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Changing Geographic Patterns of High- and Low-Income Groups in Eight United States Metropolitan Areas

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Abstract

Income segregation produces unequal social outcomes and has steadily increased since the 1970s. High-poverty neighborhoods suffer from low performing schools, fewer jobs, an evaporation of local role models (Wilson 1987; Reardon and Bischoff 2011a). Recent evidence suggests growing income inequality influences the segregation of affluence more than the segregation of poverty (Reardon and Bischoff 2011b). Metropolitan areas that display strong population and economic growth are susceptible to higher levels of income inequality. I use three unique quantitative approaches to measure the segregation of affluence and poverty in a comparison of four metropolitan areas exhibiting strong growth to four metros with weaker growth. I find the increase in income segregation between 1990 and 2010 is attributable to the increase in the segregation of affluence. Weaker metropolitan areas exhibit higher levels of income segregation than strong metros due to their significantly higher levels of segregation of poverty; however, strong metros exhibit higher levels of segregation of affluence.
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Chapter One: Introduction

Income inequality is rapidly growing in the United States and recently reached its highest level since the Great Depression. Between 1980 and 2011, the Gini coefficient for household income increased 16%, from .404 to .469 (Fry and Taylor 2012). The growth of income inequality shifted segregation research towards income segregation, specifically the segregation of poverty (Wilson 1987; Massey et al. 2009). Income segregation produces unequal social outcomes; and high-poverty neighborhoods suffer from low performing schools, fewer job opportunities, higher crime rates and an evaporation of local role models (Wilson 1987; Reardon and Bischoff 2011a). Although most research focuses only on the segregation of poverty, recent evidence suggests growing income inequality influences the segregation of affluence more than the segregation of poverty, “During the last four decades, the isolation of the rich has been consistently greater than the isolation of the poor” (Reardon and Bischoff 2011b, 22). This thesis focuses on the segregation of poverty and affluence in eight metropolitan areas over the past twenty years.

Income inequality is higher in metropolitan areas than other geographic places in the United States (Berube 2014). Furthermore, successful metropolitan areas, those with above average economic and population growth suffer from greater income inequality (Florida 2003, Brookings 2010). Metropolitan areas with below average growth are likely to have more equal distribution of income (Brookings 2010). The largest metropolitan
areas are growing faster than other size metropolitan areas and the annual gross product of the top ten US metros exceeds that of the bottom 36 states (IHS Global Insight 2013). As metropolitan areas capture larger shares of the national population and economic output, it is important to investigate how income inequality manifests spatially.

After a nationwide decline in poverty during the 1990s, a striking development occurred in the 2000s: as poverty rates increased, the majority of growth occurred in suburban areas, not the urban core. This new geography of poverty in metropolitan areas requires more research into the location and patterns of income groups in the United States because many of the current place-based policies are not designed to fight poverty in this new location. The suburbanization of poverty has broad policy implications that affect revenue sharing between levels of government, transportation planning and the implementation of social services (Kneebone and Berube 2013).

To study the relationship between metropolitan growth and income segregation, this thesis focuses on four metropolitan areas (Austin, Denver, Seattle, and Washington, DC) considered to be economically successful and four metropolitan areas (Buffalo, Cleveland, Detroit, and Memphis) with weaker growth in effort to answer: Do cities with strong economic and population growth exhibit different patterns of income segregation than cities with weak economic and population growth?

I incorporate two classic approaches, segregation indices and concentrated income neighborhoods, to analyze income segregation in the past two decades. In addition, I incorporate two local spatial statistics to explore the spatial patterns of poverty and affluence within each city. This research uses this multi-method approach to analyze the
segregation of fragmented income groups in an attempt to answer: **What are the trends of residential segregation by income between 1990 and 2010, and how have spatial patterns changed during that time?**

The aim of this paper is to analyze the impact of economic and population growth on the segregation of low-income and high-income populations in the past 20 years while incorporating classic segregation measures and a new statistical approach to gauge those impacts. Harvey (1973) calls for a greater emphasis on the relationship between social processes and space, and argues cities “are founded upon the exploitation of the many by the few” (314). Income segregation is the social process of income inequality taking spatial form. This research examines whether successful cities dampen or amplify that exploitation.

This thesis has five chapters: literature review, methods, results, discussion, and conclusion. The literature review includes the academic literature that informed the project and guided my project design; and a section focused on the history, strengths, and shortcomings of residential segregation approaches. The methods section contains an explanation of how metropolitan areas were selected, data sources, and how each statistical test was performed. The results section outlines the findings from each segregation measure. In the discussion, I relate the findings to existing literature and finally, in the conclusion, a summary of the findings and suggested avenues of potential future research.
Chapter Two: Literature Review

The first part of the literature review focuses on the growth of income inequality in the United States, its link to income segregation, and the consequences of segregation and concentrated poverty. Subsequently, I examine the prevalence of income inequality in metropolitan areas and provide two housing policy examples that illustrate how governance contributes to the rise of segregation in United States. Finally, I highlight recent research revealing the suburbanization of poverty and the policy implications of the changing geography of low-income populations.

Income Inequality, Segregation and the Underclass

Income segregation was not a great concern in the United States until inequality exploded in the 1970s. The post-World War II economic boom was distributed relatively evenly among Americans (Massey et al. 2009; Reardon and Bischoff 2011b). Yet, following this period of egalitarian growth, the Gini coefficient\(^1\) for household income in the United States grew from .395 to .464 between 1973 and 2003 (Massey 2007). By 2006, inequality was higher than any point since the Great Depression. In the late 1920s, the top 10% earned 46% of income and in 2006 the same group earned 45%. These ratios amplified even within that small group – the top 1% received 20% in the 1920s and 18% of all income in the mid 2000’s (Reardon and Bischoff 2011b). The gap between rich and

\(^{1}\) A measure of income inequality, zero expresses perfect equality while one expresses maximum inequality
poor exploded and the spatial separation of two income classes manifested spatially – affluent households on the periphery and poverty in the center.

Heightened levels of income inequality since 1970 contributed to the rapid increase of income segregation (Massey and Denton 1993; Jargowsky 1996; Massey et al. 2009; Watson 2009; Reardon and Bischoff 2011b; Fry and Taylor 2012). Between 1970 and 2000, more than 60% of metropolitan areas experienced an increase in segregation of the rich from the poor (Watson 2009). As inequality grew, the rich and poor each grew increasingly isolated. The percentage of families living in poor or affluent neighborhoods doubled from 15% in 1970 to 31% in 2010 (Reardon and Bischoff 2011a).

Metropolitan inequality is not created equally and can be measured in many ways (Berube 2014) Criteria of income groups and distributions of income are two factors that influence an inequality index. Two widely different income distributions may ultimately yield the same inequality value because inequality can be high when the rich are incredibly rich or when the poor are incredibly poor (Berube 2014).

Income inequality does not equally affect the segregation of poverty and the segregation of affluence. High levels of inequality due to the growth of a small percentage of high-income earners can minimize the difference between low-income households and actually decrease the segregation of poverty (Reardon and Bischoff 2011b). Theoretically, income inequality alone does not result in income segregation, yet a widening division of income suggests a greater discrepancy in housing prices and greater residential sorting (Bischoff and Reardon 2011a). In effect, affluent households
are able to build “citadels of power...through the use of social and/or physical means of fortification” (Marcuse 1997, 315).

The growth of income segregation is largely attributable to the growth of affluent households (Dwyer 2009; Reardon and Bischoff 2011a; Reardon and Bischoff 2011b, Fry and Taylor 2012). Reardon and Bischoff (2011b) find that income inequality influences the segregation of affluence and attribute the segregation of poverty to housing policy more than income inequality. Segregation of poverty may also be attributable to the reduction in low-skilled employment opportunities (Wilson 1987; Watson 2009). High-income households have grown faster than other income groups in recent decades and therefore occupy greater shares of metropolitan areas (Fry and Taylor 2012). The likelihood of a high-income household living in a tract with other high-income households increased by 25% between 1980 and 2010 (Fry and Taylor 2012).

The isolation of affluent populations is consequential because “a significant proportion of society’s resources are concentrated in smaller and smaller proportion of neighborhoods” (Reardon and Bischoff 2011a, 22). The best schools, parks, green spaces, and other public goods are isolated among the affluent (Reardon and Bischoff 2011a). Arguably, the concentration of affluence reduces understanding and apathy towards the challenges associated with poverty (Brinegar and Leonard 2008). Potentially the most drastic side effect of the increasing isolation of affluent populations is the lack of exposure low- and middle-income households have to affluent populations. Although income inequality is less likely to influence segregation of poverty, it inherently
concentrates poverty due to the evaporation of affluent households in low- and moderate-income neighborhoods.

The spatial separation of rich and poor negatively affect low-income groups to a greater extent due to the reduction of role models, good schools and work opportunities (Wilson 1987; Dwyer 2009; Lichter et al. 2012). Concentrating poverty concentrates single mothers, alcoholism and drug abuse (Massey and Denton 1993). The lack of strong social capital diminishes the opportunities for young people born into these neighborhoods because the networks within their communities are limited (Putnam 2000). The concentration of poverty received significant attention in the second half of the 20th century as many Americans prospered in suburban areas, but many were left behind, both economically and geographically.

Jobs left the urban core and few opportunities remained for citizens on the lowest rung of the economic ladder. People with financial ability to flee central cities did so in favor of better schools, lower taxes and the affordability of home ownership (Freeman 2010). This development reinforced racial segregation and promoted the concentration of poverty in central cities. The growth of low-income families and evaporation of middle-income families increased demand for social services; local governments were forced to cut services or raise taxes, either of which promoted additional inner city decay and population loss (Massey and Denton 1993; Joassart-Marcelli et al. 2008). Between 1970 and 1990 high poverty neighborhoods2 increased from 4.1 to 8 million (Massey et al. 1994; Jargowsky 1996). Simply, there were more poor people occupying more poor places. The group enveloped in this staggering concentration of poverty is the underclass.

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2 a census tract with a poverty rate of 40 percent or higher
The underclass is a group immersed in poverty struggling from the limitations associated with their surroundings. Ricketts and Sawhill (1988) describe the underclass as having four common characteristics: 1) high drop-out rates for high school students, 2) high percentage of single-mother households, 3) high number of able bodied men not in the work force, and 4) a high proportion of households relying on public assistance. The underclass, and the tribulations of concentrated poverty were the bases to income segregation research.

Two seminal works, William Julius Wilson’s *The Truly Disadvantaged* (1987), and Doug Massey and Nancy Denton’s *American Apartheid* (1993), are the foundation for much of today’s research focused on the underclass, segregation and economic opportunity for disadvantaged populations in urban areas. Their work piqued the interest of scholars and has fueled two decades of questions pertaining to the plight of disadvantaged groups in urban areas.

Racial segregation dominates United States history. Any discussion of segregation without racial segregation is inadequate. The injustice African-Americans faced for much of the 20th century extended far beyond residential spaces into schools, buses, churches and water fountains. Skin color greatly influenced where a person lived, among other things, until the United States Congress passed the Civil Rights Act of 1964 (Massey and Denton 1993). Prior to the Fair Housing Act of 1968, redlining – the practice of lending institutions, public and private, limiting or refusing to provide loans in particular areas of cities, particularly inner city minority areas – promoted racially segmented pockets in American cities (Massey and Denton 1993; Massey et al. 1994). The history of injustice
towards African-Americans resulted in many arguing the underclass was confined to the
ghetto, yet Hispanics and whites each had low-income neighborhoods (Massey and
Denton 1993; Jargowsky 1996). Despite the injustices toward African-Americans,
Wilson (1987) contended race was not the driving factor of the underclass.

William Julius Wilson (1987) argued the underclass was the result of broad
economic restructuring and the concentration of poverty should be studied through the
lens of class, not race. A shift away from manufacturing, low-skilled jobs to service
industry positions on the periphery left unskilled laborers in the inner city with few
opportunities. Massey and Denton (1993) reintroduced segregation into the American
vocabulary and agreed with Wilson’s assertion, yet argued what “made it a
disproportionately black underclass was racial segregation” (137).

Wilson (1987) believed the outmigration of middle class black families from
previously economically heterogeneous black neighborhoods left behind poor black
families in the inner city. Wilson studied neighborhoods and families in Chicago and
noted middle class black families leaving deeply impoverished neighborhoods upon
securing the financial means to do so. As a result, the concentration of poor families, the
majority of which were black, remained in economically depressed neighborhoods.
Middle-income families chose to live in neighborhoods of similar economic class,
regardless of race, and the result was a socioeconomically depressed class confined to
inner cities.

Massey and Denton (1993) argued racially motivated decisions, such as redlining,
excluded African Americans from neighborhoods and promoted the concentration of
poverty in the inner city (Massey et al. 1994). Massey and Denton (1993) acknowledge Wilson’s idea, yet find in their study, “(t)he residential segregation of African Americans cannot be attributed in any meaningful way to the socioeconomic disadvantages they experience, however serious these may be” (1993, 88). Blacks are more segregated than whites of similar economic status because black families do not have equal neighborhood purchasing power (Massey and Denton 1993). Blacks have higher poverty rates than whites, and as a result “racial segregation concentrates poverty, and it does so without anyone having to move anywhere else” (Massey and Denton 1993, 125). Income segregation inherently emerges as a result of racial segregation.

Racial segregation declined in the last third of the twentieth century, but given the astonishingly high degree of segregation, the problem remained (Jargowsky 1996; Massey et al. 2009). Jargowsky (1996) examined economic segregation within racial and ethnic groups. Income’s underlying relationship between race and ethnicity affects economic segregation and has a major influence on the metropolitan landscape (Massey and Denton 1993; Jargowsky 1996; Watson 2009). A high degree of economic segregation within one racial or ethnic group alters the economic segregation of the total population. Jargowsky (1997) noted high rates of poverty are common for all racial and ethnic groups. He describes ghettos, barrios and slums as residential enclaves for low-income blacks, Hispanics and whites. Between 1970 and 1990, economic segregation increased for all three of these racial or ethnic groups, however, the rate was not equally distributed between racial or ethnic groups. Income segregation of black and Hispanic populations increased at a faster rate than whites over the 20-year period and furthermore
blacks and Hispanics segregation levels grew faster in the 1980s while the majority of income segregation for white households occurred in the 1970s (Jargowsky 1996).

Racial segregation, the segregation of poverty and the segregation of affluence are linked in a way that make it challenging to discuss independent of one another, yet different processes are at play and the links are far more blurred than they inherently appear. The minority populations segregate for vastly different reasons. Moreover, despite the link between race and class, different processes influence racial segregation and the segregation of poverty. The differences are most apparent when we consider the integration processes of these three types of segregation, each would require their own unique policy prescription.

In this thesis, my focus on income segregation is not to diminish the importance of racial segregation or its consequences. Class segregation negatively effects the black population more than whites (Massey and Denton 1993). Therefore, it is important to understand what cities have the lowest levels of class segregation. Racial segregation is the result of overt discrimination and personal biases, but socioeconomic status is the market’s influence in the organization of urban areas (Fainstein et al. 1992; Jargowsky 1997). A solution to the segregation of income groups nudges toward a reduction in racial segregation. Spatial distance, and barriers to overcome it, inhibits the least advantaged populations from opportunity and conflicts with the ideals of democracy and the American Dream. I argue segregation by income concentrates the extremes of social capital and public good. In a political system where money translates into political power, attaining political influence becomes incredibly easy, or impossibly challenging,
depending on the neighborhood you live. At the very least, the growth of income inequality in the past four decades illustrates the need to investigate income segregation in metropolitan areas as the growing income disparity translates into a division of urban space (Fainstein et al. 1992; Ades et al. 2012).

Low-income neighborhoods are related to broader economic opportunities available in the metropolitan area or larger region (Jargowsky 1997, Cooke 1999). If a region is struggling from a lack of jobs (ie. manufacturing in the Midwest), more low-income neighborhoods are likely to emerge, “While the labor market generates income inequality, the housing market is the arena in which the spatial distribution of that inequality is determined” (Jargowsky 1996, 991). Income segregation is the result of economic disparities within metropolitan regions playing out in the private market.

The growth of income inequality on a national level illustrates the need to understand its influence in metropolitan areas. Metropolitan areas with above average economic and population growth are susceptible to higher levels of income inequality (Florida 2003; Brookings 2010).

**Metropolitan Area Success and Inequality**

Economic value is the most widely accepted barometer for success in the United States. Urban policies are continually evaluated in terms of economic value rather than social costs (Fainstein 2010). Urban leaders focus on economic growth as their primary responsibility, with the belief that growth is the most efficient way to ensure good for all members of the community (Fainstein 2010). Any social costs will be corrected when the economic ripples of a successful policy broaden the opportunity for all members of the
community, or so the thinking goes. The measures of a policy’s ‘success’ rarely stray from economic assessment. Evaluation centers on jobs created, effect on housing prices, or another measure of economic value, “the desirability of growth is usually assumed, while the consequences for social equity are rarely mentioned” (Fainstein 2010, 2). The idea of economic growth providing the greatest amount of good requires constant evaluation. Do cities with strong economies that attract educated workers offer the most access to opportunity to all?

The Brookings Institution (2010) highlights successful metropolitan areas as those that exceed the national average in educational attainment, population growth and diversity. In the State of Metropolitan American in 2010, Brookings classified nine metropolitan areas as the “Next Frontier.” These metropolitan areas attract immigrants, families and young workers because of strong, diversified economies and attractive climates. The authors note one drawback of these cities’ growth is the widening gap in education and income.

Another popular measure of success in urban literature is creative cities. Creative cities are regions of innovation and high-technology clusters that exceed the national average in number of people with bachelor degrees; diversity and inclusiveness to all races, ethnicities and walks of life; and attract members of the creative class (Florida 2003). Florida (2003) describes the aforementioned characteristics as the three T’s: technology, talent and tolerance. Cities with high percentages of the three T’s attract members of the creative class. Creative class members include but are not limited to: university professors, scientists, engineers, writers, artists, entertainers, and architects.
Members of the creative class place a higher value on where they live than the job itself and will move based on lifestyle confident economic opportunities will follow. Creative cities are also susceptible to high levels of income inequality.

Metropolitan areas experiencing below average growth and have weaker economies are less likely to suffer from high levels of income inequality. The Brookings Institution (2010) classified metros below the national average in population growth, educational attainment and diversity as “Industrial Cores.” These cities have less educational and income inequality because they have not attracted new residents and continue to rely on industrial employment. Industrial core metros have older populations than other metropolitan areas. It is my assumption that the lack of in-migration, combined with an older existing population reduces mobility within the metropolitan area and makes them less likely to experience an increase in concentration of income groups.

Population growth is closely aligned with immigrant populations. Immigrants constituted more than 11 percent of the United States population in 2000 and play an important role in metropolitan development (Singer 2004; Fishman 2005). Immigration – the (in)ability to attract immigrants to a city – is a key factor in the classification of “Next Frontier” and “Industrial Cores” metropolitan areas. The growing population and above national average diversity in “Next Frontier” metros is related to their ability to attract immigrants. Likewise, “Industrial Cores” lack of diversity and stagnant population growth in the past 20 years is the result of their inability to attract immigrant population.

The four metropolitan areas included in this thesis exhibiting strong growth patterns over the past 20 years, Austin, Denver, Seattle, and Washington, DC, are “Next
“Frontier” metropolitan areas and creative cities. Each of these metropolitan areas has had high immigration rates since the 1980s (Singer 2004). The four metropolitan areas included in this thesis exhibiting weaker growth, Buffalo, Cleveland, Detroit, and Memphis, are “Industrial Cores” metropolitan areas. These metropolitan areas, aside from Memphis, have low immigration rates after periods of high immigration in the early 20th Century.

Government is not an autonomous bystander to metropolitan development or income disparities (Fainstein et al. 1992). The ability and ease with which affluent populations are able to segregate from those in poverty is strongly influenced by legislative action. Many of the policies promoting segregation were racially centered, but their legacy remains imprinted on today’s metropolitan landscape. Their proliferation is visible through the dichotomous locations of the rich and poor. The federal government’s homeownership policies in the middle of the 20th century targeted a particular class, race and location that continue to influence the metropolitan landscape. The federal government promoted homeownership on the periphery and simultaneously fostered the concentration of poverty through high-density housing projects for low-income families (Massey and Denton 1993). The FHA legalized redlining and encouraged racially homogenous neighborhoods. Combined with Urban Renewal and the Interstate, whites moved to suburban areas as blacks were relegated to inner cities. Today, the mortgage interest deduction continues to incentivize economically homogenous neighborhoods. Given the lack of research on the segregation of affluence, the following section illustrates how the federal government promotes a spatial division of social groups and
entices affluent populations to separate. These examples illustrate how the “rich
class command space and the poor are trapped in it” (Harvey 1973, 171).

**Federal Policies and Segregation: FHA and Mortgage Interest Deductions**

No federal housing policy is as impactful as the government intervention in 1934:
the establishment of the Federal Housing Administration. The early policies and practices
of the FHA laid the foundation for sprawling metropolitan regions that would foster
residential segregation. Segregation is amplified through sprawl because suburbanization
enables spatial separation between populations and it promotes outward expansion and
low-density architecture (Yang and Jargowsky 2006; Dwyer 2009). Subsequent policies
only reinforced segregation practices until Congress passed the Fair Housing Act in 1968.
The Housing Act of 1949 (Urban Renewal) and The Federal Highway Act of 1956,
coupled with the rise of the automobile further supported suburban development (Lamb
2005; Levy 2011). Urban Renewal removed ‘urban blight’ to pave the way for new
highways through formerly heterogeneous neighborhoods. The displaced populations
were often relocated into public housing towers that “brought about a geographic
concentration of poverty that was previously unimaginable” (Massey and Denton 1993,
57).

