POST-RECESSION GENTRIFICATION AND SUBSIDIZED HOUSING AVAILABILITY AND AFFORDABILITY ACROSS THE UNITED STATES

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By

Madeline J. Baron, B.B.A.

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Gentrification, which occurs when high-income residents move into traditionally low-income areas, is a contentious issue facing many neighborhoods in metropolitan areas across the United States. This paper examines the relationship between gentrification and the availability and affordability of subsidized housing using data from the U.S. Department of Housing and Urban Development and the Census Bureau’s American Community Survey. Results indicate that neighborhoods experiencing “high gentrification” had lower levels of subsidized housing availability and affordability over the 2009-2012 time period relative to other neighborhoods. Additionally, these results provide additional evidence to the growing body of research on the suburbanization and re-concentration of poverty in low-gentrification neighborhoods, given the rise in housing choice voucher programs. Facing reducing supplies, rising costs, and stagnant wages, many low-income residents are increasingly vulnerable to the changing housing demands of others. This research may prompt metropolitan and city leaders to address the growing demand and rising costs of urban living across the U.S. and ensure that residents of all incomes have access to safe and affordable housing.
The hard work, thoughts, and efforts between these pages are dedicated to my loving husband, without whom none of this would have been possible.
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INTRODUCTION

Gentrification is a contentious issue relating to the changing landscape and culture of a neighborhood as new high-income residents displace existing low-income residents. Gentrification usually occurs in neighborhoods in cities and metropolitan areas with low housing costs and tight markets due to geographic boundaries, low densities, or zoning restrictions (Kennedy & Leonard, 2001). Federal research programs aimed at fostering affordable housing have been in place in various forms since the late 1800s, and there are numerous housing-related nonprofits, organizations, and associations working toward greater affordability and accessibility across the country (Edson, 2011). In addition to being a steadfast part of American culture, safe, affordable, and stable home environments provide many positive social externalities at the societal and individual levels (National Association of Realtors, 2012).

However, cities and neighborhoods across the country have a serious gap in the availability of affordable housing for moderate- and low-income residents (Badger 2013, MacDonald & Poethig, 2014). Recent research exploring the supply of housing available to an area’s median income households demonstrates the vast differences in housing affordability across the country, while taking local incomes into account (Kolko, 2013, MacDonald & Poethig, 2014). In San Francisco, 14% of the homes for sale in 2012 were considered affordable to a household with an income at the local median level, compared to 73% of homes in Chicago, and 86% in Akron, Ohio (Kolko, 2013). While local-area incomes usually account for differences in costs of living, home prices relative to these adjusted incomes still vary quite dramatically across the country, and in some cities, low-income households have very few housing options (Kolko, 2013). The lack of

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1 These values were based on homes for sale on October 2, 2013, and assume the household pays less than 31% of their pretax income on housing costs, which includes a 4.5%, 30-year fixed rate mortgage with 20% down, local property taxes, and insurance (Kolko, 2013).
affordable housing is especially stark for extremely low-income (ELI) households, defined by the Department of Housing and Urban Development (HUD) as those with incomes below 30% of an area median (MacDonald & Poethig, 2014). According to recent data from the Urban Institute, nationwide there are only 29 affordable and available rental units for every 100 ELI households – varying from 50.4 units per 100 households in Suffolk County, MA, to a paltry 2.8 units in Cobb County, GA (MacDonald & Poethig, 2014).

The housing market collapse and economic recession had a large impact on the availability and affordability of housing across the country (Badger, 2013, Goodyear, 2013, Viveiros & Brennan, 2013). While the number of people in the rental market had been increasing prior to the economic downturn, the high number of foreclosures, tight credit availability, and depressed economy increased the number of people in the rental market over the past five years, increasing rents at a time when median incomes have been stagnant or fallen (Goodyear, 2013, Viveiros & Brennan, 2013, MacDonald & Poethig, 2014). In addition, these economic trends hastened the social and demographic changes that had been building over the past decade, including the economic revival of cities and growing preferences for urban living (Florida, 2003, Florida, 2013). The imbalance in supply and demand for homes at all price ranges can lead to gentrification as middle-income households move into lower-income neighborhoods, and bring higher costs of living with them (McUsic, 1988, Kennedy & Leonard, 2001). Gentrification, rising rents, limited or declining supply of affordable homes, and flat or declining incomes, all come together to paint a troubling picture of the housing situation of many low-income households. To examine how the nation’s lowest-income households fare as their neighborhoods change around them, this paper examines how gentrification is related to the availability and affordability of subsidized housing programs in census tracts across the country.
LITERATURE REVIEW

