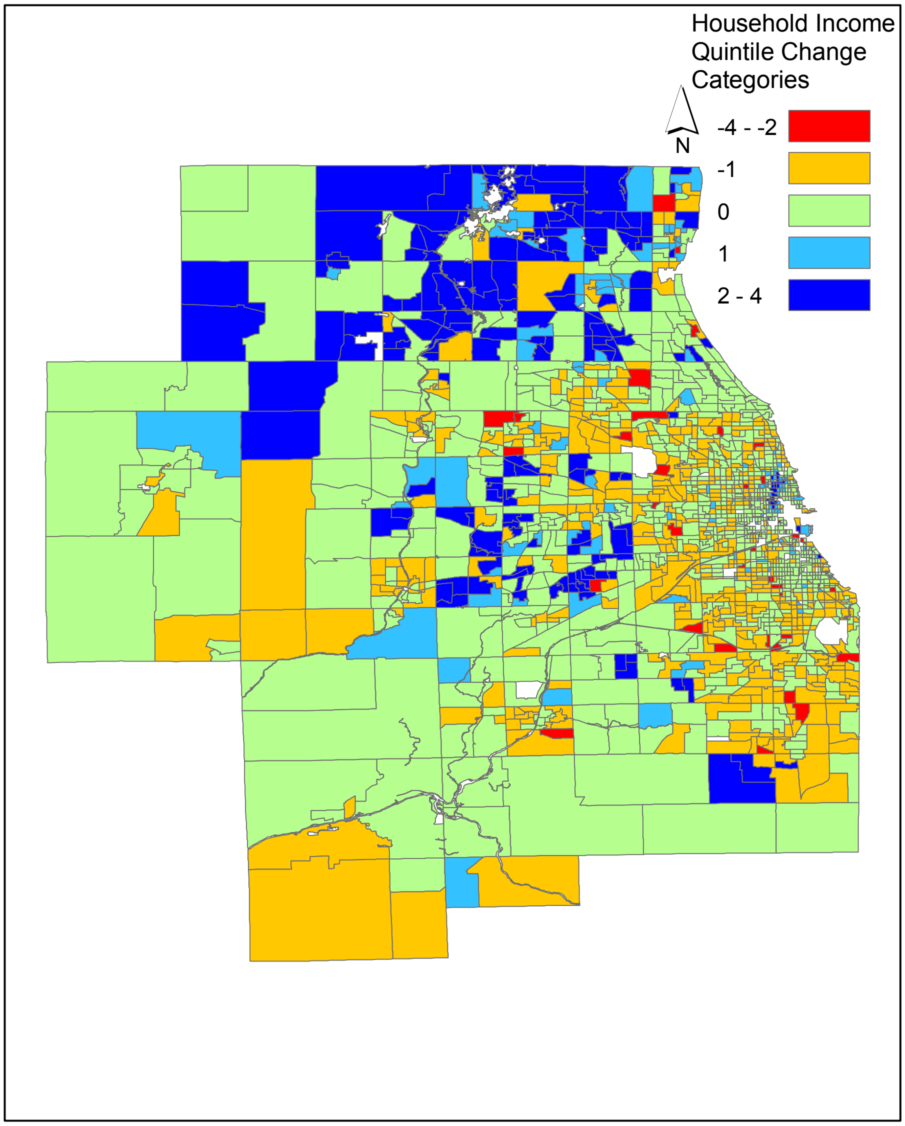

Figure 3-3a Chicago, IL, PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Chicago, IL PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

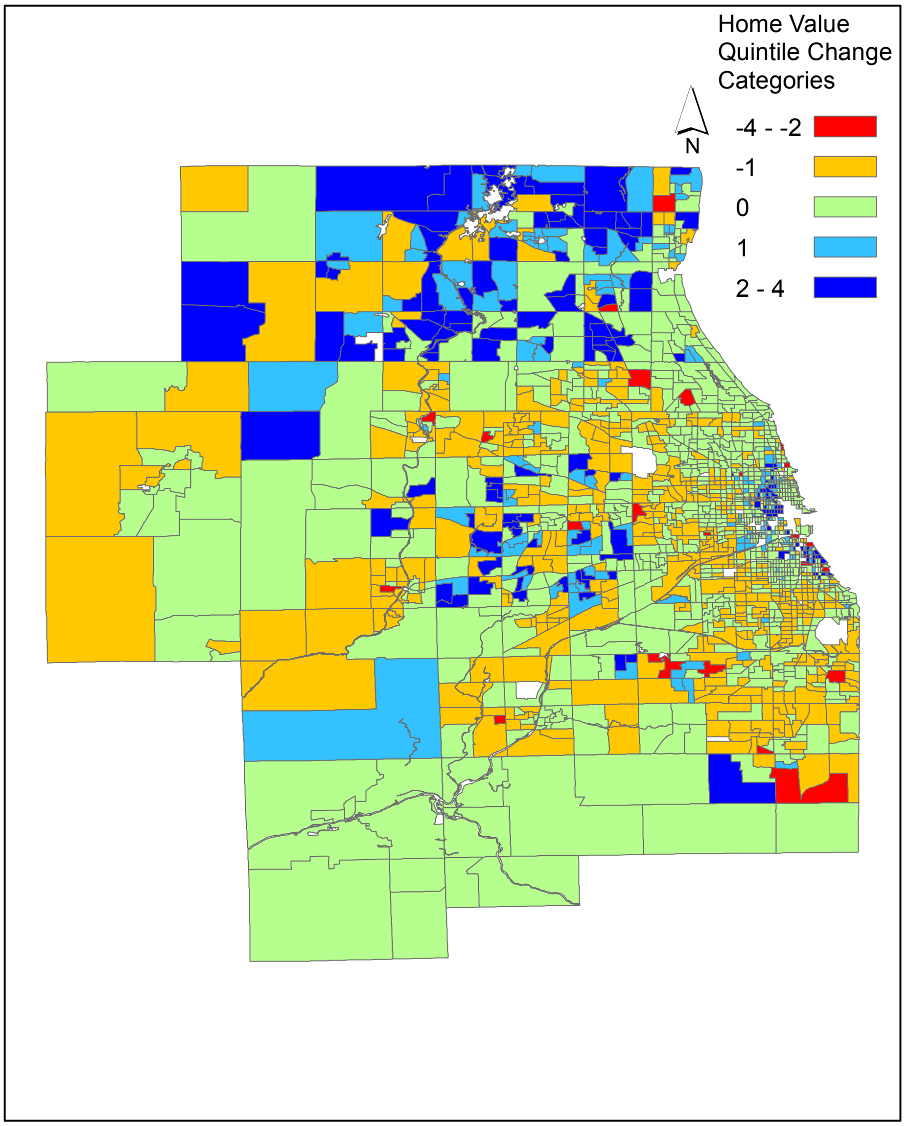

Figure 3-3b Chicago, IL, PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Dayton-Springfield, OH MSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

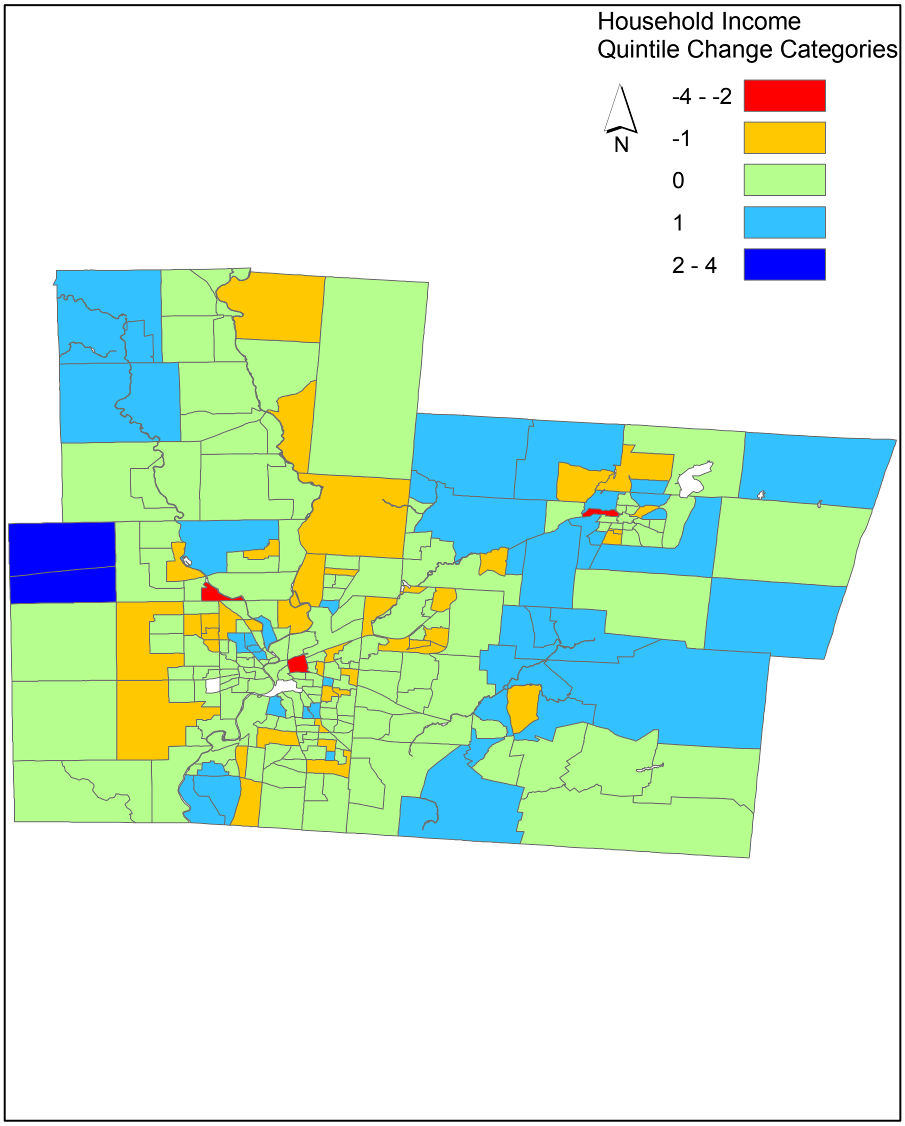

Figure 3-4a Dayton-Springfield, OH MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Dayton-Springfield, OH MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

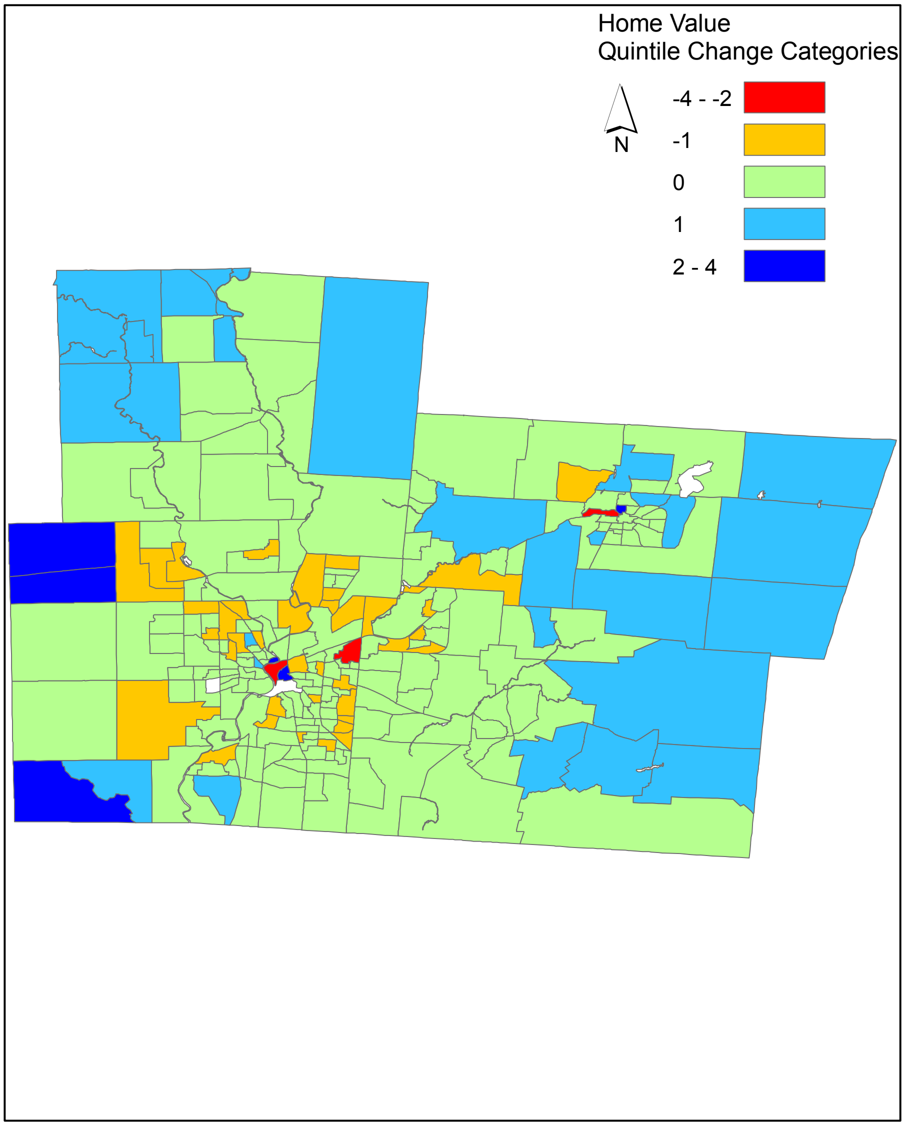

Figure 3-4b Dayton-Springfield, OH MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Denver, CO PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

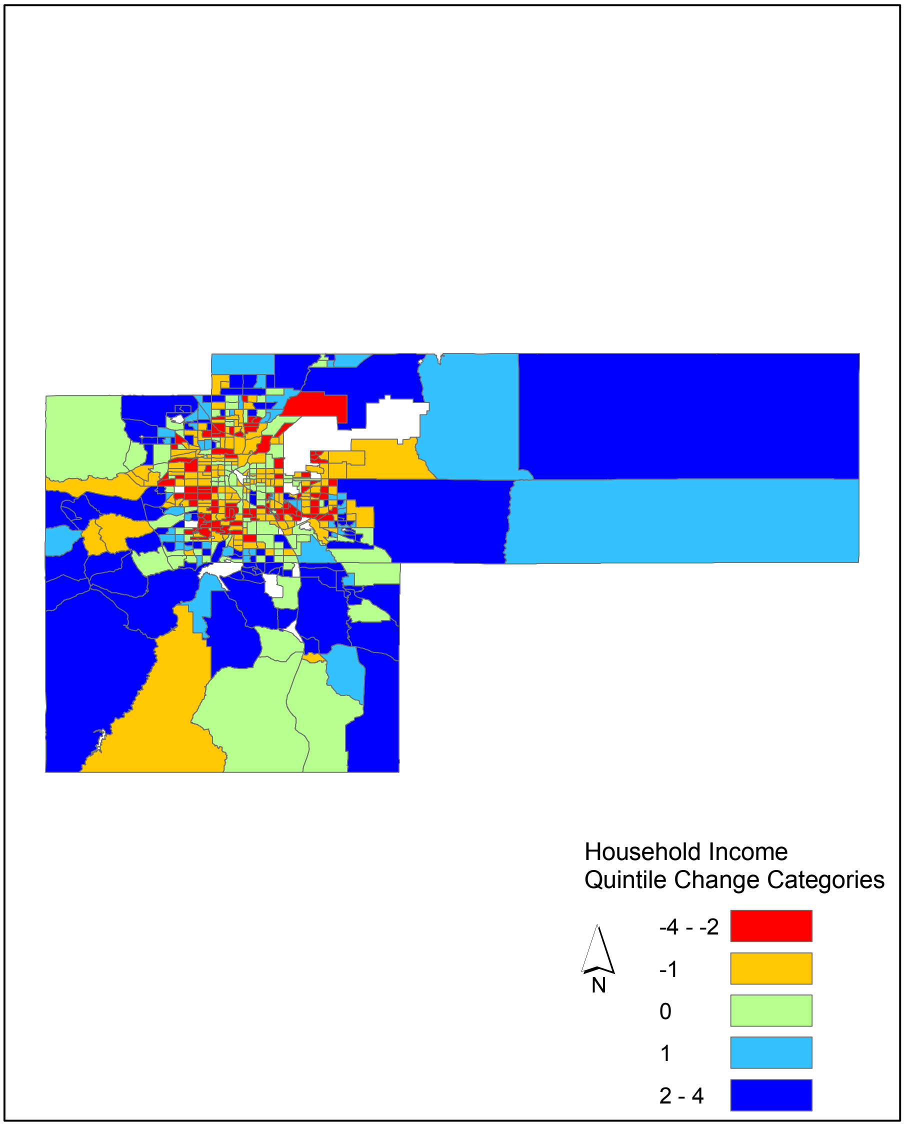

Figure 3-5a Denver, CO PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Denver, CO PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

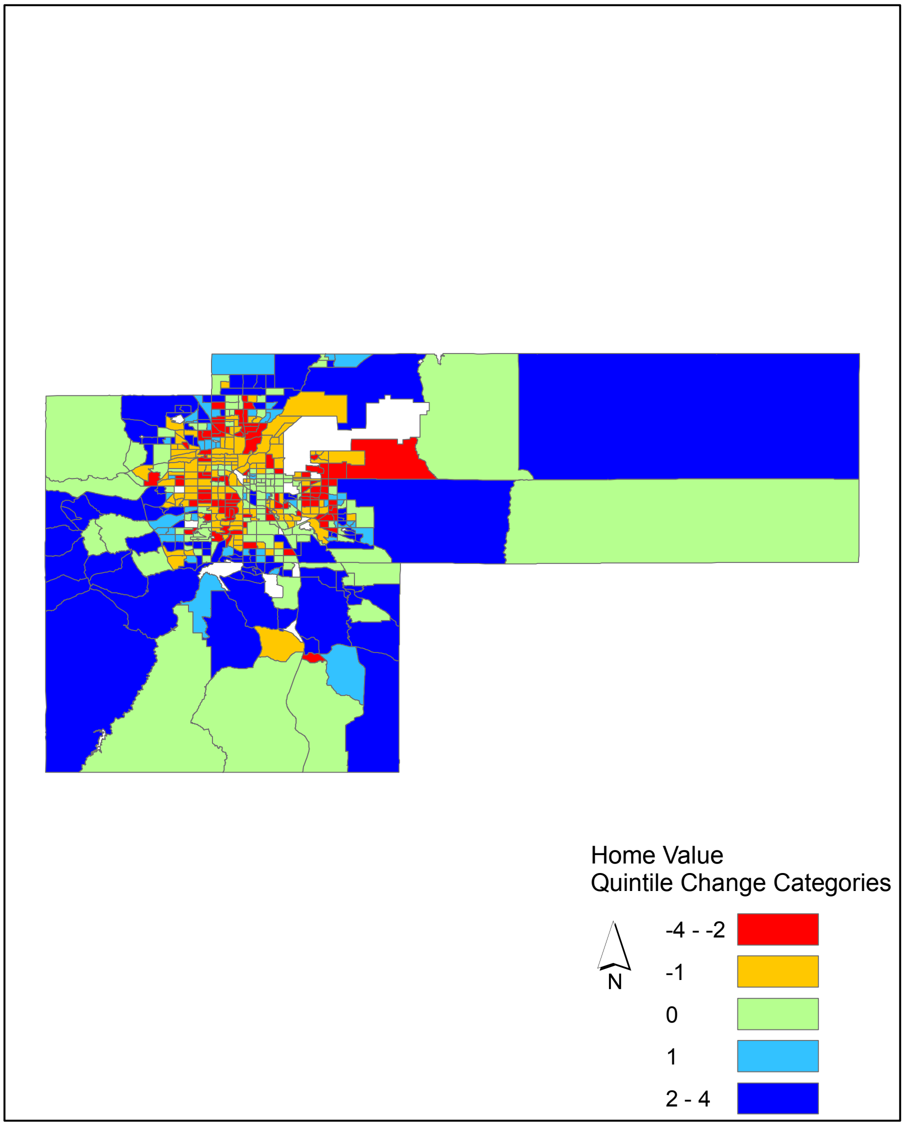

Figure 3-5b Denver, CO PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Detroit, MI PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

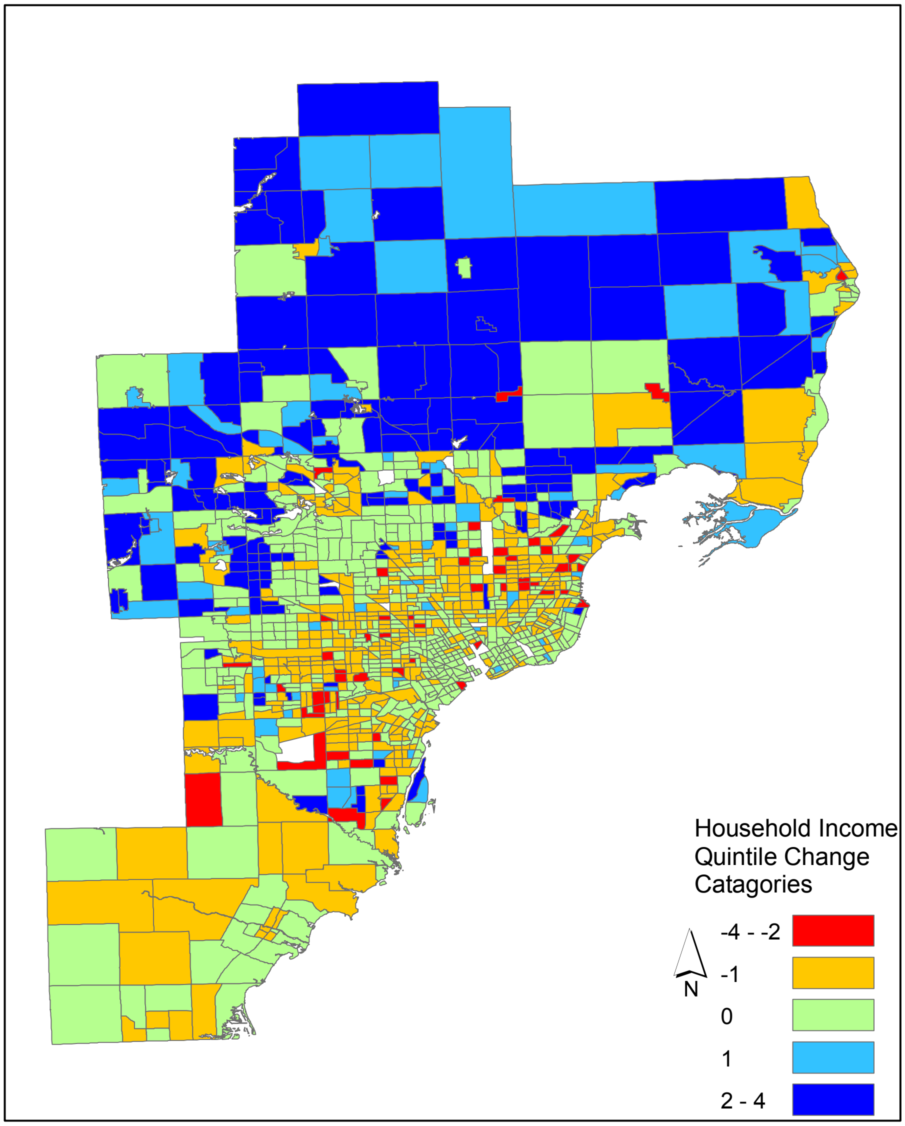

Figure 3-6a Detroit, MI PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Detroit, MI PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