The Federal Housing Administration was established to boost homeownership,
aid foreclosure prevention and stimulate residential construction (Massey and Denton
1993; Hays 1995; Levy 2011). Its primary role to insure home mortgages transformed
homeownership. Today, a 30-year loan with a 20 percent or less at time of purchase is
common practice, yet prior to 1934 it was a remote possibility (Massey and Denton
The quick success encouraged Congress to continue expansion and create the Federal National Mortgage Association, Fannie Mae, establishing a secondary mortgage market that provided banks risk aversion and more cash on hand (Hays 1995).

It was not the insurance that promoted segregation, but the FHA requirements for each individual property. FHA-insured mortgages drastically favored new, low-density, single-family housing (Massey and Denton 1993; Lamb 2005). The FHA’s valuation system placed an emphasis on stability, which in the eyes of the FHA were economic and racially homogeneous neighborhoods (Massey and Denton 1993; Meyer 2000). Racial and ethnically mixed neighborhoods located in the urban centers were devalued (Massey and Denton 1993). FHA mortgages promoted new houses for middle-income, white families and actively discouraged supporting multi-family housing. African Americans were left in dilapidated housing in central cities, unable to secure loans. The FHA was redlining (Saltman 1990).

The FHA coerced local officials into implementing zoning policies desired by federal leaders via a financing mechanism in high demand (Whittemore 2013). Homeownership became the instrument for cities to attract people and increase their tax base. Homeownership grew from 44 to 63% between 1934 and 1972. Had the FHA promoted mixed used, dense development, America’s urban fabric would be vastly different.

The fragmentation of social groups across urban spaces may be the lasting impact of the Federal Housing Administration. Through homeownership priorities, the FHA strongly influenced the organization of race and class in US metro areas; those influences
on the metropolitan landscape remain visible today. Redlining is no longer legal but the federal tax code, indirectly, continues to incentivize social division. The mortgage interest deduction influences housing choices and is the most expensive housing related policy in the US federal budget. This tax expenditure contributes to the spatial and economic gap between low and high-income populations. The diminished number of middle-income households intensifies the importance of neighborhood composition.

‘Government housing’ is not a term of endearment in American society and generally refers to low-income housing, however, whether it matches the stigma or not, I argue most Americans live in ‘government housing.’ Owning a home is considered a symbol of independence and the foundation of the American Dream, yet, the home mortgage interest deduction reduces federal government revenues $82 billion annually. In comparison, the 2012 budget for the Department of Housing and Urban Development was $40.1 billion (OMB 2013a; OMB 2013b).

Tax expenditures are “provisions in the tax code that provide special tax benefits for selected taxpayers” (Baneman et al. 2012, 1). Tax expenditures incentivize people or businesses to engage in a particular behavior to reduce taxable income. One type of incentive is a deduction, which allows people to subtract specific expenses from their taxable income. With a 65% homeownership rate, the home mortgage interest deduction is available to the majority of Americans (Callis and Kreslin 2013).

A range of familial needs and preferences influence people’s housing choice, but income is instrumental. Jobs, schools, or transportation may be the deciding factor, but except those with extraordinary financial resources, income is the principal factor of
neighborhood selection (Reardon & Bishchoff 2011b). As of 2006, more than 70 percent of people did not file itemized deductions (Lowenstein 2006). Although many homeowners may not take advantage of the deduction, it is clear the rich do. “More than 80% of taxpayers in the top quintile itemized deduction in 2011, compared with just 16 percent of those in the bottom four quintiles” (Baneman et al. 2012, 11). Wealthy households invest in mansions because the tax code encourages them to direct capital there (Lowenstein 2006). According to the Tax Foundation (2006), despite constituting less than 9 percent of tax filers, taxpayers with incomes greater than $100,000 accounted for almost 40% of the home mortgage interest deduction in 2003.

The home mortgage interest deduction is not the silver bullet to a middle class lifestyle, but the tax code explicitly values homeownership over renting. Although roughly half of the nation’s homeowners may fail to capitalize on the deduction, no tax instrument is in place to incentivize renting. The home mortgage interest deduction may not be the reason someone buys a house, but at the cost of over $80 billion per year, it greatly subsidizes homeownership and favors the affluent. This economic incentive is location specific – affordable only on the periphery in many cities – and contributes to the concentration of rich and poor. Homeownership rates influence appraisal values and therefore homeowners seeking to protect or increase their greatest financial asset locate in homogenous neighborhoods.

Homeownership in America is suburban phenomenon. Economist Edward Glaeser (2011) argues homeownership subsidies and highway investment contribute to a socially engineered suburbia and encourages people to flee dense urban areas. Between
1940 and 1960, the homeownership rate jumped from 44 percent to 62 percent (Census 2011). The mortgage interest deduction did not create suburban homeownership, but does augment the legacy of preceding federal policies such as the FHA and the Federal Highway Act to influence the social division of urban space (Lamb 2005). As neighborhoods become more economically uniform, the role of jobs, schools and transportation grow in importance. The concentration of public goods in a smaller number of neighborhoods increases the value of each place, reinforcing the economic and spatial divides.

Kneebone & Berube (2013) point out that many ‘place-based’ policies exist to alleviate poverty. HUD is not alone; it combines efforts with the Department of Education, Department of Health and Human Services and Department of Transportation. Kneebone and Berube (2013) group these efforts into three categories: improving neighborhoods, delivering services and expanding opportunity. These policies try to improve physical and economic environments in low-income neighborhoods, provide services to the residents, and diversify options for low-income people. The efforts and programs, as described by Kneebone and Berube (2013) totaled $82 billion in 2012, equal to the home mortgage interest deduction.

Homes are many people’s most valuable asset and eliminating the home mortgage interest deduction would be a political challenge, however, an examination of housing policy line items reveals the biggest contributor to deficits is not spending. According to Kneebone and Berube (2013), HUD’s budget combined with all other place-based
poverty programs equals the cost of mortgage interest deduction, a tax expenditure most beneficial to wealthy households.

The FHA and mortgage interest deduction are two examples of policies that contribute to residential sorting and the current organization of urban space. As these lasting effects are present, there is also a geographical shift in poverty that requires policy makers to assess the effectiveness of current place based poverty programs. After an encouraging decline of poverty in the 1990s, poverty rates increased in the 2000s. Potentially the most startling revelation about the increase in poverty is that the majority concentrated in suburban areas. This shift has broad implications and requires policy makers to think about new strategies to meet the needs of suburbanizing poverty.

**The Suburbanization of Poverty, 1990-2010**

A new geography of poverty emerged in the 1990s. As concentrated poverty declined in central cities, suburban areas captured a greater share of poor people. The population living in high poverty neighborhoods declined by 2.5 million between 1990 and 2000, a staggering 40 percent (Jargowsky 2003; Cooke and Marchant 2006). In addition, the total number of high poverty areas shrank from 3,417 in 1990 to 2,510 in 2000 (Jargowsky 2003; Cooke and Marchant 2006). People were not only escaping poverty on an individual level, they were less likely to be surrounded by others in poverty. Berube and Frey (2002) found that 51 percent of central cities in metropolitan areas of over 500,000 people experienced a decline in poverty, an astonishing shift from the 1980’s when poverty increased in over three-fourths of the same cities.
Amidst the good news, poverty increased in suburbs during the 1990s, especially near central cities and in large metropolitan areas (Berube and Frey 2002; Jargowsky 2003; Cooke 2010). Despite total suburban population growing at nearly twice the rate of central cities, the share of the poor population in suburban areas increased from 46 to 49 percent between 1990 and 2000 (Berube and Frey 2002). For the first time in over 50 years, the poverty rate in inner ring suburbs and the poverty rate in central cities moved in opposite directions (Berube and Frey 2002; Jargowsky 2003). Although suburban areas absorbed a greater share of the impoverished population, the poverty rate of central cities, 18.4%, remained higher than the 8.3% poverty rate in suburban areas.

The suburbanization of poverty insinuates low-income individuals are moving closer to opportunity, but the suburbanization of poverty had little effect on the spatial proximity to, and segregation of affluence (Dwyer 2009). Although poverty grew in suburban areas, affluence continued to move toward the periphery. Data revealed a reduction in the spatial distance to more advantaged populations, but the majority of the decline came between poor and near poor populations (Dwyer 2009). Poverty became less concentrated in the 1990s because of income mobility (Wagmiller 2011). Income mobility theories stress changes in poverty concentration are short term and the result of changes in the economy.

At the turn of the 21st Century, data showed that the concentration of poverty in America was decreasing. The number of high poverty areas declined for the first time in 30 years and the majority of central cities experienced a reduction in poverty rates from the previous decade, however, new concerns and problems emerged in the midst of this
change. The gains made in the urban core were at the expense of the suburban areas (Berube and Frey 2002; Jargowsky 2003; Cooke and Marchant 2006). American suburbs, particularly the inner ring suburbs near the urban fringe, experienced an increase in both total poor population and poverty rate.

Data released in the early 2000s showed the reemergence of concentrated poverty (Berube and Kneebone 2006; Kneebone and Garr 2010a; Kneebone et al. 2011; Lichter et al. 2012). Between 2000 and 2005-09, poverty levels began to rise again and 10.5 percent of poor people lived in neighborhoods with a poverty rate of 40 percent or more, an increase from 9.1 percent in 2000 (Kneebone et al. 2011).

Potentially the most striking revelation about the increase in poverty is that the majority occurred in suburban areas, not in the urban core. The rise of poverty in inner ring suburbs experienced during the 1990s continued. As early as 2005, data indicated that 1 million more poor people lived in suburban areas than in central cities (Berube and Kneebone 2006), “suburbs were home to the largest and fastest-growing poor population in the country” (Kneebone and Garr 2010a, 4). Population in extreme poverty neighborhoods increased by 41 percent in suburban areas, compared to 17 percent in central cities. Overall, poverty gains made during the 1990s were largely negated as both cities and suburbs experienced an increase in poverty. Poverty levels in central cities did not return to pre-1990 levels, but the trend turned in an unfortunate direction. (Kneebone et al. 2011; Lichter et al. 2012). As a nation, the population living in extreme-poverty neighborhoods rose by one third between 2000 and 2005-2009. The population in
extreme-poverty neighborhoods rose more than twice as fast in suburbs as in cities during this time period (Kneebone et al. 2011).

The suburbanization of poverty does not equate to a decline in poverty, an easing of the problem or a solution to poverty. Poverty moving to the suburbs does not mean low-income individuals have arrived in the land of opportunity, rather it means perceptions about the location of opportunity need to change. Kneebone and Berube (2013) argue the suburbanization of poverty is neither good nor bad, only that this new geography calls for new ideas, approaches and initiatives.

Many of the current place-based policies are not designed to fight poverty in this new location. Suburban jurisdictions are experiencing high rates of poverty for the first time and these municipalities are not equipped to meet the new challenges. Suburban areas rely on property taxes for revenues, and as lower-income populations grow, these revenues will decline as the need for social services rise (Madden 2003; Cooke 2010; Berube and Kneebone 2013). Leaders must continually evaluate policies and the implementation of policies to meet the challenges associated with the suburbanization of poverty. As Dwyer’s (2009) research illustrates, the suburbanization of poverty has not placed low-income populations in the heart of economic opportunity. Rather, the suburbanization of poverty is pushing disadvantaged populations into new municipalities that now must find ways to meet the needs of a growing low-income population.

The suburbanization of poverty alters our perceptions and the reality about the geography of poverty within metropolitan areas. The new location means low-income families are not only occupying new houses and neighborhoods, but also new
municipalities. This potentially requires individuals to enroll in new social service programs and meet new administrators, if programs for low-income populations even exist in these suburban jurisdictions. This geographical shift presents challenges for citizens and public officials at all levels of government.

The metropolitan area is a multi-layered geographic and political boundary; the contemporary US city is ‘chaotic and random’ (Boschmann and Kwan 2010). Discussing the suburbanization of poverty requires a detailed explanation and understanding of the changing metropolitan area. As poverty becomes a suburban phenomenon, it is important to relay how previous scholars analyzed the changing geography of poverty and affluence in metropolitan areas.

**Suburban Typology**

The evolution of United States metropolitan areas during the 20th century makes the simple urban-suburban division ineffective. Despite changes, many continue to perceive suburbs as home to the nuclear family with white picket fences and fertile ground for the American Dream. Much can be said about this transformation, but the point is to merely illustrate the “Leave it to Beaver” suburban oasis is not true for all suburban places and because the clear urban-suburban divide no longer exists, there is no simple way to discuss the geography of metropolitan areas. Central city-suburb dichotomous analysis does not respond to the array of socio-economic variables in metropolitan areas (Lee 2011). Discrepancies between suburbs can, and do, eclipse the differences of the central city and suburbs. Suburban areas now compete with one another
for jobs, amenities and people, and have diverse populations and functions (Mikelbank 2004). Categorizing suburban areas as simply ‘not central city’ is imprecise.

The Brookings Institution categorizes suburban places based on urbanization rate of the counties within a metropolitan area (Brookings 2010; Kneebone et al. 2011). This approach divides areas outside the central city as high-density suburbs, mature suburbs, emerging suburbs and exurbs. High density suburbs are where more than 95 percent of the population lived in an urbanized area in 2000; mature suburbs is 75 to 95 percent; emerging suburbs is between 25 and 75 percent and finally; exurbs are areas with urbanization rates below 25 percent in 2000.

Focusing on the physical landscape of high-poverty areas as opposed to jurisdictional lines accounts for regional variability across a metropolitan area and eases comparative urban analysis (Cooke 2010). Cooke and Marchant (2006) classified metropolitan areas based on age and density of the housing stock rather than use jurisdictional boundaries (later used by Lee 2011). The Sun Belt has low-density central cities (Jacksonville, FL) that appear suburban while inner-ring suburbs in northeastern cities (Hartford, CT) share similar housing characteristics to central cities (Cooke and Marchant 2006). Many areas outside Hartford appear more urban than areas within the Jacksonville city limits. Cooke and Marchant’s (2006) approach highlights the challenges facing federal officials charged with allocating funds from the federal government to address problems on the local level. Cooke and Marchant’s (2006) approach raises questions of whether poverty is responsive to physical landscape, jurisdictional lines, both, or neither.
This project aims to further the understanding of changing suburban realities. The research on income groups, and their spatial location, performed in this study potentially serve as valuable information to further describe the differences between suburban areas. The changing geography of poverty within US metropolitan areas further illustrates the complexity of the metropolitan landscape and demonstrates the importance of suburban understanding when discussing the changing spatial patterns of income groups. The suburbanization of poverty is an example of a spatial socioeconomic change on the national level, yet questions remain about the influence economic and population growth has on income segregation, specifically, the spatial patterns of affluence and poverty within metropolitan areas.

Hypothesis

This thesis focuses on four metropolitan areas (Austin, Denver, Seattle, and Washington, DC) considered to be economically successful and four cities (Buffalo, Cleveland, Detroit, and Memphis) with weaker economic and population growth in effort to answer: **Do cities with strong economic and population growth exhibit different patterns of income segregation than cities with weak economic and population growth?**

This research will use a multi-method approach to analyze the segregation of fragmented income groups in an attempt to answer: **What are the trends of residential segregation by income between 1990 and 2010, and how have spatial patterns changed during that time?**
My hypothesis is that stronger metropolitan areas are more segregated than weaker growing metropolitan areas. I anticipate the stronger metropolitan areas had lower levels of segregation of poverty and affluence in the 1990s than weaker metropolitan areas, but that segregation levels increased in stronger metropolitan areas while segregation has remained stable over the twenty-year period in weaker metro areas (Lee 2011). Following the conclusions of Reardon and Bischoff (2011) and Dwyer (2009), I predict the segregation of affluence grew in both groups of cities, however, I anticipate the rate of growth to be much faster in the strong growing metropolitan areas. As the stronger metropolitan areas experienced a significant amount of growth in the past twenty years, higher levels of income inequality accompanied this growth. This leads me to believe there will be an increase in the segregation of affluence and segregation of poverty.

I anticipate poverty moves toward the urban fringe in the majority of metros, as suggested by national trends, and affluent neighborhoods will emerge in areas near the urban core by 2010, and continue along the periphery. Stronger metro areas are more likely to witness a growth of affluence in the near urban areas because of their ability to attract new residents that are highly educated, well paid and seeking a vibrant urban lifestyle (Florida 2003). Weaker metros are less likely to experience significant changing patterns of poverty or affluence because of their stable populations and lower susceptibility to growing income inequality. I believe the weak metros will see a growing number of high poverty neighborhoods extending from the central city into the suburban areas and that areas of affluence will be concentrated far from the urban center.
Scholars continually wrestle with the best method to measure segregation. The proliferation of new methods is never ending. Prior to discussing the methodology I incorporated in this study, I believe it is important to provide a brief history of different segregation approaches. Also, I point out the limitations of methods of these fundamental methods.

**Approaches to measuring segregation**

Segregation is an intuitive idea, yet measuring it is a challenge and too complex a problem to analyze in one way (Massey and Denton 1988; Rey and Folch 2011, Ades et al. 2012). Residential segregation can be assessed as the degree of spatial separation of two groups across an urban space. Generally, segregation is assessed longitudinally in one place or in multiple places at one time, yet all segregation measures seek to understand location choices of different populations over place or time (Rey and Folch 2011).

There are two common approaches used to measure segregation: segregation indices and mapping neighborhoods at a particular threshold of poverty and/or affluence (Ades et al. 2012). Recently, spatial statistics emerged as a third approach to study segregation due to the advancement of geographic information systems, and the importance of understanding the spatial processes of residential segregation. Although these are the predominant methods, the practices of each approach are not uniform. The purpose of the following section is to demonstrate the variety of existing approaches to measure segregation and provide context for the methods ultimately selected in this study.
Segregation Indices

Familiarity with the term segregation masks the complexities that arise when trying to measure it. The most well-known and widely used measure of segregation is the dissimilarity index developed by Duncan and Duncan in 1955 (Massey and Denton 1988; Rey and Folch 2011; Spivak et al. 2011; Ades et al. 2012). The dissimilarity index remained the standard measure of segregation until the 1970s (Massey and Denton 1988). Criticism of the index did not necessarily produce a better model, yet did reignite the debate of how to best measure segregation. The debate continued until the late 1980s when Massey and Denton (1988) identified and evaluated more than 20 segregation indices and established five dimensions: evenness, exposure, concentration, centralization and clustering.

Each dimension of segregation is measured by a unique index. Evenness, measured by the dissimilarity index, describes the distribution of two social groups across a study area. The dissimilarity index denotes the percentage of the minority population that must change neighborhoods to attain an even distribution. Exposure explains the contact one group has with another and represents the average social experience of a resident (Spivak et al. 2011). Two indices measure exposure: the isolation index and interaction index. The two indices are inverses of one another and sum to 1. The isolation index ranges from 0 to 1 and shows the percentage of the neighborhood occupied by the minority group. If a study area has an isolation value of 1, the minority group is completely isolated. The interaction index illustrates the exposure the minority group has with the non-minority group. A lower number illustrates less exposure to the non-
minority, and therefore more segregation (Spivek et al. (2011). The two indices are interchangeable and should be considered equally (Massey and Denton 1988).

Evenness and exposure are aspatial, but three of Massey and Denton’s (1988) dimensions are spatial. Concentration measures the amount of physical area the minority group occupies within the study area in relation to their proportion of the population. Centralization refers to the proximity of the minority group to the core of an urban area. Finally, clustering analyzes if minority groups occupy a contiguous area or are dispersed throughout the study area.

Using factor analysis, Massey and Denton (1988) determine evenness and exposure explain the majority of the variance among the five measures but given the multidimensionality of segregation, each measure provides valuable information for a comprehensive understanding of residential segregation. The extensive usage and various combinations of these indices demonstrate their acceptance within segregation research. Ross et al. (2004) and Ades et al. (2012) used all five dimensions to study the segregation of poverty in Canadian metropolitan areas. Others limit their scope and rely on the classical dimensions of evenness or exposure in combination with other indices (Lee 2011; Rey and Folch 2011; Spivak et al. 2011). Finally, Dwyer (2009) studied the spatial dimension of segregation and used concentration, centralization and clustering. Despite their wide use, there are limitations to the various indices. The first criticism is the applicability to measuring income as a variable and secondly, a combination of two ideas: some of the dimensions are aspatial, and each produces only a single index value.
Massey and Denton (1988) established the five dimensions to measure the racial segregation of two groups: black and white. Because income is a variable on a continuous scale, applying these measures to income segregation requires dividing income into categories such as poor-nonpoor, based off of arbitrary decisions (Jargowsky 1996; Rey and Folch 2011). To account for income’s continuous nature Jargowsky (1996) developed the Neighborhood Sorting Index (NSI), which compares the standard deviation of an individual household’s income to the standard deviation of neighborhood income. While the motivation to develop NSI is clear and the model is theoretically straightforward, Jargowsky (1996) notes there are data limitations; because the Census releases income distribution in categories, assumptions must be made to calculate total variance of neighborhoods and households (Watson 2009). Although the NSI offers a solution to the categorical problems, it is an imperfect model with data limitations.