Since the suburbanization trends of the 1970s and 1980s began to reverse in the 1990s, gentrification has been well researched as cities adapt to their dynamic and changing demographics. Many economic, social, and cultural factors influence migration patterns in the U.S., such as job availability, the changing industrial makeup of an area, or demographic and social preferences that change with an individual’s age and life-stage (Molloy, Smith, & Wozniak, 2011). As people fluctuate in and around cities and neighborhoods, research demonstrates that traditional housing distribution resembles a filtering process: high-income households build new construction, which then filters down to the next income tier as the housing stock ages and newer homes are built (McUsic, 1988). In a gentrifying market, however, this process can work in reverse as higher-income residents move into lower-income neighborhoods and directly compete with existing residents for a limited supply of housing prior to new construction (McUsic, 1988). This competition can increase home values and other costs of living and place financial pressure on existing, lower-income residents (McUsic, 1988). New residents may enter a neighborhood for a variety of reasons, perhaps seeking historic or architecturally significant homes, a walkable or centrally located neighborhood, or a new community (Helms, 2000, Murph, 2012, Hartley, 2013). Residents may also seek out lower-income neighborhoods due to rising costs of living or housing shortages elsewhere, if they are unable to afford neighborhoods that have already gentrified (Aronowitz, 2012, Badger, 2013).

The factors driving gentrification are well documented in the research literature. Prior to gentrifying, a neighborhood will often have tight, low-cost housing markets with limited supply, amenities such as bike lanes, public transportation, and pedestrian-friendly areas, and lucrative investment opportunities pre- and post-development (Helms, 2000, Kennedy & Leonard, 2001,
Ugenyi, 2011). The gentrification process may also be influenced by factors in surrounding areas, such as job creation, traffic congestion and long commutes, and higher home values and costs of living (Helms, 2000, Kennedy & Leonard, 2001, Ugenyi, 2011). Researchers have also identified the changes that take place as a neighborhood gentrifies: housing values and rents increase, resident incomes and educational attainment increase, and new development occurs, among other changes (Institute for Children and Poverty, 2009, Ugenyi, 2011, Hartley, 2013).

Affecting a wide array of individuals, communities, governments, and businesses, the consequences of gentrification are not consistently agreed upon in the literature (Kennedy & Leonard, 2001, Ugenyi, 2011). Positive outcomes can occur, such as a reduction in crime or concentrated poverty, increased tax revenues for local services, new amenities such as grocers, schools, and banks, as well as an overall increase in the value and quality of housing (Kennedy & Leonard, 2001, Vigdor, 2001, Institute for Children and Poverty, 2009, Hartley, 2013). However, negative consequences may also result from gentrification, such as higher property taxes, rents, and costs of living, the displacement of original residents, and changes to the neighborhood’s existing amenities and culture (Kennedy & Leonard, 2001, Institute for Children and Poverty, 2009, Hartley, 2013). Although researchers disagree as to whether gentrification is inherently positive or negative for existing, low-income residents, most agree that the changes to housing – rising rents and costs of living – are largely negative for these residents (Duany, 1996, Vigdor, 2001, Byrne, 2003).

Much of the recent research on gentrification and affordable housing relates to the 2008-2009 recession and housing market crash (Aronowitz, 2012, Badger, 2013). After the housing market collapse, increasing numbers of people moved into the rental market, pushing prices up and reducing the supply of rental units (Badger, 2013, Goodyear, 2013, Callis & Kresin, 2014).
Nationwide, rental vacancy rates fell 2.5 percentage points from 2009 to 2013 while median asking rents increased 2.1% from 2011 to 2013, and are within 95% of their 2009 peaks (see Figure 1) (Callis & Kresin, 2014). In addition, throughout this same time period the national median income declined 1.3% (from 2010 to 2011), putting many moderate- and middle-income families in a financially difficult housing situation (Pew, 2012, MacDonald & Poethig, 2014). Out of necessity, many households moved into lower income neighborhoods further contributing to gentrification and the displacement of others (McUsic, 1988, Badger, 2013). 