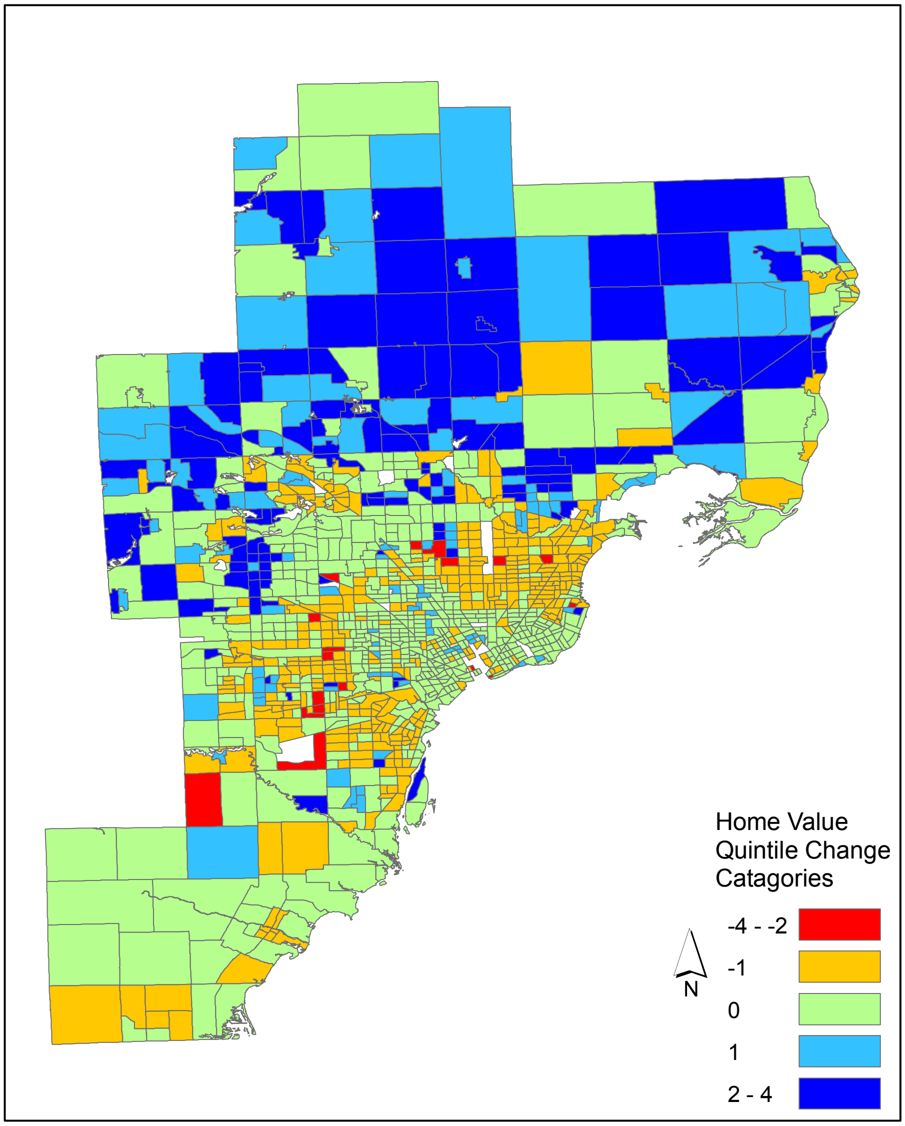

Figure 3-6b Detroit, MI PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Houston, TX PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

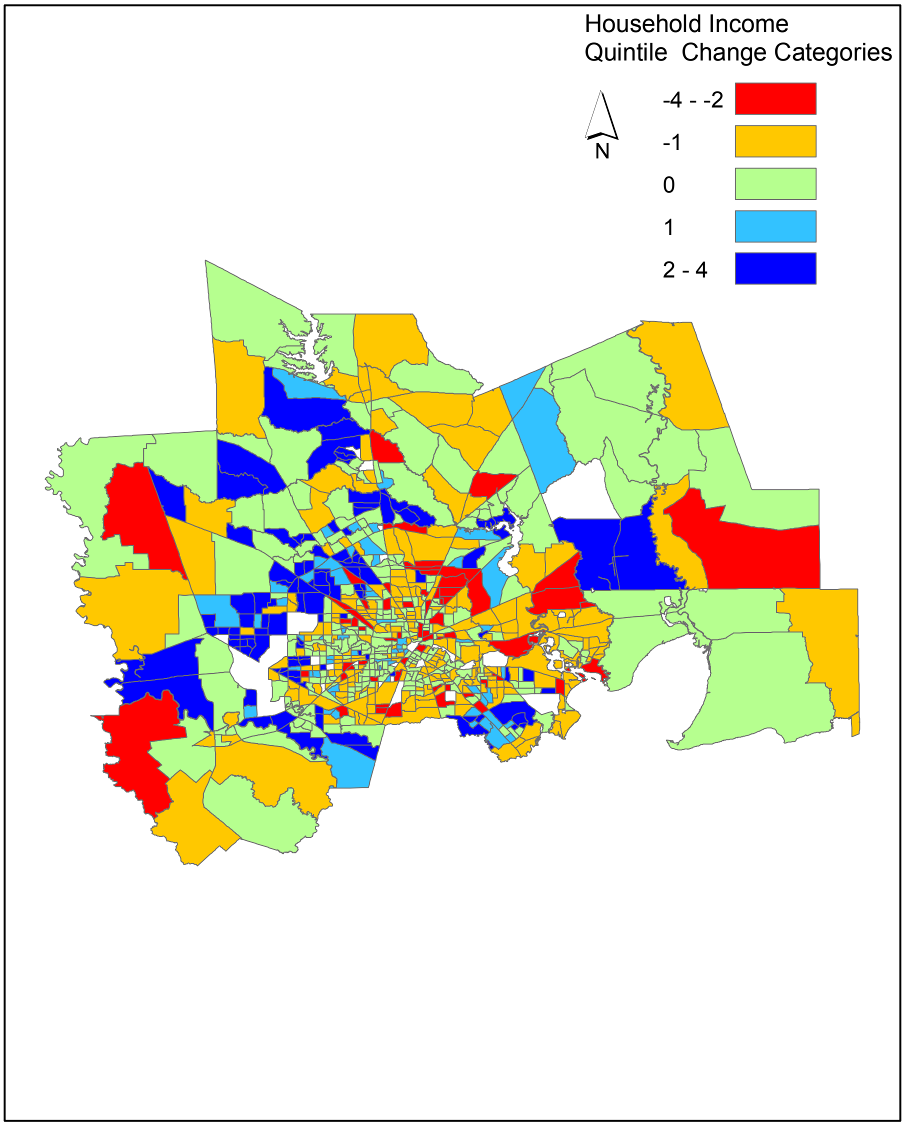

Figure 3-7a Houston, TX PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Houston, TX PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

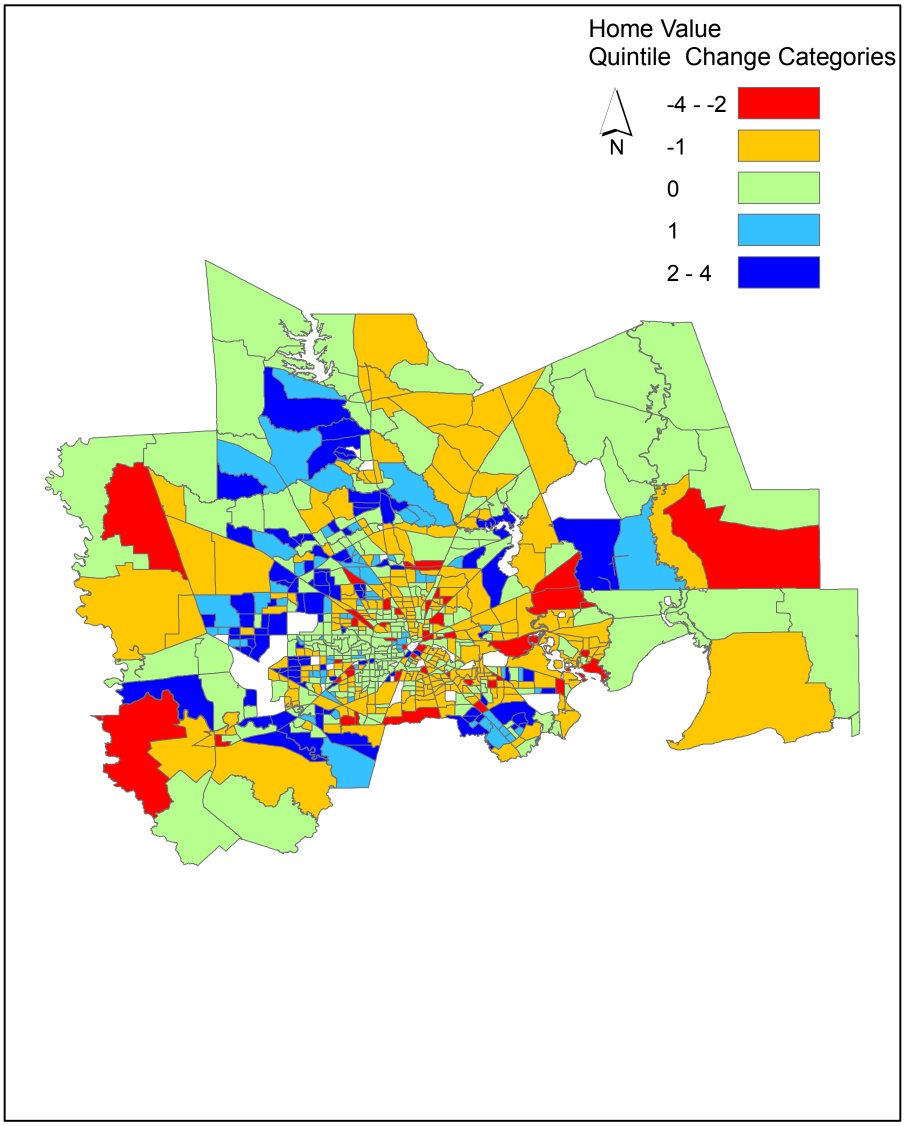

Figure 3-7b Houston, TX PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Jacksonville, FL MSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

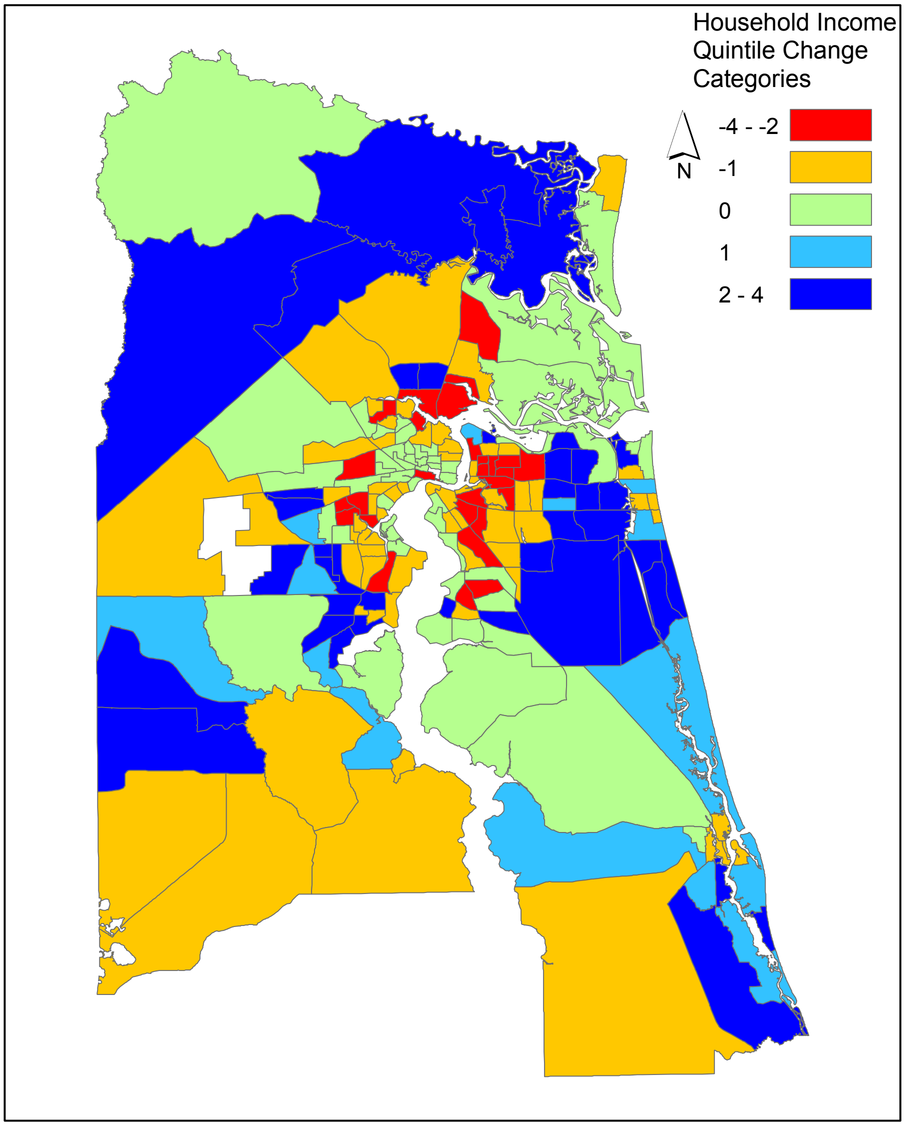

Figure 3-8a Jacksonville, FL MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Jacksonville, FL MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

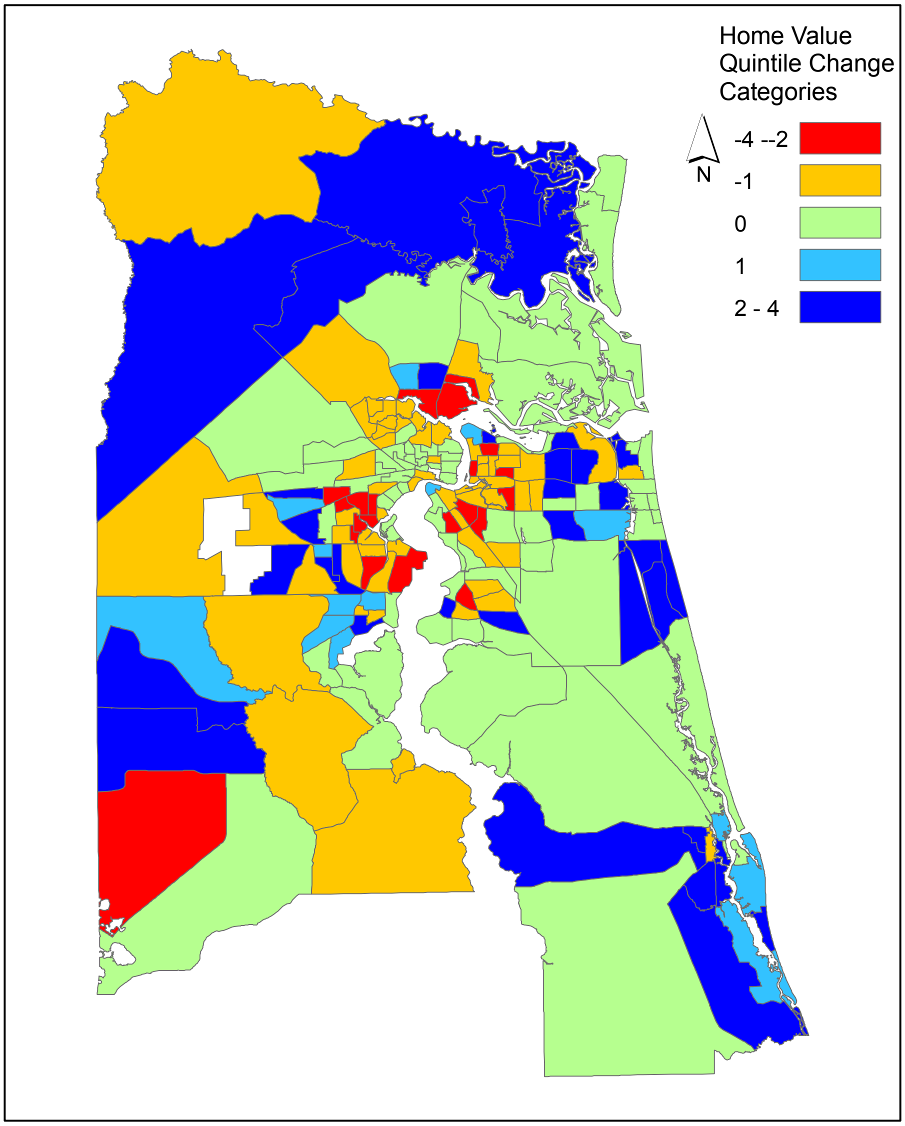

Figure 3-8b Jacksonville, FL MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

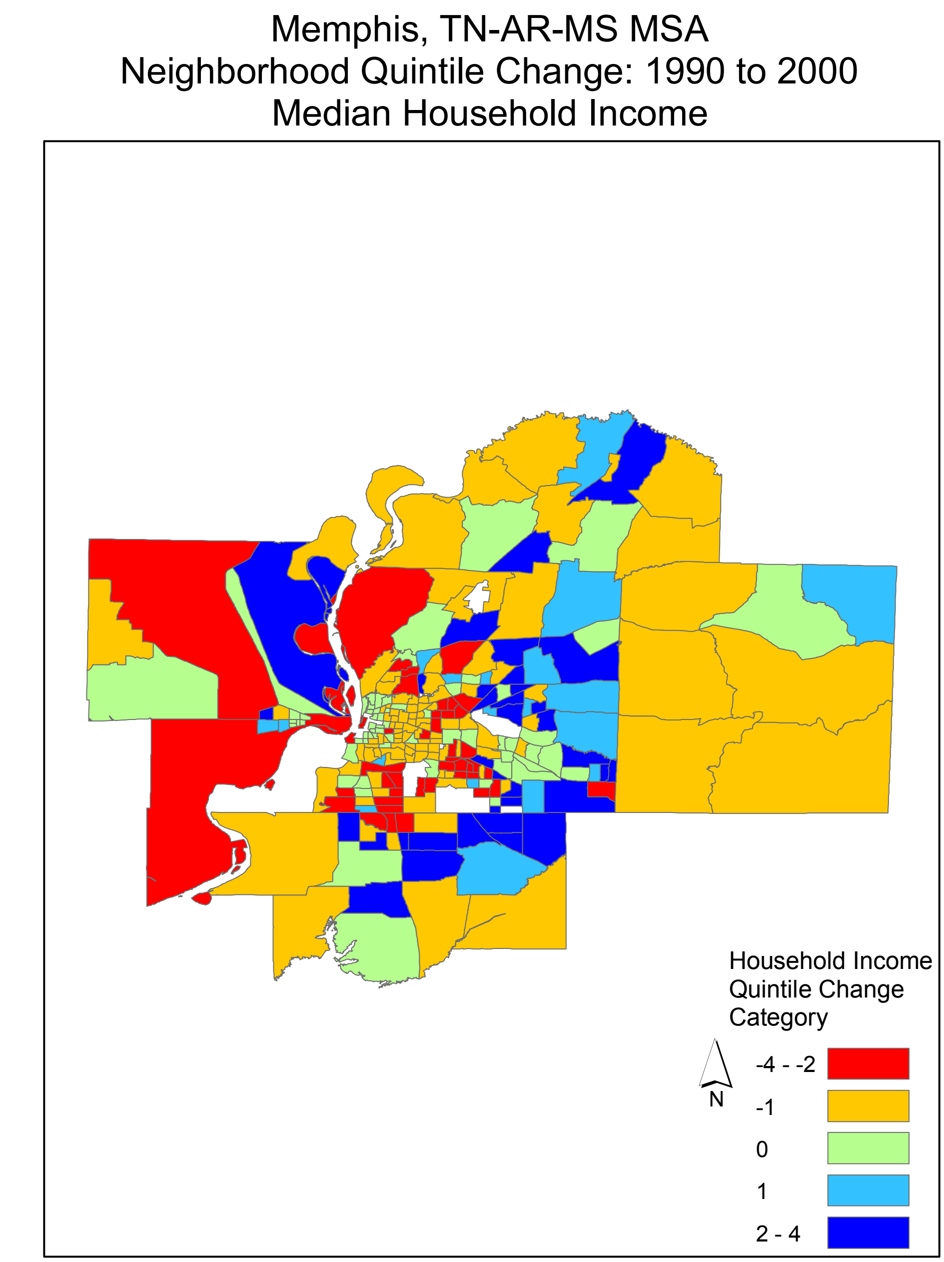

Figure 3-9a Memphis, TN-AR-MS MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Memphis, TN-AR-MS MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