Two additional shortcomings are that segregation indices yield only a single value and that they provide limited to no spatial information. First, two of the dimensions – evenness and exposure – are aspatial. Second, the single value, a global statistic, is problematic for the spatial dimensions of clustering, centralization and concentration because the patterns of segregation for the entire study area are aggregated into one number. A global statistic provides limited information about the spatial location of segregation, “The single index number is the result of many spatial decisions made by people far removed from the residents under study” (Rey and Folch 2011, 431). The global statistic makes it challenging to understand where segregation is occurring. Global tests indicate the segregation of a population across the entire area of study; local
tests allow the opportunity to interpret where clusters are taking place (Hong and O’Sullivan 2012). Residential segregation is studied through the lens of multiple disciplines and although many indices used do not reflect this fact, residential segregation is inherently spatial (Rey and Folch 2011). Geography must play a role in segregation research (Johnston et al. 2009).

**Map High & Extreme Income Group Neighborhoods**

Mapping concentrated income neighborhoods, the second most common approach to studying segregation, makes visualizing the location of concentrated income neighborhoods easy. The crux of this method involves identifying neighborhoods with a particular percentage of their population in poverty or affluence. Scholars who map concentrated income neighborhoods (census tracts) have mostly been concerned with the distribution of poverty across an urban area (Jargowsky 2003; Kingsley and Petit 2003; Cooke and Marchant 2006; Kneebone et al. 2011; Wagmiller 2011; Lichter et al. 2012). Only Brinegar and Leonard (2008) incorporated this approach to the segregation of poverty and affluence.

One criticism of this method overlaps with the indices – establishing ‘poor’ and ‘non-poor’ neighborhoods requires subjective decision-making (Ades et al. 2012). Further, the thresholds used to classify neighborhoods are inconsistent. Thresholds used to identify high-poverty neighborhoods include 30% (Wilson 1987; Kingsley and Petit 2003; Cooke and Marchant 2006; Wagmiller 2011) and 40% (Jargowsky 2003). Finally, others elected to use two thresholds, 20% and 40% to identify high- and extreme-poverty neighborhoods. (Brinegar and Leonard 2008; Kneebone et al. 2011).
Spatial Statistics

In addition to the standard approaches, spatial statistics, powered by GIS have emerged as a new tool to investigate residential segregation. Spatial statistics respond to the limitations of Massey and Denton’s spatial dimensions and provide a platform to visualize segregation (Johnston et al. 2009). Given indices’ inability to provide detailed spatial information about where segregation is occurring, Johnston et al. (2009) call for scholars focused on residential segregation to place more of an emphasis on spatial location, “[a] fuller, more informative discussion of segregation levels need more geography” (Johnston et al. 2009, 91). This argument centers on the shortcomings of global statistics and aspatial indices. Johnston et al. (2009) use the Getis-Ord Gi* local statistic to evaluate ethnic segregation in Auckland, New Zealand. Hong and O’Sullivan (2012) use the Getis-Ord Gi* to compare a heuristic algorithm designed to measure clustering. Their selection of Gi* illustrates its broad acceptance as a local statistic used to evaluate clustering.

Local statistics are derivatives of global statistics, but used to analyze each spatial unit in a study area. Anselin’s Local Moran’s I is a local statistic of Global Moran’s I (Anselin 1995). Global Moran’s I is a measure of spatial autocorrelation – it evaluates the clustering of both high and low values. In short, it evaluates the relative location of a point and its neighbors, in a multidimensional fashion. According to ArcGIS 10.1 help, Moran’s I is an inferential statistic that should be examined through z-scores and in relation to the null hypothesis. A statistically insignificant z-score indicates spatial patterns of the dataset are a random process. A statistically significant value indicates
either clustering or dispersal beyond random processes. If the z-score is positive, we reject the null hypothesis because the high and/or low values are more clustered than can be expected from a true random process. However, if a z-score is negative, we can also reject the null hypothesis, but in this case because the high and low values are more dispersed than would be expected from a random selection.

Anselin’s Local Moran’s I is the local version of the Global Moran’s I. Simply, it measures clustering at the local level and indicates, feature by feature, if a census tract is positively or negatively correlated with nearby census tracts. The test determines if there is a spatial cluster (of high or low values) or spatial outlier based on the expected distribution.

The Getis-Ord General G, an additional global statistic, measures if high or low values cluster. The General G is a measure of hot or cold-spots over a space. The General G interprets values in relation to the expected value. Higher values than expected reveal potential hot-spots, and cold-spots indicate a clustering of low values. Like the Moran’s I, the General G is an inferential statistic evaluated in terms of a null hypothesis. The null hypothesis of the General G is there is no spatial clustering. If the General G yields a significant z-score we are able to reject the null hypothesis; however we reject the null hypothesis for different reasons if the z-score is positive or negative. A statistically significant positive z-score indicates high values are more clustered than can be expected from a truly random sample. Statistically significant negative z-scores indicate the low-values are spatially clustered more than can be expected from a truly random sample.
Getis Gi* is the local test of Getis-Ord General G. The Gi* indicates hot-spots, or areas where there is spatial clustering of high values. The test also indicates cold-spots, which are areas where there is spatial clustering of low values. This clustering is determined by the z-score. A positive z-score indicates clustering of high values where as a low z-score indicates a clustering of low values.

In the following section, I discuss how I incorporated these methods into my research, and describe other key methodological decisions.
Chapter Three: Methods

The methods section is organized as follows: data, explanation of the three segregation approaches, and the criteria for selecting metropolitan areas. The first section outlines data collection and manipulation, and specific steps to complete each methodological approach. I discuss the data sources, selection of variables, and provide detail about addressing the analytical problem of changing census tract boundaries.

Following is an explanation of the key steps to complete each methodological approach: segregation indices, concentrated income neighborhoods and spatial statistics.

Data

I used census tract level data from the 1990 and 2000 decennial censuses, and the 2006-2010 American Community Survey (ACS) to compare the longitudinal changes of income segregation across the metropolitan areas of Austin, Denver, Seattle, Washington, DC, Buffalo, Cleveland, Detroit and Memphis. The 2006-2010 American Community Survey serves in place of 2010 decennial census because the Census Bureau no longer collects socioeconomic characteristics as a part of the decennial census.

The number of individuals in poverty and total number of individuals in a census tract were the key variables I used for low-income populations. To analyze affluent populations, I used household data and considered the top income bracket for each dataset to be affluent. For 1990, the top category was household income greater than $150,000, and in 2000 and 2010 the top category was household income greater than
$200,000. This categorization of affluence follows Brinegar and Leonard’s (2008) approach.

Due to available datasets, low-income and high-income data were collected from different sources. The source for low-income data in 1990, 2000 and 2010 was the Longitudinal Tract Database (LTDB), available from the Census Bureau. The LTDB is a public database hosted on the Census website provided to aid researchers performing longitudinal census tract analysis (Logan et al. 2014). The LTDB provides an extensive amount of data from the 1970 Census through the 2006-10 ACS, all modified to 2010 boundaries.

The LTDB data include individuals in poverty and the population of each census tract. Due to the availability of low-income in this dataset, and more importantly the 1990 and 2000 data being modified to 2010 census tracts, significant manipulation of data for low-income data analysis was not required. High-income data, however, required significant adjustment prior to analysis.

Although the LTDB is an extensive dataset, it does not include household income or affluence data, therefore my sources of high-income data from 1990, 2000 and 2010 are distinctive. Each dataset required unique manipulation in order to attain uniformity among the three decades and meet the requirement of all statistical approaches. Household income data for 2000 and 2010 were collected from the Census website. 1990 data were collected from the National Historical Geographic Information System from the Minnesota Population Center (2011) (used by Reardon and Bischoff 2011b) because I was unable able to locate 1990 household income information at the census tract level.
from the census website. It is not uncommon for scholars to mix data sources when performing longitudinal analysis in segregation literature (Reardon and Bischoff 2011). The NHGIS includes the complete Summary File-3 dataset.

The NHGIS 1990 data required the most attention because the original data did not include conventional Federal Information Processing – commonly known as FIPS – formatting. Common FIPS formatting is ‘SSCCCTTTTT’ where SS = state, CCC = county and TTTTTT = census tract (Logan et al. 2014). The NHGIS dataset included the correct number, but not proper formatting. For example, the NHGIS labels census tract ‘9.02’ as ‘902’ but conventional formatting is ‘000902’. NHGIS also labels census tract ‘902’ as ‘902’ but conventional formatting is ‘090200’. In an 11-character string, placeholders are imperative. The NHGIS also failed to follow conventional FIPS formatting for states and counties. The three geographic areas (states, counties, tracts) were separated into three columns in the original formatting. I modified each variable to match conventional formatting and then concatenated the columns in order to produce a conventional 11-character string.

As for 2000 and 2010, data in the ‘Factfinder’ website application is aggregated to the county level. I selected all of the counties within each of the 2010 metropolitan areas and acquired income data. I modified each dataset to contain uniform data. I downloaded 2000 and 2006-2010 data from the Census website; significant amounts of additional race and socioeconomic data were included, however, the additional data varied within each dataset, therefore, I deleted the superfluous data and my final database included only household income and family income for 1990, 2000, and 2010. Household income data
are divided into categories such as, ‘Households > $200,000’. The number of households within each income category is presented as a count variable.

Although high-income data were not available in the LTBD, Logan et al. (2014) provide a ‘crosswalk’ Microsoft Access database that interpolates data from previous decades and normalizes it to the 2010 boundary. The crosswalk database requires an input table, queries to identify variables, type of variable, and the program completes the interpolation. After multiple attempts, I successfully inputted household income census datasets from 1990 and 2000 into the crosswalk table for each metropolitan area. After successful normalization to the 2010 boundaries, I exported the data from Microsoft Access into Microsoft Excel and/or ArcGIS to run the statistical tests. Data from 2010 did not need interpolation because data were collected at 2010 boundaries.

A brief aside, although I used count data, a percentage was also included in each of the original tables but percentages would be inaccurate if used in the interpolation table. I could have retained the percentages for 2010 because it did not need to be interpolated, but I believed it was more important to have uniform data in each table to ensure later calculations were consistent. To illustrate the difference between data sources in their original form, the 2000 data included over 200 records and 2010 data included over 500 records. This disparity contributed to the emphasis on uniformity in this longitudinal study.

**Tract Boundary Changes: 1990-2010**

Using census tracts for longitudinal studies can be problematic (Jargowsky 2003; Logan et al. 2014). Census tracts are neighborhoods that consist of 4,000 people, on
average. The Census Bureau draws tracts based on the population and as populations change census tracts are dissolved, separated or modified. Various approaches exist to address these challenges, but it is crucial to maintain a consistent number of census tracts for each period of analysis because altering the number of tracts makes longitudinal analysis inconsistent (Jargowsky 2003).

Changing census tract boundaries create analytical challenges and one approach is to purchase the Neighborhood Change Database (NCDB) (Tatian 2003; Lee 2011). The NCDB contains census data from 1970 through 2000 and normalizes all data to the 2000 boundary (Lee 2011). I did not select the NCDB as a data source because it does not include 2010 data. According to the Census Bureau’s website, the solution to tract boundaries modification is areal interpolation. The Census Bureau provides the following instruction: where a 2010 census tract is larger than a 2000 census tract, the solution is to create a new record (polygon) and assign proportional attributes to the new polygon based on the size of the 2010 polygon in relation to the 2000 polygon. The Census Bureau provides 2000 to 2010 and 1990 to 2000 Census Tract Relationship Files to aid this process.

In addition to this general instruction, the Census Bureau provides the Longitudinal Tract Data Base (LTDB). The LTDB uses areal interpretation to normalize historic data to the 2010 boundary. For this reason, I used the 2010 Metropolitan Statistical Area boundaries. Logan et al. (2014) write the 2000 to 2010 data comparison has a high degree of accuracy but note the 1990 to 2010 data comparison has more variability because it relies on land area interpolation. Its commercial counterpart,
NCDB, interpolates data based on block group data. Because block groups are smaller geographic areas than census tracts, allocating data at this smaller geographic scale makes interpolation more accurate. Allocating a percentage of the larger geographic area (census tract) reduces accuracy. Logan et al. (2014) do not make clear why there is more variability in 1990 than 2000 but I assume the variability is a function of more boundary changes due to more elapsed time.

**Segregation Indices**

I used five dimensions of segregation to analyze income segregation in these metropolitan areas: evenness, exposure, concentration, centralization, and clustering. Evenness is best measured by the dissimilarity index, the classic segregation measure developed by Duncan and Duncan (1955). The isolation and interaction indices are both appropriate measures of exposure (Massey and Denton 1988).

The dissimilarity index indicates the evenness of two groups and measures the overrepresentation or underrepresentation in a spatial unit. The formula to measure poverty is:

\[
D = .5 \times \sum \left| \frac{p_i}{P} - \frac{x_i}{X} \right|
\]

where \( p_i \) and \( x_i \) are the number of poor and nonpoor individuals who live in neighborhood \( i \), and \( P \) and \( X \) are the number of poor and nonpoor who live in the MSA. To measure affluence, \( p_i \) and \( x_i \) are substituted with number of affluent households and number of non-affluent households in neighborhood \( i \), and \( P \) is the total number of affluent households in the MSA.
The isolation index is an experiential measure and indicates the probability that a member of particular group shares the same spatial unit with a member of the same group. The closer to 1, the more isolated a group is within that particular unit. The formula to measure poverty is:

$$\text{Isolation} = \sum \left[ \left( \frac{p_i}{P} \right) \times \left( \frac{p_i}{t_i} \right) \right]$$

where $p_i$ is the number of poor individuals who live in neighborhood $i$, $P$ is the total number of poor individuals who live in the MSA, and $t_i$ is the total number of individuals who live in neighborhood $i$. To measure affluence, $p_i$ is the number of affluent households in neighborhood $i$, and $P$ is the total number of affluent households in the MSA.

The interaction index is the second index that measures exposure, and is the inverse of the isolation index. When measuring the segregation of poverty, it measures the average percentage of nonpoor individuals that share the spatial unit with individuals in poverty. The formula to measure poverty is:

$$\text{Interaction} = \sum \left[ \left( \frac{p_i}{P} \right) \times \left( \frac{x_i}{t_i} \right) \right]$$

where $p_i$ and $x_i$ are the number of poor and nonpoor individuals who live in neighborhood $i$, $P$ is the total number of poor individuals who live in the MSA, and $t_i$ is the total number of individuals who live in neighborhood $i$. To measure affluence, $p_i$ and $x_i$ are substituted with number of affluent households and number of non-affluent households in neighborhood $i$, and $P$ is the total number of affluent households in the MSA.
I performed all three segregation tests using Microsoft Excel and maintained separate data tables of poverty and affluence for each metropolitan area. To measure the segregation of poverty, I compared individuals in poverty to individuals not in poverty. Likewise, to measure the segregation of affluence I compared affluent households to non-affluent households. A direct comparison cannot be made between households and individuals; therefore I was not able to compare affluent versus rich. Studying the relationship of both poverty and affluence provides a comprehensive view of income disparities. The majority of studies only focus on poverty through the poor-nonpoor relationship. Although data limitations prevent a direct comparison, this research does focus on both spectrums of the income continuum.

The three additional dimensions of segregation improve our spatial understand of segregation. I originally calculated these variables in Microsoft Excel, as well, yet after human error, I determined a more precise tool was the Geo-Segregation-Analyzer, designed by Apparcio et al. (2014). This is an open-source application that calculates 43 different indices. I followed Ades et al. (2012) and used the Absolute Concentration Index (ACO), Absolute Clustering Index (ACI), and Absolute Centralization Index (ACE).

The ACO ranges from 0 to 1 and measures the physical space occupied by the minority group. A value of 0 indicates minimal concentration, and 1 indicates maximum concentration in the smallest geographic places. For poverty, the formula is:

\[
ACO = \left\{ \frac{\sum_{i=1}^{n} \left( \frac{x_i A_i}{X} \right) - \sum_{i=1}^{n_1} \left( \frac{t_i A_i}{T_1} \right)}{\left[ \sum_{i=n_2}^{n} \left( \frac{t_i A_i}{T_2} \right) - \sum_{i=2}^{n_1} \left( \frac{t_i A_i}{T_1} \right) \right]} \right\}
\]
where $x_i$ is the total population of group X in spatial unit $i$, $t_i$ is the total population in spatial unit $i$, $Ai$ equals the surface area of spatial unit $i$, $X$ is the total population of group $X$ in the metro area, $T_1$ is the cumulative sum of the $t_i$ in spatial units from 1 to $n_1$, and $T2$ is the cumulative sum of the $ti$ in spatial units from $n2$ to $n$.

The ACL ranges from 0 to 1 and indicates how likely the minority group is to live in adjoining spatial units. The closer to 1, the higher degree of clustering is present. The formula is:

$$ACL = \left\{ \frac{\sum_{i=1}^{n} x_i \sum_{j=1}^{n} (c_{ij}x_j)}{X} - \frac{X}{n^2 \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij}} \right\}$$

where $x_i$ is the total population of group $X$ in spatial unit $i$, $c_{ij}$ is the value of the cell of the of the total distance between $i$ and $j$, $X$ is the total population of group $X$ in the metro area, $x_j$ is the total population of group $X$ in spatial unit $j$, $t_j$ is the total population of in spatial unit $j$.

Lastly, The ACE ranges from -1 to 1 and measures how likely the minority group is to the central city. A negative value indicates the group is dispersed from the central city and 1 indicates the group is near the central city; a 0 indicates the group is randomly dispersed. The value of 1 is given to all spatial units inside the central city. The formula is:

$$ACE = \left( \sum_{i=1}^{n} X_{i-1}S_i \right) - \left( \sum_{i=1}^{n} XiS_{i-1} \right)$$
where $X_{t-1}$ is the cumulative proportion of group $X$ in spatial unit $i$ (from 1 to $i$)
and $S_t$ is the cumulative proportion of surface area of spatial unit $i$ (from 1 to $i$)

Despite their value and prevalence in segregation research, segregation indices fail to produce a clear spatial understanding about segregation in a metropolitan area. Rey and Folch (2011) conclude that segregation measures are affected by changing spatial configuration of data far removed from the data under study. For this reason, I use two additional methods to visualize the spatial changes of poverty and affluence: map high- and extreme-income neighborhoods, and use spatial statistics.

**High- and Extreme-Income Neighborhoods**

I mapped extreme-poverty neighborhoods (40% or greater) and high-poverty neighborhoods (20-39%) following the approach of Brinegar and Leonard (2008) and Kneebone et al. (2011). I chose to map both thresholds for two reasons: research up to this point uses thresholds ranging from 20-40%; incorporating both into this study allows my study to be compared with the larger body of research. Second, the difference between a neighborhood with 39% poverty and one of 40% is minimal. Including both groups make tracking neighborhoods near this threshold over time easier. Mapping the two thresholds helps identify anomalies and provides two degrees of concentrated income neighborhoods.

Affluent tracts are identified using the same cutoffs: for extreme-affluence neighborhoods are classified as those with 40% or greater affluent households in a census tract and high-affluence neighborhoods as tracts with 20-39% of the households in a census tract with incomes greater than $150,000 or $200,000, depending on the year. As
mentioned earlier, there is little attention on high-income households in segregation literature, and I only found one article using this method to study the segregation of affluence (Brinegar and Leonard 2008).

As mentioned earlier, I modified the datasets to include only count variables. I manually calculated a poverty rate and an affluence rate for each census tract. I calculated the poverty rate for each census tract by dividing the number of individuals in poverty by the total population. I calculated the affluence rate for each census tract by dividing the number of households in the top income category by the total number of households. In my analysis, I present the total number of census tracts classified as high- or extreme poverty/affluence. I calculated these numbers in ArcGIS 10.1.

**Spatial Statistics**

Lastly, I incorporated spatial statistics to analyze high and low-income groups in the eight metropolitan areas. The emergence of spatial statistics to analyze residential segregation is relatively new, thus I included multiple tests in effort to better understand segregation in the eight metro areas and also add fresh analytical perspective to a field of study that constantly wrestles with the most appropriate way to measure segregation. I used two global statistics, Moran’s I and Getis-Ord G, and two local statistics, Anselin’s Local Moran’s I and Getis-Ord Gi* to analyze clustering of income groups.

All four of these statistics are standard in the ArcGIS 10.1 Spatial Statistics Toolbox. I used the total number of people in poverty and total affluent households within each census tract as my variable. Ultimately, I selected total number in each census tract over the poverty or affluence rate within each tract because of the
suburbanization of poverty literature. The ‘suburbanization of poverty’ refers to more poor people living in suburban areas than in central cities despite the poverty rate remaining higher in central cities. Given the higher density and higher poverty rates of census tracts in central cities, I assumed an analysis of poverty rates clusters in the urban core. Selecting the total number of people within each census tract shows where clusters of people are in the metro, rather than the clusters of neighborhoods. Further, analyzing the number of people rather than neighborhoods allows us to observe if a suburbanization of poverty occurs in each metro. It is not my aim to predetermine results to match the literature; rather, that my analysis accurately tests previous research and national trends. Selecting the total number of individuals in poverty is a better test of the current phenomena that is receiving significant attention in academic and mainstream journalism. Given the limited research on the geography of affluence in the context of segregation studies, any rebuttal on this front seemed speculative and a candidate for additional research.

