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The Consequences of Gentrification in Washington, D.C.

Gentrification of the urban landscape has become an increasingly prevalent and relevant phenomenon in the United States as run-down neighborhoods are reinvigorated by new investment and more affluent residents. As defined by the U.S. Department of Housing and Urban Development, gentrification is "the process by which a neighborhood occupied by lower-income households undergoes revitalization or reinvestment through the arrival of upper-income households" (U.S. Department of Housing and Urban Development 1979: 4). The increase in gentrification leads naturally to questions about its impact on neighborhood renewal and whether this process improves inner-city neighborhoods or simply masks old forms of inequality such as racial segregation. Few sociologists have studied the process since Ruth Glass (1964) first created the term in the 1960s, leaving it mainly to geographers and urban planners. Conversely, racial and class inequality have become important and pervasive topics in sociology, with a wide body of literature examining these issues from a variety of perspectives.

While proponents of gentrification have championed its ability to channel investment, resources, new people, and new businesses in often disinvested neighborhoods, it remains unclear how it affects race relations and whether it mitigates rising inequality between people of different educational backgrounds and individuals from various classes. For advocates, gentrification lifts neighborhoods out of poverty, increases the tax base, reduces crime, and brings new amenities and services to blighted communities. For opponents, gentrification makes housing unaffordable for most low and middle-income households, sterilizes local culture, and serves the needs of the upper class. In this paper, I investigate the relationship between

gentrification and inequality by focusing on Washington, D.C., a city notorious for long standing racial disparities, but that has also experienced rapid gentrification in the past twenty years. Thus, my main research question asks: Does gentrification lead to lower levels of urban inequality (through greater racial diversity and integration of neighborhoods) or does it represent a new form of inequality that exacerbates racial and class disparities?

The literature remains divided on this question, in part due to trouble in relating it to processes of displacement, a force that removes low-income residents from their original dwelling and perpetuates differences between rich and poor. For example, gentrification may result in rising property values, which can both benefit and hurt long-term property owners by increasing the value of their investment but increasing the property taxes they must pay. Unfortunately, there is not usually data to determine whether homeowners sold their house due to the spike in prices or because they could no longer afford the property taxes. For renters, gentrification mostly harms because it leads to higher rents that are sometimes unaffordable. However, most surveys do not ask renters whether they moved to their current residence because they could no longer afford their previous rental.

Moreover, the answer to this question depends in part on the metropolitan context and what instruments local policy makers decide to use or not to use. In cities with tight housing markets such as San Francisco we might expect increased inequality than in a city like Cleveland, where a surplus of housing stock exists and much land remains vacant and unused. Developers can build new housing for upper income individuals on vacant land in Cleveland without displacing low income residents. In areas with housing shortages, such as Washington, D.C., market pressures from an influx of affluent individuals may price out long term residents and force them to relocate to neighborhoods with lower rents, higher crime, poorer schools and

fewer amenities. However, city officials can abate many of the negative effects for low income residents by establishing price regulations and protections. For example, Atlanta has property tax deferment laws, which enables some residents to defer increased tax payments due to property appreciation until the sale of the house (Kennedy and Leonard 2001). This helps many elderly citizens living on fixed incomes remain in their homes. Additionally, some cities such as Washington, D.C. have rent control and subsidized housing for low-income families and individuals.

Looking for theoretical guidance on how gentrification impacts racial segregation and diversity can further complicate matters. After decades of racial residential segregation within central cities, an influx of new people via gentrification should increase diversity. If this in-migration displaces certain racial groups through prohibitively expensive housing or discrimination, however, then an increase in diversity will only be a temporary phase in long-term racial turnover (Kirkland 2008). Additionally, gentrification may further constrain specific groups if there is widespread displacement because they would have fewer neighborhoods in which to reside, thereby increasing segregation (Freeman 2009). Furthermore, individuals may move out of gentrifying and diversifying neighborhoods because they prefer to live in homogenous areas around members of the same race (Farley 1978). Taking this individual-based approach, one can hypothesize that gentrification increases segregation, not necessarily through forced removal of certain racial groups, but rather by individuals choosing to leave because they no longer feel comfortable in their increasingly diverse surroundings and wish to live somewhere that more closely resembles what their neighborhood was prior to gentrification. Thus, one can also picture increased segregation without high levels of displacement, thereby uncoupling the two. However, this perspective ignores larger structural economic forces,

stratified by race, which may have greater weight on residential mobility. For example, deindustrialization, commercialization and the integration of real estate into global capital markets have destabilized the economic security many individuals and households once possessed (Ley 1996; Smith 2002).

Thus, the ways in which gentrification, racial composition, and displacement are related to each other remains largely a mystery, partially because empirically measuring these concepts has proven difficult, and also because holding constant other important factors, such as housing market dynamics and local regulations, is often infeasible. Therefore, it is no surprise that some scholars have found no evidence of an association between gentrification and displacement or segregation (Freeman 2009; Freeman 2005; Freeman and Braconi 2004; McKinnish et al. 2009; Slater 2004; Vigdor et al. 2002) while others have (Atkinson 2004; McGee Jr. 2010; Kennedy and Leonard 2001; Wyly and Hammel 2004). The concept of displacement is important to understanding the implications of gentrification for patterns of neighborhood inequality, but it is rarely included in empirical analyses which often take the city as the unit of analysis and are unable to track neighborhood change over time. This paper contributes to this debate in three ways: First, rather than following other studies that typically take a very macro-view by using metropolitan areas as the unit of analysis, I provide a more nuanced view by considering changes at the neighborhood level within a single American city. Second, by focusing on neighborhood change, I am able to examine the association between gentrification and both displacement and racial composition, which is something that prior studies were unable to do. And third, I look at changes from 1990 to 2009, thereby providing a timely update since previous, quantitative research on gentrification has only looked at data up to 2000.

Overall, the purpose of these analyses is to examine the impact of gentrification on inequality and whether it improves neighborhoods for most or a select few. By looking at both changes in displacement and racial diversity, we can see if gentrifying neighborhoods better the prospects of certain racial and educational groups more than others. Therefore, I estimate displacement at the neighborhood level and changes in the racial diversity and evenness of neighborhoods, analyzing how such changes differ in gentrifying and non-gentrifying neighborhoods.

Why Do Neighborhoods Gentrify?

Social and urban theorists have developed three schools of thought to explain causes and consequences of gentrification: changing preferences, changing economies and demographics, and rent gap. These theories usually gravitate towards either forces of production or consumption as the main engine driving changes in the urban landscape. Although these theories differ in what social forces bring about gentrification, the end results in both production and consumption explanations have similar implications for inequality. Production theories see gentrification as an urban policy designed to cleanse urban neighborhoods for moneyed interests, thereby leaving little room for low-income residents to continue living in these areas due to lack of affordability. On the other hand, consumption theories imply that gentrifiers unintentionally drive out the poor by making neighborhoods more attractive and less affordable as a consequence.

Consumption-oriented theories focus on who gentrifies and what draws them towards central-city neighborhoods. Among its proponents are David Ley (1996) and Chris Hamnett (2000), who draw heavily from David Bell's "postindustrial thesis." This thesis states that the economy has shifted from a focus on manufacturing to service (Bell 1973). As any economic restructuring destroys existing social relations and gives birth to new social groups, the new

"knowledge class" stands at the top of the postindustrial economy. This "knowledge class" is comprised of technical, professional and managerial workers employed in the city center (Bell 1973). Furthering this postindustrialism is economic globalization, which by breaking down barriers to trade and development has increased the liquidity of goods and services and strengthened the power of the knowledge class, who sit at the top of the international division of labor (Sassen 2004). According to Sassen (2004), cities have become key nodes for these global flows, creating pressure on them to design the urban landscape in ways which attract elite transnational firms operating along these flows (Sassen 2004). As a result, gentrification has become a popular policy tool to maintain competitiveness in this neoliberal economic order (Hackworth 2007).

While employment in a central business district is nothing new, the preference to live in the city near one's workplace is relatively new. The professional-managerial class, as well as members of the creative class, now often desire to live in the city center, where they can live an urban, cosmopolitan lifestyle. They want access to amenities that urban centers often possess, such as art and cultural institutions, shopping centers offering luxury goods and services, and a diverse array of personalities.

While consumption-side theories emphasize people moving back into the city, production-side explanations focus on the movement of capital back into the inner-city. The most prominent perspective within this theoretical sphere is Neil Smith's (2002) "rent gap" thesis. According to Smith, if a large gap exists between the current price of land or real estate and the potential price, then investors will step in and redevelop the property to sell it at a large return (Lees et al. 2008). While Smith's idea does not show which specific impoverished neighborhoods are reinvested first, it gives an approximation as to which areas are susceptible.

As many inner-city neighborhoods suffered from disinvestment and decay following post-World War II suburbanization, large rent gaps existed in many metropolitan areas in the U.S. by the 1970s.