Recent research on the state of affordable housing in the United States generally paints a bleak picture (DeFilippis & Wyly, 2008, Edson, 2011, Vale, 2011, MacDonald & Poethig, 2014). Currently, subsidized housing assists approximately five million households, yet demand far outweighs the available supply as only about one in four eligible low-income families receive subsidies (Fischer & Sard, 2013). In addition, federal housing-related spending largely benefits higher-income households and homeowners through tax credits and mortgage interest deductions, while spending for lower-income households, who disproportionately rent their homes, has barely kept pace with inflation (Fischer & Sard, 2013). Many researchers also discuss the privatization trends that have occurred in the subsidized housing market (DeFilippis & Wyly, 2008). Originating from concerns over concentrated poverty in housing projects, the housing choice voucher program (as it is known today) was created in 1974 as a more flexible, tenant-based form of housing subsidy unattached to a specific location (Edson, 2011). A growing body research demonstrates that this mobile housing subsidy may have contributed to a re-concentration of poverty in suburban neighborhoods, driven at least in part by urban gentrification and the economic revival of cities (Covington, Freeman, & Stoll, 2011, Kneebone & Berube, 2013, Shaw, 2013). This displacement can be a severe hardship for low-income residents, who may rely on community and family for
social or employment needs, and may lack the financial resources necessary to relocate (Kennedy & Leonard, 2001, Goodyear, 2013).

The literature on gentrification and subsidized housing overlap with regard to policy solutions aimed at reducing displacement and ensuring that the positive consequences of gentrification are available to all residents (McUsic, 1988, Kennedy & Leonard, 2001, Cohen & Salomon, 2010, Ugenyi, 2011). In response to gentrification, policy recommendations often call on metropolitan leaders to implement tax and zoning regulations, stricter rent controls, and more affordable housing units to improve housing availability and affordability for low-income households (Kennedy & Leonard, 2001, Cohen & Salomon, 2010, Ugenyi, 2011). However, no prior research documents the direct relationship between gentrification and subsidized housing at the neighborhood level to assist policymakers in these decisions. This paper attempts to fill this void by empirically analyzing the relationship between gentrification and the availability and affordability of subsidized housing in census tracts across the country. Facing rising housing costs, declining availability, and depressed incomes, I examine how the lowest-income residents of subsidized housing fare as their neighborhoods change around them.

CONCEPTUAL MODEL & HYPOTHESES

This paper defines gentrification as the process of change that occurs in a neighborhood including economic development and the displacement of low-income residents with higher-income residents. Gentrification generally occurs in three phases, beginning with government intervention, property investment, or new residents moving in, followed by higher prices and costs of living, and then new amenities and displacement (see Figure 2). While this construction

Gentrification usually begins with government intervention, an influx of “urban ambassadors,” or increased property investment in a neighborhood (Kennedy & Leonard, 2001, Immergluck, 2009). Government intervention may be the direct result of a program aimed at reducing poverty or incentivizing new development, or a byproduct of new development such as a convention center or transportation hub (Kennedy & Leonard, 2001, Immergluck, 2009). “Urban ambassadors” may also trigger the gentrification process (Murph, 2012). These residents are usually younger, better-educated, and higher-income than current residents and may move into a neighborhood to experience a new community culture or because they cannot afford more expensive neighboring areas (McKinnish, Walsh, & White, 2008, Murph, 2012). In the past, gentrifiers were predominately white but recently they include many races (Kennedy & Leonard, 2001, Institute for Children and Poverty, 2009). Property investments, renovations, and upgrades can also spur gentrification (Helms, 2000, Kennedy & Leonard, 2001). Researchers have identified the presence of a “rent gap” as a potential cause of gentrification, as residents look to realize capital gains from upgrading the existing housing stock (Helms, 2000, Kennedy & Leonard, 2001, Institute for Children and Poverty, 2009). In this first phase of the gentrification process, prices have not yet risen but housing development, government programs, and urban ambassadors set the stage for higher prices and more high-income residents to follow.