After identifying the variable, all four spatial statistics require a conceptualization of spatial relationship and provides the option of establishing a distance band. Below is a screenshot of options:
The conceptualization of spatial relationships used in this study was the zone of indifference. The zone of indifference assigns an equal weight to all tracts within the distance band and then diminishes as it moves away from that polygon (census tracts). Therefore finite boundaries are not enacted with the introduction of the distance band.

I used a distance band of 2500 meters. Selecting the appropriate distance band required exploration and it appears there is no formula to select a ‘perfect’ distance band. According to ArcGIS help resources, a combination of the k-function test and an investigation of the minimum, maximum and average distance neighbors are each important factors to evaluate. I also ran exploratory tests with Local Moran’s I Spatial Autocorrelation, testing distance bands of 1000, 1500, 2000, 2500, and 3000 meters, to determine which distance band yielded the highest z-score. After evaluating each of these factors for all eight metropolitan areas, I selected 2500 meters. The average distance between neighbors for the eight metro areas was 2111.6 meters. The average k-function maximum clustering was 2625 meters. Using the Moran’s I Spatial Autocorrelation for
distance bands of 2000 and 2500 meters, each metro area had a higher z-score at 2500 meters, except for Seattle, but the difference was minimal³.

Despite running four unique statistical tests, the parameters required for each test are uniform. I selected the Zone of Indifference and used 2500 meters as a distance band for all four statistical tests. The descriptions and intellectual merit of each analysis were discussed earlier. Each of the measures was analyzed at the metropolitan level. Below is a summation of how each metropolitan area was selected.

**Metropolitan Area Selection Criteria**

Richard Florida’s Creative Class in 2002, his updated list in 2012 and “The Brookings Institution “State of Metropolitan American in 2010” each identify metropolitan areas with strong economies that successfully attract jobs, an educated workforce and employers. I used these sources to develop the groups of metropolitan areas included in this study because Florida and Brookings use distinct approaches aimed at producing a list of successful, economically thriving, and forward-thinking metropolitan areas.

Austin, Seattle and Washington, D.C. each appeared on all three lists. Denver appeared as a “Next Frontier” city and on Florida’s inaugural list but not the updated release in 2012. However, Boulder, CO – formerly a part of the Denver metro area – is one of Florida’s 2012 creative cities. Although they are now in separate MSA’s, Boulder and Denver continue to share planning efforts within the region such as the regional

³ Given Johnston et al. (2009) use of 1000 m distance band, I also tested 1000m and 1500 m for Denver. However, the z-scores were significantly lower at this distance. My assumption is the difference between Auckland’s classification of meshblocks and US census tracts may be the key reason. However, Johnston et al. (2009) did not explain their reason for selection and I therefore used the general research on distance band selection as my guide.
transit network, FasTracks. Also, I am conducting my research at the University of Denver. Although it is not on Florida’s 2012 list, I believe it’s proximity to Boulder and appearance on the other two lists justifies its inclusion.

To find a comparison to the successful metropolitan areas, I turned to the Brookings Report. “Industrial Cores” provide a nearly perfect ‘opposite’ to “Next Frontier” metropolitan areas. The metropolitan areas are below the national average in growth, education attainment and are less diverse. Additionally, these metropolitan areas have less educational and income inequality.

Austin, Denver, Seattle and Washington, DC are popular immigrant destinations. A 2004 report on immigration comparing historic immigrant patterns to current growth rates ranked Austin, TX as a ‘pre-emerging’ immigrant gateway; Denver and Seattle as ‘re-emerging gateways’; and Washington, D.C. as an ‘emerging gateway’ (Singer 2004). In sum, each of these metros is experiencing a period of rapid growth of immigrant populations. This aligns closely with the narrative of ‘Next Frontier’ metropolitan areas.

Three of the four metropolitan areas experiencing below average population and economic growth are classified in the same study as ‘Former-gateways’. Buffalo, Cleveland and Detroit attracted immigrants in the early part of the 20th century, but now have low immigration rates. The lack of population growth in ‘Former-gateway’ metropolitan areas is largely attributed to their inability to attract immigrants. Memphis is not included in this report. The discussion on immigrant population in each metropolitan area further supports two of the key factors – growth and diversity – in the classification
of ‘Next Frontier’ and ‘Industrial Cores’ metropolitan areas. Further, it illustrates the role immigration plays on overall population growth.

The Brookings Institution and Florida each caution that one shortcoming of economic success at the metropolitan scale is higher levels of income inequality. The comparison of these two groups provides a good opportunity to study income segregation and the relationship of metropolitan strength. This study could potentially highlight positive or negative effects success has on low- and high-income populations. The consensus on the importance of economic growth led me to believe other metropolitan areas would seek to mimic the successful metropolitan areas. For that reason, I believed it is important to evaluate income segregation in metropolitan areas considered to be successful. In the following section, I present the results of each segregation measure for the eight metropolitan areas included in this study.
Chapter Four: Results

This section presents the results of each method used to analyze the patterns of poverty and affluence, but first it is important to illustrate the dichotomous growth the two groups of metropolitan areas experienced in comparable time periods. First is a discussion on population growth between 1990 and 2010, and second, the changes in Gross Metropolitan Product in the past five years.

Following the discussion of economic and population growth, I present the results of poverty and affluence separately, but follow the same organizational pattern within each income group. Results of poverty are discussed first and the initial data presented are the poverty rates for each metropolitan area in 1990, 2000, and 2010. After the introductory depiction of poverty within each metro, the remaining portion is divided into three sections: segregation indices, high- and extreme-poverty neighborhoods, and spatial statistics. Within segregation indices, I discuss the result of the dissimilarity and isolation indices. The discussion of neighborhood poverty is divided into three groups: high-poverty, extreme-poverty, and the spatial patterns of concentrated poverty. Finally, within spatial statistics section, the results of the four spatial statistics are presented: Global Moran’s I, Getis-Ord General G, Local Moran’s I, and the Getis Gi*. The discussion on the segregation of affluence follows this and is organized in the same structure.
Population Growth

Population growth is one of the factors the Brookings Institution used to classify metropolitan areas. The ‘Next Frontier’ metropolitan areas, which include the successful metropolitan areas in this study, experienced a growth in population above the national average. The ‘Industrial Cores’ metropolitan areas – which include those metropolitan areas exhibiting weaker growth – are below the national average in population growth.

The population totals and growth rates for each metropolitan area are in Table 1 and Table 2. The total population, average population, and average growth rate are included.

Table 1: Weaker Growing Metropolitan Areas Population, 1990-2010

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>1,161,659</td>
<td>1,138,205</td>
<td>-2.06%</td>
<td>1,107,000</td>
<td>-2.82%</td>
<td>-4.94%</td>
</tr>
<tr>
<td>Cleveland</td>
<td>2,068,045</td>
<td>2,105,448</td>
<td>1.78%</td>
<td>2,044,199</td>
<td>-3.00%</td>
<td>-1.17%</td>
</tr>
<tr>
<td>Detroit</td>
<td>4,197,092</td>
<td>4,394,866</td>
<td>4.50%</td>
<td>4,298,214</td>
<td>-2.25%</td>
<td>2.35%</td>
</tr>
<tr>
<td>Memphis</td>
<td>1,038,562</td>
<td>1,179,978</td>
<td>11.98%</td>
<td>1,273,061</td>
<td>7.31%</td>
<td>18.42%</td>
</tr>
<tr>
<td>Total pop</td>
<td>8,465,358</td>
<td>8,818,497</td>
<td></td>
<td>8,722,474</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average pop</td>
<td>2,116,340</td>
<td>2,204,624</td>
<td>4.00%</td>
<td>2,180,619</td>
<td>-1.10%</td>
<td>2.95%</td>
</tr>
</tbody>
</table>

Table 2: Stronger Growing Metropolitan Areas Population, 1990-2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin</td>
<td>816,641</td>
<td>1,215,827</td>
<td>32.83%</td>
<td>1,592,568</td>
<td>23.66%</td>
<td>48.72%</td>
</tr>
<tr>
<td>Denver</td>
<td>1,641,166</td>
<td>2,151,410</td>
<td>23.72%</td>
<td>2,433,756</td>
<td>11.60%</td>
<td>32.57%</td>
</tr>
<tr>
<td>Seattle</td>
<td>2,496,830</td>
<td>2,984,177</td>
<td>16.33%</td>
<td>3,295,755</td>
<td>9.45%</td>
<td>24.24%</td>
</tr>
<tr>
<td>Washington DC</td>
<td>4,017,817</td>
<td>4,700,220</td>
<td>14.52%</td>
<td>5,311,742</td>
<td>11.51%</td>
<td>24.36%</td>
</tr>
<tr>
<td>Total pop</td>
<td>8,972,454</td>
<td>11,051,634</td>
<td></td>
<td>12,633,821</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average pop</td>
<td>2,243,114</td>
<td>2,762,909</td>
<td>18.81%</td>
<td>3,158,455</td>
<td>12.52%</td>
<td>28.98%</td>
</tr>
</tbody>
</table>

Source: 1990 Census, 2000 Census, and 2006-10 American Community Survey

In 1990, the two groups had roughly the same total number of residents, a difference slightly more than 110,000 people. However, the stronger metropolitan areas increased, on average, by roughly 500,000 citizens per decade as the average population increased from 2.24 million in 1990 to 3.15 million in 2010. At the same time, the weaker
metropolitan areas average population increased by about 80,000 people between 1990 and 2000 and then experienced a small decrease in average population between 2000 and 2010. Thus, their average population changed from about 2.12 million in 1990 to about 2.18 million in 2010.

**Gross Metropolitan Product**

Table 3: Weaker Growing Metropolitan Areas, Gross Metropolitan Product

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>rate of change (2011-2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>$45.8</td>
<td>$47.1</td>
<td>$47.2</td>
<td>$48.5</td>
<td>5.57%</td>
</tr>
<tr>
<td>Cleveland</td>
<td>$108.1</td>
<td>$111.6</td>
<td>$112.7</td>
<td>$116.1</td>
<td>6.89%</td>
</tr>
<tr>
<td>Detroit</td>
<td>$199.6</td>
<td>$208.4</td>
<td>$211.0</td>
<td>$218.7</td>
<td>8.73%</td>
</tr>
<tr>
<td>Memphis</td>
<td>$64.3</td>
<td>$66.7</td>
<td>$68.3</td>
<td>$71.2</td>
<td>9.69%</td>
</tr>
<tr>
<td>Average</td>
<td>$104.5</td>
<td>$108.5</td>
<td>$109.8</td>
<td>$113.6</td>
<td>7.72%</td>
</tr>
</tbody>
</table>

Source: *IHS Global Insight, US Metros Economies (2013)*

Table 4: Stronger Growing Metropolitan Areas, Gross Metropolitan Product

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>rate of change (2011-2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin</td>
<td>$91.5</td>
<td>$98.7</td>
<td>$103.2</td>
<td>$109.3</td>
<td>16.29%</td>
</tr>
<tr>
<td>Denver</td>
<td>$161.8</td>
<td>$167.9</td>
<td>$173.3</td>
<td>$182.2</td>
<td>11.20%</td>
</tr>
<tr>
<td>Seattle</td>
<td>$243.8</td>
<td>$258.8</td>
<td>$268.5</td>
<td>$281.0</td>
<td>13.24%</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>$437.2</td>
<td>$446.9</td>
<td>$455.8</td>
<td>$477.5</td>
<td>8.44%</td>
</tr>
<tr>
<td>Average</td>
<td>$233.6</td>
<td>$243.1</td>
<td>$250.2</td>
<td>$262.5</td>
<td>12.29%</td>
</tr>
</tbody>
</table>

Source: *IHS Global Insight, US Metros Economies (2013)*

The different paces of economic growth between the two groups are revealed in the gross metropolitan product, as seen in Table 3 and Table 4. The growth rates are not as divisive as the population growth rates, but the disparity of average growth rate in the past four years is clear. Further, this illustrates the range of economic output of the metropolitan areas included in the study. Washington, DC’s growth rate is below Memphis and Detroit, but Washington, DC’s economy is more than twice as large as
Detroit, and four times the size of Memphis. The growth rates inferred from the methodological section are confirmed in the two previous sections.

**Segregation of Poverty**

**Poverty Rate**

Before engaging the results from the segregation measures, the poverty rate for each metropolitan area is presented, as well as the trends experienced from 1990 to 2010 and what patterns emerge between the stronger and weaker growing metros. The poverty rate informs the results of segregation measures, is well understood, easy to conceptualize, and a familiar reference to contextualize broad trends. Further, it provides a link to the relationship between poverty rate on a metropolitan-wide scale and segregation. The results are presented in Figure 1.

**Figure 1: Poverty Rates, 1990-2010**

As illustrated in Figure 1, Memphis had the highest poverty rate in 1990 at 19.2%. The four weaker cities had four of the five highest poverty rates of the group. Austin,
which had the second highest poverty rate at 15.9%, was the only stronger metro to have a poverty rate in the top five. In 1990, the average poverty rate of the weaker cities was 14%, while the stronger cities average 10.1%.

At the turn of the century, most of the eight metropolitan areas followed the national trend and experienced a decline in poverty (Jargowsky 2003). The poverty rate in all four of the weaker metro areas declined, although Buffalo only dropped 0.1%. As for the stronger metropolitan areas, Austin and Denver’s poverty rates decreased, Seattle’s plateaued and Washington, D.C. increased – but maintained its status as the metropolitan area with the lowest poverty rate – from 6.5% to 7.4%. As in 1990, Austin was the only stronger metropolitan area to have a higher poverty rate than any of the weaker cities. Austin had the third highest poverty rate, 11.1%. Again, Denver, Seattle and Washington, DC had the three lowest poverty rates of the eight metropolitan areas. The average poverty rate of the weaker metropolitan areas dropped to 12.2% and the stronger group declined to 8.7%.

Between 2000 and 2010, all metropolitan areas aside from Washington, DC experienced an increase in their poverty rate. Memphis, 18.6%, and Washington, DC, 7.3%, remained on each end of the spectrum for the third straight decade. Again, Austin was the only metropolitan area within its group to attain one of the four highest poverty rates, although this time it ranked third and maintained its edge over Buffalo and Cleveland by a mere 0.1%. The weaker metropolitan areas average poverty rate in 2010 increased to 15.1% and the stronger metros to 10.8% – averages that exceed values either group experienced in 1990 or 2000.
All of the metropolitan areas, except for Austin and Memphis experienced an increase in poverty rate over the 20-year period. Austin and Memphis had the highest poverty rates for each group all three decades but their poverty rates dropped from 19.2 to 18.6%, and from 15.9 to 13.9%, respectively. Perhaps the most noteworthy change was the increases of the perennial bottom three – Washington DC, Seattle, and Denver – which saw their collective average increase from 8.2% to 9.8% between 1990 and 2010, a trend otherwise muted by Austin’s 2% decline.

**Dissimilarity Index**

The dissimilarity index is a measure of evenness. When used to measure the segregation of poverty, it indicates how many low-income people need to move out of the neighborhood for it to reflect the metropolitan area’s composition of poor to non-poor residents. Thus, the metropolitan area’s poverty rate does inform the interpretation of the dissimilarity values. For example, if a metropolitan area has a poverty rate of 15% and a non-poor population of 85%, then a neighborhood must have the same composition for it to be considered ‘even’ (Massey and Denton 1993). A dissimilarity value of .15 indicates the metro area is ‘even.’ For context, in all three decades, none of the eight cities had poverty rates higher than 20% or lower than 6%. Based on my review of the literature, it seems this key point is frequently lost in the discussion – my assumption is because residential segregation scholars frequently engage a macro-scale view, studying multiple metropolitan areas with one test and trust imbalances are corrected through sample size. The Dissimilarity Index results are in Figure 2.
Data from 1990 reveal a clear split between the stronger and weaker metropolitan areas. The weaker metropolitan areas all have a dissimilarity score of greater than .42 while all metros in the stronger group have scores below .40. Detroit has the highest score at .51, with Cleveland closely behind at .50. Aside from Seattle at .31, the disparity between the two groups is not especially great; all other metros were greater than .38.

Cleveland and Detroit have the highest dissimilarity scores in 2000, each with .46. Seattle continues to have the lowest dissimilarity score at .30, but otherwise, the remaining five metros fall between .37 and .44. The stronger metros have the three lowest dissimilarity scores and the weaker metros have the three highest scores. Memphis (.40) and Austin (.41) split from their respective groups. From 1990 to 2000, the dissimilarity index for all metropolitan areas, except Austin, decreased. This is potentially related to the overall decline of poverty in the majority of these eight metropolitan areas.

In 2010, Cleveland and Detroit, despite both experiencing decreases, again had the highest dissimilarity index scores at .44 and .43, respectively. For the third
consecutive decade, Seattle had the lowest dissimilarity index score, .33. The gap between the strong and weak metros decreased in 2010, however, the weaker metros continued to have higher scores. Denver had the highest dissimilarity index score of the stronger metros, .41, tying Memphis, which had the lowest for the weaker metro areas. Between 2000 and 2010, the weaker metropolitan areas, save Memphis, saw their scores decrease as the stronger metro areas, aside from Austin, experienced an increase.

Over the two-decade period, all four strong metropolitan areas – Austin, Denver, Seattle and Washington, DC – experienced an increase in their dissimilarity scores. In that time, the weaker growing metropolitan areas – Buffalo, Cleveland, Detroit and Memphis – experienced a decrease. To compare the magnitude of the changes, the increase experienced in the stronger metropolitan areas was minimal – likely due to the decrease between 1990 and 2000. However, the weaker metropolitan areas demonstrated a steady decline in their dissimilarity scores over the 20-year period. While Memphis’ decline was subdued, it is worth noting its relatively low dissimilarity score given the high poverty rate.

Ultimately, between 1990 and 2010, the weaker metropolitan areas have higher degrees of unevenness. However, the unevenness declined in the weaker metro areas. On the other hand, unevenness increased as the populations and economies of stronger metropolitan areas grew.

**Exposure Indices**

The lack of exposure to different income groups can compromise the quality of everyday life, economic opportunity and social relations (Ross et al. 2004). The isolation
and interaction indices each measures exposure (Massey and Denton 1988). For the following discussion I present the isolation index values because it is more intuitive to use the index where a higher value relates to higher segregation. The values are listed in Figure 3. As discussed in the methods section, the isolation index measures the likelihood a member of minority group (in this instance, low-income) lives in a neighborhood with another individual in poverty (Spivek et al. 2012). A value of 1 indicates all low-income people live in neighborhoods of only low-income people.

Figure 3: Isolation Index, Poverty

In 1990, Memphis had the highest isolation value at .34 and Washington, DC had the lowest at .14. All of the weaker metropolitan areas had isolation values greater than .24 while the four stronger metros had values below .26. The weaker metros had the highest three values and the stronger metros had the three lowest values but low-income population in Austin (.26) are more isolated than in Buffalo (.25). Overall, the weak four...
metropolitan areas had an average isolation value of .29 and the stronger metros are significantly lower at .19.

Cleveland and Buffalo had the highest values of isolation, 24, in 2000. Seattle had the lowest levels of isolation at .14. Isolation values declined for all metropolitan areas, except Washington, DC, during the 1990s. Although Washington, DC increased during this time span, its value remained quite low at .15. The most significant change in this period was Memphis’ decline from .34 to .16. The division between strong and weak metros diminished during the 1990s; by 2000, the weaker metropolitan areas average isolation value decreased to .21 and the stronger metros dropped to .17. As in 1990, Austin stands out among the stronger metropolitan areas with an isolation value of .21; otherwise, the remaining strong metropolitan areas have values below .16. Memphis is the outlier among the weaker metropolitan areas at .16 while the other weaker metro areas are all greater than .22.

Both groups of metropolitan areas experienced an increase in average isolation values. The weaker metropolitan areas increased to .28, just shy of its score in 1990, and the stronger metros escalated to .20, eclipsing its previous peak in 1990. In 2010, just as in 1990, Memphis and Washington, DC re-emerged as the metropolitan areas with the highest and lowest isolation values. Once again, Austin had the highest isolation value of the stronger metropolitan areas at .26, the same as Buffalo, the lowest value of any weak metropolitan area. In the 2000s, the isolation values of all eight metropolitan areas increased. Further, over the 20-year period, each of the strong metropolitan areas experienced a stable or increasing isolation value. Denver, Seattle and Washington, DC
each experienced an increase during this time span and Austin, which consistently had
the highest isolation value of its metropolitan peers, had the same value in 2010 as in
1990, .26. On the other hand, isolation values of the weaker metropolitan areas stabilized
or decreased. Memphis, Detroit and Cleveland each experienced a decline in isolation
while Buffalo, which was consistently the lowest of its group, maintained the same value
over the two-decade span.

The isolation index responds to changes in the poverty rate. The decline in
poverty rates in the 1990s accompanied decreasing isolation values. Likewise, there was
in increase in poverty rate and isolation in the 2000s. Between 1990 and 2010, the weaker
metros slightly declined while the stronger metropolitan areas increased, however, low-
income populations in weaker metropolitan areas consistently experienced higher levels
of isolation from non-low-income groups.  