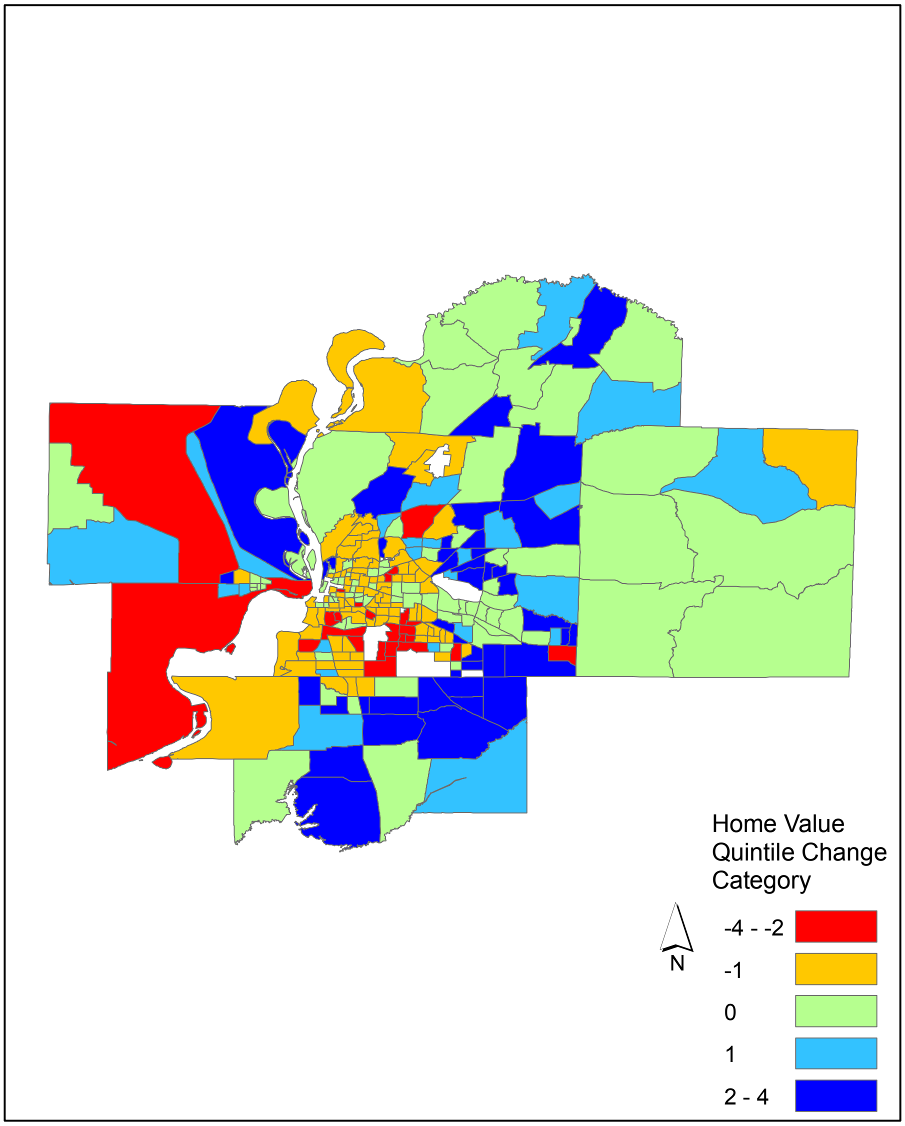

Figure 3-9b Memphis, TN-AR-MS MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Miami, FL PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

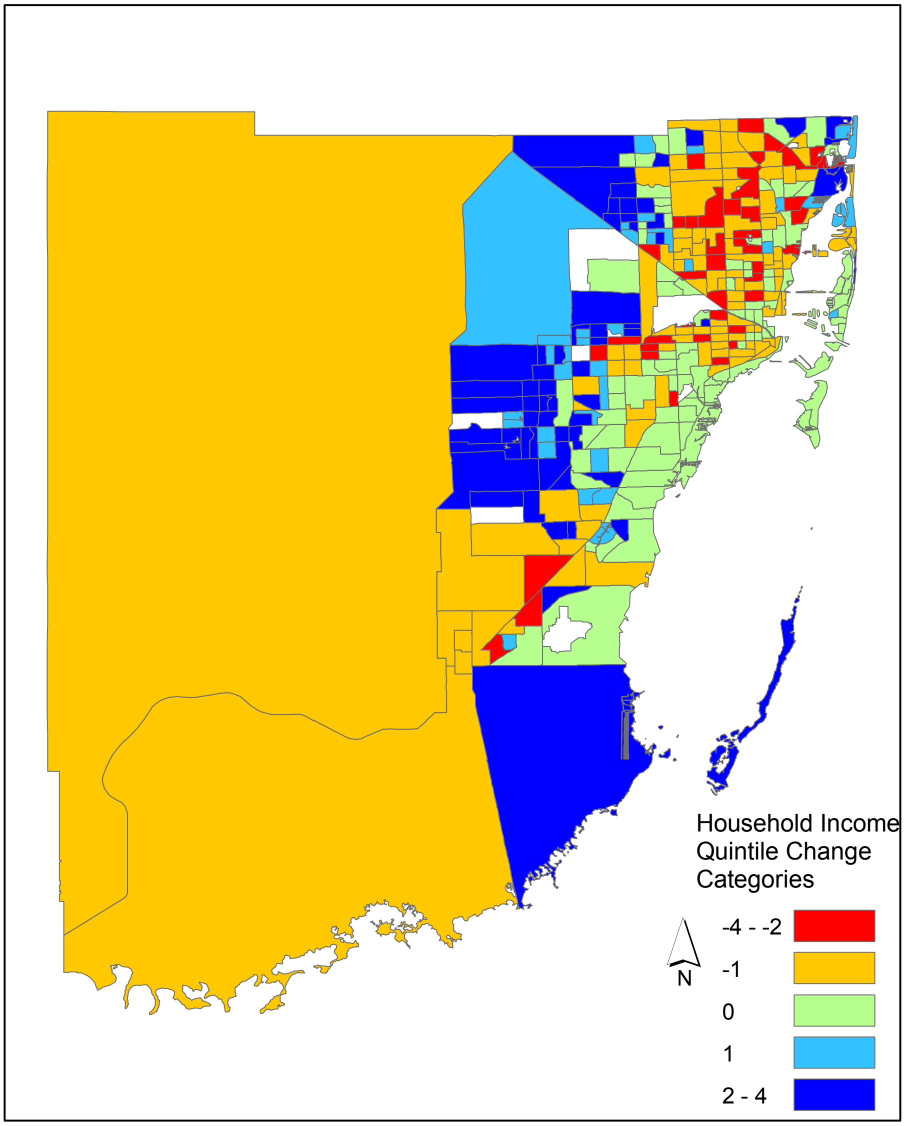

Figure 3-10a Miami, FL PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Miami, FL PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

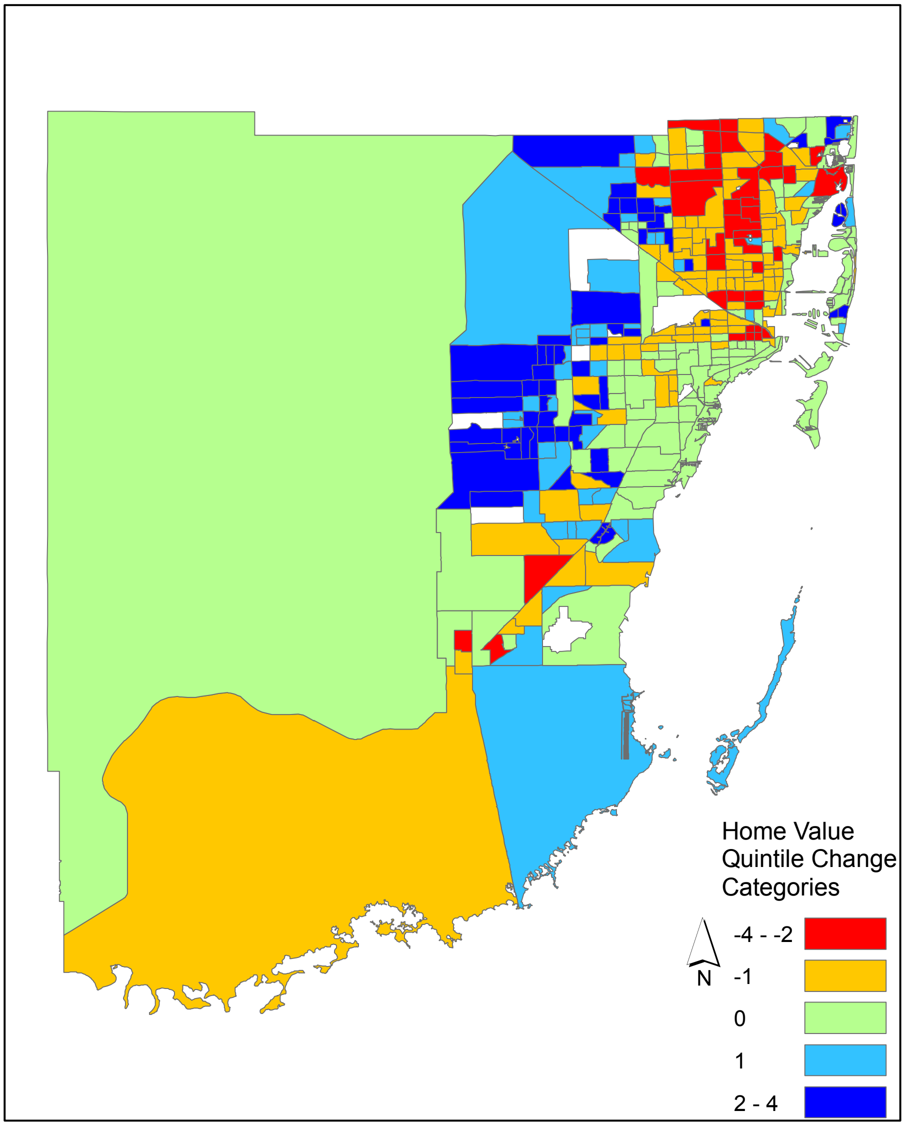

Figure 3-10b Miami, FL PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Minneapolis-St. Paul, MN-WI, MSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

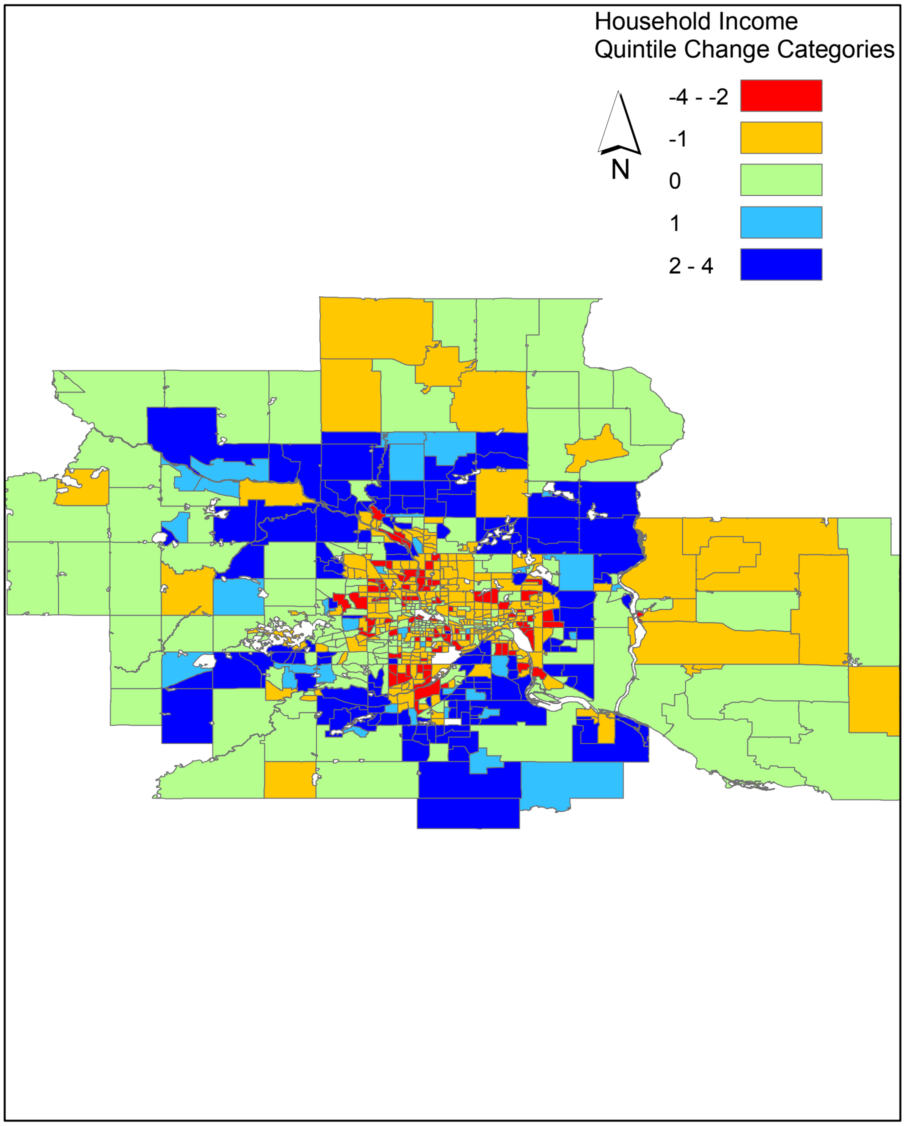

Figure 3-11a Minneapolis-St.Paul, MN-WI MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Minneapolis-St. Paul, MN-WI, MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

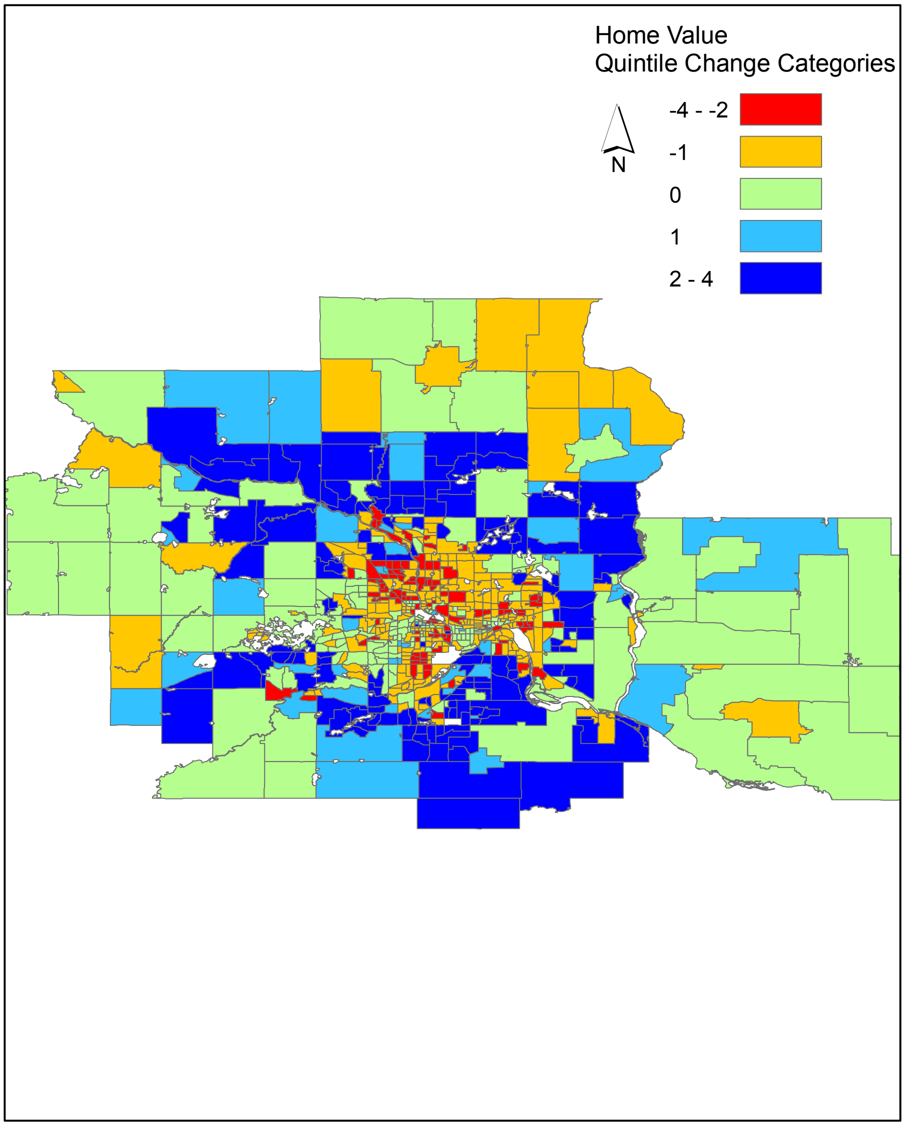

Figure 3-11b Minneapolis-St.Paul, MN-WI MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Philadelphia, PA-NJ PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

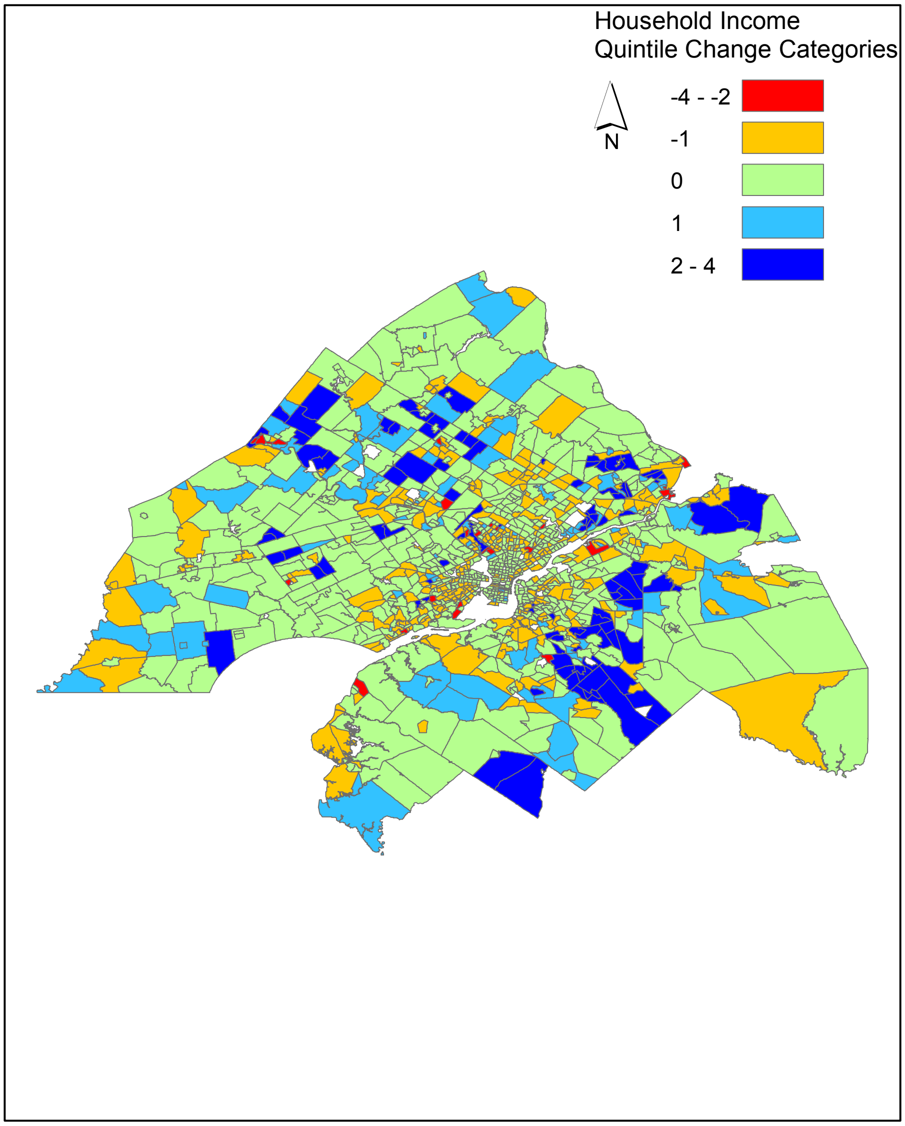

Figure 3-12a Philadelphia, PA-NJ PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Philadelphia, PA-NJ PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