Thus, consumption and production-side theories differ in what brings about gentrification, but they both foresee a new urban landscape that benefits affluent members of society much more than low-income individuals. The poor may temporarily benefit from an influx of new and diverse individuals, but if they disperse geographically, they could face greater hardship.

How Have People Studied Gentrification's Influence on Neighborhoods?

Most of the research that has looked at the impact of gentrification on neighborhoods has focused on what happens to people who live in those neighborhoods and whether revitalization benefits them or causes harm. However, it is difficult to study this at the micro-level because we rarely have data about people who are affected by gentrification. But in the aggregate, it is possible to study the processes of neighborhood change in terms of the displacement of disadvantaged populations as well as racial composition of neighborhoods. As a result, scholars have sought to measure the association between gentrification, displacement, and the racial dynamics of neighborhoods.

At the heart of the debate over whether gentrification causes harm is the issue of displacement. Indeed, Wyly and Hammel (1996: 250) define gentrification as "the replacement of low-income, inner-city working class residents by middle- or upper class households, either through the market for existing housing or demolition to make way for new upscale housing construction." Wyly and Hammel are not alone in arguing that the removal of low-income households is a common by-product (Atkinson 2004; Kirkland 2008; Smith 2002). This is a reason why many community activists resist local policies that promote gentrification, claiming

that it does more harm than good to the poor because low-income residents are forced to relocate just as the neighborhood improves, meaning they do not get to share in the potential benefits of community revitalization. Recent research, however, has produced contradictory results. While much of the evidence presented by popular media on displacement has been spotty and anecdotal, several scholars have published noteworthy findings. Some researchers have found that gentrification has displaced vulnerable populations (Kennedy and Leonard 2001; Atkinson 2000; Davidson and Lee 2005; Kirkland 2008; Newman and Wyly 2006; Slater 2004), while others found little evidence for such a claim (Freeman 2005; McKinnish et al. 2010; Vigdor et al. 2002). Additionally, scholars are sometimes unable to use their findings to argue whether or not displacement results from gentrification because of technical limitations (Wyly and Hammel 2004).

Since data availability governs many of the methods that researchers use, different ways of measuring displacement may be the reason for this discrepancy. For example, McKinnish (2009) uses restricted census data to study the characteristics of individuals migrating into and out of gentrifying versus nongentrifying low-income neighborhoods. Freeman, on the other hand, uses PSID data to compare mobility and displacement in gentrifying and nongentrifying neighborhoods. Displacement, here, is measured by whether or not individuals said they moved involuntarily (Freeman 2005). While these scholars could directly link forced removal with outmigration, scholars usually have to infer displacement occurs when a large group that is considered vulnerable moves out of an area.

Another reason that scholars have produced conflicting results on whether gentrification produces displacement comes from not accounting for the current housing supply and policies protecting more vulnerable residents from relocation. Unfortunately, controlling for local

housing policy is very difficult or impossible for most researchers, including this study, which uses census data not containing any information on the role of the city government. By looking at only one city, however, I can control for the policy context because the results are not colored by variation in policies across large numbers of cities that may be affecting the findings in unknown ways. For future analyses, I will systematically add cities with different urban policies in order to compare the impact of the policy context on the consequences of gentrification. In turn, this will help illuminate the role of the social safety net in protecting residents from sharp economic fluctuations.

In addition to studies on displacement, a body of literature exists that explores the relationship between gentrification and racial diversity or segregation. While scholars such as Kirkland (2008) have argued that gentrification reproduces and exacerbates racial inequality in American cities, the issue is often framed in terms of class transformation, as the movement of wealthier households to central-city neighborhoods does not necessarily coincide with a change in racial composition, especially when viewed within a global context. For example, fairly homogeneous cities such as Portland, Maine or Leeds, England may undergo gentrification but lack the racial diversity for substantial changes in racial residential segregation. Additionally, some research has provided evidence of black gentrification in the U.S., even though the process is seen as mainly the in-migration of white households (Bostic and Martin 2003). This is particularly true in neighborhoods such as Chicago's Bronzeville or New York's Harlem, which served as cultural hubs for the African American community (Hyra 2006). Even more counter-intuitive than this finding is Newman and Wyly's study (2006) of the New York City Housing and Vacancy Survey from 1991 to 2002 showing that white tenants in New York City were more likely to be displaced than Black, Hispanic, and Asian renters. However, gentrifying

neighborhoods often experience a decrease in the number of minority residents (Aka 2010; Essoka 2010; McGee 2010). This may stem from longstanding inequalities in educational attainment, earnings, and net-worth between whites and other racial groups. These educational and financial gaps make it harder for some vulnerable groups to cope with the rising costs that often accompany gentrification and thus can disproportionately price them out. In sum, gentrification can be either positively or negatively linked to racial segregation, depending on the dynamics of the city and its neighborhoods. Cities with a longstanding history of discrimination or racial inequities are more likely to see an association between gentrification and racial segregation. For neighborhoods with a strong cultural heritage for a particular minority group, wealthier members of this group may be the gentrifiers and poorer members may still be displaced, whereas gentrification would have little to no effect on segregation in already homogenous cities. Thus, gentrification can be a process of race effects, class effects, or both, thereby showing how inextricably linked displacement and segregation can be at times.

While the literatures for racial residential segregation and gentrification are expansive and well-developed, research that has synthesized the two remains in its infancy, although the body of work is growing. Part of the interest over the relationship between gentrification and segregation is that it goes against the traditional narrative on racial residential patterns. For most of the latter half of the twentieth-century, urban neighborhoods underwent decay, as wealthier whites fled to suburban areas, meaning poverty among blacks remained concentrated in the inner-city. Now that more affluent individuals are moving back to urban cores, the question arises as to whether or not segregation still limits residential choices. Since most metropolitan areas in the U.S. are less segregated now than in the 1960s, there is reason to expect gentrification may have played a role (Farrell 2008; Iceland 2008). As is the case with

displacement studies, however, the findings are mixed as to whether gentrification leads to more or less racial segregation.

Using an innovative design to measure gentrification's influence on segregation and discrimination, Wyly and Hammel (2004) find evidence of heightened discrimination in gentrifying neighborhoods. In a study of the housing market in 23 cities in the U.S., they find that on average black home buyers are 2.33 times more likely to be denied a mortgage than identically qualified white applicants, in comparison to Hispanics being 1.44 times more likely to be denied. Such discrimination prevents integration and leads to racial residential segregation by establishing enclaves for whites and forcing other groups to live apart from them. Even if local governments protect long-term residents they eventually move out or die, further homogenizing the area if new households are likely to be white.

While Wyly and Hammel's research suggests a link between gentrification and racial segregation, others have found that gentrification can increase racial segregation without decreasing other forms of diversity such as by income or education (Freeman 2009). In fact, Freeman's findings imply it may even increase other forms of diversity such as income. While gentrifying neighborhoods undergo changes, Freeman finds they are more diverse in terms of income than similar non-gentrifying neighborhoods (Freeman 2009). These results suggest that well-educated and affluent individuals can migrate into neighborhoods without displacing less-educated or low-income individuals, but instead increase socioeconomic diversity. However, discriminatory practices may still discourage racial minorities from moving into these neighborhoods, even if individual characteristics such as education and income do not.

Thus, evidence from the literature seems to suggest that gentrification is a double edged sword. While gentrification is sometimes associated with increases in racial diversity and does

not necessarily lead to displacement of low-income individuals, it may increase discrimination in some neighborhoods and price out groups who make up a disproportionate share of low-income individuals.

What Do We Still Need to Know?

Previous research has given us a sense of what gentrification consists of and how it generally affects cities and neighborhoods. Nevertheless, research that takes a middle-range approach is sorely missing. While multicity studies produce summary measures to look at a broad swath of changes across metropolitan areas, they do not tell us what happens to individual neighborhoods that gentrify. For example, Freeman (2009) analyzes the association between change in the proportion of tracts gentrifying and change in the information theory index in 701 central cities, but does not look at what happens to neighborhoods because his study looks at changes across cities. Furthermore, qualitative studies have produced insightful results about how individuals perceive and view gentrification, but they do not give a very full picture of change within a city because they cannot sample a wide range of neighborhoods. For these reasons, I adopt an approach that looks at one city (but will later extend this model to a few more cities), which allows for a richer, more in-depth study where one can highlight certain neighborhoods that have undergone change in the past few decades and compare changing patterns of inequality in gentrifying and non-gentrifying neighborhoods.

Washington D.C.

I have chosen Washington, D.C. for this study because its history of racial conflict and recent demographic shifts make it an excellent case study to examine neighbor change. The high concentration of racial minorities sets Washington apart from most other cities, and the riots of 1968 left many neighborhoods in shambles for years (Meyer 2006), making their revitalization

even more dramatic and contentious. Gentrification has become a very controversial topic for the nation's capital in recent years and a thorough analysis will inform the debate over whether the significant changes Washington has undergone have benefited many or just a privileged few.