**Spatial Segregation Indices**

While the dissimilarity index and isolation index are aspatial, three of the
segregation dimensions are spatial: concentration, clustering and centralization. Results
from the Absolute Concentration Index (ACO) are presented in Figure 4. The ACO ranges
from 0 to 1 and the higher value corresponds with higher segregation.

All of the metropolitan areas exhibit high levels on concentration in 1990. Five
metros – Buffalo, Cleveland, Detroit, Denver, and Washington, DC – share the highest
value, .91. Memphis has the lowest value, likely due to the high number of poverty in
large census tracts far from the urban center. There is little separation between the strong
and weak metros, as all but Austin and Memphis have values between .89 and .91.
In 2000, the difference between the metropolitan areas diminishes as Austin and Memphis each experience an increase in their ACO values. Denver increases to .93 and is the highest. Despite increasing from .69 to .79, Memphis continues to have the lowest value. All eight metropolitan areas experienced an increase in the 1990s. The strong metro areas have an average of .91 and the weaker metros have an average ACO of .89.

Denver (.93) and Memphis (.80) remain on either end of the spectrum in 2010. Although some metropolitan areas demonstrate a moderate decline, values still remain high in 2010, and on average, both groups experienced an increase during the twenty-year period. The strong metropolitan areas averaged .90 and the weaker metros averaged .87 in 2010.
The Absolute Clustering Index (ACI) measures the degree to which poverty neighborhoods adjoin one another. The ACI ranges from 0 to 1; the closer a value is to 1 indicates higher segregation. The results are presented in Figure 5.

In 1990, Detroit had the highest degree of clustering and Seattle had the lowest. There is a clear division between the two groups in 1990, as the strong metropolitan areas had the four lowest values, all below .13, and the weak metropolitan areas all had above .13. The strong metro areas averaged .09 and the weaker metropolitan areas averaged .15.

Figure 5: Absolute Clustering Index, Poverty

All eight metropolitan areas exhibited a decline in the clustering of poverty during the 1990s, likely due to the decline in overall poverty rates experienced during that same time. Detroit and Washington, DC continued to have the highest and lowest degrees of clustering, respectively; however, the gap between the two groups lessened. In 2000, the strong metropolitan areas averaged .07 and the weaker metropolitan areas dropped to .1.
Finally, in 2010, the differences continued to decline. Washington, DC and Denver increased, minimizing the separation between strong and weak metropolitan areas. Detroit continued to have the highest value, but the weak metropolitan areas average declined to .09 and the strong metropolitan areas plateaued at .07.

The final spatial segregation index is the Absolute Centralization Index (ACI), which measures the proximity of individuals in poverty to the central city. The ACI ranges from -1 to 1; a positive value indicates a high degree of centralization, a negative value indicates individuals in poverty are far from the central city, and a 0 indicates there is even dispersion throughout the metropolitan area. The one shortcoming of this approach is the various size and shape of jurisdictional boundaries.

The strong metropolitan areas and weak metropolitan areas both averaged .75 in 1990. Denver had the highest value at .92, and Austin had the lowest, .61. The other six metropolitan areas ACI values range from .71 to .81.

There was not a great degree of change between 1990 and 2000 in the centralization values. Detroit and Washington, DC each experienced a moderate decline, and Austin exhibited the greatest change, an increase of .07, however, the averages of the two groups did not adjust significantly. The strong metropolitan areas average increased from .75 to .77 and the weak metro areas remained at .75 in 2000.

Lastly, in 2010, most of the metropolitan areas experienced a decline in the ACI values. Denver remained the highest, remaining at .92 for the third consecutive decade, and Cleveland had the lowest value at .65. The strong and weak metropolitan areas experienced a decline in their average as a group. The strong metros decline to their 1990
average of .75 while the weaker metros dropped to .72. Denver’s consistently high values may be the result of a particularly odd shaped central city in comparison to the other metro areas included in this study.

Figure 6: Absolute Centralization Index, Poverty

High- and Extreme-Poverty Neighborhoods

In this section, I discuss the findings of high-poverty and extreme-poverty neighborhoods independent of one another and then offer a holistic interpretation of the two groups. Following this is a discussion of the spatial pattern of concentrated-poverty neighborhoods. I mapped the concentration of poverty at two different thresholds, 20-39% (high-poverty) and greater than 40% (extreme poverty). The results are presented as percentages of census tracts within each threshold because of the wide disparity between total census tracts in each metro. For example, Washington, DC and Detroit each have over 1200 census tracts while Austin, Memphis and Buffalo have less than 350. To
illustrate, Washington, DC has 22 extreme-poverty neighborhoods and Memphis has 29 in 2000; although similar total numbers of extreme poverty tracts, that is 9.3% of census tracts in Memphis and only 1.6% in Washington, DC.

**Extreme-poverty neighborhoods**

Figure 7: Extreme-Poverty Neighborhoods, as a Percent of Total Census Tracts

In extreme-poverty neighborhoods, there is a clear division between the strong and weak metropolitan areas for each decade. In 1990, Memphis had the highest, 14.4%, of extreme-poverty census tracts. The metropolitan area with the lowest percentage of extreme-poverty tracts was Washington, DC, with only 0.8%. The weak four metropolitan areas had the four highest percentages of extreme-poverty tracts, all with greater than 5.7%. The strong four metropolitan areas all had less than 4.6% of their census tracts classified as extreme-poverty.

Despite more than a 5% decrease, Memphis had the highest percentage of extreme-poverty tracts again in 2000. Denver replaced Washington, DC as the metro with
the lowest percentage at 0.5%. Detroit also experienced a noticeable decline of over 5%.
The division between strong and weak narrowed, but remained, as the weaker four
metros all had greater than 3.5% of their census tracts classified as extreme-poverty. The
strong metros all had less than 2.9%. Between 1990 and 2000, seven of the eight
metropolitan areas experienced a decrease in the percentage of extreme-poverty
neighborhoods; only Washington, DC experienced an increase – from 0.8 to 1.6%.

For the third consecutive decade, Memphis had the highest percentage of
extreme-poverty census tracts, and the percentage skyrocketed to 15.1% - the highest for
any metropolitan area in any decade. Washington, DC again had the lowest percentage
with 1.5% extreme-poverty tracts. The separation between the two groups reached its
greatest divide as the weak four metro areas all had higher than 8.8% and the stronger
metros had less than 5.4% of their neighborhoods classified as extreme poverty tracts.

Between 2000 and 2010, seven of the metropolitan areas, excluding Washington,
DC increased the percentage of extreme poverty tracts. Both groups witnessed a
significant jump in their percentages during the 2000s, particularly the weaker metros.
The average percentage of extreme-poverty neighborhoods increased from 5.8 to 11.1%.
During the same time, the stronger metros increased from 1.5 to 2.6%. Between 1990 and
2010, seven of the metros areas experienced an increase. Only Seattle (no change) did not
increase the percentage of extreme-poverty neighborhoods during the two-decade span.
The numbers in 1990 closely resemble those in 2010. Over the time study period, weaker
metros, on average, increased from 9.5% to 11.1% while the stronger metros increased
from 2.2 to 2.6%. The decline in extreme-poverty neighborhoods during the 1990s, which
matches nationwide trends, appears to only be a short-term decline in the metropolitan areas examined here.

**High-Poverty Neighborhoods**

Figure 8: High-Poverty Neighborhoods, as a Percent of Total Census Tracts

As shown in Figure 5, Austin’s rate of high-poverty tracts, 22.0, certainly bucks the trend between the two groups observed in extreme-poverty neighborhoods but following Austin are the four weaker metros, all had percentages higher than 11.4%. Washington, DC, 4.8, had the lowest percentage. Aside from Austin, the remaining three strong metros had less than 8.5% of their neighborhoods classified as high-poverty.

In 2000, Memphis replaced Austin with the highest percentage of high-poverty tracts, 22.8%, and Seattle displaced Washington DC as the lowest with 5.7%. By 2000, the four weaker metros had the four highest percentages of high-poverty neighborhoods; all greater than 16.6%. The strong metros each had percentages less than 13.4%. During
the 1990s, high-poverty neighborhoods increased in all four weak metro areas, likely related to the decline of extreme-poverty neighborhoods observed during the same time period in all four metros. Only DC experienced an increase in both high- and extreme-poverty neighborhoods in 1990s. Austin had a significant decline to 13.4%, Seattle decreased from 6.1 to 5.4%, and Denver dropped from 8.5 to 7.4%.

Again in 2010, Memphis had the highest percentage of high-poverty neighborhoods, 28.5% - the highest percentage for any metro in any decade. Washington, DC, although increasing to 6.2%, had the lowest percentage of any metropolitan area. The division between the strong and weaker metros is blurred in 2010. Cleveland is the second highest at 22.4% and despite doubling the number of high-poverty tracts during the time period, Seattle remains the second lowest at 11.4%, but there is a a cluster around 19-20% for the remaining four cities. Overall, all eight metropolitan areas increased between 2000 and 2010. Further, aside from Austin, the remaining seven metropolitan areas increased between 1990 and 2010.

On average, the percentages of high-poverty tracts increased for each group between 1990 and 2010. The trends are not equal when comparing the two decades; the percentage of high-poverty neighborhoods in weaker metro areas increased roughly 3% each decade, however, the stronger metros experienced a much different pattern. After a 2.5% decline in the 1990s, the stronger metro areas increased 6% between 2000 and 2010.
High- and Extreme-Poverty Neighborhoods

Overall, there is a clear difference between the strong and weak metropolitan areas in extreme-poverty neighborhoods. The four weak metros have the highest percentage in all three decades. In sum, there is a much higher likelihood for a person to live in an extreme poverty neighborhood if that person lives in Buffalo, Cleveland, Detroit or Memphis. Neither the strong nor weak metros were immune to the growth of concentrated poverty during the 2000s after the brief period of relief in the 1990s.

The high-poverty neighborhoods do not present such a clear division between the two groups, particularly in 2010. There is some separation in 1990 and 2000, if not for Austin’s incredibly high number of high-poverty tracts in 1990.

After examining the percentage of extreme- and high-poverty neighborhoods in each decade, it is crucial to understand how these trends manifest spatially, and how location changes over time. In the following section, I discuss the location of extreme- and high-poverty tracts in each metropolitan area between 1990 and 2010.

Spatial Patterns of Concentrated Poverty

Within this section, I explain the spatial patterns of concentrated poverty in each metropolitan area separately. The weak metropolitan areas are described first followed by the strong metropolitan areas; each group is organized alphabetically. Additionally, high- and extreme-poverty neighborhoods are discussed together. If noticeable geographic patterns exist for one group in particular, that will be noted, but otherwise I will simply refer to the neighborhoods as concentrated poverty neighborhoods. The patterns from 1990 to 2010 are discussed within each metro area. All maps are in Appendix A.
Buffalo

High- and extreme-poverty neighborhoods grew each decade in Buffalo. In 1990, extreme-poverty neighborhoods were located in central Buffalo, north of Interstate-190 and West of Interstate-90, and extend northeast. High-poverty neighborhoods surround downtown Buffalo. There are also high- and extreme-poverty neighborhoods near Niagara Falls in the northern metro area. There was little change in the location of neighborhoods in the 1990s aside from some slight dispersal from central Buffalo and growth near Lockport. Finally, in 2010, the high-poverty neighborhoods expand around Lockport and Niagara Falls. Downtown Buffalo also absorbed some of the growth in concentrated poverty, primarily near the northern boundary of the city.

Cleveland

In 1990, high- and extreme-poverty neighborhoods are throughout downtown and central city neighborhoods, extending both east and west as the eastern boundary of high-poverty neighborhoods extended as far east as East 152\textsuperscript{nd} Street. There are also isolated groups in the western part of the metro near Lorain and Elyria.

Those isolated groups remain on the periphery in 2000 and experience very little change. The concentration near downtown Cleveland remains and the concentration of extreme-poverty neighborhoods shift to the south. High poverty tracts continue to move east and a new area emerges south of Cleveland around North Randall. In 2010, the concentration spreads from downtown – both high and extreme neighborhoods – into central city neighborhoods in all directions. Extreme-poverty neighborhoods growth is
noticeable to the west near the Lakewood and Cleveland boundary and to the east in East Cleveland. Finally, there is a growth near North Randall and Bedford Heights.

**Detroit**

There is a concentration of high- and extreme-poverty neighborhoods throughout Detroit in 1990. There is a clear boundary of this concentration along 8 Mile Road to the north and Highway 24 to the west. Pontiac, to the northwest of Detroit, has a concentration of poverty neighborhoods as does an area to the west around the intersection of Interstate-94 and Interestate-275.

The northern and western boundaries of concentrated poverty neighborhoods remain in downtown Detroit but a significant number of extreme-poverty tracts are reduced to high-poverty in 2000. The clustering west of the city and in Pontiac decline slightly. In 2010, a large number of extreme-poverty census tracts re-emerge in central Detroit. The number of high-poverty tracts moves west and north from the central city. The area west of the city appears again and expands beyond its 1990 coverage. Additionally, there is a growth of high-poverty neighborhoods in the northeastern part of the metro, roughly 40 miles from downtown Detroit.

**Memphis**

Over 32% of Memphis’ census tracts are high- or extreme-poverty in 1990, therefore it is little surprise to find concentrated poverty neighborhoods located throughout the Memphis metropolitan area. The western periphery has multiple extreme-poverty neighborhoods while the tracts found on the eastern periphery are high-poverty neighborhoods. This east-west divide remains true near downtown Memphis as a the
portion of the city west of Interstate-240 is covered with extreme-poverty tracks and the
neighborhoods east of the thoroughfare are predominately high-poverty. The division
along I-240 becomes even clearer in 2000. High-poverty tracts move south to the
Tennessee border and north of I-40. The neighborhoods on the eastern periphery diminish
and those on the western boundary reduce to high-poverty.

Memphis’ high- and extreme-poverty neighborhood eclipse 40% in 2010 and the
boundaries of the metropolitan area absorb some of this growth, but to a lesser extent
than in 1990. Near downtown extreme-poverty neighborhoods increase and high-poverty
neighborhoods emerge. The extreme-poverty tracts appear east of I-240 along I-40 and
both north and south of the city. The most noticeable change is the growth of high- and
extreme-poverty tracts beyond the outer belt.

Austin

In 1990, high- and extreme-poverty neighborhoods are located throughout the
central city. The majority of extreme-poverty census tracts are east of Interstate-35.
Beyond the near urban area, high and extreme poverty neighborhoods are located in the
southern portion of the metro area near San Marcos and in southeastern Austin MSA near
Red Rock. Also, Paige to the east and Granger to the northeast are both home to high-
poverty neighborhoods in 1990.

Austin’s high- and extreme-neighborhoods decreased significantly by 2000 and
noticeable change in the spatial patterns accompanied the decline. The reduction of
extreme-poverty neighborhoods in near urban areas, particularly east of downtown was
the most significant. The outer suburban areas almost disappear aside from the area near San Marcos in the south and in Taylor to the northeast.

During the 2000s Austin experienced a growth in high- and extreme-poverty neighborhoods. High-poverty neighborhoods emerge south of Highway 290 and to the southeast along the urban fringe near the Austin-Bergstrom International Airport. Within the city, high-poverty neighborhoods run in a linear pattern from the southern to northern boundary of Austin, and extreme poverty neighborhoods emerge in the northeast area, near the University of Texas – no surprise with the concentration of students. In the suburban areas, poverty neighborhoods remain and expand around San Marcos and Taylor.

**Denver**

Extreme-poverty neighborhoods are located along Interstate-25 from north of Louisiana Avenue to Interstate-70 in 1990. Many high-poverty neighborhoods are located west of I-25 along 6th Avenue, northwest of downtown; and to the north and south of I-70, east of I-25. High-poverty neighborhoods are also located along Colfax Avenue, east of Quebec to I-225. Further, Glendale and the area west of Santa Fe have high poverty neighborhoods.

Denver experienced a drop in high- and extreme-poverty neighborhoods between 1990 and 2000, but the spatial location did not change a great deal. Overall, there was a reduction in extreme-poverty tracts but minor changes in location aside from extreme-poverty neighborhoods concentrating around I-25 and 6th Avenue.
The number of high- and extreme-poverty tracts jumped from 49 to 140 between 2000 and 2010 in Denver. This increase in number of tracts resulted in a drastic change in geography of poverty. The extreme-poverty neighborhoods continued around 6th Avenue and I-25 and transitioned from high-poverty neighborhoods along East Colfax and Alameda, west of I-225. High poverty areas expanded from this region to the north of I-70 and south towards Aurora. Aurora experienced enormous growth in concentrated poverty neighborhoods to the west of I-225.

*Seattle*

The extreme-poverty neighborhoods in 1990 are located predominantly in downtown Seattle and around the University of Washington. High-poverty neighborhoods extend south from downtown along Interstate-5. Tacoma, Washington – in the southern part of the Seattle MSA – also has multiple high- and extreme-poverty neighborhoods. Finally, Everett has a small presence of high-poverty neighborhoods.


Between 2000 and 2010, the number of high- and extreme-poverty neighborhoods nearly doubled, from 48 to 94. The growth largely occurred in Tacoma, south of downtown Seattle, and near Everett. The growth around Tacoma and Everett were largely expansions of previous locations of high-poverty areas, however, the area south of
downtown Seattle emerged in 2010, just as downtown experienced a decline. The growth occurred at the previous southern boundary of where poverty extended from downtown but now extends further south than in 1990.

Washington, DC

In 1990, high- and extreme-neighborhoods are located predominantly on the east side of Washington, DC. Additionally, there are areas to the northeast around College Park, Maryland. Washington, DC had about 20 more high or extreme-poverty tracts in 2000, and this growth continued to move north and east. The area around College Park, MD expands and directly east of the District in Glenarden, MD grows, as well.

Washington, DC experienced only a small growth in high- or extreme-poverty neighborhoods between 2000 and 2010, but the location dispersed slightly from downtown Washington, DC and continued to move north of Interstate-695, south of Florida Avenue NW, and east. High-and extreme-poverty neighborhoods continue to expand around College Park, MD and high-poverty neighborhoods emerge beyond the DC boundary along 495, the beltway, in various directions.

Spatial Statistics

Global Moran’s I

Global Moran’s I is a measure of spatial autocorrelation – it evaluates the clustering of both high and low values. Global Moran’s I is an inferential statistic and can be evaluated based on the z-score. The null hypothesis of the Global Moran’s I is that the spatial distribution is random. A statistically insignificant z-score indicates we can not reject the null hypothesis, and spatial patterns of the dataset are a random process. A
A statistically significant z-score indicates either clustering or dispersal beyond random processes. If the z-score is statistically significant, we can reject the null hypothesis. The direction (positive or negative) of the z-score and the Moran’s Index will correspond. If the z-score is a statistically significant positive value, and the Moran’s Index is positive, we reject the null hypothesis because the high and/or low values are more clustered than can be expected from a true random process. If the z-score is a statistically significant negative value, and the Moran’s Index is negative, we can also reject the null hypothesis, however in this case because the high and low values are more dispersed than would be expected from a random selection. The z-score and Moran’s Index should be evaluated only in relation to another decade of the same metropolitan area, and not in comparison to other metros due to the variation in number of census tracts and spatial units.

Table 5: Global Moran’s I, Individuals in Poverty

<table>
<thead>
<tr>
<th>City</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>0.912</td>
<td>0.862</td>
<td>0.559</td>
</tr>
<tr>
<td></td>
<td>29.15**</td>
<td>27.5**</td>
<td>17.89**</td>
</tr>
<tr>
<td>Cleveland</td>
<td>1.005</td>
<td>0.8552</td>
<td>0.396</td>
</tr>
<tr>
<td></td>
<td>54.73**</td>
<td>46.59**</td>
<td>21.64**</td>
</tr>
<tr>
<td>Detroit</td>
<td>1.018</td>
<td>0.9262</td>
<td>0.632</td>
</tr>
<tr>
<td></td>
<td>72.88**</td>
<td>66.33**</td>
<td>45.43**</td>
</tr>
<tr>
<td>Memphis</td>
<td>0.6639</td>
<td>0.397</td>
<td>0.22995</td>
</tr>
<tr>
<td></td>
<td>16.297**</td>
<td>9.7**</td>
<td>5.658**</td>
</tr>
<tr>
<td>Denver</td>
<td>0.827</td>
<td>0.72</td>
<td>0.586</td>
</tr>
<tr>
<td></td>
<td>37.55**</td>
<td>32.69**</td>
<td>26.56**</td>
</tr>
<tr>
<td>Seattle</td>
<td>0.612</td>
<td>0.467</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>25.62**</td>
<td>19.43**</td>
<td>12.54**</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>1.071</td>
<td>0.88</td>
<td>0.486</td>
</tr>
<tr>
<td></td>
<td>82.598**</td>
<td>67.8**</td>
<td>37.43**</td>
</tr>
<tr>
<td>Austin</td>
<td>0.647</td>
<td>0.738</td>
<td>0.509</td>
</tr>
<tr>
<td></td>
<td>16.89**</td>
<td>19.31**</td>
<td>13.37**</td>
</tr>
</tbody>
</table>

** indicates statistically significant at 99%
Table 5 includes the Moran’s Index and z-score for each metropolitan area in 1990, 2000, and 2010. The italicized number below the Moran’s Index is the z-score, which indicates statistical significance. When measuring the number of individuals in poverty in each census tract for 1990, 2000 and 2010, we are able to reject the null hypothesis in all eight metropolitan areas because of statistically significant, positive z-scores, which indicates poverty is spatially autocorrelated.