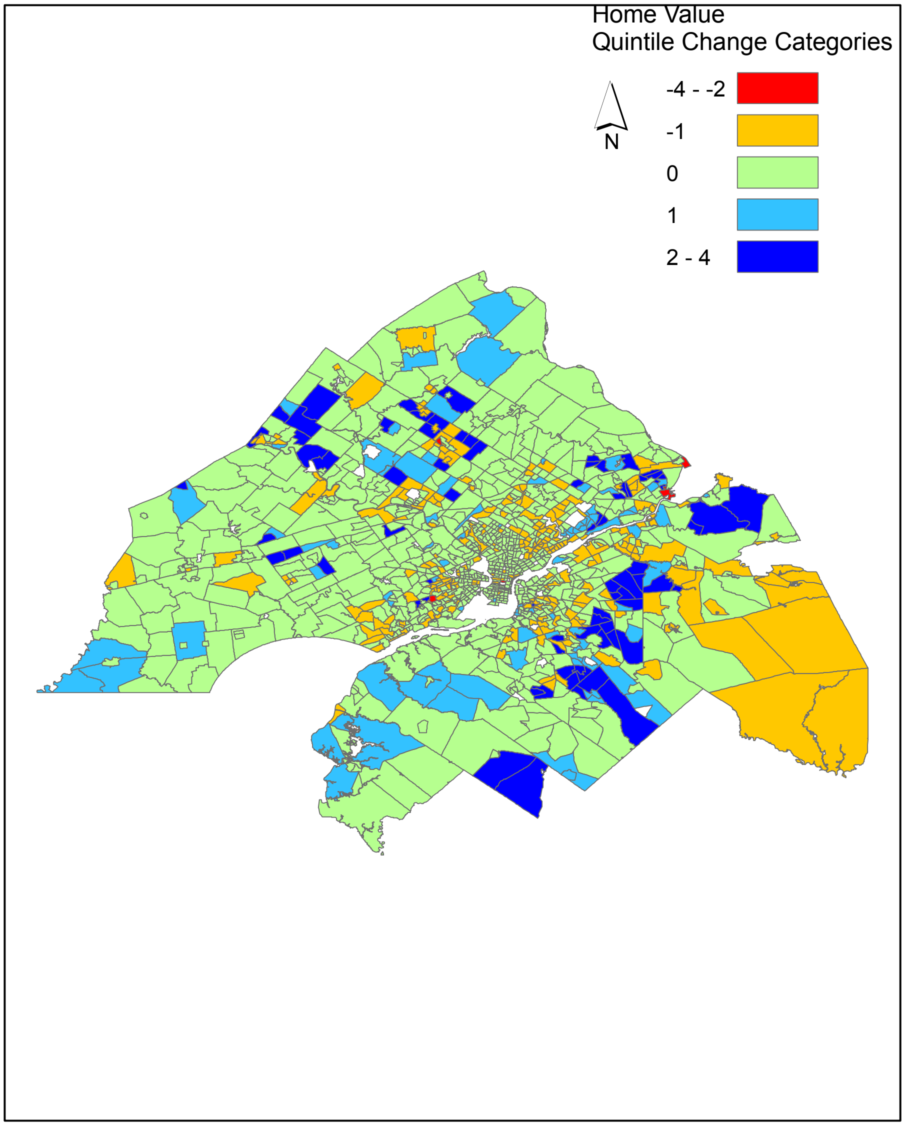

Figure 3-12b Philadelphia, PA-NJ PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Pittsburgh, PA MSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

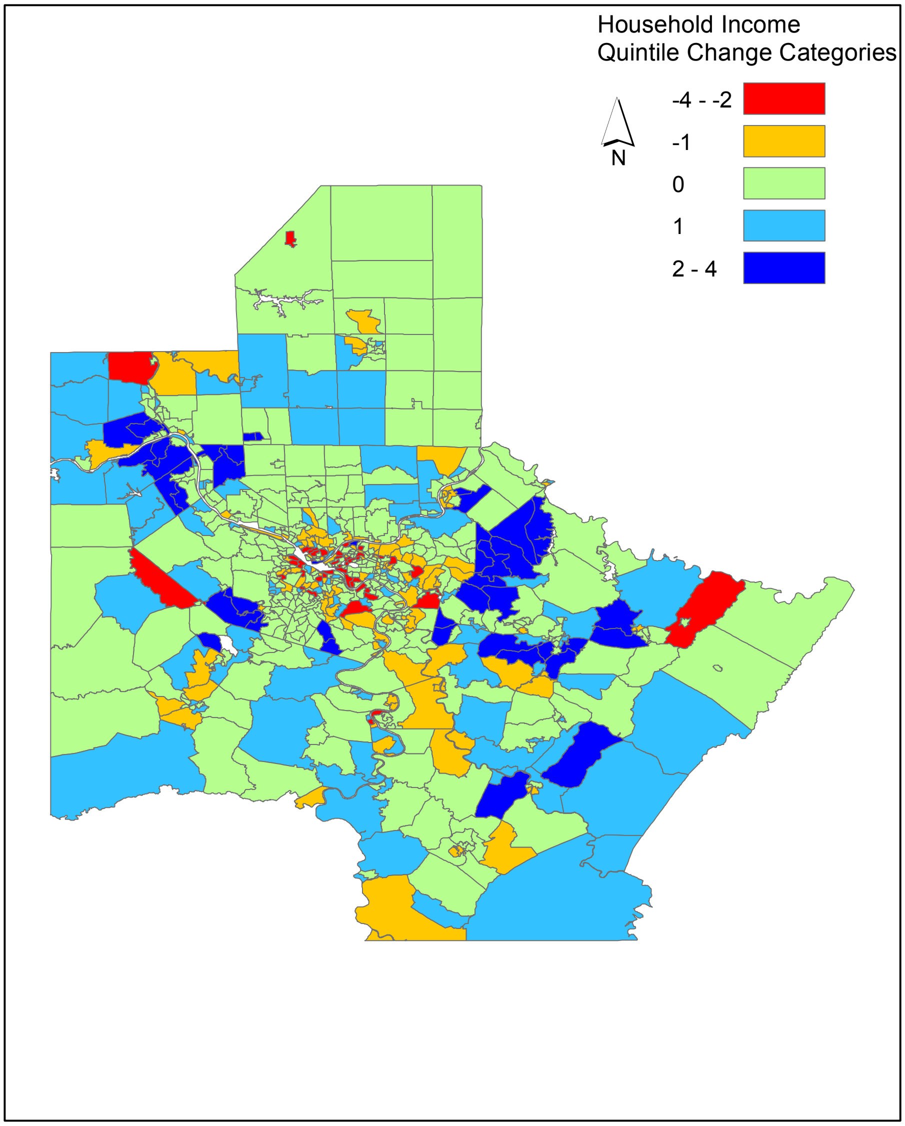

Figure 3-13a Pittsburgh, PA MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Pittsburgh, PA MSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

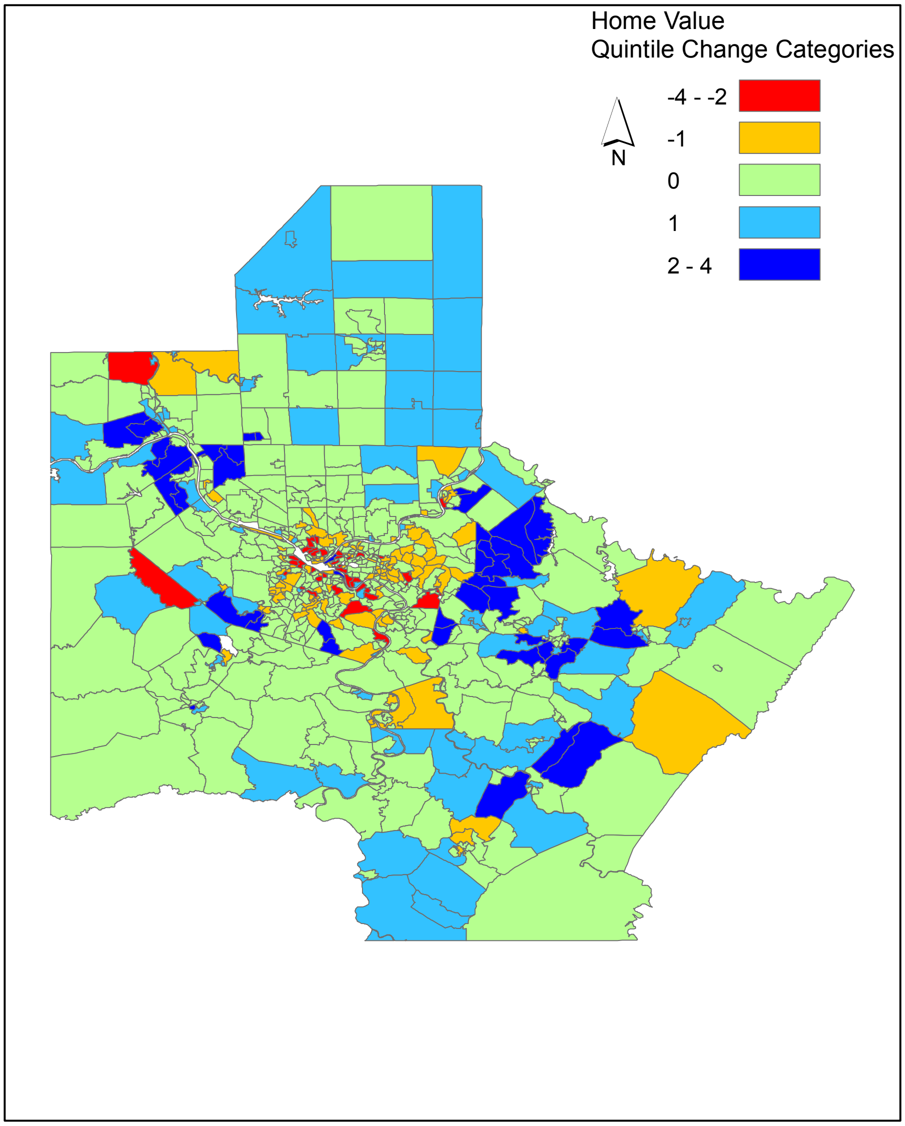

Figure 3-13b Pittsburgh, PA MSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Sacramento, CA PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

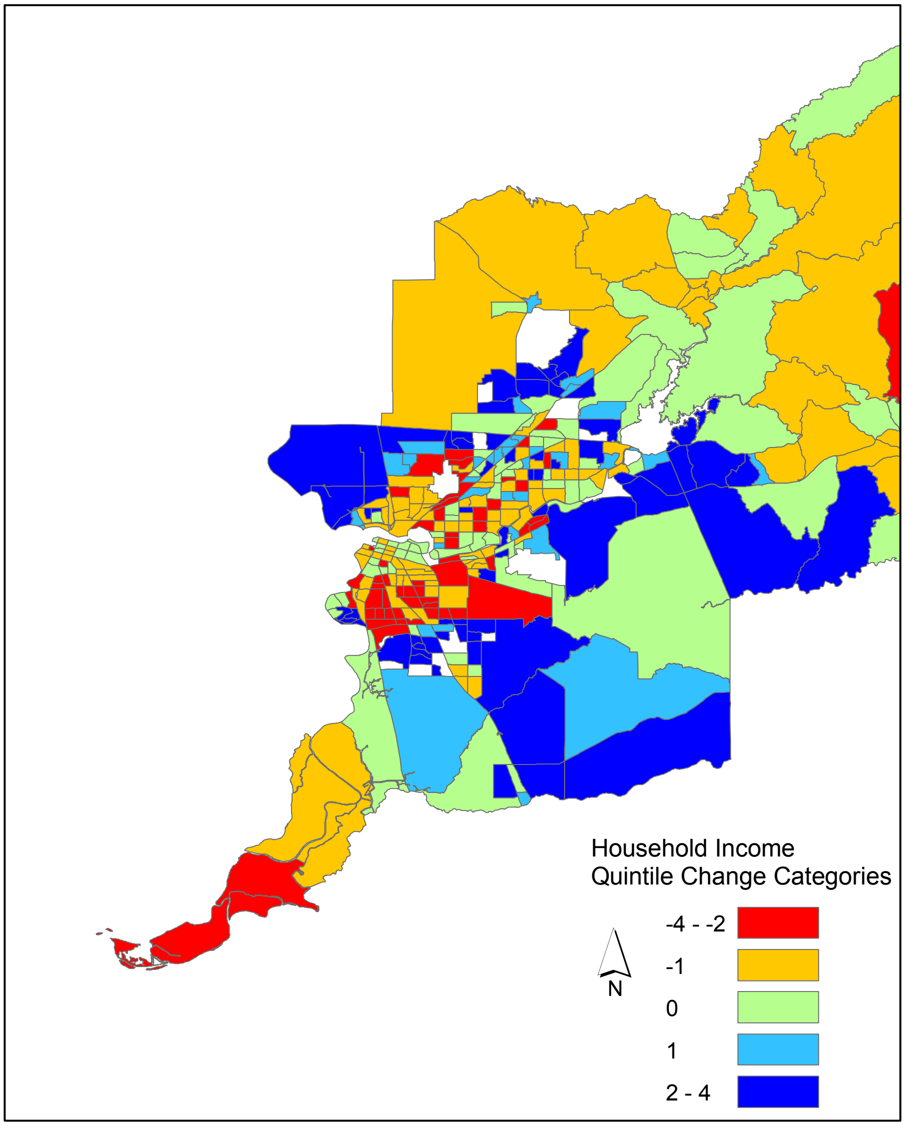

Figure 3-14a Sacramento, CA PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Sacramento, CA PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

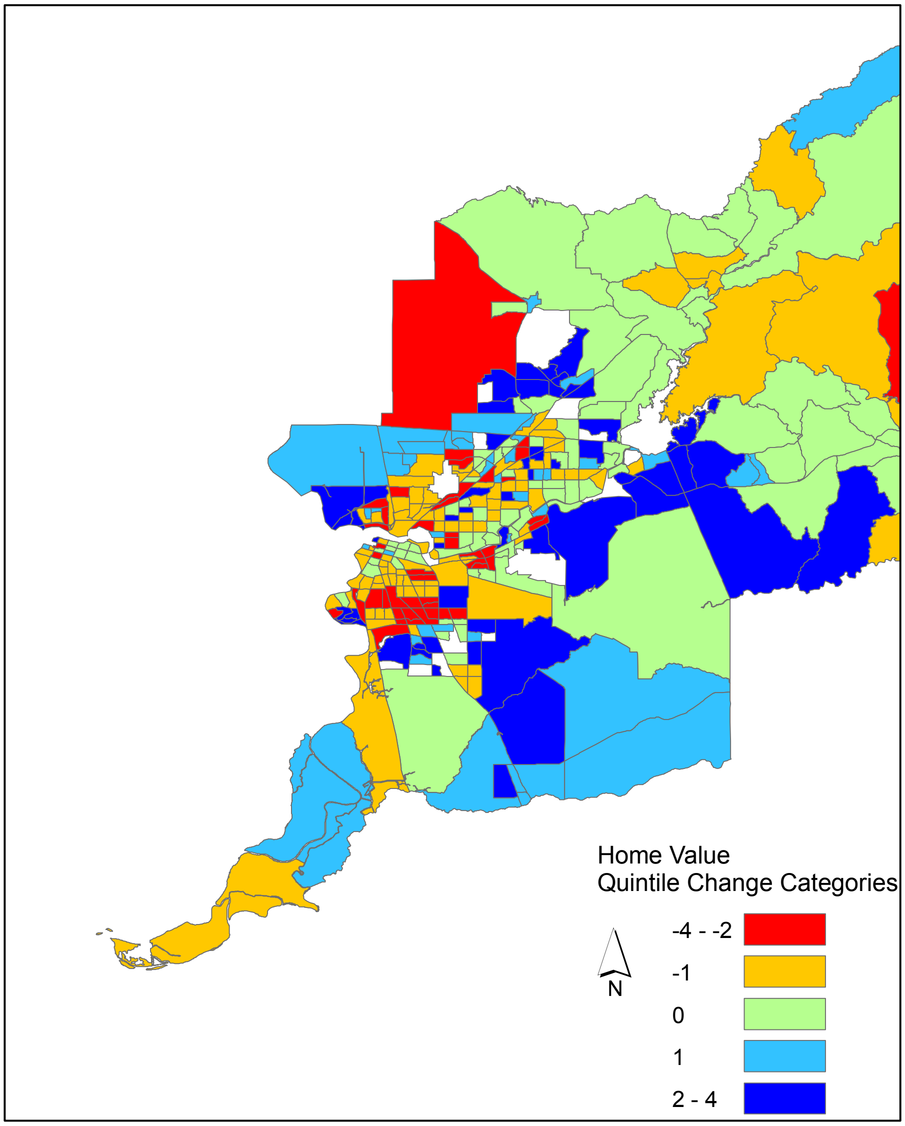

Figure 3-14b Sacramento, CA PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

San Francisco-Oakland, CA PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Household Income

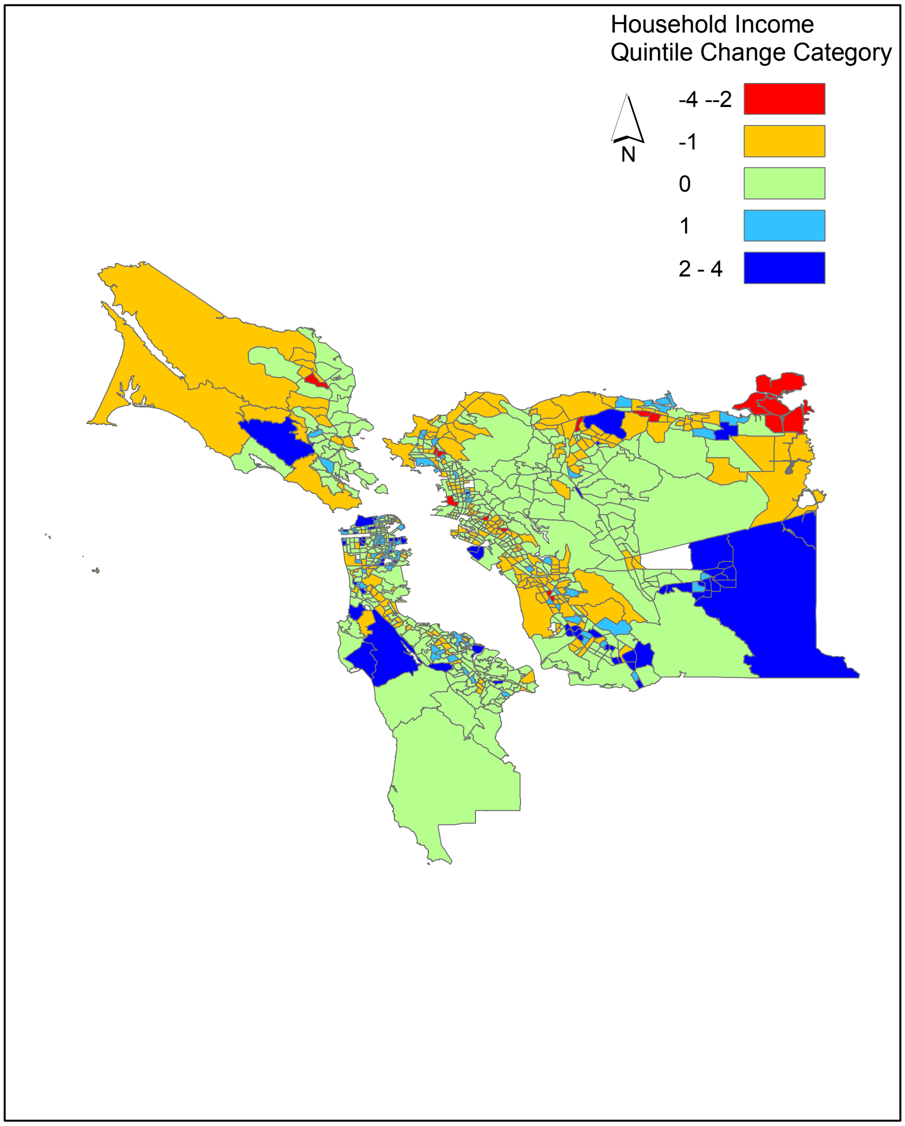

Figure 3-15b San Francisco-Oakland, CA PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

San Francisco-Oakland, CA PMSA
Neighborhood Quintile Change: 1990 to 2000
Median HomeValue

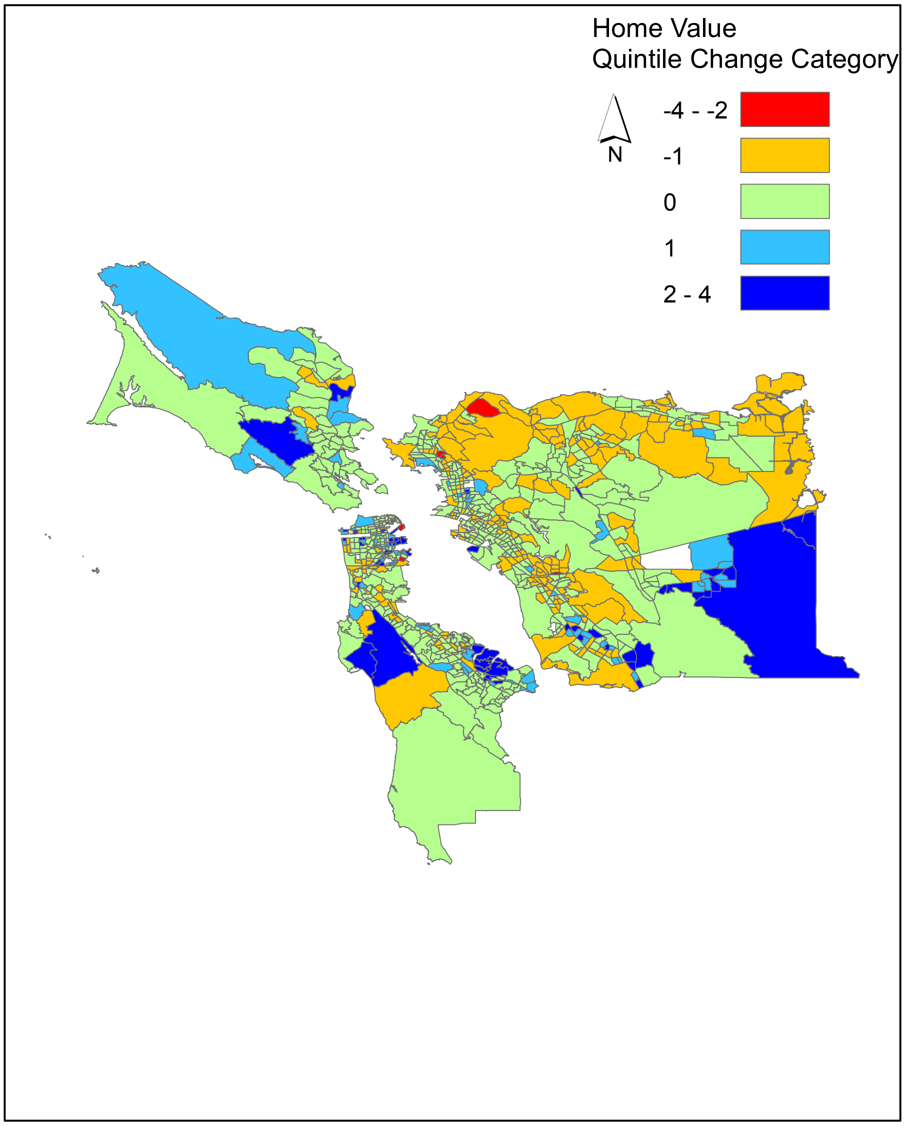

Figure 3-15a San Francisco-Oakland, CA PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