Over the past 30 years Washington has undergone rapid economic and demographic change. For example, its black population has declined from near 70% in 1980 to just above 50% in 2010 (U.S. Census Bureau; Census Scope). During the same time period, its Hispanic population increased from roughly 3% to 9% (U.S. Census Bureau 2010; Census Scope 2012). Its foreign-born residents, which constituted 13.5% of its population in 2010, are most likely to hail from Latin America (44.1%) but many also come from Europe (17.5%), Asia (18.6%), and Africa(16.1%) (U.S. Census Bureau 2010). Washington is also one of the most highly educated areas in the United States, with nearly 27 percent of its inhabitants over age 25 possessing a graduate degree and an additional 23 percent with a bachelor's degree in 2010 (U.S. Census Bureau 2010). At the same time, almost 13 percent of individuals over 25 had no high school diploma in 2010. While the city remains fairly young, its pre-senior population is growing quickly, as the population between the ages of 55 and 64 grew by 50% from 2000 to 2008 (Orr 2010). Despite the continued suburbanization of employment, nearly one-quarter of the metropolitan area's jobs are located in DC and it began adding jobs after the recession quicker than the region's average (Orr 2010). Overall, Washington's social landscape has become much more complex and diverse in the last few decades.

While DC provides an interesting case study, its uniqueness makes it more difficult to compare to other cities undergoing gentrification. As the nation's capital, the federal government grants a disproportionate share of employment opportunities, giving a large number

of low-income people job security they would otherwise not possess. Furthermore, there is no state government to provide the kind of tax base most cities have.

Vast changes in urban, economic and social policy greatly altered the city landscape of Washington, D.C. in the 1990s. While the metropolitan area's subway system was established in the 1970s, it greatly expanded in the 1990s, with extensions reaching many neglected neighborhoods. As with other cities in the United States, housing authorities began to tear down many of the city's housing projects with funds from the HOPE IV program and erected mixed-income developments in their place (Eckholm 2008). In an effort to deconcentrate poverty, the Section 8 Housing Program enabled low-income individuals to use vouchers for private landlords willing to accept them (hud.gov).

The first half of the 1990s saw the District's government on the verge of bankruptcy, but restructuring and strong economic progress soon placed the city on a sound foundation once again (Swope 2004). The economic growth of the late 1990s brought newfound prosperity to the area and continued in the 2000s. Backed by ambitious mayors such as Williams and Fenty, new housing and commercial construction boomed, leading to a dizzying array of new apartments, office buildings and mixed-use projects (Swope 2004). The city had done so well, that its total population increased from 2000 to 2010, marking the first time the population had not declined between decades since 1950. Even though the area entered a downturn during the Great Recession, Washington fared relatively well compared to other cities (Orr 2010).

While the new development and affluence that has cascaded over the city is largely welcomed, it has been accompanied with abrupt changes in racial composition, with the percentage of blacks declining from roughly 60% in 2000 to 52% in 2008, raising concern over whether this boom has improved the lives of everyone (Orr 2010). Of course, the percentage

decline in the black population could stem from several reasons. Some affluent black residents may have moved to suburban areas amidst white in-migration without any poor blacks pushed out.

Many of Washington D.C.'s neighborhoods have received media attention for undergoing urban renewal, including the U street corridor, Columbia Heights, LeDroit Park, Bloomingdale, and Petworth. While many of these neighborhoods appear to have undergone dramatic changes, concern remains over how this affects residents susceptible to displacement, as well as the African American community. This was reflected in the most recent mayoral election, which many viewed as having racial undertones, as the ousted Mayor Fenty received a majority of white votes and opponent Gray received a majority of black votes (Stewart and Cohen 2010).

This Study

After looking critically at the literature on gentrification and inequality, two noticeable gaps emerge. First, few studies have focused on one or a handful of cities with a quantitative approach, and research on Washington, D.C. that utilizes such methods is glaringly absent. Second, research on gentrification has not yet applied census data from the decade of the 2000s. As the literature suggests that gentrification can lead to both positive and negative outcomes for neighborhoods, I can form hypotheses with regards to my main question: is gentrification associated with the displacement of the poor and increased racial homogeneity in Washington, D.C.? Prior research suggests that gentrification is associated with greater racial diversity but also the displacement of vulnerable populations; my hypotheses reflect this.

H1: Gentrifying neighborhoods are more likely to see displacement of vulnerable populations than non-gentrifying neighborhoods.

H2: Gentrifying neighborhoods will experience larger increases in racial diversity than non-gentrifying neighborhoods due to an influx of affluent individuals into formerly homogenous and poor areas.

Data

The data I use come from summary file three of the 1990 and 2000 decennial census and the 2005-2009 five year summary files of the American Community Survey, which together allow me to examine the nearly two decade period between 1990 and 2009. These summary files include data that have been aggregated to different geographic levels (e.g. census tract, county, state). For this study, I use tract-level data for three points in time, 1990, 2000, and roughly 2007 (the average of the 2005-2009 data). The Census Bureau began carrying out the American Community Survey (ACS) in 2001 to replace the long-form issued to a sample of U.S. residents during decennial censuses. Just like the long-form census, the ACS collects information on demographic and economic changes in American households and this information can be aggregated to represent neighborhoods and larger aggregations. To protect the confidentiality of respondents, data on small geographic entities are pooled across five years (each tract has a yearly sample of around 2,000-6,000, so there is a total of roughly 20,000 across five years from which to draw a 2,000-6,000 sample). I use the combined 2005-2009 ACS data because the finer geographic detail allows me to conduct analyses at the tract level.

Census tracts are subsections of counties, and although they do not conform exactly to traditional neighborhood boundaries, they are divided so that the characteristics within a census tract (i.e. household income, house value, poverty rate, etc.) are relatively uniform. Additionally, census tracts contain roughly 2,000 to 6,000 residents. Although tract boundaries change periodically, I have utilized Geolytics (Neighborhood Change Database) for 1990 and 2000,

which normalized the data by 2000 tract boundaries for both decades. In addition, the 2005-2009 summary file uses the boundaries created in 2000. A unit of analysis of this size serves the needs of this study well because it allows me to examine differences in economic characteristics, racial composition, and gentrification at the "neighborhood" level. While scholars define the concept of the "neighborhood" in a variety of ways, many researchers have used the geographic boundaries created by agencies such as the Census Bureau to spatially identify their area of interest (Guo and Bhat 2007). For this paper, neighborhoods are viewed in a manner similar to Galster's definition of a "bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses" (2001: 2112).

Method

Very few scholars have attempted to operationalize gentrification empirically, but instead have sought to learn how it affects people in neighborhoods by interviewing individuals and conducting field work. Rather than quantitatively measuring gentrification, scholars have often researched how individuals perceive this phenomenon to see whether it is a racially charged process and residential displacement is a common outcome.

To supplement their research scholars sometimes couple quantitative definitions of gentrification with qualitative work. For example, Wyly and Hammel (2004) conducted field work and archival research to determine which census tracts should be labeled as "gentrifying" in their analysis of 23 metropolitan areas. Complementing archival research with quantitative analyses is a useful method to verify that the neighborhoods labeled as "gentrifying" by a quantitative definition actually match the reality on the ground. The disadvantage to these methods is they can be very cumbersome when dealing with large numbers of metropolitan areas. However, solely using quantitative measures may label some neighborhoods as

"gentrifying" because they meet all the criteria even though an entirely different phenomenon is occurring. Thus, one could ideally employ qualitative checks to reduce error in identifying gentrifying neighborhoods. Unfortunately for this paper, utilizing qualitative methods are largely beyond the scope and time available.

Another operationalization of gentrification comes from Freeman (2009), whose description lends itself for quantitative analysis. According to Freeman, gentrifying neighborhoods contain five key characteristics: 1) located in the central city; 2) have a median household income below the 40th percentile of the metropolitan area at the beginning of an intercensal period; 3) have a percentage of housing built over the past 20 years that is below the 40th percentile for the metropolitan area; 4) have a percentage increase in educational attainment that is greater than that of the metropolitan area; 5) Real housing prices increased. This operationalization does not mention displacement, but instead includes spatial location, prior disinvestment, current reinvestment, and class change. By defining gentrification as a central city phenomenon, Freeman sets the geographical boundaries in which it can take place. The change in education attainment speaks to class change in gentrifying neighborhoods via an influx of well-educated individuals. Additionally, the percentage of recently built housing measures the notion of prior disinvestment, which is the idea that capital and resources have abandoned certain neighborhoods. Since Freeman's definition captures many of the theoretical components of gentrification and lends itself for empirical analysis, it is a suitable choice to test whether displacement is a function of gentrification.