**Getis-Ord General G**

The Getis-Ord General G measures if high or low values cluster. The General G interprets values in relation to the expected value. The null hypothesis of the General G is no spatial clustering. If the General G yields a statistically significant z-score we are able to reject the null hypothesis. A statistically significant positive z-score indicates high values are more clustered than can be expected from a truly random sample. Statistically significant negative z-scores indicate the low-values are spatially clustered more than can be expected from a truly random sample. The observed General G ranges from 0-1; the closer to 1 indicates high values are clustered, and closer to 0 indicates low values are clustered, however, the z-score must be significant in order to reject the null hypothesis.

In Table 6, the z-score is the italicized value below Observed General G for each metropolitan area in 1990, 2000, and 2010. Testing the number of individuals in number of poverty with the Getis-Ord General G, we are able to reject the null hypothesis in each metropolitan area because of statistically significant, positive z-scores.
Table 6: Getis-Ord General G, Individuals in Poverty

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>0.074</td>
<td>0.0628</td>
<td>0.0484</td>
</tr>
<tr>
<td></td>
<td>18.78**</td>
<td>17.891**</td>
<td>13.303**</td>
</tr>
<tr>
<td>Cleveland</td>
<td>0.0475</td>
<td>0.039</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>29.563**</td>
<td>25.753**</td>
<td>14.14**</td>
</tr>
<tr>
<td>Detroit</td>
<td>0.0232</td>
<td>0.018</td>
<td>0.0129</td>
</tr>
<tr>
<td></td>
<td>47.745**</td>
<td>41.42**</td>
<td>28.18**</td>
</tr>
<tr>
<td>Memphis</td>
<td>.0288</td>
<td>0.0207</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>10.559**</td>
<td>7.006**</td>
<td>3.887**</td>
</tr>
<tr>
<td>Denver</td>
<td>0.032</td>
<td>0.027</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td>27.05**</td>
<td>23.44**</td>
<td>18.94**</td>
</tr>
<tr>
<td>Seattle</td>
<td>0.014</td>
<td>0.01196</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>17.289**</td>
<td>14.365**</td>
<td>10.11**</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>0.025</td>
<td>0.0196</td>
<td>0.0142</td>
</tr>
<tr>
<td></td>
<td>41.84**</td>
<td>34.33**</td>
<td>21.12**</td>
</tr>
<tr>
<td>Austin</td>
<td>0.029</td>
<td>0.0325</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>12.92**</td>
<td>14.77**</td>
<td>9.82**</td>
</tr>
</tbody>
</table>

** indicates statistically significant at 99%

**Anselin’s Local Moran’s I**

Anselin’s Local Moran’s I is the local version of the Global Moran’s I. Simply, it measures clustering at the local level and indicates, feature by feature, if a census tract is positively or negatively correlated with nearby census tracts. The test determines if there is a spatial cluster (of high or low values) or spatial outlier based on the expected distribution.

**Buffalo**

Downtown Buffalo has a clustering of High/High tracts with four Low/High tracts interspersed throughout the area. The High/High clusters cover the area from the Niagara River to Ogden Street and south of Interstate-90. There are similar clusters observed in 2000 as in 1990, but the High/High tracts do move slightly to the north. A Low/Low tract
emerges to the southeast of Buffalo. In 2010, the High/High clusters continue to move north near I-90 and High/High groups are pushed slightly east and west where a minor division emerges in north central Buffalo. As is true with previous decades, a small number of Low/High tracts are intermixed within the urban area.

**Cleveland**

High/High clusters are throughout downtown and into eastern neighborhoods of the central city, extending to the western boundary of Shaker Heights, an eastern suburb. There are also High/High tracts near Lorain in the western part of the metropolitan area. Lastly, the southwest portion of the metropolitan area has multiple Low/Low tracts. In 2000, there isn’t much change in the clusters of High/High tracts downtown or in Lorain. Also, the Low/Low tracts continue in Beachwood and expand north on the west side towards Avon.

Lastly, in 2010, High/High clusters remain in Lorain and emerge in the far eastern part near Painesville and Grand River. Downtown, the High/High tracts split down the center and move west, southeast and northeast. Low/Low tracts retreat to the southwestern corner of the metro in a similar pattern as 1990.

**Detroit**

There is a considerable concentration of High/High tracts in the Detroit urban area, primarily south of 8-Mile Road and east of Highway 24 and Dearborn. There are some scattered Low/High tracts in downtown – however, these are primarily low population tracts with less than 200 people. Further there is an isolated High/High tract
west of the city and multiple in the Pontiac region. Finally, Low/Low neighborhoods are found throughout the western and northern metro area.

The concentration of High/High neighborhoods in central Detroit continue but there is a slight reduction in the number of tracts classified as High/High, particularly in the northwest part of Detroit near the intersection of 8 Mile and Highway 24. The isolated group of High/High tracts west of the city remains and the cluster near Pontiac slightly expands. The number of Low/Low tracts increases in the north and western part of the metro area. These areas could potentially have a strong link to Ann Arbor, Michigan – just outside the Detroit metro area.

In 2010, the High/High clusters in downtown deconcentrated slightly and move toward the north and the west. Further, the High/High tracks near Pontiac and the area west of the city continue to expand from their coverage in 2000.

**Memphis**

High/High tracts cover much of downtown and predominantly are located in the western part of downtown Memphis and extend north and south. The western most boundary of the metropolitan area is also home to High/High clusters. East of Memphis there is clusters of Low/Low tracts near Collierville, Macon and Brunswick. There is also a High/Low tract near Mt. Pleasant. In 2000, the Low/Low to the east expands north towards Brighton and south towards West Olive Branch and the High/Low near Mt. Pleasant remains. The High/High clusters near downtown remain in similar locations with some growth to the south.
Lastly, the High/High clusters in 2010 are similar to the pattern in 2000 but there is a slight reduction in downtown as High/High clusters expand to the southwest and north. The Low/Low tracts remain east of the city and Low/High tracts emerge northwest of Memphis in Arkansas.

**Austin**

Clusters of High/High neighborhoods are noticeable in the southern and eastern part of Austin’s metropolitan area, near San Marcos and Cedar Creek, respectively. High/High clusters are also near downtown Austin, primarily north of Highway 290, extending north along Interstate along and to the east of Interstate-35. There are two neighborhoods of Low/High near the University of Texas and surrounded by High/High neighborhoods. There are also Low/High tracts around Lamar Boulevard, north of E 38th and south of East 51st. There are Low/Low clusters north of the city around Florence, Lake Georgetown and Hutto; as well as to the northwest near Jonestown, Pointe Venture, Laga Vista and Volente. High/Low clusters are along the western and northern fringe of the metro area.

The clusters of High/High tracts in the central city move east and south. No clusters remain in the northeastern portion of Austin, near Chestnut and Martin Luther King. Clusters of High/High also continue in San Marcos area. Low/Low neighborhoods are again located north of the city near Liberty Hill, Georgetown municipal Airport and Hutto.

In 2010, High/High neighborhoods move north of 290 and east of Highway 130. Growth continues to the south of the city. Clustering continues to disappear near the area
around Martin Luther King, Manor Road and Springdale Road that began to experience
no clustering in 2000. High/High neighborhoods continue and grow in the southern and
easternmost regions of the metropolitan area. Additionally, the Low/Low neighborhoods
perpetuate around Liberty Hill, Georgetown and Hutto.

Denver

From 1990 to 2010, Low/Low clusters are throughout the southern metro area. In
1990, High/High clusters are located throughout Denver, particularly west of Santa Fe;
west of I-25 along 6th Avenue; along Interstate-70 east of Interstate-25; and East Colfax.
In 2000, there is little change in the High/High clusters, but there is some growth on the
east side, to the north of Interstate-70 near the I-225/I-70 intersection. Three Low/High
tracts emerge west of Sheridan Avenue, east of I-25 and West of Broadway, south of
Colfax. Finally, in 2010, High/High clusters disperse a bit from city center. There is
significant growth in Aurora, along the I-225 corridor, as well as growth to the north near
Westminster.

Seattle

Many neighborhoods of High/High clusters are found in the Seattle metro area in
1990. High/High clusters are throughout downtown Seattle and extend south along and to
the west of Interstate-5. Clusters of High/High tracts are also prevalent in Tacoma.
Everett, Washington – in the northern metro area – has a mix of High/High and
Low/High tracts. Finally, the eastern part of the metro is home to multiple Low/Low
tracts from directly east of Seattle and extending north.
In 2000, High/High tracts continue near downtown Seattle; clusters reduce to the area west of Interstate-5, south of Seattle. Near Tacoma, the High/High clusters move east and Low/High tracts emerge to the west and northeast of Tacoma. Everett continues to be an even mix and the concentration of Low/Low neighborhoods remains but moves slightly east.

In 2010 the north and eastern area of the metro experience few changes. The concentration of High/High tracts diminishes around downtown and High/High clusters emerge south of downtown Seattle, as well Low/High tracts interspersed in this area. The area around the University of Washington has a mix of High/High and Low/High neighborhoods.

*Washington, DC*

In 1990, High/High clusters dominate eastern half of Washington, DC as well as College Park, MD and Glenarden, MD. Additionally, there are Low/High clusters northwest of downtown along Massachusetts Avenue, near Georgetown University (I think). Patterns are similar in 2000 as in 1990, but High/High clusters expand east. Further, High/High clusters emerge outside of DC south of Arlington and west of Alexandria. The areas extending southeast of the US Capital along Pennsylvania Avenue that were not significant in 1990 emerge as Low/High cluster in 2000. Lastly, in 2010 there is a growth of High/High clusters to the northeast, outside of Washington, DC towards Silver Spring, MD – along the northeast border south of College Park, MD. By 2010, there is a complete absence of High/High tracts in the western half of Washington, DC and scattered Low/High tracts invade the eastern and northern parts of DC.
Getis Gi*

Getis Gi* is the local test of Getis-Ord General G. The Gi* indicates hot-spots, or areas where there is spatial clustering of high values. The test also indicates cold-spots, which are areas where there is spatial clustering of low values. To be clear, cold-spots do not signal affluent areas, cold-spots only indicate clustering of tracts with low-numbers of individuals in poverty.

Buffalo

There is little change in the location of hot-spots in Buffalo from 1990 to 2000. In 1990, hot-spots are located throughout downtown Buffalo. In 2000, those hot-spots have extended slightly north and in addition, a hot-spot emerges near Niagara Falls in the northern part of the Buffalo MSA. In 2010 the hot-spots near Buffalo move both north and south along the Niagara River while the tracts in north central Buffalo disappear. Further, isolated cold-spots emerge to the east of Buffalo.

Cleveland

In 1990, hot-spots are found in Lorain and encompasses the majority of downtown – extending west, northeast and southeast. Cold-spots surround the western boundary near Rocky River and Brook Park; in the southwest near Parma Heights and in the east around Beachwood, South University Heights and Cleveland Heights. In 2000, the cold-spots around Rocky River disperse in the southwest a bit. As for the hot-spots, there is almost zero change between 1990 and 2000. Finally, in 2010 hot-spots emerge near Painesville and expand around Lorain. Further, the hot-spot in downtown splits and there is growth to the west and southwest as well as the northeast. The intensity around
90/71/77 (Newburgh Heights?) diminishes and the cold-spots remain similar as in 2000 – only Westlake emerges as a cold-spot.

_Detroit_

Unlike many other metros, Detroit’s cold spots are as notable as their hot-spots. There are four areas surrounding Detroit with cold-spots in 1990. Broadly, these areas are Livonia, Sterling Heights and Warren; more specifically: Redford to the west; West Bloomfield to the northwest; Beverly Hills and Huntington Woods to the north; and Warren, St. Clair Shores, and Grosse Point to the northeast. Hot-spots are found in downtown Detroit – south of 8 Mile Road and east of Dearborn. Pontiac, to the northwest of Detroit, also has a clustering of high poverty tracts.

The cold-spots remain and expand in 2000. Further, a new area – Southgate to the south of the city – emerges. There is also growth to the west of Redford and Beverly Hills expands north towards Bloomfield Hills. Hot-spots continue to cover the majority of downtown and grow north and west towards 8 Mile Road and Highway 24. Finally, in 2010, the cold-spots continue to expand and intensify because the confidence level increases. West Bloomfield, Plymouth and Redford nearly merge as the cold-spots move south of West Bloomfield. Bloomfield Hills continues to intensify and there is an emergence of cold-spots in Rochester Hills. The area between Warren and St. Clair widens as the cold-spots retreat towards each community. Finally, the hot-spots move slightly north and northwest as the central city intensity diminishes.
**Memphis**

There are cold-spots near Germantown, TN, southeast of Memphis in 1990. The hot-spots are found along the western side of Interstate-240 in downtown Memphis and extends north and south throughout the city limits plus north of I-240. Further, hot-spots are located on the western periphery.

**Austin**

Hot-spots emerge in downtown Austin and various suburban locations. There are hot-spots in the southern portion of the metropolitan area near San Marcos and in scattered areas to the east and northeast part of the metro area. Similar patterns are present in 2000. Within the downtown area, the intensity is reduced but clusters remain in the similar locations. In 2010, clusters occur in fewer neighborhoods to the south, but higher intensity within the tracts that do. There is a noticeable change in the clustering of individuals in poverty near downtown Austin. Clustering moves north near Pflugerville, east towards Walter E. Long Lake. The most noticeable change is the disappearance of clustering east of Interstate-35, north of 7th Street and south of E 51st Street.

**Denver**

In 1990, there are hot-spots, signaling a high number of individuals in poverty, along Santa Fe from the southwest into downtown Denver. There are also hot-spots along east Colfax; and northeast of Denver near Commerce City. Three areas experience cold-spots: east of I-225 in Aurora, Highlands Ranch in the south as well as an area near Englewood.
There is very little change between 1990 and 2000 for cold-spots or hot-spots in Denver. Cold-spots continue in the same areas in 2000 as in 1990 with the emergence of a small area west of Arvada. As for hot-spots, the east side expands north of Colfax. Finally, in 2010, the growth of high- and extreme-poverty neighborhoods resulted in increased hot-spots and cold-spots. Cold-spots expand from the areas in 1990 in 2000 and the confidence levels increase, especially in Highlands Ranch. To the north and west, the minor cold-spot from 2000 around Arvada expands in 2010 and cold-spots emerge in Broomfield and Henderson. Hot-spots move north of Denver towards Westminster and expand along I-225 corridor in Aurora. Lastly, the consistent hot-spot in the center of downtown splits and a gap emerges between the hotspots along I-25 and I-225 from Lincoln to Quebec, south of Colfax and towards City Park.

Seattle

In 1990 there are three distinct hot-spots in the Seattle metropolitan area. The hot-spots are located around downtown Seattle, Tacoma and Everett. Also during this time, there is cold-spot around Mill Creek. In 2000, the same general patterns are present, yet the hot-spots near downtown Seattle move to the north and diminish slightly west of I-5 near the coast. The intensity, or confidence intervals of the tracts, increases around Tacoma and expands to the south. Cold-spots emerge east of the city extending both north and south. In 2010, the hot-spots near Tacoma contract. The hot-spots in downtown Seattle diminish and move south as the previously southern boundary becomes a northern boundary. Small clusters remain north of downtown and near the University of
Washington. Hot-spots continue around Everett. Cold-spots expand and/or merge along the eastern boundary of Seattle.

**Washington, DC**

In 1990, there are cold spots west of Washington, DC near Washington Dulles Airport, north in Ashburn, east of Herndon and to the south near Centerville. Hot-spots dominate the eastern half plus much of the area near downtown, north of the Potomac River. Hot-spots extend toward Silver Spring, College Park and Glendarden, Maryland with a small cluster in southwest Arlington.

In 2000, the hot-spot in southwest Arlington expands greatly. The concentration to the east remains and intensifies beyond DC boundary. Scattered cold-spots continue around Washington Dulles Airport and emerge northwest of DC in Chevy Chase.

In 2010, the cold-spots expand from Chevy Chase and West of Alexandria. Arlington experiences growth of cold spots and the area around Dulles expands. Hot-spot continues to cover eastern half of District but areas emerge far north near Aspen Hill, south of Gaithersburg, MD and to the far west near Manassas Park, VA.

The following section describes the results of each segregation measure regarding the segregation of affluence. The section is organized in the same order as the segregation of poverty.

**Segregation of Affluence**

**Affluence Rate**

The affluence rate reflects the percentage of household in the top income category for each decennial census. In 1990, the top income bracket was household income greater
than $150,000 and in 2000 and 2010, the threshold was $200,000 and above. Using this threshold as a barometer for affluence means the affluent population constitutes a smaller portion of the metropolitan populace than the poor residents. Results are in Figure 6.

Figure 9: Affluence Rates, 1990-2010

The story of affluence rates is the story of Washington, DC. In 1990, Washington, DC had an affluence rate of 3.17% and Buffalo had the lowest that decade at 0.9%. There was no clear pattern between the strong and weak metro areas. The average affluence rate in the strong metro areas was 1.97% and the weak average was 1.35%.

In 2000, the affluence rate for all eight metropolitan areas increased, but Washington, DC (4.76%) and Buffalo (1.27%) remained the benchmarks. The average affluence rate for the strong metropolitan areas increased to 3.18%. The gap between the two groups widened slightly as the weaker metros average affluence rate in 2000 was 2.09%.
For the third consecutive decade, Washington, DC had the highest affluence rate – skyrocketing to 11.6% – and Buffalo had the lowest, 2.5%. The affluence rate increased in all eight metros for the second decade in a row, but the stronger metros increased at a much faster rate. In addition to Washington, DC’s explosion to 11.6%, Austin, Seattle and Denver all more than doubled the total number of affluent households in this period. The strong metros each had affluence rates above 5.13% and none of the weaker metros eclipsed 3.6%. The average affluence rate in stronger metros was 6.9%, more than twice that of the weaker metros average, 3.13%.

To illustrate the difference of growth in affluent households between the two groups, examine the effects of the higher affluence rate combined with the population growth between 1990 and 2010. In 1990, when the population and affluence rate were similar, the difference of affluent households was only 60,000. Between 1990 and 2010 in the stronger metropolitan areas, the total number of affluent households increased by almost 700,000. Affluent households in the weaker metropolitan areas increased by just under 160,000. As a result, the stronger metropolitan areas had roughly 600,000 more affluent households than the weaker metropolitan areas in 2010.

**Dissimilarity Index**

As discussed in the segregation of poverty, the affluence rate of the metro does influence how we interpret the dissimilarity values. On average, the affluence rates were much lower than the poverty rates; the highest observed affluence rate was 11.6% and the remaining 23 values were all below 5.7%. Thus, values that indicate ‘evenness’ between affluent – non-affluent households must be lower than when discussing low-income
groups. In a scenario where the affluence rate is 6% and the non-affluence rate 94%, a dissimilarity value of .06 indicates ‘evenness’.

Figure 10: Dissimilarity Index, Affluence

However, low values are not what we find. In fact, they exceed dissimilarity values observed in the segregation of poverty despite affluence rates being less than half the poverty rates. In 1990, Cleveland had the highest dissimilarity value, .64 and Seattle had the lowest at .48. The weaker metropolitan areas all had values higher than .61 and as a group, averaged .625. The stronger metro areas values were below .62, but averaged .545 as a group.

The dissimilarity values decreased for all eight metropolitan areas in the 1990s. This diminished the gap between the highest and lowest metro areas and between the two groups. Denver, Detroit and Cleveland had the highest value, .52 and Seattle again had the lowest of .45. The stronger metropolitan areas average value was .49 and the weaker metro areas average was .515. Six of the eight metros had values of either .51 or .52; only Seattle and Washington, DC had values below that threshold.
In 2010, the gap between the strong and weak metropolitan areas increased. Memphis had the highest dissimilarity value of .58. Seattle and DC again had the lowest two values, each .43. Between 2000 and 2010, the weak metropolitan areas increased or did not change. On the other hand, the stronger metro areas decreased or stabilized, aside from Austin, which increased from .51 to .52. The weaker metros all had values greater than .51 for the second consecutive decade, with an average value of .55. The strong metros had values below .52, and an average of .47.

Given the significantly higher affluence rate of the stronger metros in 2010, this relationship between strong and weak metros, and the degree of the relationship, is quite surprising. Further, these trends occurred as the strong metropolitan areas experienced a noteworthy increase in their affluence rates. What this relationship potentially suggests is that the growing number of affluent households in the strong metro areas makes it easier for high-income households to disperse throughout the metro area and still live in relatively high-income neighborhoods. Additionally, in stagnant cities, neighborhoods may be more strongly defined by socioeconomic status, culture or heritage. Without an influx of new people, roles within the community are less likely to undergo change. Future indices and other tests will provide an indication if these assumptions have merit. Beyond the potential scenarios contributing to the division between the two groups, the most notable result is the ability of affluent populations to segregate, despite constituting such a small percentage of the population.
Exposure Indices

The isolation index is a measure of how isolated the minority group (in this case, high-income household) is from the majority. The isolation index value indicates the likelihood an affluent household will live in the same neighborhood as other affluent households. An index value of 1 indicates that all affluent households live in neighborhoods of only affluent households.