Washington DC-MD-VA-WV PMSA
Neighborhood Change Quintiles: 1990 to 2000
Median Household Income

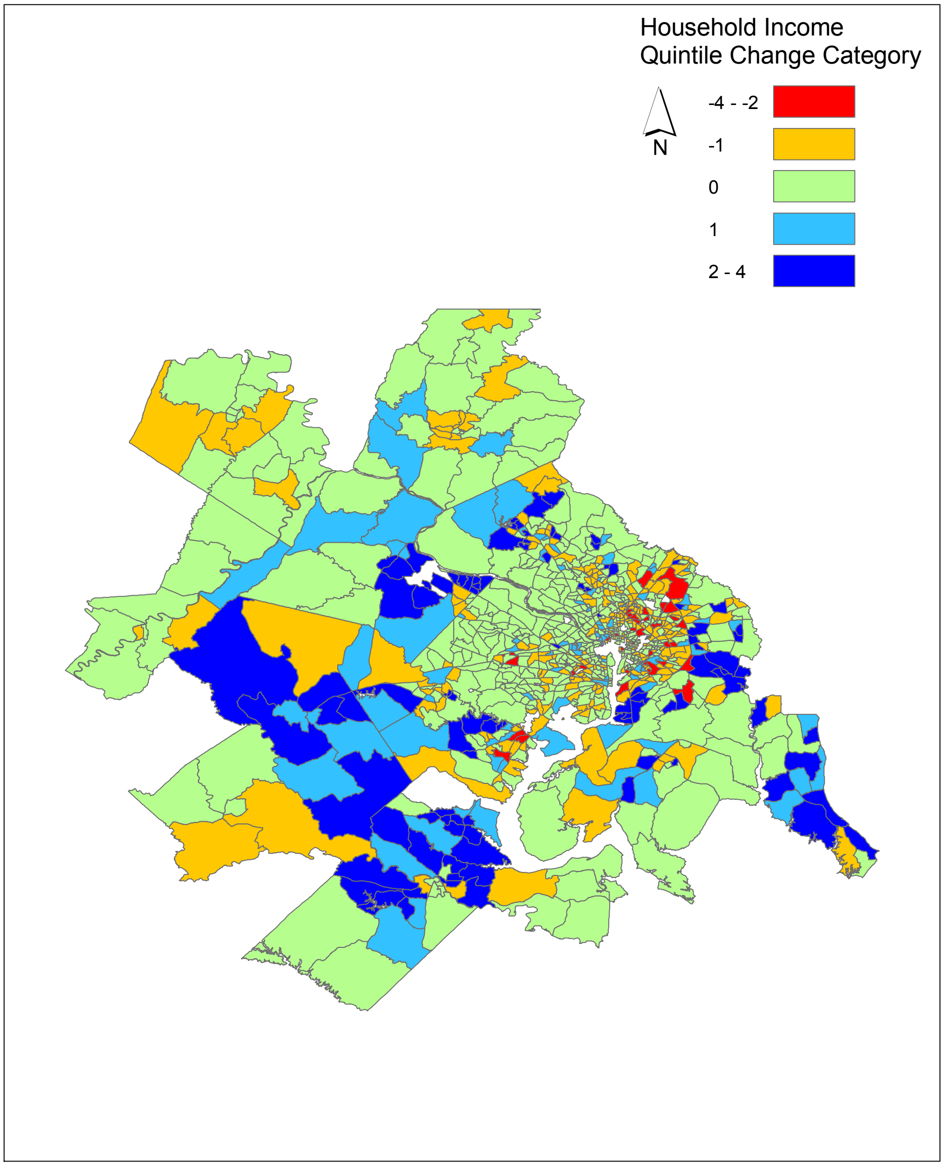

Figure 3-16a Washington, DC-MD-VA-WV PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Household Income

Washington DC-MD-VA-WV PMSA
Neighborhood Quintile Change: 1990 to 2000
Median Home Value

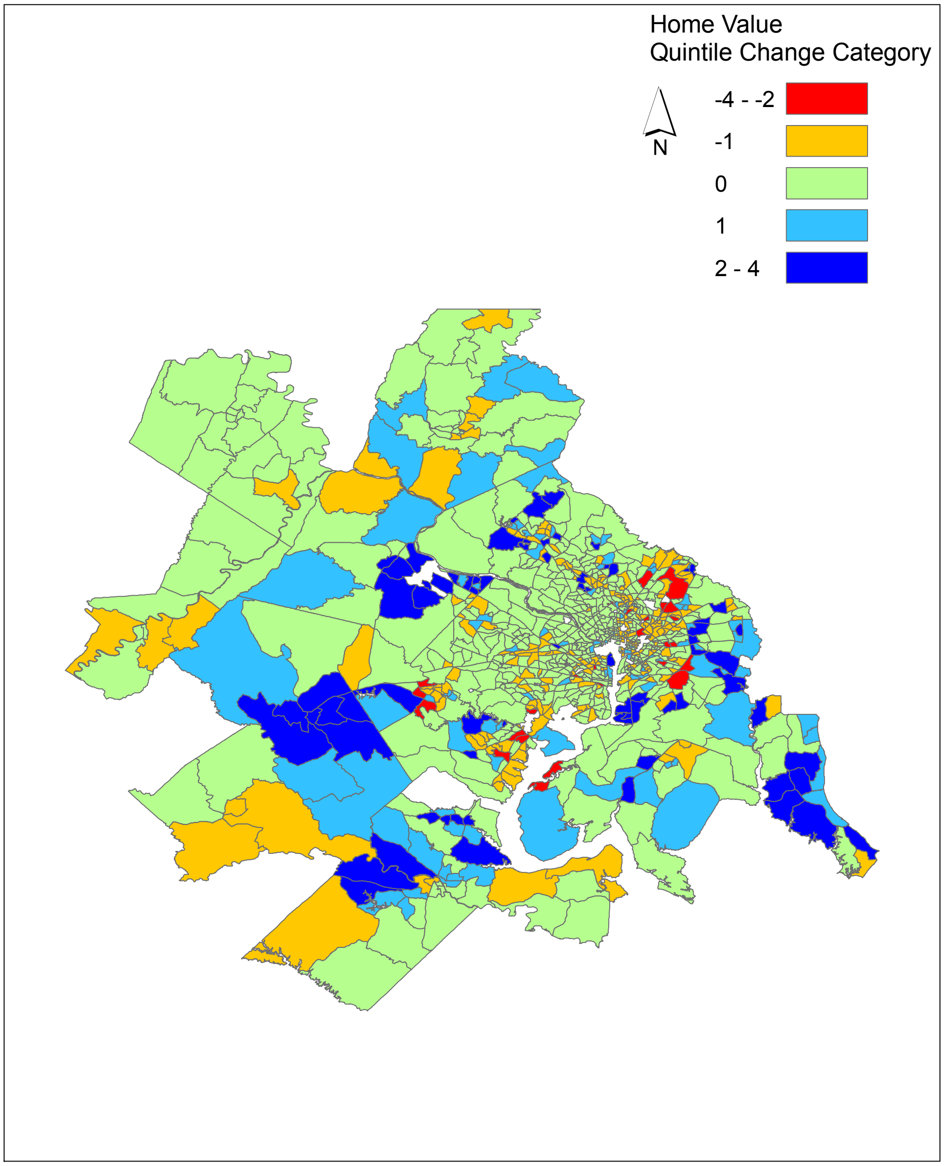

Figure 3-16b Washington, DC-MD-VA-WV PMSA Neighborhood Quintile Change: 1990 to 2000; Outcome Indicator: Median Home Value

CHAPTER 4

DATA ANALYSIS AND RESULTS

RESULTS

A summary of the distribution of how neighborhoods changed from 1990 to 2000 is provided in Table 4-1 Distribution of Metropolitan Area Neighborhoods by Income and Home Value Quintile Changes (by census tract). In addition, Table 4-1 specifies the distribution of metropolitan area census tracts and their respective 1990 and 2000 population for large negative change (-4 to -2) and large positive change (2 to 4) income and value indicators. This provides an indication of whether the proportion of the population in the large negative/positive indicator change tracts fared better or worse between 1990 and 2000. While the magnitude varied, most metropolitan areas in the sample experienced higher proportions of neighborhoods that had notably larger increases for both household income and home value indicators compared to those that had decreases: Austin, Chicago, Detroit, Houston, Jacksonville, Memphis, Miami, Minneapolis, Philadelphia, San Francisco/Oakland, and Washington DC. The second dominant trend is that the metropolitan area had a relatively similar percent of neighborhoods that increased and decreased: Atlanta, Dayton, Denver, Pittsburgh, and Sacramento.

[Table 4-1 inserted here]

Table 4-2 is a similar summary as Table 4-1 but shows the distribution of subsidized households by large decrease and large increase based on the number of assisted housing units. While the magnitude and number of subsidized housing units varied, some trends in their distribution were noted. There was only one metropolitan area in which subsidized housing units were more notably located in increasing rather than decreasing neighborhoods on both indicators: Chicago. Most metropolitan areas experienced a higher percent of subsidized households in decreasing neighborhoods than increasing neighborhoods: Atlanta, Autstin, Denver, Houston, Jacksonville, Memphis, Miami, Minneapolis, Pittsburgh, and Sacramento. Two metropolitan areas had relatively similar percent of subsidized households in inceasing and decreasing neighborhoods on both indicators: Detroit and Philadelphia. However, metropolitan areas did not follow the trend of similar outcomes on both indicators and had mixed location outcomes for subsidized households: Dayton, San Francisco/Oakland, and Washington DC.

[Table 4-2 inserted here]

Transition Matrices Analyses Summary

There were three main findings upon examination of metropolitan area transition matrices and two main findings upon examination of the PSH data.

- Neighborhoods experience much change. Median household income and median home value changes had similar trends. Consistent with Life Cycle and Filtering theories of neighborhood change, median household income and home values react similarly during times of change. Building a multinomial logit model for median household income and one for median home values will provide information on if and which variables have different from and/or similar impacts on the individual outcome variables.
- Neighborhood change trends: The 1st and 5th quintiles tend to hold their ground more from 1990 to 2000. The middle neighborhood quintiles experienced the most change, over the same period.
- Median home values performed better than median household income. That is, large losses and gains for the two indicators behaved differently but at similar trends: large home value gains exceeded large household income gains. Large household income declines exceeded large home value declines.
- In analyzing the trends in the distribution of subsidized households by initial neighborhood quintile (1990) two trends emerged: PSH reported households were mostly located in the first three neighborhood quintiles and PSH reported households were located in the first three median household income initial quintiles but located in the middle three value quintiles.
- In analyzing the trends in the distribution of subsidized households among neighborhoods experiencing large declines and large gains three trends emerged: PSH residents were overrepresented in neighborhoods with large declines and underrepresented in neighborhoods with large gains; PSH residents were distributed along similar trends as the metropolitan area in location in neighborhoods with large declines but underrepresented in neighborhoods with large gains; PSH residents were similarly distributed among neighborhoods as their metropolitan area trends.

Hypotheses Testing

Introduction

This section will achieve two goals: to develop a general model of neighborhood change and summarize the results of hypotheses test using three primary variations of the general model.

General Model of Neighborhood Outcome

A general model of neighborhood outcome was estimated based on running numerous multinomial logit models with different housing stock, neighborhood characteristic, and PSH reported HUD unit variables for multiple study sample metropolitan areas. To address the research questions and related hypotheses, a base subsidized housing model and full model are created. The base subsidized housing model with neighborhood change quintile category as the outcome is varied in a second base subsidized housing model with 2000 neighborhood quintile ranking as the outcome. The general model is used to test the relationship between neighborhood outcome and neighborhood change/PSH reported HUD units applied to each study metropolitan area. A variation of the general model is created that tests the relationship between neighborhood outcome and PSH reported HUD units. A more specific discussion of these models and their results follows Table 4-3 of select variables and their descriptions.

Table 4-3 Selected Variables and Variable Descriptions

Variable	Variable Description
Incqchgcat	Income quintile change category
Valqchgcat	Home value quintile change category
Incq0	Neighborhood Income quintile ranking (2000)
Valq0	Neighborhood home value quintile ranking (2000)
Mdhhy9_0dlrs_metro	1990 Census tract, metro-relative income
Mdvalhs9_0dlrs_metro	1990 Census tract, metro-relative home value
Trpoppc	% Population Change (1990-2000)
AllHUD	#PSH HUD Units (2000)
Blt10yrchg	%Change in prop new housing (1990-2000)
Ttunit11pch	%Change in prop of single family, detached units (1990-2000)
Bdtot3pch	%Change in prop of 3 bedroom units (1990-2000)
Vachu9	% Units vacant (1990)
Ownocc9p	% Owner occupied (1990)
Kitno9	#Units lack adequate kitchen facilities (1990)
Plmbno9	#Units lack adequate plumbing facilities (1990)
Shrnhw9	% White (1990)
Old9	% Elderly (1990)
Kids9	% Children 5 Yrs and less (1990)
Unemprt9	Unemployment rate (1990)
Povrat9	Poverty rate (1990)

Base Subsidized Housing Model: To explore hypothesis 1a, the base subsidized housing model estimates the relationship between assisted housing and the level of neighborhood change. The base subsidized housing model consists of initial relative median household income (1990), census tract population change from 1990 to 2000, and number of PSH reported HUD units (2000) predictor variables. It should be noted that the base model indicates that initial neighborhood quality is a perfect predictor for many census tracts thus prohibiting further analysis of other indicator variables on neighborhood change. As such, relative median outcome (household income; home value) is used as a proxy for initial neighborhood quintile (Allison, 2008).

Base subsidized housing model one: Pr (quintile change category: large negative, stable/small change, and large positive from 2000-1990) = Mdhhy9_0dlrs_metro (or Mdvalhs9_0dlrs_metro) + Trpoppc + AllHUD

Base Subsidized Housing Model Two. The first base subsidized model addresses the relationship between assisted housing and level of neighborhood change (large decline, stable, large gain) but does not speak to the level of neighborhood ranking. To further explore the relationship between assisted housing and level of neighborhood ranking, as stipulated in hypothesis 1a, several variations of the base subsidized housing model were explored. The variation selected, presented, and discussed is as follows.

Base subsidized housing model two: Pr (2000 neighborhood income/home value quintile ranking: 1^{st} or lowest to 5^{th} or highest) = Mdhhy9_0dlrs_metro (or Mdvalhs9_0dlrs_metro) + Trpoppc + AllHUD

Final General Model Estimated for Each Metropolitan Area

One of the goals of this study is to develop a parsimonious model of neighborhood change. This model is used to study the relationship between neighborhood change outcome and select neighborhood change and PSH HUD variables. The general model is presented first with a brief discussion of how this model is used to test hypotheses in two variations of the general model.

Pr (income quintile change category: large negative, stable/small change, and large positive from 2000-1990) = Mdhhy9_0dlrs_metro + Trpoppc + AllHUD + Blt10yrChg + Ttunit1pc + Vachu9 + Kitno9 + Plmbno9 + Shrnhw9 + Old9 + Kids9 + Unemprt9

The outcome indicator variable is income quintile change category of neighborhoods that experienced large decline (-4 to -2 quintile ranking changes) or large gain (2 to 4 quintile ranking changes) compared to neighborhoods that remained stable or experienced small change (-1 to 1 quintile ranking changes). The large decline category is for neighborhoods that dropped 2 to 4 quintile rankings from 1990 to

2000. Since only neighborhoods with 3rd, 4th, and 5th initial (1990) income quintile rankings are able to decline by 2 to 4, this outcome indictor will be interpreted for those middle to upper income neighborhoods that experienced large declines compared to neighborhoods that remained stable or experienced small changes. Large growth category is for neighborhoods that dropped 2 to 4 quintiles from 1990 to 2000. Since only neighborhoods with 1st, 2nd, and 3rd initial (1990) income quintile rankings are able to decline by 2 to 4, this outcome indicator will be interpreted for those lower to middle income neighborhoods that experienced large gains compared to neighborhoods that remained stable or experienced small changes.

First Full Model (Neighborhood Change Model). To address hypothesis 2, the first full model estimates the impact of select neighborhood change and PSH HUD variables on the likelihood of neighborhood outcome. Variables included in this model are from the general set of select variables applied to each metropolitan area that have tolerance levels greater than 0.40 and that have coefficients with standard errors less than 2.0. Thus, the first full model treats all the independent variables, which are not collinear and have low standard errors around the mean for the indictors, as predictors.

Second Full Model. To address hypothesis 3a, the second full model estimates the impact of PSH reported HUD units on likelihood of neighborhood outcome. This model uses quintile change category as the outcome variable and all the variables in the general set of select indicators applied to each metropolitan area that have tolerance levels less than 0.40. Thus, the second full model treats the PSH HUD (AllHUD) as the only predictor variable and the remaining variables as control variables in order to help isolate the impact of assisted housing on neighborhood change.

Second Full Model Variation One. The second full model focuses on the general impact of assisted housing on neighborhood outcome, but does not speak to the possibility of a different relationship between neighborhood outcome and number/concentration of assisted housing units as stipulated in hypothesis 3a. To address the different impact of assisted housing on neighborhood outcome for different levels of PSH HUD concentration, the second full model is stratified by number of PSH HUD units: census tracts with 0 to 8 units of PSH HUD households and census tracts with 9 or more units of PSH HUD households.

Second Full Model Variation Two. To explore the impact of assisted housing on neighborhoods with different poverty levels as stipulated by hypothesis 3b, the second full model is stratified by poverty level.

Results

Results and analyses for individual metropolitan areas are not presented. However, this section will provide a discussion of general trends in the models across all the metropolitan areas for the median household income and home value outcome indicators. The results will be interpreted based on the direction of the impact (sign of coefficient) and magnitude (size of the coefficient). Discussion of the odds of an impact compared to stable neighborhoods should be provided in the discussion of the results for individual metropolitan areas.

The summary of the metropolitan area results are presented in Table 4-4. In discussing the impact of predictors on outcome, the results are read as the influence of a predictor on the likelihood of large decline or large gain, holding all other predictors constant, compared to neighborhoods that remained stable. In general, the base subsidized housing model provides the core factors impacting the likelihood of a neighborhood experienced large decline or large gain from 1990 to 2000, compared to stable neighborhoods. For the most part, core factors in the base model remain significant in the first full model of the relationship between neighborhood outcome and neighborhood change and PSH HUD indicators.

[Table 4-4 to be inserted here]

Direction of Impact

Base subsidized housing model: Of the core factors, initial neighborhood income/home value appears to have the reverse impact of what may be expected: For every increase in income/home value, there is a corresponding decrease (negative) in the likelihood that a neighborhood will experience large gain and for every increase in income/home value, there is a corresponding increase in the likelihood that a neighborhood experienced large decline. Specifically, on the neighborhood median household income outcome, eleven out of fourteen metropolitan areas had estimated a positive impact on decline (increased likelihood of decline) while all fourteen had estimated a negative impact on gain (decreased likelihood of gain). This can be attributed to the fact that in this logit model, only lower to middle income neighborhoods can experience large gain and only middle to upper neighborhoods can experience large decline. The results are similar on the home value indicator.

The second core indictor, change in census tract population from 1990 to 2000, had the expected impact on neighborhood outcome: an increase in population change increased the likelihood of large gain while an increase in population change decreased (negative) the likelihood of large decline. The results are similar for income and home value outcomes that population change was more influential on the likelihood of large gain, but far less so for large decline.

The third core indicator, PSH HUD units in 2000 had an increasing impact on the likelihood of decline and decreasing impact on the likelihood of large gain. Similar to the population change indicator, PSH HUD was more influential on the likelihood of large gain than on large decline for both income and home value indicators. This result is consistent in the second full model that isolates the relationship between assisted housing and neighborhood change outcome. This can be interpreted as: of the lower to middle income/values communities that experienced large gain, PSH HUD units decrease the likelihood of that gain. On the other hand, of the middle to upper neighborhoods that experienced large decline, PSH HUD units did not play a significant role in that decline.

First full model. The first full model for income and home value outcomes contained similar predictor variables, except the home value model included change in the proportion of three bedroom units and 1990 percent owner occupied. For the neighborhood income change outcome, after the three core indicators, the sequentially next most influential were1990 percent White, change in the proportion of new housing, change in the proportion of single family detached units, lack of kitchen and plumbing facilities, and 1990 percent old. It should be noted that these predictors were more influential on the likelihood of large gain than on the likelihood of large decline as indicated by the pseudo R^2 statistics. The 1990 percent White had the expected impact of increasing the likelihood of gain and decreasing the likelihood of decline. Change in the proportion of new housing had the unexpected impact of decreasing the likelihood of large gain but the expected impact of decreasing the likelihood of large decline. This could have many interpretations, one being that the lower to middle income neighborhoods that experienced large gain had older housing stock (possibly gentrifying). Change in the proportion of single family detached units had the expected impact of increasing the likelihood of large gain and decreasing the likelihood of large decline. Units that lacked adequate kitchen and plumbing facilities in 1990 had the expected impact on the likelihood of large gain but mixed impact on the likelihood of large decline. That is, an increase in the number of units with inadequate kitchen and plumbing facilities decreased the likelihood of large gain while these units had both an increasing and decreasing influence on large decline. Finally, the 1990 percent elderly indicator had the expected decreasing impact on the likelihood of large gain and increasing impact on the likelihood of large decline. The remaining variables, 1990 vacancy rate, 1990 percent children 5 years and under, and 1990 unemployment rate met criteria for inclusion in the model, but did not impact neighborhood outcome.