Prices and diversity generally increase in the second phase of gentrification. Government programs can have direct effects on prices and resident mix, such as a new transit line leading to increased home values, or a city initiative to attract higher-income residents and reduce concentrated poverty (Kennedy & Leonard, 2001, Immergluck, 2009, Cohen & Salomon, 2010). Higher prices and
increased diversity can also come from property development, as rising home values attract a
diverse set of new residents either looking to profit from the “rent gap” or to experience a
developing neighborhood culture (Helms, 2000, Kennedy & Leonard, 2001). The first newcomers
in a lower-income neighborhood – urban ambassadors, artists, or young, often single residents –
may act as a signal that the neighborhood possesses overlooked qualities and convenience at
moderate price levels compared to surrounding areas. As the neighborhood’s reputation spreads
over time, the influx of higher-income residents reaches an inflection point at which prices and
speculation rise rapidly (Levy, Comey, & Padilla, 2006). Figure 3 demonstrates this process,
showing price increases over time. Theoretically, new development increasing the supply of
housing in a neighborhood should lead to lower prices, but often this does not occur due to
geographic or zoning density limitations, or due to continually rising demand (McUsic, 1988,
Goodyear, 2013). If costs of living rise faster than incomes, or if incomes are flat or declining,
existing lower-income residents may be unable to afford their homes (Levy, Comey, & Padilla,
2006). While rising home values could potentially benefit low-income residents who decide to
sell, many low-income households rent rather than own their homes, and may see higher taxes
with increased home values (Institute for Children and Poverty, 2009, Fischer & Sard, 2013).

The third phase of gentrification captures this displacement. As a neighborhood becomes more
expensive and trendy it attracts commercial development targeted at the new, higher-income
residents, such as grocers, banks, and restaurants (Duany, 1996). Existing residents may or may
not appreciate the new amenities, businesses, and redevelopment in their communities, but the
effect this process has on the availability and affordability of housing for existing residents, is
often negative (Kennedy & Leonard, 2001, Vigdor, 2001). As housing and living costs increase to
price in new neighborhood amenities, existing lower-income residents may be priced out of their
homes if their incomes do not keep pace, and future low-income residents may be prevented from moving in (Levy, Comey, & Padilla, 2006, Institute for Children and Poverty, 2009).

While much of the gentrification process occurs in the private housing market, publicly subsidized housing is not immune to rising prices and falling availability. In large part, this comes from recent trends toward privatizing the subsidized housing market and mobilizing rental assistance so as to avoid concentrating poverty in housing projects (DeFilippis & Wyly, 2008, Vale, 2013). The rise of housing choice vouchers exemplifies this, as residents receive a subsidy to live in a number of eligible private-market homes (HUD, 2014). In a gentrifying neighborhood, with rising land values and housing costs, residents in subsidized housing may be vulnerable to rising rents or declining availability due to eviction, demolition, or apartment conversion (McUsic, 1988, DeFilippis & Wyly, 2008, Goode & Miller, 2013). Further, it is unlikely that new subsidized housing units would be built in a gentrifying market, because building and maintaining subsidized housing is unprofitable for a municipal government, which could pursue new tax revenues from private investment (McUsic, 1988, MacDonald & Poethig, 2014).

Although various policies attempt to maintain adequate and affordable low-income housing in response to gentrification and development, they are not without limitations. These regulations include rent and eviction controls, which protect tenants from large rent increases or improper eviction; zoning and land use controls, which govern the types of structures that can be built in an area; and inclusionary housing or tax increment financing, which incentivize developers to include low-income housing units in new development (McUsic, 1988, Newman & Wyly, 2005, Cohen & Salomon, 2010, Ugenyi, 2011). Often, these policies run into duration limits, sunset clauses, and other mechanisms that allow apartment conversion or eviction (McUsic, 1988, Newman & Wyly, 2005, Goode & Miller, 2013). Additionally, as these policies are usually implemented by local
governments, they vary across communities (Hickey, 2013). Although they have limitations, these policies are important for protecting low-income tenants who are vulnerable to shifts in the housing landscape (Hickey, 2013).

**Hypotheses**

Facing the higher costs that generally come with gentrification, I hypothesize that gentrification has a negative effect on the availability and affordability of government-subsidized housing:

\[ \text{Availability}_{12} = \beta_0 + \emptyset \text{High Gentrification} + \beta_i \text{Availability Controls} + \alpha_i \text{State Controls} \]

\[ \text{Affordability}_{12} = \beta_0 + \emptyset \text{High Gentrification} + \beta_i \text{Affordability Controls} + \alpha_i \text{State Controls} \]

To support my hypothesis, the coefficient on *high gentrification* should be negative and statistically significant for the availability regression, indicating a negative relationship between high gentrification and subsidized units available, and the coefficient should be positive and statistically significant for the affordability regression, indicating a positive relationship between
high gentrification and median monthly subsidized rent. As there are numerous factors affecting subsidized housing availability and affordability, such as declining numbers of units reducing supply and increasing prices, I include the change in the total number of subsidized units from 2009-2012 as a control in each regression equation. In addition, because my analysis spans the entire country, I include 2009 baseline measures of subsidized housing availability in the availability regression, and include 2009 measures of subsidized housing affordability in the affordability regression, to control for initial differences in availability and affordability across neighborhoods. I also include state fixed effects in each regression, to control for time-invariant factors that may differ across states. These controls allow me to examine the relationship between gentrification and subsidized housing holding other influential factors constant.