Figure 11: Isolation Index, Affluence

In 1990, Washington, DC and Detroit had the highest isolation value, .13. Seattle and Buffalo had the lowest index, .06. There is no separation between the two groups of metros, each range from .06 to .13 and the strong metros average isolation index value was .09 and the weak metros were .1.

In 2000, Washington, DC had the highest isolation value, .14 and Buffalo remained the lowest at .06. All four strong metropolitan areas increased between 1990
and 2000, causing their average to increase from .09 to .11. The weaker metros average decreased from .1 to .09.

Washington, DC and Buffalo continued to have the highest and lowest isolation values in 2010. Buffalo’s value increased from .06 to .08 and Washington, DC’s isolation value jumped from .14 to .23, accompanying the rapid increase observed in the nation’s capital affluence rate. All eight metropolitan areas increased between 2000 and 2010. The average for the strong metropolitan areas increased to .17 and the weaker metros climbed to .12. Between 1990 and 2010, the stronger metros average nearly doubled, from .09 to .17 while the weaker metropolitan areas increased modestly from .1 to .12. Despite lower levels of unevenness, affluent households in the stronger metros are twice as isolated, on average, as in the weaker metros.

**Spatial Segregation Indices**

While the dissimilarity index and isolation index are aspatial, three of the segregation dimensions are spatial: concentration, clustering and centralization. To my knowledge, these three indices have not been used to measure the segregation of affluence; therefore, the value of this approach is unknown due to the lack of comparable research. Results from the Absolute Concentration Index (ACO) are presented in Figure 12. The ACO ranges from 0 to 1 and the higher value corresponds with higher segregation.

All eight metropolitan areas exhibited particularly high levels of concentration of affluence, which I find interesting due to affluence usually occurring on the periphery in larger census tracts with less population density. The ACO values range from .87 to .98.
in 1990. Denver and Seattle have the highest degree of concentration at .98, and Cleveland the lowest at .87. There is not a clear division between the two groups, but the stronger metropolitan areas have a higher average, .96 compared to .92.

Figure 12: Absolute Concentration Index, Affluence

All eight metros exhibited a decline during the 1990s. Denver and Memphis had the highest ACO values, .86, and Cleveland remained the lowest, declining to .84 in 2000. The strong metros averaged .94, and the weaker metros averaged .90.

For the second straight decade, all eight metros experienced a decline in ACO values. Denver and Memphis remained as the metros with the highest values, .95, and for the third straight decade, Cleveland experienced the lowest concentration of affluence, with a value of .82. The weak metros average dropped to .88 and the strong metros to .91. This consistent decline over the 20-year study period occurred as affluence rates and isolation increased in these metropolitan areas.
The Absolute Clustering Index (ACI) measures the degree to which poverty neighborhoods adjoin one another. The ACI ranges from 0 to 1; the closer a value is to 1 indicates higher segregation. The results are presented in Figure 13.

Detroit and Washington, DC experienced the highest levels of clustering, .08, in 1990. The values are low, likely due to the small affluence rate in 1990 – there were not enough affluent neighborhoods to cluster. Buffalo and Seattle had the lowest values, .02. The weaker metropolitan areas averaged .05 and the strong metros .04.

Clustering increased in all metros, aside from Cleveland, during the 1990s. Washington, DC (.09) and Buffalo (.03) remained the highest and lowest metropolitan areas. The strong metropolitan areas average increased to .06 and the weak metros remained at .05.

Figure 13: Absolute Clustering Index, Affluence

![Figure 13: Absolute Clustering Index, Affluence](image-url)
Clustering increased in all eight metros during the 2000s. For the third consecutive decade, Washington, DC and Buffalo exhibited the highest and lowest levels of clustering. The averages of each group increased by .02 during this decade; the strong metros to .08, and the weak metros to .07.

The Absolute Centralization Index (ACI), which measures the proximity of individuals in poverty to the central city. The ACI ranges from -1 to 1; a positive value indicates a high degree of centralization, a negative value indicates affluent households are far from the central city, and a 0 indicates there is even dispersion throughout the metropolitan area.

Figure 14: Absolute Centralization Index, Affluence

Denver had the highest degree of centralization, .86, in 1990. Cleveland had the lowest value, .61. There is a noticeable division between the two groups, aside from
Memphis, the strong metropolitan areas had the four highest values. The strong metropolitan areas averaged .82 while the weaker metros averaged .68.

Between 1990 and 2000, all eight metropolitan areas declined or remained the same. Seattle joined Denver as the metro area with the highest ACE, .84, and Cleveland remained the lowest at .57. Consequently, the averages for each group declined. The strong and weak metros averaged .80 and .65, respectively.

The Absolute Centralization Index declined in all eight metros for the second consecutive decade. Denver and Seattle remained the highest at .83, and Cleveland had the lowest ACE for the third consecutive decade. The strong metros average declined to .78 while the weak metros average dropped to .61. It is important to note Denver consistently high values in all three decade for both the segregation of poverty and affluence, raising the possibility that the results are a product of the index as much as they are a result of the data.

**High- and Extreme-Affluence Neighborhoods**

I mapped the concentration of affluence at two different thresholds, 20-39% (high-affluence) and greater than 40% (extreme-affluence). Affluence rates are lower than poverty rates therefore I anticipate fewer numbers of high- and extreme-affluence neighborhoods, yet any neighborhood that does reach these thresholds illustrates concentrations of an incredibly small minority.

I present the results of extreme-affluence neighborhoods using total numbers due to the small number of tracts that qualify. To discuss high-affluence neighborhoods, I use percentages and total numbers. The percentages correct for the wide range of census
tracts within each metropolitan area and raw numbers are important due to the small numbers of high-affluence tracts in many metro areas.

**Extreme-affluence neighborhoods**

Washington, DC had the highest number of extreme-affluence census tracts all three decades and until 2010, the only metro area to have a noteworthy percentage. In 1990, eight, or 0.59% of the census tracts in Washington, DC were extreme-affluence neighborhoods. In that same decade, Austin, Seattle, Memphis and Buffalo all had zero neighborhoods.

Table 7: Extreme-Affluence Census Tracts

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In 2000, Washington, DC had eight extreme-affluence neighborhoods for the second consecutive decade. Cleveland lost its one neighborhood of extreme-affluence, joining Buffalo, Memphis and Seattle with zero extreme-affluence neighborhoods. Austin gained 1.

There was noticeable change in 2010 data. Washington, DC’s number of extreme-affluence neighborhoods exploded from 8 to 67, constituting 4.97% of the district’s census tracts. Buffalo and Memphis had zero for the third straight decade. All growth pales in comparison to DC, but, the other three strong metropolitan areas experienced
growth in the number of extreme-affluence neighborhoods. Denver increased from 2 to 6, Austin from 1 to 3 and Seattle from 0 to 3. The weaker metros combined to have four, two in Cleveland and Detroit, respectively. The strong metropolitan areas average percentage of extreme-affluence neighborhoods was 1.8%, while the weaker metropolitan areas was only 0.12%. The margins are small when excluding DC, but the increase in concentration of affluent households occurs mostly in the strong metropolitan areas.

**High-affluence neighborhoods**

Washington, DC leads the way in high-affluence census tracts, as well. In 1990, DC had 26 – 1.93% – neighborhoods with affluence rates between 20 and 39%. Detroit had the second most, 19 neighborhoods, 1.47%. On the low end, Memphis had zero high-affluence neighborhoods, Buffalo had one, and Austin and Seattle each had 2.

Table 8: High-Affluence Census Tracts

<table>
<thead>
<tr>
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<th>1990</th>
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<th>2010</th>
<th>total CT</th>
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Washington, DC had 57 high-affluence neighborhoods, 4.23% of the metro’s tracts, in 2000. Buffalo had 1 high-affluence neighborhood and Memphis had 2. As a result of the small number in 1990, seven metropolitan areas increased their number of high-affluence neighborhoods; Buffalo had one again. The strong metropolitan areas
higher affluence neighborhoods constituted, on average, 2.73% of the metros tracts and the weaker metros averaged 1.12%.

Figure 15: High-Affluence Neighborhoods, as a Percent of Total Census Tracts

Finally, Washington experienced a rapid growth in high-affluence neighborhoods in 2010, just as in extreme-affluence neighborhoods. In 2010, DC had 194 high-affluence neighborhoods, 14.4% of the metro area’s census tracts. Buffalo remained on the low end with only one high-affluence neighborhood for the third consecutive decade. Mimicking the trend of extreme-affluence, the disparity between the strong and weak metropolitan areas grew in 2010. The strong metropolitan areas all had more than 4% of their census tracts classified as high-affluence, while no weak metro area had a percentage higher than 3.55%. The stronger metropolitan areas averaged 7.26% and 2.72% for the weaker metros. Aside from Buffalo, the seven metros each noticed an increase in the concentration of affluent households, but the magnitude of the growth which took place between the two groups is wide.
**High- and Extreme-Affluence Neighborhoods**

Overall, in 1990 and 2000, there was only minor separation between the two groups in the concentration of affluence, at the high- and extreme- threshold. Denver and Seattle noticed a small increase in high-affluence neighborhoods in 2000, but the disparity that did exist between the two groups at any other point could be attributed largely to Washington, DC. However, a clear division emerges in 2010 when considering the number of high- and extreme-affluence neighborhoods. Only 2.84% of the census tracts in the weaker metropolitan areas had concentration levels of affluence higher than 20%. On the other hand, 9.06% of the strong metropolitan areas’ census tracts were classified as high- or extreme-affluence. The growth of affluent household between 1990 and 2010 in the strong metropolitan areas contributed to higher rates of affluence metropolitan wide and the clustering of those populations.

**Spatial Patterns of Concentrated affluence**

The spatial patterns of concentrated affluence are less notable because of the small number of high- and extreme-affluence neighborhoods. Below is a summary of the patterns observed.

*Buffalo*

Buffalo has only one – the same one – high-affluence tract each decade. The tract is located northeast of Buffalo near the area of East Amherst. The percentage of affluent households in the tract each decade is 20.6% in 1990, 21.7% in 2000 and 25.4% in 2010.
Cleveland

Concentrated affluence is located near the eastern suburbs – Shaker Heights, Gates Mills and Chagrin Falls – of Cleveland in 1990. These core areas remain the location of concentrated affluence neighborhoods in 2000 and 2010 and the seven new neighborhoods that emerge over the two-decade span are located in these areas.

Detroit

Detroit had the second highest number, 20, of neighborhoods exceeding 20% affluence in 1990 and they were located to the northwest of Detroit near Bloomfield. The location did not change significantly in 2000 or 2010; the total number of tracts more than doubled over the 20-year period and grew from Bloomfield to the north and southwest.

Memphis

Memphis had zero neighborhoods of concentrated affluence in 1990. The two tracts that appear in 2000 are southeast of Memphis near Germantown. In 2010, the number expands to nine and a linear group of tracts forms along Poplar Avenue (Highway 72) from eastern Memphis to Germantown.

Austin

Austin’s two concentrated affluence neighborhoods are west of downtown near Rollingwood and West Lake Hills in 1990. As the number grows to 8 in 2000, one of the neighborhoods from 1990 becomes extreme and surrounding neighborhoods emerge as high-affluence tracts. Affluent neighborhoods increase from 8 to 21 and the growth
continues west of Austin. As the number of neighborhoods more than doubles, the growth spreads from the original 1990 neighborhoods in all cardinal directions.

Denver

Denver’s high- and extreme-affluence neighborhoods are located in Cherry Hills Village in 1990. As the number of tracts increases nearly four-fold by 2000, the area expands, but they persist largely to the south of Denver and 470. Of note, three tracts near Washington Park and Capital Hill, southeast of downtown, emerge as high-affluence neighborhoods. The number of neighborhoods increased from 19 to 40 by 2010 and growth continues to take place south of Denver along the periphery and an additional tract emerges near Washington Park.

Seattle

The only concentrated affluence tracts in 1990 are east of Seattle on Lake Washington near Clyde Hill and in 2000, additional tracts emerge in a similar area. In 2010, Seattle’s increase of concentrated affluence neighborhoods, from 14 to 32, grows to the east of downtown. The original two high-affluence tracts in 1990 are extreme-affluence by 2010.

Washington, DC

In 1990, the other seven metropolitan areas have a total of 34 concentrated affluence neighborhoods, Washington DC has 34. The majority these tracts are located northwest of DC near Potomac, MD and extend towards the western boundary. There is a similar pattern in 2000, but a noticeable increase in the total number of tracts that spread in all directions from the 1990 concentrated affluence neighborhoods. In 2010, there is
noticable growth, to 261 tracts, throughout the metro area. Potomac, Tyson’s Corner and McLean are filled with extreme-affluence neighborhoods. Neighborhoods emerge southwest of DC in Fairfax, VA and near Brookeville, MD.

**Spatial Statistics**

*Global Moran’s I*

Global Moran’s I is a measure of spatial autocorrelation – it evaluates the clustering of both high and low values. Global Moran’s I is an inferential statistic and can be evaluated based on the z-score. The null hypothesis of the Global Moran’s I is that the spatial distribution is random. A statistically insignificant z-score indicates we can not reject the null hypothesis, and spatial patterns of the dataset are a random process. A statistically significant z-score indicates either clustering or dispersal beyond random processes. If the z-score is statistically significant, we can reject the null hypothesis. The direction (positive or negative) of the z-score and the Moran’s Index will correspond. If the z-score is a statistically significant positive value, and the Moran’s Index is positive, we reject the null hypothesis because the high and/or low values are more clustered than can be expected from a true random process. If the z-score is a statistically significant negative value, and the Moran’s Index is negative, we can also reject the null hypothesis, however in this case because the high and low values are more dispersed than would be expected from a random selection. The z-score and Moran’s Index should be evaluated only in relation to another decade of the same metropolitan area, and not in comparison to other metros due to the variation in number of census tracts and spatial units.
Table 9 includes the Moran’s Index and z-score for each metropolitan area in 1990, 2000, and 2010. The italicized number below the Moran’s Index is the z-score for the dataset. To test the spatial autocorrelation of affluence, I used the total number of households in the top income bracket for each decade.

Table 9: Global Moran’s I, Affluent Households

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Austin</strong></td>
<td>0.38</td>
<td>0.29</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>10.15**</td>
<td>7.619**</td>
<td>5.47**</td>
</tr>
<tr>
<td><strong>Denver</strong></td>
<td>0.26</td>
<td>0.25</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>12.27**</td>
<td>11.38**</td>
<td>14.1**</td>
</tr>
<tr>
<td><strong>Seattle</strong></td>
<td>0.27</td>
<td>0.32</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>11.41**</td>
<td>13.3**</td>
<td>14.04**</td>
</tr>
<tr>
<td><strong>Washington DC</strong></td>
<td>0.33</td>
<td>0.36</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>26.00**</td>
<td>27.97**</td>
<td>28.38**</td>
</tr>
<tr>
<td><strong>Buffalo</strong></td>
<td>0.10</td>
<td>0.07</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>3.72**</td>
<td>2.52*</td>
<td>5.299**</td>
</tr>
<tr>
<td><strong>Cleveland</strong></td>
<td>0.19</td>
<td>0.18</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>11.00**</td>
<td>10.12**</td>
<td>11.3**</td>
</tr>
<tr>
<td><strong>Detroit</strong></td>
<td>0.28</td>
<td>0.30</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>20.79**</td>
<td>21.81**</td>
<td>23.17**</td>
</tr>
<tr>
<td><strong>Memphis</strong></td>
<td>0.30</td>
<td>0.03</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>7.7**</td>
<td>6.64**</td>
<td>4.38**</td>
</tr>
</tbody>
</table>

** indicates statistically significant at the 99%
* indicates statistically significant at the 95%

Buffalo, NY had a statistically significant positive z-score – indicating the high and/or low values are clustered in 1990 and 2010. In 2000 Buffalo had a positive z-score but significant only at the 95% interval. The remaining seven metropolitan areas experienced a positive z-score indicating spatial clustering above the 99% confidence interval, therefore I believe Buffalo’s lower value in 2000 is noteworthy. Due to the particularly high z-scores of spatial autocorrelation for both poverty and affluence, the
global Moran’s I make it challenging to determine if high and/or low values are contributing to the spatial autocorrelation.

**Getis-Ord General G**

The Getis-Ord General G measures if high or low values cluster. The General G interprets values in relation to the expected value. The null hypothesis of the General G is no spatial clustering. If the General G yields a statistically significant z-score we are able to reject the null hypothesis. A statistically significant positive z-score indicates high values are more clustered than can be expected from a truly random sample. Statistically significant negative z-scores indicate the low-values are spatially clustered more than can be expected from a truly random sample. The observed General G ranges from 0-1; the closer to 1 indicates high values are clustered, and closer to 0 indicates low values are clustered, however, the z-score must be significant in order to reject the null hypothesis.

In Table 10, the z-score is the italicized value below Observed General G for each metropolitan area in 1990, 2000, and 2010. The Getis-Ord General G measuring affluence presents the most interesting results of either global spatial statistic measuring poverty or affluence. Buffalo’s hot-spot analysis produced non-statistically significant z-scores all three decades therefore I fail to reject the null hypothesis, which means the distribution of affluent households is one of the possible spatially random scenarios. High-values clustered in Denver and Detroit in 1990 and 2000 but were randomly distributed in 2010. Austin and Memphis each experienced high-value clusters in 1990 but random distribution in 2000 and 2010. High values clustered in Seattle and Washington, DC all three decades studied. Finally, Cleveland presents arguably the most
interesting pattern. High values clustered in 1990, the distribution of affluent households in 2000 was random and in 2010, Cleveland exhibited clustering of low-values by producing a statistically significant negative value.

Table 10: Getis-Ord General G, Affluent Households

<table>
<thead>
<tr>
<th></th>
<th>Column1</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Austin</strong></td>
<td></td>
<td>0.04</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>6.33**</td>
<td>1.67</td>
<td>-0.40</td>
</tr>
<tr>
<td><strong>Denver</strong></td>
<td></td>
<td>0.02</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>8.82**</td>
<td>4.43**</td>
<td>2.35*</td>
</tr>
<tr>
<td><strong>Seattle</strong></td>
<td></td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>5.09**</td>
<td>5.06**</td>
<td>4.77**</td>
</tr>
<tr>
<td><strong>Washington DC</strong></td>
<td></td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>10.14**</td>
<td>8.08**</td>
<td>2.78*</td>
</tr>
<tr>
<td><strong>Buffalo</strong></td>
<td></td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>0.65</td>
<td>-0.45</td>
<td>-1.18</td>
</tr>
<tr>
<td><strong>Cleveland</strong></td>
<td></td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>2.86**</td>
<td>-1.12</td>
<td>-2.2**</td>
</tr>
<tr>
<td><strong>Detroit</strong></td>
<td></td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>8.33**</td>
<td>2.67**</td>
<td>1.60</td>
</tr>
<tr>
<td><strong>Memphis</strong></td>
<td></td>
<td>0.03</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>**</td>
<td></td>
<td>4.69**</td>
<td>2.55*</td>
<td>0.57</td>
</tr>
</tbody>
</table>

** indicates statistically significant at the 99%
* indicates statistically significant at the 95%

Anselin’s Local Moran’s I

Anselin’s Local Moran’s I is the local version of the Global Moran’s I. Simply, it measures clustering at the local level and indicates, feature by feature, if a census tract is positively or negatively correlated with nearby census tracts. The test determines if there is a spatial cluster (of high or low values) or spatial outlier based on the expected distribution.
*Buffalo*

Tracts with a high number of affluent households near similar tracts, High/High, are located north of Interstate-90 near East Amherst. There is also a small group of High/High tracts near Orchard Park in the southern part of the metro area. In 2000, the area near East Amherst is the only area exhibiting spatial autocorrelation. The area near Orchard Park re-emerges after its hiatus in 2000.

*Cleveland*

High/High clusters are located east of Cleveland in Shaker Heights and extend to further eastern suburbs. High/High tracts are also present near the western suburbs of Westlake, Bay Village and Rocky River. In 2000, there is little change on the east side, but a slight increase in the number of tracts in the previously discussed areas on the west side. In 2010, there is a split on the west side between Rocky River and growth further towards the periphery. On the east side, a bit of a checkerboard pattern emerges, but similar distribution to 2000.

*Detroit*

Areas with high number of affluent households near similar tracts were located around Bloomfield, to the northwest of Detroit, and further north, in 1990. Bloomfield remains the core area of High/High tracts and there is growth to the northeast and southwest. The area to the southwest potentially is linked to Ann Arbor’s economy, which is closer than Detroit. In 2010, there is continued growth around clusters observed in the previous decade.
Memphis

A linear pattern of High/High tracts extending from eastern Memphis to the southeast past Germantown is present in 1990. The pattern is apparent again in 2000 with some additional growth – extending north – east of Cordova. In 2010, there is a minor separation between the previously linked group and the most eastern section extends north.

Austin

High-affluence neighborhoods are surrounded by high-affluence neighborhoods in the western part of Austin all three decades. In 1990, High/High tracts are located along western Austin and in 2000 the growth occurs further west. In 2010, growth continues along the western periphery to the southwest of the cluster observed in the previous decade.