While a few different metrics for quantitatively defining gentrification exist (Lipton 1977; Wyly and Hammel 1996), this paper will utilize Freeman's method of operationalizing gentrification, as it captures some facets of gentrification that are often ignored, such as

disinvestment. However, this method is applied with some modifications due to this study's focus on a single city (Freeman looked at 701 central cities). Since I look at neighborhood change in 10 year intervals instead of 20, I include tracts with median household income and recently built housing that is below the 50th percentile instead of the 40th percentile in order to increase sample size. The benefit of this method is its simplicity and ability to be broken down into different pieces. By separating the different components of gentrification one can look at the relative strength of individual variables as well as construct a scale, viewing neighborhoods as undergoing varying levels of change.

My main method of analysis is to first identify gentrifying neighborhoods and then determine whether these neighborhoods also show signs of greater displacement and racial diversity compared with non-gentrifying neighborhoods. I rely on a modified version of Freeman's definition of gentrification as tracts which have: 1) a median household income below the 50th percentile of Washington, D.C. at the start of the intercensal period and above the 50th percentile at the end of the period; 2) a percentage housing built over the intercensal period that is below the 50th percentile for Washington; 3) a percentage increase in educational attainment that is greater than the 50th percentile for the city; and 4) an increase in real housing prices. For this study, I define an increase in educational attainment as a percentage increase in the population with a bachelor's degree or higher. Additionally, the housing prices examined here are the median housing prices for each tract, and are updated to 2011 dollars using the Bureau of Labor Statistics' consumer price index (U.S. Bureau of Labor Statistics 2012). I apply this definition of gentrification for two time periods, 1990 to 2000 and 2000 to 2009.

To analyze displacement I look at the percentage change in the number of "vulnerable" individuals in a census tract, measured here as individuals over the age of 25 who have less than

a high school degree. As this group has on average lower earnings and higher unemployment rates, it is a potentially vulnerable population which is threatened by price fluctuations in the housing market. Although this measure of displacement is indirect and does not track the same individuals over time, this study assumes that tract-level changes in the high school drop-out population over age 25 reflects population movement rather than changes in educational attainment (i.e. few dropouts over 25 obtain a GED) (Chapman et al. 2011). Initially, I contemplated using the number of high school drop-outs, but decided this measure was not as stable because of variability in tract size, although the regression results for this variable are similar. I also considered but then rejected the possibility of using the number of people with incomes below the poverty threshold, because this number fluctuates so much with the economic cycle.

I measure racial diversity or evenness by following Freeman (2009), analyzing changes in average entropy scores from 1990 to 2000 to 2009 and how these averages differ for gentrifying and non-gentrifying tracts. An entropy score measures how unevenly each individual unit differs from the city average of racial entropy. The higher the entropy score is, the greater the amount of racial diversity in the tract. The entropy diversity index is measured by the following equation (Reardon 2002):

$$Eu = SUM[qn * LOG(1/qn)]$$

where, qn is the proportion of the unit within category n. The entropy index is a measure of evenness and ranges from zero (only one racial or ethnic group is represented in the tract) to a varying maximum level when all groups have the same representation in the population and the tract (Massey and Denton 1988). For this paper, the maximum race entropy is 0.97. An advantage to entropy scores is it allows for an analysis of multiple racial and ethnic groups

simultaneously as opposed to the two-group comparison commonly measured in the dissimilarity index. The groups included in the entropy scores for this study are non-Hispanic whites, non-Hispanic blacks, Hispanics, and non-Hispanic other (includes Asians, American Indians, and Native Hawaiians/Pacific Islanders). To allow comparison over two decades, the entropy score does not include the multiracial category, as this was not a measure in the 1990 census.

I examine the association between gentrification and changes in both racial diversity (measured by the entropy score) and the displacement of vulnerable residents (measured as the percent change in the number of high school drop-outs), during the periods between 1990, 2000, and 2009, using ordinary least squares regression. I first consider the association between changes in all variables *within* each decade (e.g. 1990s gentrification predicting both 1990s changes in diversity and displacement, and then the same for the 2000s decade). However, because of the potential for reverse causality among variables measured during the same time interval, I also employ a stricter definition and examine the association between gentrification in the 1990s and the outcomes measured during the *subsequent* decade.

The multivariate models also include two variables that control for changes in the percent foreign-born and the percent below the poverty level. As Washington has experienced recent waves of immigration, increases in racial diversity may be largely a result of this inflow. Additionally, the poverty measure is used because the poor tend to be cut off from other groups and may have a large impact on racial diversity. They may also be indicative of the number of high school drop-outs exiting gentrifying neighborhoods. Here the regression equation is expressed as:

$$\Delta \text{entropy}_t = \alpha + \beta \text{gentrification}_t + \beta \text{foreign-born}_t + \beta \text{belowpoverty}_t$$

$$\Delta \text{high school drop-outs}_t = \alpha + \beta \text{gentrification}_t + \beta \text{foreign-born}_t + \beta \text{belowpoverty}_t$$

where, α is the intercept; β represents the coefficients for the gentrification and control variables in decade t.

Results

Table 1 presents descriptive data for the census tracts in Washington, D.C. between 1990 and 2009, highlighting changes over time in the distribution of gentrification, displacement, and racial diversity, as well as each of their component measures. The top of Table 1 displays descriptive statistics for the dependent variables, racial entropy (and its components) and the percent change in the number of high school drop-outs, followed by the independent variable (the gentrification scale), its components, and the two control variables (change in the percent foreign-born and the percent below poverty).

The results in Table 1 suggest that tract-level racial diversity has risen over time in Washington, although more strongly from 2000 to 2009 than 1990 to 2000. The average tract-level entropy score increased 30.3 % from 0.33 in 1990 to 0.43 in 2009, indicating that racial diversity increased during the period studied and all groups were more equally represented in the average tract. In order to show how levels of entropy vary across neighborhoods in Washington D.C., Figure 1 graphs the spatial distribution of entropy scores across census tracts for the entire 19 year period of this study (from 1990 to 2009). The map shows that increases in racial diversity occurred throughout much of the city, with especially stark increases concentrated in the center of the city. While declines in racial diversity are also sprinkled throughout the quadrants of Washington, they appear most often in the Southwest and Southeast regions.

[Insert Figure 1 and Table 1 about here]

An examination of racial composition reveals that the rise in racial diversity was a result of declines in the proportion non-Hispanic black and increases in the non-Hispanic white, Latino,

and other race populations. Specifically, the black population decreased approximately two percentage points from 1990 to 2000 but by over six percentage points from 2000 to 2009. On the other hand, the white population decreased by around one-half of one percentage point but increased in the 1990s by roughly four and a half percentage points to over 30 percent in the 2000s, representing a little over an 18 percent increase.

Whereas racial diversity increased in the two decades analyzed here, Table 1 shows the average number of high school drop-outs over age 25 in each tract declined during both decades. Moreover, the declining percent change in the number of high school drop-outs accelerated throughout the time period studied, suggesting a pattern of increasing displacement or mortality of the disadvantaged population. The average decrease during the 2000s decade (29.0%) was 11.3% larger than the decrease during the 1990s (17.7%). During both of these periods, high school dropouts appear to be leaving many of Washington's neighborhoods, though it is not clear whether this is due to mortality or out-migration. As evidenced by Figure 2, the vast majority of tracts saw negative percent changes in the number of high school drop-outs, with only a few tracts scattered across the city experiencing a percentage increase.

[Insert Figure 2 about here]

Table 1 also shows a general increase over time in the components that make up the gentrification scale. Overall, the city saw increases in educational attainment, household income, and housing values, which matches descriptive statistics on the city discussed previously in the paper. As seen in Figure 3, most census tracts have undergone some degree of gentrification, with only two tracts receiving a score of zero on the gentrification scale. However, tracts with higher scores tend to be concentrated in the center of the city, while low gentrifying tracts appear most frequently in the Southeast and parts of the Southwest and Northwest. In general, these

patterns fit the narrative found in the popular press. U Street, Columbia Heights, and most gentrifying neighborhoods are located in the center of the city, while many areas of the Northwest are well-established affluent enclaves and much of the Southeast is still neglected and in need of development.

[Insert Figure 3 about here]

Table 1 also shows that gentrification increased over time, as indicated by the average gentrification scale rising from 1.3 to near 2. The components that make up gentrification show that this is especially due to larger increases in educational attainment, household income, and housing values from 2000 to 2009 than the decade prior. For example, the average percentage of individuals with a bachelor's degree or higher increased slightly from 31.47 to 34.46 percent in 1990 to 2000, but from 2000 to 2009 the upward trend accelerated from 34.46 to 43.60 percent, thereby tripling its percentage point increase. Furthermore, increases in the number of housing units built also suggests a stronger influx of more affluent, highly educated individuals living in Washington during the 2000s. At first glance, the same trend seems to hold true for household income and housing values. Controlling for inflation, however, reveals that the increase in median household income was greater in the 1990s than 2000s. For housing, the real change in prices is positive in the 2000s, with gains of approximately $192,922.50 as opposed to an average decrease of 12,699.73 in the 1990s. This decrease in home prices is fairly widespread after controlling for inflation, with nearly 70 % of tracts experiencing a negative change in home price.