For home value neighborhood change outcome, after the three core indicators, the sequentially next most influential were change in the proportion of new housing, 1990 percent White, lack of adequate kitchen facilities in 1990, 1990 percent owner occupied, change in the proportion of single family detached units and lack of adequate plumbing facilities, and change in the proportion of units with 3 bedrooms. Similar to the income neighborhood outcome model results, but more dramatic, these indicators were more influential on the likelihood of large home value gain than on the likelihood of large home value decline. As with the income neighborhood outcome model, change in the proportion of new housing had the unexpected impact of decreasing the likelihood of home value gain and increasing the likelihood of home value decline. Share White had the expected impact of increasing the likelihood of large gain and decreasing the likelihood of large decline. Lack of adequate kitchen facilities had the expected impact on large gain but mixed impact on large decline. That is, an increase in the number of units in 1990 that lacked adequate kitchen facilities decreased the likelihood of large gain but both decreased and increased the likelihood of large decline. However lack of adequate kitchen facilities had a mixed impact on likelihood of both large decline and large gain. For the most part, owner occupied had the expected impact on large decline and large gain except for one metropolitan area (Houston) in which owner occupancy had a declining impact on the likelihood of gain. However, the expected impact as estimated by relevant metropolitan areas is an increase in owner occupancy increased the likelihood of gain and decreased the likelihood of decline. Finally, as experienced by one metropolitan area (Atlanta), change in the proportion of units that have 3 bedrooms had the unexpected impact of decreasing the likelihood of large gain. However, this could be due to newer housing having more bedrooms thus, housing with three bedrooms becoming less desirable. While 1990 vacancy rate, 1990 percent elderly, and 1990 percent children 5 years and under met the criteria for inclusion in the model, they did not impact neighborhood outcome.

Magnitude of Impact

The magnitude of impact of a predictor on the likelihood of large decline or large gain is estimated by the size of the coefficient on the parameter. Since 1990 metropolitan level median household income and home value information was not provided consistently for San Francisco/Oakland PMSA and Washington DC MSA, parameters are only interpreted for the remaining qualifying thirteen metropolitan areas for the 1990 relative median household income and 1990 relative median home value predictor variables. Magnitude is only assessed for variables that were significant and is evaluated by comparing: 1) behavior in base model versus full model and 2) behavior of coefficients for large decline versus large gain outcomes.

Magnitude: Median Household Income Neighborhood Change Outcome.

The three base model variables behaved in similar overall patterns in the base model and in the first full model for large gain outcome, but some differences for large decline outcome on the 1990 income and PSH HUD variables. For the large decline outcome, the range of coefficient values of 1990 income in the base model are -1.515 (Pittsburgh) to 1.63 (Jacksonville); population change coefficients ranged from -5.679 (Pittsburgh) to -0.009 (Austin); and PSH HUD coefficients range from -0.006 (Austin) to 0.006 (Sacramento). Comparatively, the range of coefficient values of 1990 income in the first full model are 0.581 (Denver) to 1.969 (Austin); population change coefficients ranged from -5.668 (Pittsburgh) to -1.657 (Sacramento); and PSH HUD coefficients ranged from 0.0001 (Miami) to 0.006 (Jacksonville). Thus, the coefficients for the1990 income and PSH variable ranges became narrower and shifted from some being negative and positive to all parameters being positive. In addition, the population range became narrower in the first full model compared to the base model. In sum, adding additional neighborhood change variables to the model, helped to tighten the impact of predictors on the outcome.

For large income decline outcome, the additional neighborhood change indicators in the first full model had the range of coefficients values of: change in the proportion of new housing is -2.134 (Chicago) to -1.387 (Houston); change in the proportion of single family detached units is -3.799 (Detroit) to -3.749 (Houston); 1990 number of units lacking adequate kitchen facilities is 0.013 (Houston) to 0.023 (Pittsburgh); 1990 number of units lacking adequate plumbing facilities is -0.086 (Philadelphia) to 0.005 (Minneapolis); 1990 percent White is -6.286 (Washington DC) to -1.821 (Philadelphia); and 1990 percent elderly had one significant observation of 2.907 (Denver). Even though 1990 percent vacant, 1990 percent children 5 years and under, and 1990 percent unemployed met the criteria for the model, they were in none of the metropolitan area models. Thus, the range of significant coefficients is relatively narrow on all but the 1990 percent White indicator. In addition, with the exception of the 1990 lacking adequate plumbing facilities variable, the coefficients are consistently negative or positive.

For the large gain income outcome, the range of coefficient values for the base model are 1990 income coefficients range from -7.782 (Minnesota) to -4.580 (Detroit); population change coefficients range from 0.640 (Denver) to 5.716 (Pittsburgh); and PSH HUD coefficients range from -0.126 (Denver) to -0.015 (Chicago and Jacksonville). Comparatively, the range of coefficient values in the first full model are 1990 income range from -10.981 (Chicago) to -5.386 (Sacramento); population change coefficients range from 0.625 (Denver) to 6.075 (Pittsburgh); and PSH HUD coefficients range from -0.119 (Denver) to -0.010 (Chicago). Thus, unlike large income decline outcome, adding neighborhood change predictors to the model resulted in a widening of the range of coefficients between core variables in the base model and core variables in the full model.

Of the additional neighborhood change indicators for the large gain outcome, the range of coefficient values of change in the proportion of new housing is -8.282 (Philadelphia) to 0.406 (Atlanta); change in the proportion of single family detached units is -2.746 (Minneapolis) to 6.721 (Atlanta); 1990 number of units lacking adequate kitchen facilities is -0.094 (Detroit) to -0.035 (Atlanta); 1990 number of units lacking adequate plumbing facilities is -0.108 (Detroit) to 0.002 (Sacramento); 1990 percent

White is 2.777 (Washington DC) to 11.735 (Austin); and 1990 percent elderly had only one observation of -8.075 (Denver). Even though 1990 percent vacant, 1990 percent children 5 years and under, and 1990 percent unemployed met the criteria for the model, they were in none of the metropolitan area models. Unlike large income decline outcome, large income gain outcome had much wider ranges of values on the coefficients and could have either a negative or positive impact. This is especially noted for the 1990 income, change in the proportion of single family detached units, and number of units lacking adequate plumbing facilities variables. However it should be noted that the range of the coefficients for 1990 percent White is wide, but consistently positive.

While there are similarities and differences in the behavior of coefficients between the base and first full model, there are also noted differences and similarities in the size of the coefficient between large decline and large gain outcomes. For the 1990 income variable, the range of coefficient size is similar except that large decline has comparatively smaller coefficients while large gain has comparatively larger coefficients. For the population change variable, the indicators expectedly behaved in opposite, but with similar effect, at the same magnitude. For the PSH HUD variable, there is mixed impact of PSH HUD on outcome (positive and negative) but the range is very small and narrow. The PSH HUD variable had a consistently negative impact on large gain but the range and magnitude was small (but larger than the magnitude of the coefficients on the PSH HUD large decline outcome).

Magnitude: Median Home Value Neighborhood Change Outcome.

As with the household income outcome, the three base model variables behaved in similar overall patterns in the base model and in the first full model for large gain outcome. For the large decline outcome, the range of coefficient values of 1990 home value in the base model are -0.619 (Miami) to 1.009 (Philadelphia); population change coefficients ranged from -5.284 (Pittsburgh) to -0.663 (Atlanta); and PSH HUD coefficients range from 0.001 (Atlanta) to 0.005 (Sacramento). Comparatively, the range of coefficient values of 1990 income in the first full model are 0.404 (Houston) to 1.129 (Philadelphia); population change coefficients ranged from -4.942 (Pittsburgh) to -0.579 (Atlanta); and PSH HUD coefficients ranged from 0.002 (Denver) to 0.004 (Detroit). The range of the coefficients for the home value model is similar to those on the household income model for both large decline and large gain. The coefficients for the1990 home value variable range became narrower and shifted from some being negative and positive to all parameters being positive. In addition, the population change and PSH range variables became narrower in the first full model compared to the base model.

For large home value decline outcome, additional neighborhood change indicators in the full model resulted in one significant observation for change in the proportion of new housing at a value of 3.688 (Miami); no significant observations for change in the proportion of single family detached units and change in the proportion of 3 bedroom units variables. The range of coefficient values on the other indicators are 1990 percent owner occupied of -4.628 (Philadelphia) to -4.026 (Chicago) (only 2 significant observations); 1990 number of units lacking adequate kitchen facilities of -0.045 (Denver) to -0.027 (Austin); 1990 number of units lacking adequate plumbing facilities is -0.097 (Jacksonville) to -0.058 (Sacramento) (only 2 significant observations); 1990 percent White is -3.881 (Sacramento) to -2.105 (Houston) (only 2 significant observations). Even though 1990 percent vacant, 1990 percent elderly, and 1990 percent children 5 years and under met the criteria for the model, they were in none of the metropolitan area models. The range of significant coefficients is relatively narrow on all but the population change indicator. In addition, all of the coefficients are consistently negative or positive. However, it was not expected that housing stock indicators, except change in the proportion of 3 bedroom units, did not significantly impact the likelihood of neighborhood home value decline.

For large home value gain outcome, the range of coefficient values of 1990 home value in the first full model are -17.491 (Chicago) to -3.677 (Detroit); population change coefficients ranged from 0.542 (Denver) to 8.408 (Pittsburgh); and PSH HUD coefficients ranged from -0.050 (Denver) to -0.004 (Jacksonville). Comparatively, the range of coefficient values in the first full model are 1990 home value -24.207 (Chicago) to -5.692 (Philadelphia); population change coefficients ranged from 0.542 (Denver) to 7.643 (Pittsburgh); and PSH HUD coefficients ranged from -0.033 (Austin) to -0.002 (Chicago). Adding neighborhood change predictors to the model resulted in a similar range of coefficients on core variables in the base model and coefficients on core variables in the full model.

Of the additional neighborhood change indicators for the large gain outcome, the range of coefficient values of change in the proportion of new housing is -7.545 (Philadelphia) to 2.288 (SF/Oakland); change in the proportion of single family detached units is 2.170 (Miami) to 4.330 (Sacramento); change in the proportion of 3 bedroom units has only one significant observation of -5.338 (Atlanta); 1990 percent owner occupied is -2.010 (Houston) to 8.354 (Pittsburgh); 1990 number of units lacking adequate kitchen facilities is -0.058 (Detroit) to 0.011 (Jacksonville); 1990 number of units lacking adequate plumbing facilities is -0.039 (Atlanta) to 0.00009 (Jacksonville); and 1990 percent White is 1.242 (Washington DC) to 11.754 (Detroit). Even though 1990 percent vacant, 1990 percent elderly, and 1990 percent children 5 years and under met the criteria for the model, they were in none of the metropolitan area models. In contrast to large home value decline, variables estimating change in the housing stock quality had a significant impact on the likelihood of large gain for some metropolitan areas. Change in proportion of new housing had mixed impact, but at a large magnitude while change in proportion of single family units was consistently positive with a relatively good size magnitude. The negative impact of change the proportion of 3 bedroom units in Atlanta is surprising and is addressed in the individual metropolitan area analysis. The percent owner occupied had a mixed impact on the likelihood of large gain and had a much wider range of coefficient values compared to large decline. The number of units lacking adequate kitchen and plumbing facilities had a mixed impact on large gain. The coefficient on the1990 percent White indicator has a wide range, unlike large decline, and is consistently positive.

SUMMARY

Direction and magnitude of impact of PSH HUD on neighborhood change quintile outcome

- An increase in population change from 1990 to 2000 increased the likelihood of large gain and decreased the likelihood of large decline. Thus, population growth had a positive impact on how neighborhoods changed during the 1990s.
- An increase in PSH HUD units (2000) increased the likelihood of large decline and decreased the likelihood of large gain. The magnitude of the impact is extremely small but the odds ratios are relatively strong.

Direction and magnitude of impact of PSH HUD on 2000 neighborhood quintile ranking

- An increase in PSH HUD units (2000) increased the likelihood of being in the 1st and 2nd 2000 neighborhood quintiles and decreased the likelihood of being in the 4th and 5th 2000 neighborhood quintiles compared to the 3rd (middle income/quality) neighborhood quintile.

Direction and magnitude of impact of PSH HUD and neighborhood change indicators on neighborhood change quintile outcome.

- An increase in the change of the proportion of new housing increased the likelihood of large income decline and decreased the likelihood of large gain with a strong magnitude of impact. An increase in the change in housing stock variables (age, type, and number of bedrooms) had mostly non-significant impact on the likelihood of large home value decline, but more of an impact on large home value gain.
- An increase in the change of the proportion of single family detached units increased the likelihood of large income decline, but mixed impact on the likelihood of large gain with a very strong magnitude of impact.

- An increase in the change of the proportion of 3 bedroom units did not significantly impact the likelihood of large decline for any metropolitan area but decreased the likelihood of large gain in only one metropolitan area.
- An increase in the number of units that lacked adequate kitchen facilities increased the likelihood of large income decline and decreased the likelihood of large gain with relatively small magnitude of impact. Surprisingly mixed, but small, impacts of these indicators on the likelihood of large home value gain.
- An increase in the number of units that lacked adequate plumbing facilities had a mixed impact on large income decline and large gain with relatively small magnitude of impact. Surprisingly mixed, but small, impacts of these indicators on the likelihood of large home value gain.
- For home value, 1990 owner occupied decreased the likelihood of large decline, but had mixed impact on the likelihood of large gain. Owner occupied had a significant impact on the likelihood of large decline for only two metropolitan areas but it increased the likelihood of large gain for more metropolitan areas.
- An increase in the 1990 percent White decreased the likelihood of large income decline and increased the likelihood of large gain with a strong to very strong level of impact. For home value, 1990 percent White significantly decreased the likelihood of decline for only one metropolitan area, but it increased the likelihood of large gain for many metropolitan areas.
- An increase in the 1990 percent elderly increased the likelihood of large income decline and decreased the likelihood of large gain (for one metropolitan area) with very strong magnitude of impact.

Direction of impact of PSH HUD (neighborhood change indicators as control variables) on neighborhood change quintile outcome

- An increase in PSH HUD units (2000) had a similar impact on the likelihood of large decline and large gain as in the neighborhood change model: increased the likelihood of large decline and decreased the likelihood of large gain.

For all the metropolitan areas as a whole, the most important of the selected indicators that impacted the likelihood of large income decline were population change and 1990 percent White while the most important indicators that impacted the likelihood of large income gain were population change, change in the proportion of new housing, change in the proportion of single family detached units, and 1990 percent White. The most important indicators that impacted the likelihood of large home value decline was population change while the most important indicators that impacted the likelihood of large home value gain were population change, change in the proportion of new housing, change in the proportion of single family detached units, 1990 percent owner occupied and 1990 percent White. PSH HUD units had a significant though very small impact on large household income and home value decline and gain. Similarly, units that lacked adequate kitchen and plumbing facilities, though significant, had a small impact on large household income and home value decline and gain.

Chapter 5 will summarize the study results, discuss their importance and theoretical and policy implications, and suggest directions for future research.

Table 4-1 Summary MSA/PMSA Neighborhood Change Indicator Change: Large Decrease (-4 to -2) and Large Increase (2 to 4)

			1990		2000	
Metropolitan Area	#Census Tracts	% of MSA/PMSA Census Tracts	Tract Population	% of MSA/PMSA Population	Tract Population	% of MSA/PMSA Population
Atlanta MSA						
Decrease Household Income	103	15.92%	526,058	17.96%	656,926	16.12%
Increase Household Income	114	17.62%	425,979	14.54%	718,438	17.63%
Decrease Home Value	108	16.69%	555,474	18.96%	691,059	16.96%
Increase Home Value	110	17.00%	405,941	13.86%	672,537	16.50%
Austin						
Decrease Household Income	23	9.24%	77,535	9.40%	111,739	9.12%
Increase Household Income	41	16.47%	82,255	9.98%	178,263	14.55%
Decrease Home Value	29	11.65%	104,276	12.65%	142,253	11.61%
Increase Home Value	42	16.87%	81,356	9.87%	172,755	14.10%
Chicago PMSA						
Decrease Household Income	43	2.45%	169,818	2.35%	180,673	2.23%
Increase Household Income	188	10.72%	619,009	8.56%	826,420	10.22%
Decrease Home Value	28	1.60%	124,092	1.72%	128,707	1.59%
Increase Home Value	167	9.53%	457,004	6.32%	604,657	7.48%
Dayton MSA						
Decrease Household Income	3	1.26%	14,598	1.55%	11,934	1.27%
Increase Household Income	2	0.84%	8,390	0.89%	8,605	0.91%
Decrease Home Value	3	1.24%	12,217	1.30%	9,640	1.02%
Increase Home Value	8	3.32%	17,274	1.83%	17,915	1.90%

Table 4-1 Summary MSA/PMSA Neighborhood Change Indicator Change: Large Decrease (-4 to -2) and Large Increase (2 to 4)

			1990		2000	
Metropolitan Area	#Census Tracts	% of MSA/PMSA Census Tracts	Tract Population	% of MSA/PMSA Population	Tract Population	% of MSA/PMSA Population
Denver MSA						
Decrease Household Income	86	17.34%	325,277	20.24%	373,604	18.05%
Increase Household Income	101	20.36%	199,245	12.40%	357,593	17.28%
Decrease Home Value	90	18.15%	341,493	21.25%	386,385	18.67%
Increase Home Value	104	20.97%	215,509	13.41%	382,417	18.48%
Detroit PMSA						
Decrease Household Income	56	4.51%	205,617	4.86%	204,568	4.65%
Increase Household Income	164	13.20%	380,202	8.99%	518,011	11.77%
Decrease Home Value	18	1.45%	71,048	1.68%	69,998	1.59%
Increase Home Value	126	10.14%	254,928	6.03%	365,237	8.30%
Houston PMSA	749					
Decrease Household Income	60	8.01%	278,706	8.51%	319,562	7.82%
Increase Household Income	114	15.22%	390,223	11.91%	634,829	15.53%
Decrease Home Value	43	5.74%	187,871	5.74%	208,983	5.11%
Increase Home Value	106	14.15%	324,400	9.90%	556,460	13.62%
Jacksonville MSA	194					
Decrease Household Income	27	13.92%	129,353	14.49%	136,833	12.55%
Increase Household Income	40	20.62%	170,316	19.09%	270,948	24.85%
Decrease Home Value	20	10.31%	85,661	9.60%	89,612	8.22%
Increase Home Value	34	17.53%	127,741	14.31%	204,324	18.74%

Table 4-1 Summary MSA/PMSA Neighborhood Change Indicator Change: Large Decrease (-4 to -2) and Large Increase (2 to 4)

			1990		2000	
Metropolitan Area	#Census Tracts	% of MSA/PMSA Census Tracts	Tract Population	% of MSA/PMSA Population	Tract Population	% of MSA/PMSA Population
Memphis MSA	258					
Decrease Household Income	20	7.75%	90,873	9.25%	92,983	8.32%
Increase Household Income	42	16.28%	92,322	9.40%	174,761	15.63%
Decrease Home Value	25	9.69%	109,125	11.11%	112,445	10.06%
Increase Home Value	42	16.28%	88,786	9.04%	168,577	15.08%
Miami	332					
Decrease Household Income	41	12.35%	251,621	13.16%	274,363	12.41%
Increase Household Income	59	17.77%	289,273	15.13%	441,658	19.98%
Decrease Home Value	38	11.45%	235,867	12.34%	252,144	11.41%
Increase Home Value	54	16.27%	270,537	14.15%	379,510	17.17%
Minneapolis MSA	731					
Decrease Household Income	86	11.76%	351,684	13.96%	359,066	12.21%
Increase Household Income	139	19.02%	345,331	13.71%	558,516	18.99%
Decrease Home Value	100	13.68%	390,421	15.50%	392,147	13.33%
Increase Home Value	150	20.52%	388,017	15.41%	614,906	20.91%
Philadelphia PMSA	1,261					
Decrease Household Income	24	1.90%	71,102	1.47%	71,431	1.42%
Increase Household Income	103	8.17%	372,404	7.69%	438,633	8.73%
Decrease Home Value	5	0.40%	13,329	0.28%	13,248	0.26%
Increase Home Value	77	6.11%	247,971	5.12%	310,971	6.19%

Table 4-1 Summary MSA/PMSA Neighborhood Change Indicator Change: Large Decrease (-4 to -2) and Large Increase (2 to 4)

			1990		2000	
Metropolitan Area	#Census Tracts	% of MSA/PMSA Census Tracts	Tract Population	% of MSA/PMSA Population	Tract Population	% of MSA/PMSA Population
Pittsburgh MSA	689					
Decrease Household Income	44	6.39%	142,161	6.00%	129,547	5.55%
Increase Household Income	42	6.10%	162,912	6.88%	171,398	7.35%
Decrease Home Value	35	5.08%	114,611	4.84%	102,138	4.38%
Increase Home Value	41	5.95%	159,103	6.72%	166,261	7.13%
Sacramento	343					
Decrease Household Income	58	16.91%	263,622	20.02%	281,847	18.21%
Increase Household Income	66	19.24%	167,674	12.73%	287,783	18.60%
Decrease Home Value	44	12.83%	205,185	15.58%	221,673	14.32%
Increase Home Value	54	15.74%	110,262	8.37%	210,316	13.59%
San Francisco/Oakland PMSA	829					
Decrease Household Income	12	1.45%	55,873	1.56%	59,106	1.47%
Increase Household Income	64	7.72%	237,798	6.64%	285,697	7.11%
Decrease Home Value	8	0.97%	27,965	0.78%	31,429	0.78%
Increase Home Value	57	6.88%	204,367	5.71%	243,061	6.05%
Washington DC PMSA	998					
Decrease Household Income	38	3.81%	162,310	3.92%	172176	3.56%
Increase Household Income	99	9.92%	315,811	7.62%	476123	9.84%
Decrease Home Value	25	2.51%	115,949	2.80%	124636	2.58%
Increase Home Value	73	7.31%	218,889	5.28%	339754	7.02%

Table 4-2 Distribution of Subsidized Households by Neighborhood Change
Quintile Indicator: Large Decrease (-4 to -2) and Large Increase (2 to 4)