Denver

The cluster High/High neighborhoods in 1990 is located around the intersection of Interstate-225 and Interstate-25. Further, there is a cluster in southeast of downtown Denver near Washington Park. In 2000, High/High clusters move south and more clusters emerge in the southern area. Although it diminishes slightly, there is a similar pattern near Washington Park as well as growth on the western periphery. Finally, in 2010, the clusters in the southeastern part of Denver, and further south. Finally, the area near Washington Park grows beyond its previous extent observed in 1990.
Seattle

In 1990, there are High/High clusters in downtown Seattle and the significant number of tracts is located in Bellevue, east of Seattle. Further, there are scattered High/Low tracts in the southern metro area, indicating there are a small number of tracts with high numbers of affluent households in an area generally characterized as having limited affluent households. The areas of High/High clusters extend to the north and east in 2000, while Low/Low tracts are prominent in the southern metropolitan area. The only slight change in 2010 is further eastward expansion of High/High tracts.

Washington, DC

In 1990, High/High clusters are located northwest of DC, extending from central DC to Potomac. There are also small groups southwest of DC in Fairfax, VA; northwest in Brookeville, MD and west near Oakton, VA. In 2000, the northwest quadrant grows north, west and southwest towards Oakton to narrow the spatial gap. The areas near Fairfax and Brookeville both expand. Lastly, in 2010 there is continued growth to the west and near Fairfax. Low/Low clusters, signaling tracts with low numbers of affluent households are near areas with similar attributes, are present on the east side of DC near the fringe and inside I-495 in places such as Forest Heights, Temple Hills, Fairmont Heights and Tacoma Park.

Getis Gi*

Getis Gi* is the local test of Getis-Ord General G. The Gi* indicates hot-spots, or areas where there is spatial clustering of high values. The test also indicates cold-spots, which are areas were there is spatial clustering of low values. To be clear, cold-spots due
not signal poor areas, cold-spots only indicate clustering of tracts with low-numbers of affluent houses.

**Buffalo**

In 1990, hot-spots of affluent households are northeast of Buffalo, extending from inside I-290 to East Amherst and in the south near Orchard Park. Although there is a reduction in tracts near Orchard Park, the same geographic patterns are present in 2000. In 2010, the hot-spots remain in similar locations and cold-spots appear east of downtown Buffalo.

**Cleveland**

Hot-spots are found on the east side and west side of Cleveland. The eastern suburbs of Shaker Heights, Beachwood, Hunting Valley and near the western suburbs along the shore of Lake Erie in Rocky River and Bay Village. Cold-spots are found east of downtown. In 2000, the hot-spots on the west side expand further west and south. There is an increase in the number tracts experiencing hot-spots in 2000, but not a significant geographical shift. The intensity of cold-spots increases and expands to the south and east of the tracts observed in 1990. New cold-spots emerge south of Interstate-90. In 2010, the cold-spots continue spreading and cover much of the central city while the hot-spots remain similar with some growth.

**Detroit**

Detroit experiences hot-spots and cold-spots in 1990. Hot-spots, areas with clusters of tracts with high numbers of affluent households, are located around Bloomfield to the northwest of Detroit and near Grosse Point on Lake St. Clair just north
of downtown. Cold-spots, with low intensity, are located in downtown Detroit. In 2000, hot-spots extend northeast and southwest from Bloomfield and remain in Grosse Point. The cold-spots in downtown area expand geographically to the west and northwest and increase in intensity. These trends from 2000 to 2010 mimic those observed in the previous decade. By 2010, the cold-spots encompassing the downtown are as noteworthy and prominent as the hot-spots.

*Memphis*

A linear pattern of hot-spots are present from east Memphis to Germantown in 1990 and the same pattern persists in 2000, but there is a slight retreat away from Memphis. The core pattern persists in 2010 and the eastern boundary expands slightly north and south.

*Austin*

As indicated via the concentrated affluence neighborhoods and Morans I, the hot-spots of affluence are in the western part of the Austin metropolitan area near Rollingwood and West Lake Hills. The hot-spots perpetuate in this area in 2000 and there is some growth further west and north. Finally, in 2010 hot-spots remain in similar locations and expand to the south and west, in addition tracts to the north of Austin near Round Rock emerge. Further, isolated cold-spots indicating low number of affluent households emerge to the east of Interstate-35, primarily southeast of the city.

*Denver*

Hot-spots are in the southeastern part of Denver and to the east of Interstate-25 near Glendale to Colfax Avenue in 1990. There are similar patterns in 2000 and
additional growth to the southeast of the city as well as isolated cold spots throughout the city. In 2010, hot-spots perpetuate in similar areas as the previous two decades and there is additional growth in the southern metropolitan area. Further, cold-spots are located throughout Aurora and west of Interstate-25 from west Denver to Westminster.

Seattle

In 1990, hot-spots are east of Seattle in Bellevue and in the western part of downtown Seattle with a few tracts to the north. The intensity of near downtown tracts increased in 2000 and there is growth south of downtown near the coast while the area near Bellevue expands north. In 2010, there is a similar distribution of hot-spots and continued expansion in east. Further, cold-spots emerge in Tacoma in the southern part of the Seattle Metropolitan area.

Washington, DC

Hot-spots and cold-spots are present in Washington DC each decade. In 1990, hot-spots range from downtown DC to the northwest near Potomac, MD and to the southwest near Fairfax, VA. Cold-spots are located along the eastern half of DC extending in all directions. Most notably outside of DC is an area near Silver Springs, MD. In 2000, hot-spots remain in similar locations but increase south of the 1990 cluster – west of DC. A small hot-spot is located in Alexandria, VA to the south of DC, and west of the Potomac River. The cold-spots in 2000 remain and grow outwards with increased intensity in comparison to 1990. Finally, in 2010, the hot-spots continue spreading west of DC towards the periphery and continue to the southwest. The cold-spots intensify in the eastern half of DC and grow north, south and east of the clusters in 2000. Further,
isolated groups of cold-spots are north of DC near Gaithersburg in Kensington, just north of the beltway.

**Site Visits: Affluent Centers on the Periphery**

I visited two of the strong metropolitan areas, Austin and Denver, to compare neighborhoods that, according to the data, exhibited similar patterns. Affluent census tracts in Austin and Denver demonstrated relatively equal patterns of growth during the study period. In 1990, affluent neighborhoods constituted less than 1% of the census tracts and in 2010, each metro area had greater than 6%. Additionally, the affluent tracts observed in 1990 remained affluent throughout the study period, and the growth of wealthy neighborhoods over the past twenty years spread from these original neighborhoods. The neighborhoods I visited in Austin were Rollingwood and West Lake Hills, located in the western part of the Austin MSA. In Denver, I visited Cherry Hills Village, to the southeast of the city. No two neighborhoods are the same, yet the similarities between the neighborhoods, particularly neighborhoods over 900 miles apart, are striking.

The obvious parallel was the fortification around neighborhoods, and to a lesser degree within the neighborhood, around the majority of homes. In some cases this fortification was evident through walls and gates, but at the very least, neighborhoods were separated by walls of urban forests and dense plantings. Illustrations are included in
Figures 16-19. Three other similarities were apparent: each neighborhood was anchored by a strong elementary school; well-maintained greenspace (Figures 20 & 21); and public signage was frequent, new, and detailed (Figures 22 & 23). These similarities are three public goods concentrated within a small number of neighborhoods. Arguably, public goods should be available to all members of a community, and not reserved for the affluent. Additionally, further examination may reveal the fortification around neighborhoods was supported with public money, illustrating an even greater divide between affluent and non-affluent neighborhoods.

These similarities across different urban spaces reveal the benefits isolation offers affluent populations. Other patterns such as large homes, high-end cars, and well-manicured lawns were also present, but those are all private market functions. The heightened quality of public goods recognizable in these neighborhoods compared to general observation throughout other neighborhoods of both cities is not the product of a democracy. While affluent neighborhoods clearly label the appropriate distance from a park along the highway (Figure 23), low-income neighborhoods lack greenspace of any type. Public goods are not being distributed equitably.

These site visits were brief and only a small portion of this larger product, yet the similarities between these neighborhoods, the centers of affluence in both cities for the past twenty years, clearly demonstrate preconceived notions about the disparity between affluent and non-affluent neighborhoods.
Chapter Five: Discussion

The results illustrate the importance of methodology in segregation research. The different measures of segregation indicate unique patterns, and in some cases, different relationships altogether. Methodological differences aside, four broad conclusions can be garnered from this research. First, income segregation is increasing and the number of moderate-income neighborhoods is declining. Second, weaker metropolitan areas are more segregated by income than strong metropolitan areas. Third, opposing income extremes contribute to segregation in the two groups of metros: the segregation of poverty is higher in weaker metropolitan areas, while the segregation of affluence is higher in stronger metropolitan areas. Lastly, despite the suburbanization of poverty, poverty remains a near-urban phenomenon and is not being displaced by neighborhoods of affluence.

Income Segregation Increases between 1990 and 2000

Income segregation increased between 1990 and 2010. In line with other scholars, there is an evaporation of middle class neighborhoods and it is attributable to the growing segregation of affluence (Reardon and Bischoff 2011a; Fry and Taylor 2012). There are an increasing percentage of neighborhoods classified as high- or extreme-income, and the isolation of affluence is growing. Aside from the dissimilarity index, all measures reveal an increasing segregation of affluence in the metropolitan areas examined. The statistical
approaches measuring the segregation of poverty present unique and inconsistent patterns, and the trends vary between groups.

The loss of moderate-income neighborhoods (those not classified as high- or extreme-poverty/affluence) is reflected in metropolitan areas exhibiting weak and strong growth. In 1990, the average percentage of high- or extreme-poverty neighborhoods for the eight metropolitan areas was 18.9% and the average percentage of high- or extreme-affluence neighborhoods was .9%. In 2010, however, those percentages increased to 25.2% and 5.7%, respectively, meaning the number of non high- or extreme-income neighborhoods decreased from 80.2% in 1990 to 69.1% in 2010.

The isolation index also reveals an increase in segregation. The segregation of poverty is stagnant over the twenty-year period, but there is an increase in the segregation of affluence, indicating increased residential sorting among affluent households. Despite remaining high, the dissimilarity index indicates a decline in unevenness of both poverty and affluence over the twenty-year period.

These broad trends characterize the increase of income segregation for the eight metropolitan areas as a collective group. Additionally, this increased segregation is observed in each group of metropolitan areas; and to answer the direct research question, the increase of income segregation is greater in the weaker metropolitan areas.

**Weaker Metropolitan Areas Exhibit Greater Segregation**

In contrast to my hypothesis, weaker metropolitan areas exhibit higher degrees of income segregation than stronger metropolitan areas. Weaker metropolitan areas saw the share of non high- or extreme-income neighborhoods decline from 74.8% in 1990 to
64.5% in 2010. In comparison, the percentage declined from 86.2% to 74.1% in stronger metropolitan areas.

The segregation indices present a similar, but more complex, relationship. Regarding the dissimilarity index, the weaker metropolitan areas have higher levels of unevenness in all three decades, for both poverty and affluence. The lower levels of unevenness in the stronger metropolitan areas align with Massey and Denton’s (1993) discussion on racial segregation. Places with lower rates of minorities exhibit lower degrees of unevenness because neighborhood composition remains within the majority’s tolerance and fears are muted due to lack of potential in-migration (Massey and Denton 1993). The segregation of affluence is decreasing between 1990 and 2010 for both groups of metro areas. As for the segregation of poverty, the dissimilarity index is decreasing in the weaker metros, and increasing in the stronger metropolitan areas. The isolation index presents a mixed bag. The weaker metropolitan areas exhibit greater segregation of poverty than the stronger metropolitan areas, but the gap between the two groups narrowed over the twenty-year period.

In each of these cases, the higher levels of income segregation in the weaker metropolitan areas are attributable to their legacy of higher segregation in 1990. Despite the weaker metropolitan areas higher income segregation, high- and low-income groups contribute to income segregation within the two groups of metros in considerably different ways. The greater income segregation within weaker metropolitan areas is related to greater segregation of poverty, whereas the segregation of affluence is greater in the stronger metropolitan areas.
Segregation of Poverty is Higher in Weak Metros

Weaker metropolitan areas have higher segregation of poverty than stronger metros. The encouraging news of poverty decline in the 1990s is reflected in the analysis (Jargowsky 2003). Unfortunately, the discouraging news indicating growth in poverty during the 2000s is also reflected in the analysis (Kneebone et al. 2010a). The segregation of poverty declined in the 1990s, but returned in the 2000s to surpass levels observed in 1990. After a decline in extreme-poverty neighborhoods in the 1990s, the number increased in the 2000s beyond 1990 levels. The stronger metropolitan areas experience a decline in high- and extreme-poverty neighborhoods in the 1990s, but the values observed in 2010 eclipsed 1990 levels. In weaker metropolitan areas a neighborhood is almost two times as likely to be considered high- or extreme-poverty (33.3% to 16.9% in 2010). This disparity is amplified in extreme-poverty neighborhoods; 10.9% of neighborhoods are extreme-poverty in weaker metropolitan areas, and only 2.6% in stronger metropolitan areas.

The segregation indices tell a similar story, but do reveal an interesting fact about the trends of the segregation of poverty. Examining the dissimilarity index or isolation index values, the weaker four metropolitan areas have higher values in all three decades however, the two groups are (slightly) trending in different directions. The weaker metros experienced a decline, and the stronger metros an increase, in both segregation indices between 1990 and 2010.

This lower level of segregation of poverty in stronger metropolitan areas may be related to the growth of the high-income group, therefore diminishing the gap between
low-income and middle-income groups (Reardon and Bischoff 2011b). The growth, and accompanying segregation of affluence is reflected in the next section.

**Segregation of Affluence Higher in Strong Metros**

The segregation of affluence is increased in both groups of metropolitan areas during the study period, but increased faster in the stronger metros. This increase of segregation is accompanied by a period of nearly all income growth occurring within high-income households (Fry and Taylor 2012). Consequently, the stronger metropolitan areas, which have an affluence rate twice that of the weaker metropolitan areas, has considerably higher segregation of affluence. Affluent households are more isolated in stronger metros and are four times as likely to have high- or extreme-affluence neighborhoods. Just as in the segregation of poverty, the dissimilarity index is an outlier. Otherwise, all measures – isolation index, high-, extreme-, and high-and extreme-affluence neighborhoods – reveal a higher segregation of affluence in the stronger metropolitan areas.

**Segregation of Affluence v. Segregation of Poverty**

Although recent research reveals higher levels of segregation of affluence than segregation of poverty, that cannot be confirmed in this study (Dwyer 2009; Reardon and Bischoff 2011a; Reardon and Bischoff 2011b: Fry and Taylor 2012). As stated above, the segregation of affluence is responsible for the increasing income segregation in the eight metropolitan areas – and each group – since 1990, but the isolation index and the number of high- and extreme-poverty neighborhoods demonstrates greater segregation of poverty than affluence. As discussed earlier, the dissimilarity index bucks the trend. According to
the dissimilarity index, there is a greater unevenness between affluent and non-affluent populations than there is between poor and non-poor populations.

The isolation values are similar, however, the number of high-and extreme-affluence neighborhoods is a fraction compared to poverty neighborhoods. Potentially, this research contradicts with previous studies due to unique calculations of affluence. Reardon and Bischoff (2011a and 2011b) consider households in the 90th percentile of income as affluent. Fry and Taylor (2012) consider affluent households as those at twice the median household income. Given the gap between poverty and affluence rates included in this study, it is possible a more even distribution between the two income groups would result in higher segregation of affluence. Despite this likelihood, reclassifying income thresholds to make the distribution more even does not change the distribution of income it only changes the parameters with which we classify the income. Changing the classification would mute the current income disparities in the United States.

**Suburbanization of Poverty Remains “Near-urban”**

The suburbanization of poverty may have dispersed from primary cities into neighboring jurisdictions, but low-income individuals remain clustered near urban centers. Broadly, the two local spatial statistics and high-poverty neighborhoods show poverty areas remain near large, urban centers. The majority of poverty observed beyond urban centers are located in two places: far on the periphery in places easily considered rural with little affiliation to the urban core, demonstrated in places such as Memphis and Austin; and secondly, in secondary cities outside of primary cities such as in Tacoma,
Washington; Aurora, CO; Erie, NY; and Silver Springs, MD. Locals may argue these places are urban centers, but in a classic central city-suburban area dichotomy, these places are often classified as suburbs in research.

This conclusion does not offer a sharp contrast to existing literature on the suburbanization of poverty; rather it supports it and provides visual evidence of the location of poverty clusters. The suburbanization of poverty rhetoric may insinuate concentrations of poverty far from urban cores, but that is indicative of perceptions about suburban places rather than the actual location. The suburbanization of poverty indicates poverty is changing jurisdictional boundaries, and signals the importance of prescribing policies that meet the needs of low-income individuals in municipalities unequipped to meet the needs of this growing population.

Additionally, in contradiction to my hypothesis, affluent neighborhoods did not emerge in the urban core to the degree I anticipated in the metropolitan areas investigated in this study. Austin, Seattle and Washington, DC, however, did experience a higher number of affluent neighborhoods near the central city in 2010 than in 1990. Additionally, there were instances where urban neighborhoods did transition from high-poverty areas to no poverty over the twenty-year period in multiple metropolitan areas. These events occurred in places such as Austin and Washington, DC. Additionally, affluent households persisted near Denver’s urban core in the Washington Park neighborhood. These transitioning neighborhoods present interesting case studies for future research. On the periphery, many of the affluent neighborhoods served as epicenters for the growth of additional affluent neighborhoods. Future research can
investigate if urban neighborhoods complete the transition from poverty to affluent, and become centers of newly established pods of wealth.

**Spatial Statistics as an approach to segregation**

The local spatial statistics offer a unique platform to visualize clusters of segregation, however, they do not present a quantitative mechanism to easily demonstrate results beyond that visualization and interpretation. A unique corollary between Getis Gi*, Local Moran’s I, and the mapping of high- and extreme-income groups was the ability of the two local spatial statistics to highlight areas of future high- or extreme-poverty and/or affluence. The Local Moran’s I or Getis Gi* highlighted areas of spatial clustering at one period that emerged as high- or extreme-income neighborhood in one of the subsequent decades. This is true for high poverty areas in Washington, DC and Seattle. It was more valuable, however, to visualize clusters of affluence. There were few neighborhoods classified as high- or extreme-affluence, particularly in 1990, yet clusters indicated by the spatial statistics emerged as areas of high-affluence by 2010 in metros such as Austin, Seattle, Denver, Memphis, and Washington, DC. Local spatial statistics prove to be a valuable asset towards visualizing the processes of segregation in a metropolitan area and also demonstrate a clear picture of where clusters take place.

The global statistics, however, did not provide great insight into the spatial patterns of poverty or affluence. The high rate of statistical significant clustering failed to produce useful findings between the metropolitan areas. Further research should be incorporated to improve the selection of distance bands for segregation analysis.
Chapter Six: Conclusion

This research yielded four conclusions. First, this study supports recent research suggesting income segregation is increasing. Second, weaker metropolitan areas experience higher income segregation than strong metropolitan areas. Third, weaker metropolitan areas have higher segregation of poverty while stronger metropolitan areas have higher segregation of affluence. Lastly, poverty remains a near-urban phenomenon and is not being displaced by neighborhoods of affluence.

Income segregation is increasing due to the growing segregation of affluence. There is a consistent decline in the number of moderate-income neighborhoods in the metropolitan areas examined here, as neighborhoods of high- and extreme-poverty and affluence constitute larger shares of metropolitan areas. Overall, metropolitan areas with below average growth have higher levels of income segregation than metropolitan areas with strong growth rates. Low-income individuals are more segregated and more likely to live in an extreme-poverty neighborhood if they live in the weaker metropolitan areas.

The gap between the two groups of metros, however, diminished between 1990 and 2010. If successful metropolitan areas continue to attract affluent populations, this study suggests those affluent populations will continue to segregate at a faster rate than in metropolitan areas experiencing slower growth. Although weaker metropolitan areas experience higher levels of income segregation, it is important to note the consequences of high levels of the segregation of affluence. An increasing isolation of affluence signals
a potential isolation of the best public goods, such as schools, parks, greenspaces, and infrastructure (Reardon and Bischoff 2011a). If affluence continues to segregate, both low- and middle-income populations may experience ramifications. Ultimately, ensuring all populations have access to opportunity is the most important outcome. This research indicates low-income individuals are less likely to be segregated from other populations if they live in one of the stronger metropolitan areas.

Future research initiatives should include a more in-depth analysis of each metropolitan area, examining both poverty and affluence. A qualitative approach may indicate perceptions about segregation and opportunity within each of the metropolitan areas. Further, an examination of local policies aimed at affordable housing or zoning policies may provide additional insight into segregation levels in each metropolitan area. From a quantitative approach, information on housing prices and ownership percentages within neighborhoods of affluence and poverty could provide further depth and improve understanding at the neighborhood and metropolitan scale. Investigating ways for weaker metropolitan areas to reduce the segregation of poverty is needed and crucial for future generations as successful metros attract greater shares of population and economic output. Lastly, further studies should focus on the segregation of affluence. Recent studies (Reardon and Bischoff 2011a; 2011b; Fry and Taylor 2012) indicate an increasing segregation of affluent populations, but potential solutions receive little attention. Although weaker metropolitan areas exhibit higher levels of income segregation, the segregation of affluence is increasing. If this pattern continues, it will soon outpace the segregation of poverty, regardless of measure.
References


Madden, J.F. 2003. Has the concentration of income and poverty among suburbs of large US metropolitan areas changed over time? Papers in Regional Science 82: 249-275


Appendix A