Relationship between Gentrification and Inequality

To provide a sense of how the most gentrifying neighborhoods differ from the least gentrifying, Table 2 presents the same characteristics as Table 1 but is limited to tracts with the

highest and lowest scores on the gentrification scale for the entire 1990-2009 period. While Table 2 does show summary statistics for the gentrification scale from 1990 to 2009, the general patterns described here are the same as the other two gentrification scales (i.e. 1990-2000, 2000-2009). Overall, the components of the gentrification scale have higher averages over time, thereby paralleling the findings seen in Table 1. Interestingly, both low and high gentrification tracts saw improvements over this period, but gentrifying ones saw more pronounced growth. For example, the percent with a bachelor's or higher in low gentrifying neighborhoods increased from 28.4% to 32.7% between 2000 and 2009 but from roughly 37.0% to 50.9% in highly gentrifying tracts. Additionally, more highly gentrifying neighborhoods have much lower poverty rates, growing diversity, steeper declines in high school drop-outs, and bigger increases in the foreign-born population than the low gentrifying neighborhoods.

[Table 2 about here]

As expected, educational attainment, median household income, and median home values all have higher means at the upper end of the gentrification scale than at the lower end. This pattern holds true for each time period. For example, the average median household income in tracts with a gentrification score of three in 2009 is $75,500 but $46,660 for tracts with a score of one. In contrast, the average percentage of recently built housing in the 1990s or 2000s is higher in tracts with a low gentrification score than tracts with a high gentrification score. Although this finding may seem inconsistent with the other trends, it fits the theoretical expectations of Freeman (2009) and the notion that gentrifying neighborhoods have undergone disinvestment and should have below average levels of new housing construction. While the percentage of housing built between 1990 and 2000 and 2000 and 2009 increases in both low and high

gentrifying tracts, tracts with a gentrification score of one have more than double the percentage of recently built housing for each decade.

The general trend of increasing racial diversity found in Table 1 holds true for both low and high gentrifying tracts, although tracts with high levels of gentrification exhibit both greater overall entropy scores for each decade and more marked increases. For example, tracts with low gentrification in 2000 had an average entropy score of 0.23 as opposed to 0.45 in high gentrifying areas. In 2009, the average entropy score in tracts with low gentrification rose to 0.26 but in tracts with high gentrification the average score increased to 0.58. A look at racial composition reveals that the large increases in high gentrification tracts were a result of sharper declines in the black population coupled with sharper increases in the white and Hispanic population. For example, the average decline in the black population for low gentrifying tracts was only -1.10 percent from 2000 to 2009 but -11.20 in high gentrifying tracts. In turn, racial composition barely changed at all in low gentrifying tracts, whereas high gentrifying tracts saw much greater diversity over time, driven mostly by the influx of Hispanics throughout the period and whites after 2000. For example, the average increase in the white population was only 0.33 percent from 2000 to 2009 in areas with low gentrification but 8.55 percent in areas with a gentrification score of three.

The decline in the number of high school drop-outs also stayed in line with city-wide patterns, but an examination across decades shows that the difference between low and high gentrifying tracts is much more pronounced in the 1990s than the 2000s. From 2000 to 2009, drop-outs declined by around 26% in low gentrifying areas and by 30% in high gentrifying areas, which is striking given the influx of Latinos, of which many would be expected to have low levels of education. While both tracts with high and low gentrification scores experienced

declines in the number of high school drop-outs, the gap between these two types of tracts narrowed over time. Although the drop was more precipitous in the second decade in low gentrifying areas (-10.99 from 1990-2000 and -25.89 from 2000-2009) and less steep in highly gentrifying areas (-38.7 from 1990-2000 and -30.3 from 2000 to 2009), the decline was still larger in highly gentrifying areas.

Multivariate Results

Tables 3 and 4 measure the degree to which changes in displacement and racial diversity (by census tract) are associated with changes in the gentrification scores. In both tables, models 1 and 2 show 1990s independent variables predicting 1990s outcomes; models 3 and 4 show 2000s independent variables predicting 2000s outcomes; and models 5 and 6 showing the most temporally appropriate model of 1990s independent variables predicting 2000s outcomes.

Table 3 looks at the association between the gentrification score and the percentage change in the number of high school dropouts, which is the proxy measure for displacement. The bivariate model in Table 3 shows that there was a significant, negative relationship between the change in the gentrification score during the 1990s and the percentage change in the number of high school drop-outs over age 25 between 1990 and 2000. On average, a one point increase in the 1990-2000 gentrification score is associated with an 8.45 percent decline in the number of high school drop-outs for a given tract from 1990 to 2000. The bivariate relationship remains significant in the next decade, although the negative association between gentrification and the percent change in the number of high school drop-outs becomes stronger. As seen in the model (3) for the 2000s decade, a one point increase in the gentrification scale is associated with an average decrease of 11.0% in the number of individuals with less than a high school degree. The last bivariate model (model 5) looks at changes in the gentrification score from 1990 to 2000 on

changes in the number of high school drop-outs from 2000 to 2009. Although the relationship is not statistically significant, the coefficient stays negative and is thereby consistent with the other models. Thus, the bivariate models in Table 3 suggest that gentrification was significantly and negatively associated with the percent change in the number of high school drop-outs in both the 1990s and 2000s.

For the multivariate models, I add two control variables: changes in the percent below poverty and changes in the percent foreign-born. As the poor may have a substantial impact on racial diversity and the number of high school drop-outs, I added the percent below the poverty line to the model. The foreign-born measure is intended to tap the impact of new immigrants who settled within neighborhoods. Since Washington has experienced an influx of immigrants and has become a new immigrant gateway in the latter half of the twentieth century (Singer et al. 2005), I added the percent foreign-born to the model to see if it accounts for more of the increases in racial diversity than gentrification.

The multivariate model for high school drop-outs (Table 3) has more explanatory power for the 2000 to 2009 period than for the 1990 to 2000 period. Changes in gentrification from 1990 to 2000 are not significantly related with changes in the number of high school drop-outs over age 25 during that decade, but they are negatively and significantly associated from 2000 to 2009. On average, a one point increase in the gentrification scale from 2000 to 2009 is associated with an 8.9% decrease in the number of individuals with less than a high school education in a census tract, holding changes in the percent below poverty and the percent foreign-born constant. The change in the percent below poverty is significant for both decades, but it is positively associated with changes in the number of individuals with less than high school education. Noticeably absent in both decades is a significant relationship between the

percent foreign-born and the percent change in the number of high school drop-outs, indicating that the foreign-born population has varying levels of educational attainment. Lastly, using the gentrification score from 1990 to 2000 as a predictor of changes in the number of high school drop-outs from 2000 to 2009 reveals no significant relationship in the multivariate model, suggesting that gentrification in the 1990s did not have a lagged effect on displacement or diversity.

[Table 3 about here]

Table 4 measures the amount of variation the gentrification score explains on changes in racial entropy, which is the variable for racial diversity. The bivariate model in Table 4 shows that there was no significant relationship between changes in racial diversity from 1990 to 2000 and gentrification in the 1990s. The relationship does become significant, however, in the next decade, as gentrification appears positively associated with changes in racial diversity. As seen in the third model, a one point increase in the gentrification scale is associated with an average increase of 0.025 in racial entropy. The last bivariate model looks at changes in the gentrification score from 1990 to 2000 on changes in racial entropy from 2000 to 2009. The relationship is positive and marginally significant (p-value=0.055) for changes in racial entropy, indicating that gentrification in the 1990s had a small amount of influence on the positive increase in racial diversity in the 2000s. Thus, the bivariate model suggests that gentrification did not significantly impact changes in racial diversity in the 1990s but was positively associated with increases in racial diversity in the 2000s. Additionally, changes in gentrification from 1990 to 2000 were significantly associated with moderate increases in racial diversity from 2000 to 2009.

[Table 4 about here]

For the model of racial diversity (Table 4), we see that the gentrification score is not significantly related to changes in racial entropy scores in the 1990s or the 2000s, although it is marginally significant in the 2000 to 2009 period (p-value=0.068). Additionally, changes in the percent below poverty do not have a significant effect on changes in racial diversity. In both decades, however, the percent foreign-born is positively associated with changes in racial entropy and greatly increases the explanatory power of the model, as evidenced by an R^2 of 0.20 in the 1990 to 2000 model and 0.21 in the 2000 to 2009 model. An additional model is presented to see if there was any lagged effect of gentrification from 1990 to 2000 on changes in racial entropy in the 2000s. Here, changes in the gentrification score and the percent below poverty are positively and significantly related to racial diversity, but the percent foreign-born is no longer statistically significant.