	All HUD PSH Units Reported: 2000			HCV Units Reported: 2000		
Metopolitan Area	Metro Total	#Units in Change Category	% of Metro All HUD PSH Units Reported	Metro Total	#Units in Change Category	% of Metro HCV Units Reported
Atlanta MSA	45,849			18,465		
Decrease Household Income		10,783	23.52%		5,678	30.75%
Increase Household Income		1,757	3.83%		893	4.84%
Decrease Home Value		12,260	26.74%		6,699	36.28%
Increase Home Value		3,884	8.47%		1,367	7.40%
Austin	8,799					
Decrease Household Income		1,374	15.62%	2,977	880	29.56%
Increase Household Income		228	2.59%		92	3.09%
Decrease Home Value		1,517	17.24%		675	22.67%
Increase Home Value		305	3.47%		107	3.59%
Chicago PMSA	94,653			29,949		
Decrease Household Income		1,867	1.97%		999	2.50%
Increase Household Income		4,401	4.65%		1,662	4.16%
Decrease Home Value		1,678	1.77%		598	1.50%
Increase Home Value		9,058	9.57%		1,906	4.77%
Dayton MSA	15,277			4,618		
Decrease Household Income		118	0.77%		71	1.54%
Increase Household Income		41	0.27%		1	0.02%
Decrease Home Value		667	4.37%		65	1.41%
Increase Home Value		700	4.58%		27	0.58%

Table 4-2 Distribution of Subsidized Households by Neighborhood Change
Quintile Indicator: Large Decrease (-4 to -2) and Large Increase (2 to 4)

	All HUD PSH Units Reported: 2000			HCV Units Reported: 2000		
Metopolitan Area	Metro Total	#Units in Change Category	% of Metro All HUD PSH Units Reported	Metro Total	#Units in Change Category	% of Metro HCV Units Reported
Denver MSA	21,772			9,510		
Decrease Household Income		4,380	20.12%		2,423	25.48%
Increase Household Income		300	1.38%		239	2.51%
Decrease Home Value		6,655	30.57%		2,401	25.25%
Increase Home Value		487	2.24%		205	2.16%
Detroit PMSA	51,178			13,718		
Decrease Household Income		2,327	4.55%		775	5.65%
Increase Household Income		973	1.90%		131	0.95%
Decrease Home Value		1,830	3.58%		352	2.57%
Increase Home Value		1,304	2.55%		198	1.44%
Houston PMSA	26,795			12,524		
Decrease Household Income		3,165	11.81%		1,466	11.71%
Increase Household Income		608	2.27%		460	3.67%
Decrease Home Value		2,526	9.43%		879	7.02%
Increase Home Value		687	2.56%		573	4.58%
Jacksonville MSA	14,825			5,665		
Decrease Household Income		3,523	23.76%		1,740	30.71%
Increase Household Income		860	5.80%		502	8.86%
Decrease Home Value		2,219	14.97%		866	15.29%
Increase Home Value		961	6.48%		418	7.38%

Table 4-2 Distribution of Subsidized Households by Neighborhood Change
Quintile Indicator: Large Decrease (-4 to -2) and Large Increase (2 to 4)

	All HUD PSH Units Reported: 2000			HCV Units Reported: 2000		
Metopolitan Area	Metro Total	#Units in Change Category	% of Metro All HUD PSH Units Reported	Metro Total	#Units in Change Category	% of Metro HCV Units Reported
Memphis MSA	16,028			4,763		
Decrease Household Income		2,871	17.91%		1,220	25.61%
Increase Household Income		241	1.50%		36	0.76%
Decrease Home Value		1,602	10.00%		734	15.41%
Increase Home Value		337	2.10%		36	0.76%
Miami	32,980			13,071		
Decrease Household Income		4,744	14.38%		2,096	16.04%
Increase Household Income		1,728	5.24%		1,269	9.71%
Decrease Home Value		6,048	18.34%		2,005	15.34%
Increase Home Value		1,763	5.35%		1,344	10.28%
Minneapolis MSA	36,515			14,037		
Decrease Household Income		6,961	19.06%		2,920	20.80%
Increase Household Income		1,603	4.39%		697	4.97%
Decrease Home Value		8,347	22.86%		3,202	22.81%
Increase Home Value		2,760	7.56%		1,036	7.38%
Philadelphia PMSA	54,738			18,878		
Decrease Household Income		1,021	1.87%		350	1.85%
Increase Household Income		1,272	2.32%		313	1.66%
Decrease Home Value		211	0.39%		58	0.31%
Increase Home Value		785	1.43%		155	0.82%

Table 4-2 Distribution of Subsidized Households by Neighborhood Change
Quintile Indicator: Large Decrease (-4 to -2) and Large Increase (2 to 4)

	All HUD PSH Units Reported: 2000			HCV Units Reported: 2000		
Metopolitan Area	Metro Total	#Units in Change Category	% of Metro All HUD PSH Units Reported	Metro Total	#Units in Change Category	% of Metro HCV Units Reported
Pittsburgh MSA	43,866			11,278		
Decrease Household Income		4,753	10.84%		1,588	14.08%
Increase Household Income		626	1.43%		102	0.90%
Decrease Home Value		4,634	10.56%		1,336	11.85%
Increase Home Value		1,120	2.55%		139	1.23%
Sacramento	14,603			7,160		
Decrease Household Income		4,227	28.95%		2,414	33.72%
Increase Household Income		799	5.47%		674	9.41%
Decrease Home Value		3,276	22.43%		1,847	25.80%
Increase Home Value		1,084	7.42%		525	7.33%
San Francisco/Oakland PMSA	56,024			28,591		
Decrease Household Income		1,436	2.56%		557	1.95%
Increase Household Income		1,675	2.99%		961	3.36%
Decrease Home Value		768	1.37%		185	0.65%
Increase Home Value		5,412	9.66%		1,093	3.82%
Washington DC PMSA	52,966			19,017		
Decrease Household Income		2794	5.28%		1372	7.21%
Increase Household Income		1482	2.80%		914	4.81%
Decrease Home Value		1553	2.93%		897	4.72%
Increase Home Value		1372	2.59%		624	3.28%

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Household Income Variable Description	Atlanta Base	First Full	Austin Base	First Full	Chicago Base	First Full
Large Decline:						
Mdhhy9_0dlrs_metro	0.5281(0.234)**	0.770(0.268)***	1.145(0.410)***	1.969(0.572)****	0.574(0.258)**	1.073(0.276)****
Trpoppc	-0.520(0.305)*	-0.433(0.304)	-0.009(0.394)****	0.057(0.444)	0.006(0.602)	0.147(0.417)
AllHUD	0.001(0.001)*	0.0006(0.001)	-0.006(0.003)**	0.001(0.003)	-0.0003(0.002)	-0.002(0.002)
Blt10yrchg		0.381(0.692)		0.201(1.387)		-2.134(1.288)*
Ttunit1pc		-1.086(1.214)				-2.324(2.664)
Kitno9		0.008(0.007)		0.005(.010)		-0.006(0.012)
Plmbno9		0.004(0.011)		-0.005(0.023)		-0.0009(0.017)
Shrnhw9		-0.672(0.435)		-3.860(1.169)****		-2.095(0.520)****
Old9						
Large Gain:						
Mdhhy9_0dlrs_metro	-6.646(0.738)****	-8.121(0.967)****	-6.378(1.172)****	-7.591(1.463)****	-5.092(0.389)****	-10.981(0.824)****
Trpoppc	1.085(0.215)****	1.003(0.299)****	1.574(0.406)****	0.962(0.474)**	1.955(0.251)****	1.411(0.278)****
AllHUD	-0.023(0.004)****	-0.015(0.004)****	-0.0373(0.013)***	-0.019(0.015)	-0.015(0.002)****	-0.010(0.002)****
Blt10yrchg		0.406(0.930)****		-1.412(1.537)		-0.861(0.947)
Ttunit1pc		6.721(1.375)****				3.334(1.481)**
Kitno9		-0.035(0.019)*		-0.046(0.023)**		-0.012(0.009)
Plmbno9		-0.076(0.028)***		-0.025(0.045)		0.005(0.015)
Shrnhw9		4.283(0.809)****		11.735(3.764)***		8.130(0.696)****
Old9						
Chi-Square	257.64****	349.03****	136.95****	174.63****	392.47****	741.99****
Cox and Snell	0.328	0.417	0.423	0.504	0.201	0.345
Nagelkerke	0.398	0.506	0.548	0.653	0.337	0.579
McFadden	0.229	0.310	0.373	0.475	0.247	0.467

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Home Value/	Atlanta		Austin		Chicago	
Variable Description	Base	First Full	Base	First Full	Base	First Full
Large Decline:						
Mdvalh9_0dlrs_metro	-0.258(0.199)	-0.183(0.213)	0.068(0.453)	0.075(0.473)	1.398(1.056)	3.426(1.144)***
Trpoppc	-0.663(0.317)**	-0.579(0.342)*	-0.547(0.453)	-0.543(0.484)	-2.197(1.233)*	-1.565(1.242)
AllHUD	0.001(0.001)**	0.0008(0.001)	0.002(0.003)	0.002(0.003)	0.0006(0.001)	-0.0004(0.002)
Blt10yrchg		0.409(0.701)		-0.413(1.127)		-0.017(1.927)
Ttunit1pc		-1.108(1.253)				
Bdtot3pch		1.284(1.778)				
Ownocc9p				0.139(1.029)		-4.026(1.035)****
Kitno9		-0.002(0.008)		-0.027(0.016)*		-0.021(0.015)
Plmbno9		0.008(0.011)		0.024(0.018)		0.024(0.016)
Shrnhw9		-0.282(0.423)				0.891(0.806)
Large Gain:						
Mdvalh9_0dlrs_metro	-7.133(0.807)****	-7.573(0.892)****	-11.600(2.057)****	-11.162(2.040)****	-17.491(1.317)****	-24.207(1.712)****
Trpoppc	1.180(0.234)****	1.005(0.298)****	0.770(0.315)**	0.528(0.337)	1.435(0.245)****	0.567(0.355)
AllHUD	-0.004(0.002)**	0.0005(0.002)	-0.029(0.011)***	-0.033(0.013)**	-0.005(0.001)****	-0.002(0.001)**
Blt10yrchg		-1.675(0.833)**		1.692(1.458)		1.225(0.757)*
Ttunit1pc		3.047(1.332)**				
Bdtot3pch		-5.338(1.939)***				
Ownocc9p				-0.475(1.773)		0.467(0.666)
Kitno9		0.006(0.011)		-0.021(0.029)		-0.002(0.006)
Plmbno9		-0.039(0.021)*		-0.064(0.055)		0.006(0.009)
Shrnhw9		1.916(0.587)****				3.193(0.501)****
Chi-Square	217.26****	267.57****	149.69****	160.14****	352.48****	465.34****
Cox and Snell	0.285	0.339	0.452	0.474	0.182	0.233
Nagelkerke	0.346	0.410	0.569	0.597	0.334	0.427
McFadden	0.192	0.237	0.380	0.407	0.255	0.336

* $p < .10$; ** $p < .05$; *** $p < .01$; **** $p < .001$

Note (a): Quasi-complete separation in data; no full model estimated.

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Household Income	Dayton		Denver		Detroit	
Variable Description	Base (a)	First Full(a)	Base	First Full	Base	First Full
Large Decline:						
Mdhhy9_0dlrs_metro	1.251(.0855)		0.561(.217)***	0.581(.229)**	.650(214)***	0.611(235)***
Trpoppc	-15.334(6.312)**		-0.647(0.393)*	-0.486(.375)	-.614(834)	-1.469(.960)
AllHUD	-0.007(0.011)		0.0004(.001)	0.00004(.002)	.001(.002)	0.001(.001)
Blt10yrchg				-0.649(.699)		1.228(1.403)
Ttunit1pc				2.015(1.626)		-3.799(2.011)*
Kitno9				-0.008(.010)		-0.029(.020)
Plmbno9				0.025(.025)		0.009(.022)
Shrnhw9						
Old9				2.907(1.604)*		
Large Gain:						
Mdhhy9_0dlrs_metro	-8.061(3.472)**		-7.684(1.001)****	-8.444(1.145)****	-4.580(418)****	-5.676(.507)****
Trpoppc	0.947(4.065)		0.640(.271)**	.625(.291)**	3.414(.421)****	3.311(.457)****
AllHUD	-0.036(0.029)		-0.126(.024)****	-.119(.024)****	-.029(.006)****	-0.024(.005)****
Blt10yrchg				-.795(.942)		-3.266(.891)****
Ttunit1pc				2.742(1.399)**		5.156(1.145)****
Kitno9				-.024(.034)		-0.094(.021)****
Plmbno9				-.014(.057)*		-0.108(.031)****
Shrnhw9						
Old9				-8.075(3.579)**		
Chi-Square	16.47*		328.51****	350.10****	432.28****	554.43****
Cox and Snell	0.067		0.484	0.506	0.294	0.360
Nagelkerke	0.322		0.575	0.601	0.433	0.531
McFadden	0.298		0.359	0.382	0.307	0.393

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Home Value/ Variable Description	Dayton Base	First Full(a)	Denver Base	First Full	Detroit Base	First Full
Large Decline:						
Mdvalh9_0dlrs_metro	1.460(0.916)		-0.029(0.214)	-0.037(0.223)	0.598(0.177)****	0.667(0.195)****
Trpoppc	-5.993(4.900)		-1.949(0.625)***	-2.144(0.664)****	-1.704(1.608)	-2.335(1.683)
AllHUD	0.010(0.004)***		0.003(0.001)**	0.002(0.001)*	0.004(0.001)***	0.004(0.002)**
Blt10yrchg				-0.802(0.660)		2.290(2.481)
Ttunit1pc				-1.203(1.503)		
Bdtot3pch						
Ownocc9p				-0.961(0.678)		-1.402(1.441)
Kitno9				-0.045(0.018)**		0.0005(0.008)
Plmbno9				0.029(0.026)		0.021(0.015)
Shrnhw9						1.240(1.026)
Large Gain:						
Mdvalh9_0dlrs_metro	-7.060(2.435)***		-5.807(0.728)****	-6.704(0.868)****	-3.677(0.437)****	-7.075(0.695)****
Trpoppc	8.567(2.907)***		0.542(0.195)***	0.491(0.207)**	3.751(0.416)****	3.182(0.474)****
AllHUD	0.004(0.004)		-0.050(0.012)****	-0.016(0.011)	-0.015(0.004)****	-0.005(0.004)
Blt10yrchg				0.398(0.787)		-4.412(0.908)****
Ttunit1pc				1.829(1.159)		
Bdtot3pch						
Ownocc9p				7.343(1.698)****		1.653(1.019)
Kitno9				-0.012(0.031)		-0.058(0.025)**
Plmbno9				0.032(0.050)		-0.051(0.038)
Shrnhw9						11.754(2.775)****
Chi-Square	23.98****		279.29****	320.52****	303.46****	486.63****
Cox and Snell	0.095		0.431	0.476	0.217	0.324
Nagelkerke	0.310		0.508	0.562	0.392	0.586
McFadden	0.272		0.300	0.344	0.304	0.487

* p < .10; **p < .05; ***p < .01;**** p < .001

Note (a): Quasi-complete separation in data; no full model estimated.

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Household Income	Houston		Jacksonville		Memphis	
Variable Description	Base	First Full	Base	First Full	Base	First Full(a)
Large Decline:						
Mdhhy9_0dlrs_metro	0.534(.198)***	1.377(.250)****	1.63(.68)**	.901(.748)	1.183(0.474)**	
Trpoppc	-1.196(.593)**	-0.652(.632)	-1.53(1.02)	-2.102(1.239)*	-1.658(1.155)	
AllHUD	0.002(.001)	-0.00003(.002)	.004 (.002)**	.006(.002)****	0.003(0.002)*	
Blt10yrchg		-1.387(.847)*		.315(1.706)		
Ttunit1pc		-3.749(1.998)*				
Kitno9		0.013(.005)***		-.026(.028)		
Plmbno9		0.007(.010)		-.065(.042)		
Shrnhw9		-3.002(.633)****		1.139(1.231)		
Old9						
Large Gain:						
Mdhhy9_0dlrs_metro	-5.637(.610)****	-8.049(.881)****	-6.22(1.16)*****	-7.249(1.529)*****	-7.749(1.571)****	
Trpoppc	2.044(.345)****	1.854(.488)****	2.61(.90)****	2.212(1.054)**	4.027(0.827)****	
AllHUD	-0.044(.010)****	-0.023(.008)***	-.015(.005)****	-.004(.005)	-0.023(0.013)*	
Blt10yrchg		-2.982(.884)****		-1.983(1.981)		
Ttunit1pc		2.897(1.434)**				
Kitno9		0.007(.013)		-.035(.037)		
Plmbno9		-0.056(.026)**		.015(.034)		
Shrnhw9		7.027(1.133)****		4.883(2.276)**		
Old9						
Chi-Square	313.68****	478.51****	118.58****	140.10****	162.10****	
Cox and Snell	0.342	0.472	0.457	0.514	0.467	
Nagelkerke	0.457	0.630	0.553	0.622	0.618	
McFadden	0.303	0.462	0.348	0.412	0.447	

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Home Value/ Variable Description	Houston Base	First Full	Jacksonville Base	First Full	Memphis Base	First Full(a)
Large Decline:						
Mdvalh9_0dlrs_metro	0.0816(0.139)	0.404(0.151)***	0.539(0.604)	0.115(0.671)	0.178(0.405)	0.172(0.408)
Trpoppc	-1.873(0.785)**	-1.220(0.870)	-1.257(1.080)	-1.216(1.134)	-0.907(0.872)	-0.868(0.859)
AllHUD	0.002(0.001)	-0.0001(0.002)	0.002(0.002)	0.003(0.002)	-0.0009(0.002)	-0.0008(0.002)
Blt10yrchg		-1.077(1.077)		2.489(1.771)		-0.066(1.533)
Ttunit1pc		-2.068(2.264)				
Bdtot3pch						
Ownocc9p		-0.309(0.738)		-0.650(1.373)		
Kitno9		0.009(0.006)		-0.057(0.039)		
Plmbno9		0.017(0.011)		-0.097(0.053)*		
Shrnhw9		-2.105(0.708)***				
Large Gain:						
Mdvalh9_0dlrs_metro	-8.693(0.980)****	-8.906(1.053)****	-8.008(1.605)****	-8.432(1.738)****	-7.673(1.540)****	-8.418(1.722)****
Trpoppc	2.982(0.432)****	2.635(0.488)****	2.186(0.731)***	2.988(0.856)****	3.493(0.768)****	4.595(0.984)****
AllHUD	-0.031(0.008)****	-0.023(0.008)***	-0.013(0.005)***	-0.006(0.005)	-0.029(0.015)	-0.027(0.015)*
Blt10yrchg		-0.556(0.875)		-6.143(2.386)***		-5.625(1.779)***
Ttunit1pc		1.027(1.287)				
Bdtot3pch						
Ownocc9p		-2.010(0.977)**		4.526(2.394)*		
Kitno9		-0.037(0.019)		0.011(0.037)*		
Plmbno9		0.014(0.023)		0.0009(0.030)****		
Shrnhw9		4.181(1.009)****				
Chi-Square	353.33****	418.11****	100.83****	125.25****	155.17****	166.70****
Cox and Snell	0.376	0.428	0.405	0.476	0.452	0.476
Nagelkerke	0.530	0.603	0.515	0.604	0.584	0.615
McFadden	0.381	0.451	0.335	0.417	0.404	0.434

* p < .10; **p < .05; ***p < .01;**** p < .001

Note (a): Quasi-complete separation in data; no full model estimated.

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Household Income	Miami		Minneapolis		Philadelphia	
Variable Description	Base	First Full	Base	First Full	Base	First Full
Large Decline:						
Mdhhy9_0dlrs_metro	-0.162(0.313)	-0.397(0.355)	1.187(0.317)****	1.216(0.335)****	0.859(0.277)***	0.901(0.291)***
Trpoppc	-0.115(0.715)	-0.241(0.693)	-3.197(0.920)****	-3.313(0.921)****	-2.332(1.501)	-1.807(1.473)
AllHUD	-0.0002(.001)	0.0001(.001)***	0.003(0.001)***	0.003(0.001)***	0.0008(.002)	0.0004(.002)
Blt10yrchg		2.301(1.447)		0.985(0.965)		0.137(0.004)
Ttunit1pc				-3.424(2.109)		
Kitno9		-0.014(0.009)		-0.0004(0.011)		-0.007(0.022)
Plmbno9		0.006(0.013)		0.005(0.021)*		-0.086(0.045)*
Shrnhw9						-1.821(0.781)**
Old9						
Large Gain:						
Mdhhy9_0dlrs_metro	-6.948(1.063)****	-7.109(1.181)****	-7.782(0.795)****	-8.716(0.895)****	-5.763(0.497)****	-7.354(0.641)****
Trpoppc	1.344(0.461)***	0.932(0.427)**	1.819(0.377)****	2.382(0.461)****	2.929(0.482)****	4.248(0.721)****
AllHUD	-0.019(.005)****	-0.015(0.005)****	-0.037(0.006)****	-0.041(0.007)****	-0.028(0.005)****	-0.012(0.004)***
Blt10yrchg		-0.926(1.143)		-4.341(1.056)****		-8.282(1.159)****
Ttunit1pc				-2.746(1.643)*		
Kitno9		-0.011(0.012)		-0.048(0.031)		-0.053(0.025)**
Plmbno9		-0.044(0.022)**		-0.094(0.046)**		-0.008(0.030)*
Shrnhw9						4.083(1.164)****
Old9						
Chi-Square	172.37****	188.33****	458.90****	509.03****	314.98****	442.09****
Cox and Snell	0.405	0.501	0.466	0.502	0.221	0.296
Nagelkerke	0.503	0.599	0.578	0.622	0.419	0.560
McFadden	0.318	0.384	0.382	0.424	0.333	0.467

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Home Value/ Variable Description	Miami Base	First Full	Minneapolis Base	First Full	Philadelphia Base	First Full
Large Decline:						
Mdvalh9_0dlrs_metro	-0.619(0.373)*	-0.446(.0483)	-0.119(0.299)	-0.297(0.332)	1.009(0.375)***	1.129(0.433)***
Trpoppc	-0.867(0.791)	-0.290(0.576)	-4.497(0.987)****	-4.570(1.022)****	-4.063(3.596)	-3.373(3.129)
AllHUD	0.001(0.001)	0.0003(.001)	0.002(0.001)***	0.003(0.001)**	0.001(0.004)	-0.002(0.006)
Blt10yrchg		3.688(1.717)**		-0.193(0.919)		-4.090(2.877)
Ttunit1pc		-0.606(2.414)		-1.726(2.196)		
Bdtot3pch				-0.023(0.683)		
Ownocc9p		-0.634(1.008)		-0.023(0.683)		-4.628(2.077)**
Kitno9		-0.007(0.009)		-0.043(0.020)**		0.003(0.024)
Plmbno9		0.011(0.013)		0.010(0.022)		-0.011(0.063)
Shrnhw9		-1.794(1.156)		0.781(0.994)		-0.556(2.451)
Large Gain:						
Mdvalh9_0dlrs_metro	-6.628(1.025)****	-7.829(1.385)****	-8.888(0.868)****	-10.743(1.130)****	-4.251(0.470)****	-5.692(0.615)****
Trpoppc	0.210(0.211)	-0.024(0.252)	1.897(0.414)****	1.882(0.578)****	3.886(0.526)****	5.379(0.719)****
AllHUD	-0.011(0.004)***	-0.009(0.003)***	0.002(0.001)***	0.003(0.001)**	-0.037(0.008)****	-0.012(0.006)**
Blt10yrchg		0.467(1.078)		-3.436(1.093)***		-7.545(1.134)****
Ttunit1pc		2.170(1.335)*		3.892(1.924)**		
Bdtot3pch						
Ownocc9p		1.702(1.357)		4.545(1.523)***		0.610(1.312)
Kitno9		0.012(0.009)		-0.052(0.032)*		-0.050(0.029)*
Plmbno9		-0.0006(0.024)		-0.001(0.047)		-0.043(0.041)
Shrnhw9		2.690(1.261)**		5.266(2.488)**		5.328(1.934)***
Chi-Square	143.16****	171.04****	471.66****	557.34****	228.23****	339.12****
Cox and Snell	0.350	0.403	0.475	0.533	0.166	0.236
Nagelkerke	0.444	0.510	0.576	0.646	0.414	0.589
McFadden	0.277	0.331	0.370	0.437	0.354	0.526

* p < .10; **p < .05; ***p < .01;**** p < .001

Note (a): Quasi-complete separation in data; no full model estimated.