Overall, an increase in the percent foreign-born is the strongest predictor of increases in racial entropy in the multivariate model. This relationship was statistically significant for both decades analyzed here. On the other hand, the gentrification measure displayed a small, positive impact on changes in racial diversity in the 2000s but not the 1990s, indicating that gentrification was more pervasive and powerful after 2000. In general, tracts with higher poverty see less growth in diversity and more growth in the low-educated population whereas tracts that have attracted more immigrants have experienced more diversity.

With regards to the hypotheses mentioned earlier, the regression models appear to provide evidence for both. On the whole, gentrifying neighborhoods experienced more displacement of vulnerable individuals, even after taking into account poverty levels and the foreign-born population. Increases in racial diversity also appear to be larger in gentrifying neighborhoods, as evidenced by positive changes in entropy-index scores. However, the

regression models do not provide as much support for this hypothesis, as many of the coefficients in the models are not statistically significant, meaning the positive association between gentrification and racial diversity is weak.

Hot Spots of Gentrification

As mentioned earlier, an advantage to a single-city approach is that one can examine closely individual neighborhoods and the changes they have undergone. While the gentrification scale shows a wider spectrum of change by ranging from 0 to 4, no tracts received a score of four from 1990 to 2000 or 2000 to 2009. In this section, I focus on the four tracts which received a score of 4 on the gentrification scale over nearly a 20 year interval. These four tracts correspond to portions of the neighborhoods known as Columbia Heights, U Street, Bloomingdale, and Capitol Hill, which are all areas discussed in the media as hot spots of gentrification (Meyer 2006). On the one hand, this speaks to the robustness of the gentrification measure, as these are all areas which have undergone rapid neighborhood change. On the other hand, only four tracts receiving a score of four testifies to the limitations of the scale and the use of census tracts instead of official neighborhood boundaries, as there were other portions of these four neighborhoods that did not show up, in addition to other neighborhoods which are supposedly undergoing rapid gentrification. Table 5 presents the two outcome variables (change in entropy score and high school drop-outs) and the two control variables (change in percent foreign-born and percent below poverty) by decade for each tract.

[Insert Table 5 about here]

As evidenced by Table 5, there are a few similarities among these hot spots of gentrification. One of these patterns is the decrease in the percent below poverty from 2000 to 2009, increases in the negative percent change in the number of high school drop-outs for each

decade, and increases in the foreign-born population from 1990 to 2000. With regards to changes in entropy scores, Columbia Heights appears to have experienced substantial gains in racial diversity for both decades. The next largest gain in racial diversity can be found in Capitol Hill, which saw a decrease in its entropy score in the 1990s (-0.057) but had an increase of 0.154 in the 2000s.

For changes in the less than high school population, the decline was uniformly stronger in the 2000s like the regression models above suggest. For Columbia Heights and U Street, the negative percent change in the number of high school drop-outs increased the most from 2000 to 2009. The positive change in the percent foreign-born from 1990 to 2000 appears strongest in Columbia Heights and U Street, while the largest declines in this population in the 2000s were in U Street and Capitol Hill. Interestingly, Columbia Heights experienced a decline in its foreign-born population from 2000 to 2009 but witnessed even larger gains in racial diversity than the previous decade, which saw over a 19 percentage point increase in the foreign-born population. The same phenomenon applies for Capitol Hill but not U Street, whose racial diversity and foreign-born population declined in the 2000s. Despite overall poverty levels increasing in the 1990s, the change in the percent below poverty declined for every neighborhood in every decade except for Bloomingdale in the 1990s. While Capitol Hill and Columbia Heights experienced the most consistent large declines in the percent below poverty (-5.4 to -9.3 percent), Bloomingdale saw the largest intercensal decline, with levels declining -14.5 percent. Overall, the data suggest that gentrification has a variety of effects on the ground, but a decline in the less educated population does appear to be a common fixture. Although these neighborhoods may have met the four conditions to be considered gentrifying, they started out with different

education, income, and housing price levels. As a consequence some areas experienced greater change than others, which in turn affects racial and low-income groups differently.

Future Research

Overall, this study contains important information for those concerned about neighborhood change, as the results suggest that gentrification benefits the well-educated, whites, and Hispanics more than blacks and the less-educated. Although the association between gentrification and changes in racial diversity and the number of high school drop-outs is weak, the relationships appear to have become stronger over time. However, more research is needed before drawing firm conclusions about gentrification impact on urban inequality in Washington and recommending a course of action for policymakers.

While the results of this analysis suggest that gentrification was stronger in the 2000s than the 1990s, going back to the 1980s could provide a richer story. A few official publications on gentrification in the Washington area appeared in the 1980s, indicating it was an issue even back then (Henig 1982; Williams 1988). Whether gentrification has followed a linear path of ever rising strength starting in the 1980s remains uncertain, however, and extending this analysis prior to 1990 would provide a more accurate picture of how this force has evolved over time.

Additionally, the findings in this study suggest that immigrants play a prominent role in increases in racial diversity. Future research should examine this relationship in more detail, paying particular attention to how influxes in immigrants affect long term residents and processes of gentrification. Traditionally, scholars have displayed concern over the displacement of immigrants due to gentrification (Betancur 2011), yet the data here suggest they may be more facilitators or even gentrifiers. As the purpose of this study was not to study the dynamics of immigration in detail and only looked at changes in the foreign-born population, additional

research that analyzes this population in more detail at the neighborhood level could yield valuable insights.

As mentioned earlier, this study contains a number of limitations which future research could address. Due to missing data in the 2005-2009 summary file, 13 tracts had to be excluded in the models above. Imputation for missing values on median household income and median home values would provide a more robust model, as it would allow an analysis on all 188 tracts.

Although the findings of this study have some generalizability outside of the Washington area, the nation's capital contains many idiosyncracies. It is a quasi-city-state, but it also possesses no congressional representation. While its status as a federal district makes it a recipient of a large amount of government funding, it is not autonomous and the area did not win home rule until 1973, meaning its Mayor was appointed by the federal government. Even today, Congress still reserves a large amount of control over its jurisdiction, making its urban policy unique from other metropolises in the United States (Gilette Jr. 2006; Swope 2004). As a result, extending this analysis to other cities that have undergone gentrification would provide a clearer picture.

Conclusion

Since the 1960s, gentrification has arisen as a small counter-force against urban disinvestment and out-migration. This study has aimed to measure how gentrification has impacted class and racial inequality by looking at changes in racial diversity and the percent change in the number of high school drop-outs over two decades. Specifically, this paper established two hypotheses: gentrifying neighborhoods seeing more displacement of vulnerable populations than non-gentrifying neighborhoods, and gentrifying neighborhoods experiencing larger increases in racial diversity. The data do seem to support the first hypothesis, as

gentrifying neighborhoods are associated with greater decreases in the percent change of the number of high school drop-outs, but this relationship appears weak and could be influenced by a myriad of other factors. Due to this, support for the second hypothesis is mixed, as gentrification is weakly associated with greater racial diversity.

Aside from trends in racial diversity and displacement, one noticeable finding to emerge from this study is the intensification of gentrification in the 2000s. Why gentrification became more prevalent in the 2000s is no doubt complex and multifaceted. The city may have benefited from larger national trends such as reduced crime and an increased desire among professionals to live in the urban core. As metropolitan areas have continued to sprawl outward and energy costs have risen, some have grown tired of suburban life and developed a renewed interest in urban living. The past decade of mayors in Washington have worked with businesses and community leaders to make the city's central neighborhoods attractive to developers and affluent individuals, and this may have changed Washington's reputation. Today, the District is one of the nation's top destinations for college educated people aged 25-34, and this most likely has played a role in the momentum gentrification appears to have gained in the 2000s (Frey 2011).

While the in-migration of middle and upper income individuals to central city neighborhoods in Washington, D.C. predominantly composed of racial and ethnic minorities seems to offer the promise of greater integration and reduced segregation, it remains uncertain whether this pattern holds true for other urban areas in the U.S., thereby calling for additional research in cities known to have undergone gentrification in the recent past. Furthermore, the process of gentrification may not be complete in many of these historic neighborhoods, meaning the gains in racial integration may still fall to greater racial residential segregation, especially as rents continue to rise and housing becomes more unaffordable (Orr 2010). As gentrification

appears to have accelerated in the 2000s, policy makers in Washington should continue to closely monitor trends over the next decade.

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Figure 1. Change in Entropy Scores, 1990-2009

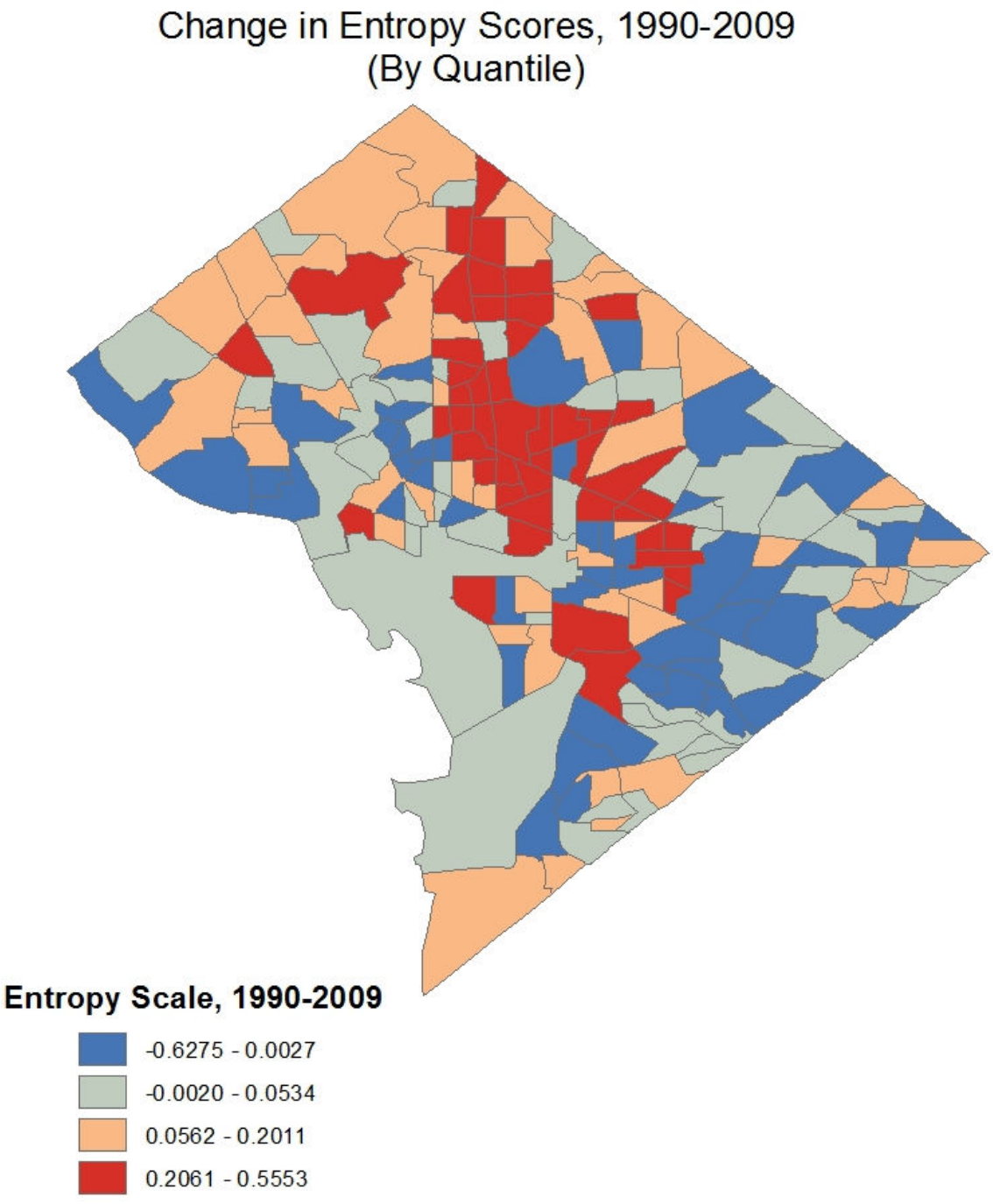

Figure 2. Percent Change in the Number of High School Drop-Outs, 1990-2009

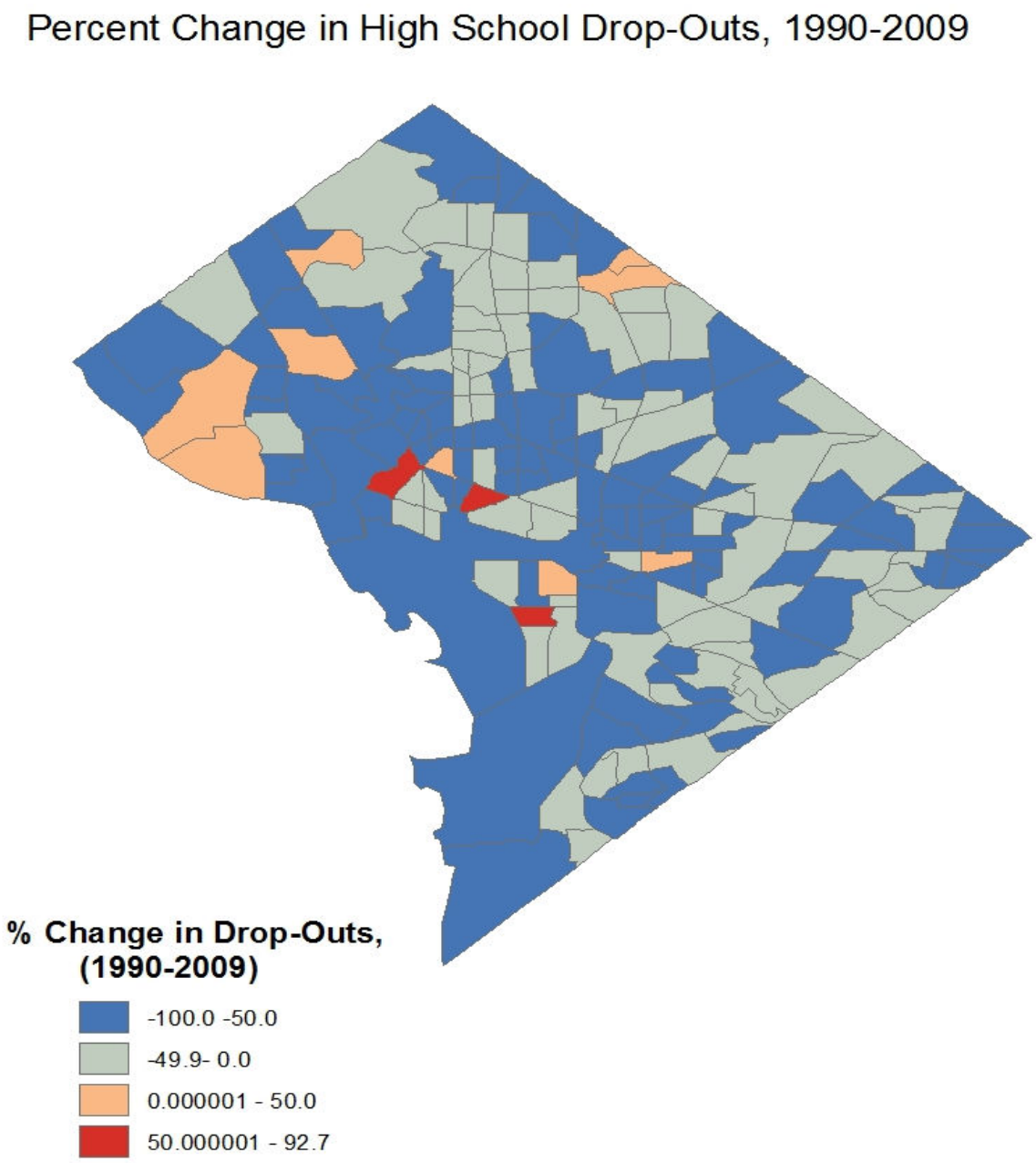

Figure 3. Gentrification Scores for Census Tracts, 1990-2009

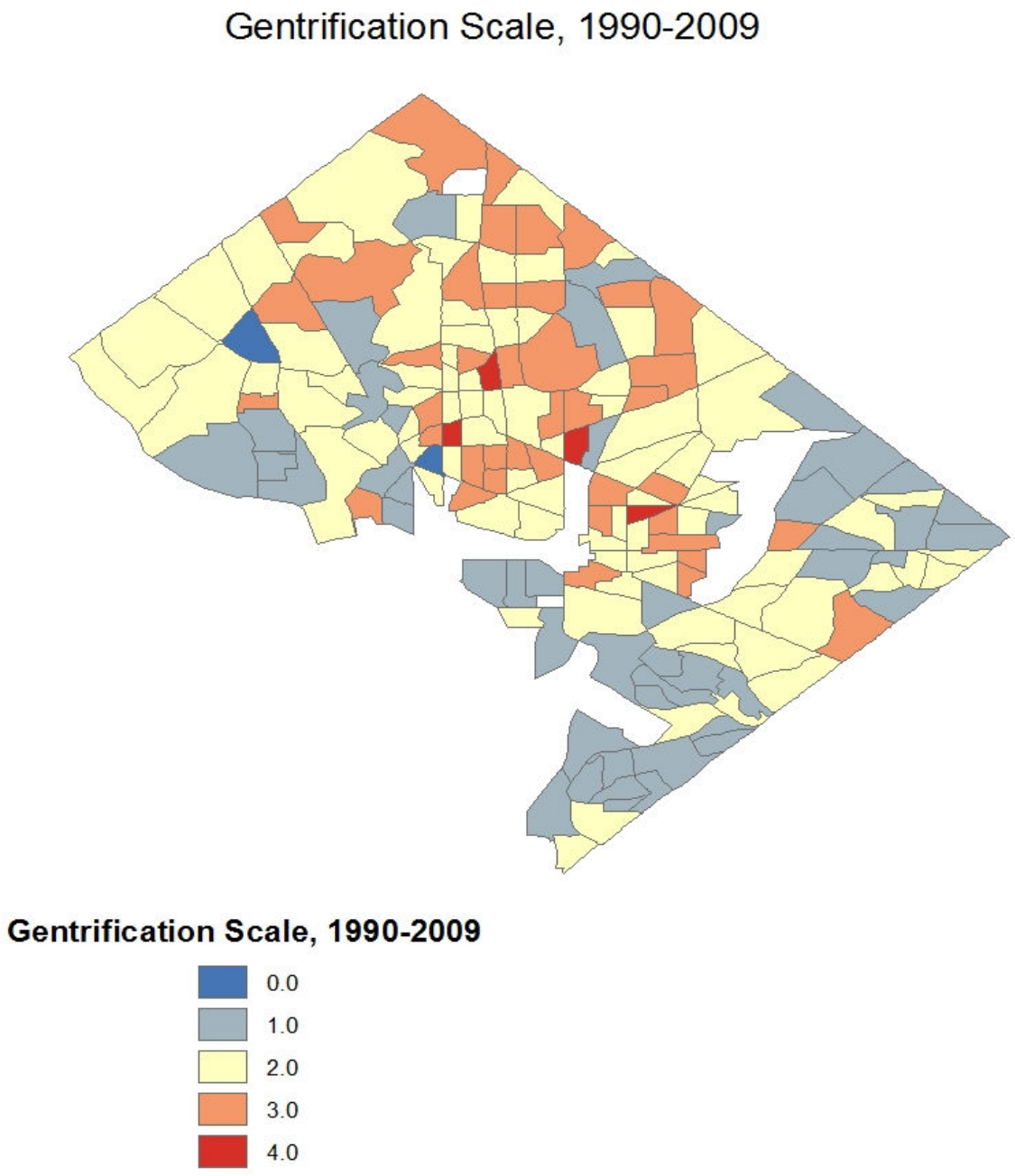

Table 1. Descriptive Statistics, Median Household Income and Housing Values in Thousands

All Tracts (N=175)

	1990	2000	2009	1990-2000	2000-2009	1990-2009
Dependent Variables						
Entropy Components						
% non-Hispanic Black	66.92	64.87	58.76	-2.05	-6.11	-8.16
% non-Hispanic White	26.26	25.82	30.48	-0.44	4.66	4.23
% non-Hispanic Other	2.33	3	3.32	0.67	0.31	0.99
% Hispanic	4.49	6.3	7.44	1.81	1.13	2.95
Entropy	0.33	0.36	0.43	0.03	0.07	0.10
# High-School Drop-Outs Over 25	584.39	453.45	312.04	-134.59	-150.46	-285.05
%Change in # of High-School Drop-Outs				-17.74	-29.03	-45.52
Independent Variables						
Gentrification Components						
% Bachelors +	31.47	34.46	43.6	2.99	9.14	12.13
Median Home Value (in thousands)	294	281.31	474.23	-12.70	192.92	180.22
Median Household Income (in thousands)	43.21	56.72	66.72	13.51	10.00	23.51
Percent Housing Units Built (by decade)				2.3	5	7.3
% Above Threshold on Education				50.29	53.14	52.57
% Above Threshold on Home Values				28.57	91.43	90.86
% Above Threshold on Household Income				5.71	4.57	8
% Above Threshold on Housing Units Built				46.86	47.43	47.43
Gentrification Scale				1.31	1.97	1.97
Control Variables						
% Foreign-Born	9.63	11.33	11.36	1.7	0.03	1.73
% Below Poverty	17.1	21.11	18.44	4.02	-2.67	1.34

Source: U.S. Census Bureau

Note: 13 tracts are excluded from the analysis due to missing data. Gentrification scale ranges from 0 to 4 and is the sum of the components that meet each threshold. The four conditions are: 1) percent increase in population with bachelor's degree or higher that is greater than the 50th percentile for metropolitan area; 2) increase in real median home values; 3) Median household income below 50th percentile at start of intercensal period and above 50th percentile at end of intercensal period; and 4) percentage of housing built over the intercensal period that is below 50th percentile. Median household income and median housing values are controlled for inflation in 2011 dollars using Consumer Price Index.

Table 2. Characteristics of Tracts with High and Low Gentrification Scores

	Low Gentrification: Gentrification Scale 1990-2009=1 (N=47)			High Gentrification: Gentrification Scale 1990-2009=3 (N=41)		
	1990	**2000**	**2009**	**1990**	**2000**	**2009**
Dependent Variables						
Entropy Components						
% non-Hispanic Black	72.55	72.67	71.58	68.18	65.05	53.85
% non-Hispanic White	22.89	22.22	22.55	24.83	23.93	32.48
% non-Hispanic Other	2.16	2.66	2.29	2.13	2.74	3.52
% Hispanic	2.39	2.44	3.59	4.86	8.28	10.14
Entropy	0.22	0.23	0.26	0.39	0.45	0.58