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Household Income Variable Description	Pittsburgh Base	First Full	Sacramento Base	First Full
Large Decline:				
Mdhhy9_0dlrs_metro	-1.515(0.258)****	1.656(0.271)****	0.797(0.438)*	1.380(0.506)***
Trpoppc	-5.679(1.392)****	-5.668(1.398)****	-1.742(1.007)*	-1.657(1.021)*
AllHUD	0.004(0.001)****	0.004(0.001)***	0.006(0.002)***	0.002(0.003)
Blt10yrchg				0.381(0.868)
Ttunit1pc				
Kitno9		0.023(0.011)**		0.020(0.009)**
Plmbno9		0.001(0.019)***		-0.056(0.023)**
Shrnhw9				-4.935(0.966)****
Old9				
Large Gain:				
Mdhhy9_0dlrs_metro	-6.676(0.929)****	-7.330(1.006)****	-5.718(0.895)****	-5.386(0.907)****
Trpoppc	5.716(1.341)****	6.075(1.359)****	1.585(0.392)****	1.805(0.425)****
AllHUD	-0.022(0.006)****	-0.022(0.006)****	-0.031(0.008)****	-0.033(0.010)****
Blt10yrchg				-2.138(0.949)**
Ttunit1pc				
Kitno9		-0.039(0.027)		-0.061(0.043)
Plmbno9		-0.047(0.031)		0.002(0.027)***
Shrnhw9				-0.978(1.827)
Old9				
Chi-Square	180.06****	196.79****	196.02****	238.18****
Cox and Snell	0.230	0.248	0.435	0.501
Nagelkerke	0.381	0.411	0.521	0.599
McFadden	0.282	0.309	0.316	0.384

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Home Value/ Variable Description	Pittsburgh Base	First Full	Sacramento Base	First Full
Large Decline:				
Mdvalh9_0dlrs_metro	0.684(0.168)****	0.713(0.174)****	-0.045(0.436)	0.597(0.493)
Trpoppc	-5.284(1.407)****	-4.942(1.739)***	-1.297(0.990)	-1.416(1.058)
AllHUD	0.004(0.001)****	0.003(0.001)***	0.005(0.002)***	0.002(0.003)
Blt10yrchg				-0.752(0.835)
Ttunit1pc				0.196(2.841)
Bdtot3pch				
Ownocc9p		1.022(1.077)		0.115(1.006)
Kitno9		0.009(0.013)		0.015(0.010)
Plmbno9		0.002(0.020)		-0.058(0.026)**
Shrnhw9		-0.875(0.879)		-3.881(1.037)****
Large Gain:				
Mdvalh9_0dlrs_metro	-7.076(0.990)****	-7.773(1.072)****	-5.627(0.988)****	-6.223(1.134)****
Trpoppc	8.408(1.487)****	7.643(1.746)****	1.297(0.353)****	1.631(0.448)****
AllHUD	-0.011(0.004)***	-0.002(0.004)	-0.008(0.005)	0.004(0.006)
Blt10yrchg				0.070(1.056)
Ttunit1pc				4.330(1.815)**
Bdtot3pch				
Ownocc9p		8.354(2.252)****		-1.645(1.277)
Kitno9		0.014(0.017)		-0.058(0.049)
Plmbno9		-0.028(0.022)		0.005(0.041)
Shrnhw9		1.478(2.361)		7.475(2.493)***
Chi-Square	146.12****	170.80****	147.57****	191.44****
Cox and Snell	0.191	0.220	0.350	0.428
Nagelkerke	0.335	0.384	0.439	0.537
McFadden	0.251	0.293	0.271	0.351

* p < .10; **p < .05; ***p < .01;**** p < .001

Note (a): Quasi-complete separation in data; no full model estimated.

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Household Income Variable Description	SF/Oak Base	First Full	Washington DC Base	First Full
Large Decline:				
Mdhhy9_0dlrs_metro	5.881E-06(0.000)	-8.531E-07(0.000)	1.694(0.317)****	3.872(0.525)****
Trpoppc	-2.846(2.142)	-2.972(2.288)	-1.976(1.026)*	-0.444(0.734)
AllHUD	0.002(0.001)	0.002(0.002)	0.003(0.001)***	-0.002(0.002)
Blt10yrchg		-0.765(2.224)		2.564(1.653)
Ttunit1pc				
Kitno9		-0.054(0.043)		0.006(0.014)
Plmbno9		0.020(0.036)		-0.021(0.025)
Shrnhw9		0.787(1.538)		-6.286(0.986)****
Old9				
Large Gain:				
Mdhhy9_0dlrs_metro	-9.134E-05(0.000)****	-1.421E-04(0.000)****	-7.072(0.683)****	-7.661(0.764)****
Trpoppc	1.620(0.495)****	1.762(0.594)***	0.968(0.179)****	1.201(0.221)****
AllHUD	-0.021(0.004)****	-0.020(0.004)****	-0.029(0.006)****	-0.029(0.007)****
Blt10yrchg		-4.229(1.271)****		-3.668(0.884)****
Ttunit1pc				
Kitno9		0.004(0.009)		-0.057(0.032)*
Plmbno9		-0.030(0.023)		-0.010(0.025)
Shrnhw9		5.081(1.032)****		2.777(0.719)****
Old9				
Chi-Square	165.12****	221.92****	373.28****	516.46****
Cox and Snell	0.181	0.235	0.312	0.404
Nagelkerke	0.361	0.470	0.505	0.654
McFadden	0.288	0.386	0.389	0.538

Table 4-4 Base and First Full Model Summary for Median Household Income Neighborhood Outcome: Quintile Change Category

Median Home Value/ Variable Description	SF/Oak Base	First Full	Washington DC Base	First Full
Large Decline:				
Mdvalh9_0dlrs_metro	2.021E-06(0.000)	3.026E-06(0.000)	6.864E-07(0.000)	6.630E-07(0.000)
Trpoppc	1.132(0.983)	1.567(1.034)	-1.530(1.053)	-1.263(1.061)
AllHUD	0.002(0.002)	-0.002(0.004)	0.0004(0.002)	-0.00004(0.002)
Blt10yrchg		-0.527(2.571)		-0.698(1.190)
Ttunit1pc				
Bdtot3pch				
Ownocc9p		-0.278(1.719)		-1.007(0.980)
Kitno9		0.001(0.011)		-0.038(0.033)
Plmbno9		0.017(0.015)		-0.024(0.031)
Shrnhw9		-2.409(1.910)		-0.100(0.894)
Large Gain:				
Mdvalh9_0dlrs_metro	-1.404E-5(0.000)****	-1.773E-05(0.000)****	-3.034E-05(0.000)****	-3.104E-05(0.000)****
Trpoppc	0.714(0.470)	0.162(0.538)	0.667(0.159)****	0.589(0.204)***
AllHUD	-0.002(0.001)	-0.0004(0.001)	-0.011(0.004)***	-0.006(0.004)
Blt10yrchg		2.288(1.328)*		-1.422(0.812)*
Ttunit1pc				
Bdtot3pch				
Ownocc9p		-0.494(0.847)		2.265(1.049)**
Kitno9		-0.007(0.008)		-0.031(0.031)
Plmbno9		0.032(0.015)**		-0.022(0.026)
Shrnhw9		3.051(0.754)****		1.242(0.680)*
Chi-Square	107.88****	136.56****	232.12****	271.11****
Cox and Snell	0.122	0.152	0.208	0.238
Nagelkerke	0.268	0.333	0.392	0.449
McFadden	0.214	0.271	0.309	0.360

$* p < .10$; $**p < .05$; $***p < .01$; $**** p < .001$

Note (a): Quasi-complete separation in data; no full model estimated.

CHAPTER 5

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This study attempted to address the policy concern of neighborhood outcome of subsidized households. It specifically asks the questions: are subsidized households impacting neighborhood quality or are they responding to changing neighborhood conditions? The obvious answer is yes to both questions, but the results indicate that the answer is "it depends" to both questions. It depends on whether a neighborhood is experiencing decline or gain and to a lesser degree on the specific outcome measured. And to an even lesser degree it depends on the number of subsidized units and neighborhood poverty rate. This study only begins to scratch the surface of the complex confluence of metropolitan area characteristics, the relationship between initial and ending neighborhood conditions, housing stock and neighborhood factors, and presence and number of subsidized households that impact how and to what degree neighborhoods change. However, it is clear that the pervasive use of housing stock characteristics and quality as the primary indicator is insufficient to explain a more acceptable level of observed change at the metropolitan level.

Summary of Results

The results will be summarized by transition matrix analysis and by statistical analysis.

Results and Conclusions of Matrix Analyses

The transition matrix analyses included three components. First 1990 neighborhood quintile ranking (1st through 5th quintile—low to high) was compared to 2000 neighborhood quintile ranking (1st through 5th quintile). Second, neighborhood change quintile category (large decline, stable/small change, large gain) was compared to 1990 quintile ranking. Third, PSH distribution was examined among 1990/initial neighborhood quintile rankings (1st through 5th quintile) and among neighborhood quintile change categories (large decline, stable/small change, large gain) and compared to overall respective metropolitan area trends. From these analyses, this study identified three neighborhood change trends and two PSH HUD trends.

First, even though this dissertation looks at changes between 1990 and 2000, the descriptive results are in line with Rosenthal's (2008) analysis of change trends between 1970 and 2000 for income: neighborhoods are constantly changing. Overall, change trends were similar on both indicators by level and direction. This conclusion is consistent with Life Cycle and Filtering theories of neighborhood change: median household income and home values react similarly during times of change.

Second, even though neighborhoods change, the level of change varied, but at the same time had a noticeable trend. That is, the majority of neighborhoods hovered around the stable state (zero quintile change) within plus one and minus one quintile from zero. These neighborhoods either remained the same or increased/decreased one quintile level from their initial quintile from 1990 to 2000. The small-to-no-change patterns are important because they provide an indication of vulnerability to decline as well as potential for further gains. Another neighborhood change trend is that 1st and 5th quintiles held their ground more from 1990 to 2000 compared to the other quintiles. Similarly, the middle neighborhood quintiles experienced the most change.

Third, most metropolitan areas experienced varying levels of large declines and gains as well. The percentages of neighborhoods that experienced large losses and gains in neighborhood income and/or home values were less than those that had small or no change. Metropolitan areas behaved in a similar pattern of having higher percentages on large positive median home value changes compared to large positive median household income changes. Conversely, they had higher rates of large negative median household income changes compared to large negative median home value changes. While it is important to look at large positive to large negative changes as a total, the transition matrices provided a glimpse of the range of quintile changes in these categories (2 to 4 quintile category changes). However, it should be noted that the analysis of large changes by quintile has its limitations because of the limited range of movement a neighborhood quintile can move relative to its ranking position. For example, the 1st quintile can only remain the same or improve and the 5th quintile can only remain the same or decline. The first example, however, is contrary to traditional Life Cycle and Filtering neighborhood change theories, but is in line with Birch's Stage Model of neighborhood regeneration and gentrification paradigms.

Fourth, in analyzing trends in the distribution of subsidized households by initial neighborhood quintile (1990) two predominant trends emerged. First, PSH reported households were mostly located in the first three neighborhood quintiles. Second, PSH reported households were located in the first three median household income initial quintiles but located in the middle three value quintiles.

Fifth, in analyzing the trends in the distribution of subsidized households among neighborhoods experiencing large declines and large gains three predominant trends emerged. First, PSH households were overrepresented in neighborhoods with large decline and underrepresented in neighborhoods with large gains. Second, PSH households were located in neighborhoods with similar large income and home value declines as their metropolitan area but were underrepresented in neighborhoods that experienced large gains on both indicators. Third, PSH households were located in neighborhoods experiencing large income and home value gains and losses similar to their metropolitan area trends.

Results and Conclusions of Statistical Analyses

The statistical analyses used two primary models. First, the base subsidized housing model estimated the relationship between neighborhood change category as outcome variable (large decline, stable/small change, large gain) and three core predictors. A variation of the base subsidized housing model estimated the relationship between 2000 neighborhood quintile category/ranking (1st through 5th quintile) and the three core predictors. Second a full model is estimated in two versions the first full model and the second full model. The first full model estimated the relationship between neighborhood change category outcome and neighborhood change and PSH HUD variables as predictors. The second full model estimates the relationship between neighborhood change category outcome and PSH HUD variable as the sole predictor and other neighborhood change indicators as control variables. In addition there were two variations of the second full model: stratified by number of PSH HUD units and stratified by census tract poverty rate. The results of the base subsidized housing model and the first and second full models, the second full model and its variations, and the base subsidized housing model variation are presented in individual metropolitan area summaries that are not included in this manuscript due to the length.

The results provide the following answers to the hypotheses. First, hypothesis 1a stated that subsidized households will more likely be located in neighborhoods that are filtering down as indicated by median household income and median home value. The matrix analyses indicate that PSH HUD units were located in neighborhoods that experienced large decline compared to large gain for some, but not all, metropolitan areas. The base and first and second full models indicate that PSH HUD units, for most metropolitan areas, significantly increased the likelihood of a neighborhood experiencing a large decline and significantly decreased the likelihood of a neighborhood experiencing a large gain on both household income and home value indicators. However, the magnitude of the impact is very small, but remains significant regardless of other neighborhood change predictors.

Second, hypothesis 1b stated that subsidized households are more likely to be located in lower quintile neighborhoods than in higher quintile neighborhoods compared to general metropolitan trends. The matrix analyses provided an indication that some, but not all metropolitan areas have PSH HUD units that were disproportionately located in lower quintile neighborhoods. The base model of the relationship between 2000 neighborhood quintile ranking and three core variables indicates that PSH HUD units were consistently and positively associated with the two lowest quintiles and negatively associated with the two highest quintiles compared to the middle quintile neighborhood. This result is consistent for neighborhood quintiles based on both median household income and median home value. This means that compared to middle income/quality neighborhoods, PSH HUD units significantly increased the likelihood of lower ranking and significantly decreased the likelihood of higher ranking.

Third, hypothesis 2 stated that housing stock age and quality and neighborhood characteristics are primary indicators of neighborhood change. The first full model indicated that housing stock variables are not particularly effective, significant, and consistent indicators of the likelihood of neighborhood decline or gain. In addition, while some neighborhood characteristics were influential, such as 1990 percent White for median household income and 1990 percent White and 1990 percent owner occupied for median home value, most neighborhood characteristics were non-significant for many metropolitan areas to conclude that they were important. However, the inclusion of initial median household income and initial median home value indicators (or their proxies) in the model may obscure the level of the impact of these individual predictors.

Fourth, hypothesis 3a stated that neighborhoods with high levels of assisted households and total poor households will experience neighborhood change compared to neighborhoods with no or low levels of assisted/poor households. The results of the second model stratified by number of PSH HUD unit are not provided in the the results section, but were created by metropolitan area. Overall, the results were mixed in that PSH HUD impact may have been significant in neighborhoods with 0 to 8 PSH HUD units and/or in neighborhoods with 9 or more PSH HUD units or may not have been significant in either. However, it appears that PSH HUD units tended to be more significant to neighborhoods experiencing large gains than those experiencing large declines, but its impact on concentration of PSH HUD units is mixed.

Fifth, hypothesis 3b states that the rate of neighborhood change will change with higher levels of subsidized households compared to the rate of change at lower levels of subsidized households. Results of the second model stratified by 1990 neighborhood poverty rate are not included but are discussed in the overall metroplitian area discussion. Overall, it appears that since the majority of census tracts have poverty rates less than 30 percent, the distribution of significance tends to follow that of the second full model that contains all the census tracts. However, there are few exceptions noted for relevant metropolitan areas.

Implications for Low Income Rental Housing Policy and Policy Research and Recommendations

The goal of this study is to primarily address concerns of policy makers and officials such as HUD Secretary Donovan (2009). Donovan expressed the concerns of the current administration of current policy not contributing to racial and income segregation, its resulting social problems and inequality, and central city and inner suburban decline as done so by past national housing policies. This study attempted to investigate the effectiveness of low-income rental housing policy on neighborhood outcomes of poor households and investigate the relationship between neighborhood change and subsidized housing/households. This study's unique contribution is to using theories of neighborhood change as the theoretical framework through which to study neighborhood selection/location of subsidized households.

In a recent housing policy analysis, Landis and McClure (2010) concurred with Secretary Donovan's concern that low income housing policy should seek to increase income integration and decrease racial segregation, which are primary goals of mobility and mixed income revitalization housing programs. In addition, Landis and McClure recommend re-instituting filtering as a strategy for increasing supply of affordable housing. However, theory and practice show that filtering as a housing strategy does not necessarily reduce housing costs for low, especially the lowest, income households if housing is developed only at the higher quality submarket (Sweeney, 1974). Thus, Landis and McClure should specify that subsidized housing development (for both exclusive habitation of low income households and for market occupation) should be developed at all housing submarket quality levels.

Policy Implications. At the metropolitan level, subsidized housing could have a negative impact on the likelihood of large neighborhood decline and gain. However, because the geographic scale of this study is large, the impact is very small. The impact may be felt more in low to middle income/quality neighborhoods that are gaining in household income or in home value. But its significance, especially at that level, indicates that its impact is worthwhile to consider when siting public or scattered-site housing development or encouraging the use of tenant-based subsidies in low to middle income/quality neighborhoods. While subsidized housing impacted middle to upper income/quality neighborhoods, they were more likely to be non-significant compared to lower to middle income/quality neighborhoods. Thus, the concern of potential negative impacts of subsidized housing should be for lower to middle income communities rather than middle to upper income communities.

Policy Research. HUD dministration should commit to providing improved availability of administrative data. This study makes use of publicly available HUD administrative data which has limitations. Limitations were discussed in detail in Chapter 3 Methods. HUD Office of Policy Development and Research (PD&R) should commit to providing regularly scheduled and timely release of PSH data since it is the primary resource researchers and other interested parties in monitoring and evaluating policy effectiveness. PD&R has now established policy and protocol for monitoring subsidized households that should be improved upon by establishing deadlines for completion and release of data.

Recommendations for Future Research:

1) Further develop methodology to study the relationship between subsidized housing and neighborhood quality that uses multiple regions research design. This will assist in improving generalizability of findings.
2) Explore the use a panel data model to analyze the relationship between subsidized households/housing and neighborhood change.
3) Use fixed effects analysis that is currently being explored by Paul D. Allison as a way to create more experimental-like research design while using secondary data. In this approach, each census tract/neighborhood acts as its own control, similar to current impaction methodology but may be more readily applicable to models of neighborhood change.
4) Analyze neighborhood change over a longer period of time (i.e. 1970 to 2000 Ellen & O'Regan, 2008; Rosenthal, 2008) using 1996 (if available with 2000-defined census tracts), 2000, and 2008 PSH assisted housing data.
5) To be more relevant to current neighborhood conditions use American Community Survey data that will eventually replace the decadal census long form. However, as 2010 census data becomes available, GeoLytics will provide some version of an updated NCDB with normalized census tract boundaries for a longer period of analysis.
6) Include subsidized household resident characteristics as provided through HUD developed longitudinal data files from MTCS and TRACS data bases (i.e. Feins & Patterson, 2005).
7) To capture the multifaceted aspects of neighborhoods, create a typology of neighborhoods using multiple variables. Factors to include should be based on physical, economic, social, and political variables (i.e. Mikelbank, 2004). The purpose is to determine how neighborhoods change by type over a period of time (i.e. 40 years) and to specifically study the relationship between subsidized housing and structural and environmental neighborhood conditions.
8) As seen in studies that specifically focus on urban poverty, its distribution, and impacts, theories on the cause of urban poverty come from three main strands of thinking: structural causes, individual causes, and neighborhood causes. Similarly, neighborhood change should be studied inlight of its complex result of the main effects and interactions between ecological (economic and structural), social, and political factors (three main strands of neighborhood change theories) as well as historical, etc aspects.

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