# High-School Drop-Outs Over 25	544.66	412.21	302.68	622.9	491.12	320.12
% Change in # of High-School Drop-Outs (By Decade)		-10.99	-25.89		-38.71	-30.33
Independent Variables						
Gentrification Components						
% Bachelors +	27.87	28.4	32.74	32.14	36.95	50.91
Median Home Value	263.99	249.36	371.31	272.91	254.68	514.01
Median Household Income	38.05	46.66	49.31	45.95	59.49	75.50
Percent Housing Units Built(By Decade)		3.54	6.56		1.20	2.81
Control Variables						
% Foreign-Born	6.67	6.88	8.17	9.64	13.64	13.85
% Below Poverty	21.85	27.8	26.16	12.65	16.31	11.82

Source: U.S. Census Bureau

Note: Tracts with low gentrification only meet one of the four conditions on the gentrification scale whereas tracts with high gentrification meet three out of four. The four conditions are: 1) percent increase in population with bachelor's degree or higher that is greater than the 50th percentile for metropolitan area; 2) increase in real median home values; 3) Median household income below 50th percentile at start of intercensal period and above 50th percentile at end of intercensal period; and 4) percentage of housing built over the intercensal period that is below 50th percentile. Median household income and median housing values are controlled for inflation in 2011 dollars using Consumer Price Index.

Table 3. Regressions predicting displacement of low educated adults from Washington DC census tracts, 1990s and 2000s

Dependent Variable: % Change in # of HS dropouts, age 25+	1990-2000		2000-2009			
	(1)	(2)	(3)	(4)	(5)	(6)
Gentrification score, 1990s	-8.45*	-7.27			-1.31	-1.66
% Below Poverty, 1990		1.10*				-0.54
% Foreign born, 1990		0.31				0.34
Gentrification score, 2000s			-11.00*	-8.93*		
% Below Poverty, 2000				0.86*		
%Foreign Born, 2000				-0.32		
R-squared	0.0249	0.056	0.036	0.073	0.001	0.010
*** p<0.001, ** p<0.01, * p<0.05						
Source U.S. Census Bureau						

Table 4. Regressions predicting growth in race/ethnic diversity of Washington DC census tracts, 1990s and 2000s

Dependent Variable: Change in Entropy Score	1990-2000		2000-2009			
	(1)	(2)	(3)	(4)	(5)	(6)
Gentrification score, 1990s	0.002	0.003			0.025†	0.03*
% Below Poverty, 1990		-0.002				0.003*
% Foreign born, 1990		0.007***				0.001
Gentrification score, 2000s			0.03*	0.02†		
% Below Poverty, 2000				-0.001		
%Foreign Born, 2000				0.01***		
R-squared	0.004	0.198	0.033	0.208	0.021	0.045
*** p<0.001, ** p<0.01, * p<0.05						
† = marginally significant p<0.1						
Source U.S. Census Bureau						

Table 5. Profile of Hot Spots of Gentrification

	Tract 31 (Columbia Heights)	Tract 43 (U St.)	Tract 84.02 (Capitol Hill)	Tract 87.01 (Bloomingdale)
Entropy(1990-2000)	0.11	0.06	-0.06	-0.06
Entropy(2000-2009)	0.29	-0.08	0.15	0.02
High School Drop-outs(1990-2000)	-17.34	-11.49	-47.36	-34.80
High School Drop-outs(2000-2009)	-51.80	-45.90	-53.07	-53.60
% Foreign Born(1990-2000)	19.18	10.51	1.55	0.10
% Foreign Born(2000-2009)	-0.13	-7.52	-3.33	1.72
% Below Poverty(1990-2000)	-9.31	-0.94	-6.17	6.38
% Below Poverty(2000-2009)	-7.05	-2.50	-5.39	-14.47

Source: U.S. Census Bureau