Outcome Variables of Interest

I used the total number of subsidized units in a census tract to measure the availability of subsidized housing units, and the median monthly rent in a census tract to measure subsidized housing affordability. The median monthly subsidized rent represents the tenant’s portion of the rental payment, and represent real, 2012 dollars. These variables were used for both the Public Housing and Housing Choice Voucher samples, as described in the ‘Data and Sample’ section.

Independent Variable of Interest: Weighted Gentrification Index

To determine “whether” gentrification occurred in a census tract, I established a weighted-index of 10 gentrification indicators. This involved creating thresholds for the nominal change in each of the 10 indicators over time, weighting the indicators based on their overall importance to gentrification, and aggregating the weighted values to form the index. The criteria and weights for these indicators are found in Table 2. The 10 indicators are split between changes in the housing stock of a neighborhood, including Median Monthly Rent, Median Home Value, Total Number of
Housing Units, and the Number of Multi-Unit Structures; and changes in neighborhood
demographics, including Number of Residents with a Bachelor’s Degree (as the highest
educational attainment), Median Resident Income, Number of Residents Identifying as One Race
– White, Total Number of Residents, Number of Unmarried Households (including married same-
sex couples), and Median Resident Age.

Criteria and Weights for Gentrification Index
To determine whether a census tract met any of the 10 gentrification indicators, I established
thresholds and created dummy variables coded as 1 if the census tract was above the threshold,
and 0 if not. For standardization purposes, these thresholds were set at the 80th percentile of each
indicator’s distribution. For example, those census tracts with a nominal change above the 80th
percentile for median household income were coded as 1, having met the threshold, and those
census tracts below the 80th percentile were coded as 0. As outlined in Table 2, the weights for
these 10 indicators relate to the indicator’s overall importance in determining gentrification. I
weighted the demographic indicators more (60%) than the housing stock indicators (40%) because
in the gentrification process, the influx of new residents usually precedes changes in the housing
Children and Poverty, 2009). Additionally, I place a higher weight on monetary indicators because
higher costs of living can directly displace low-income residents, while changes in non-monetary
resident characteristics may be indirect displacement forces.

Within the housing stock indicators, I weighted change in median monthly rent the highest (20%)
for two reasons: because more people entered the rental market after the 2008-2009 housing market
crash, and because a higher proportion of low-income people rent rather than own their homes and
are vulnerable to changes in rental prices in the gentrification process (Badger, 2013, Fischer &
Sard, 2013). I weighted change in neighborhood *median home value* the next most important factor (10%), and *total number of units* and *number of multi-unit structures* each 5%.

Looking at demographic changes that indicate gentrification, I weight income and educational attainment highest (17.5% each) due to the importance of the changing income levels of the neighborhood and residents. Although income and education are highly correlated (0.526) they are important to consider separately because young, highly-educated individuals contributing to gentrification may not have high incomes (Institute for Children and Poverty, 2009). I weighted *number of white residents* 10%, and *total number of residents*, *number of unmarried residents*, and *median resident age* each 5% to represent their lower importance in gentrification.

After creating the thresholds and applying the weights, I summed the variables to create the final index – the gentrification “score.” These scores ranged from 0 to 1.10 with a mean of 0.22 and a standard deviation of 0.20. Again, I used the 80th percentile to determine whether a census tract had high- or low-gentrification. At this cutoff, 15,624 census tracts had high-gentrification.

*Data and Sample*

To perform this regression analysis, I merged data from the Department of Housing and Urban Development (HUD) and the Census Bureau’s American Community Survey (ACS). Each dataset is a collection of surveys results from a nationally representative group of households and offers data aggregated to the census-tract level – my unit of analysis.

The HUD dataset describes the state of subsidized housing for two programs across the country: Subsidized Housing Projects and Housing Choice Vouchers. Each program provides rental

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2 The correlation coefficient is 0.526 between 2009 median household income and the number of residents with at most a bachelor’s degree in 2009.
assistance for eligible low-income families, the elderly, and persons with disabilities (HUD, 2014). Subsidized housing projects are government-owned buildings offering low rents for tenants, while housing choice vouchers allow individuals and families to use subsidized housing funds in privately-owned rental housing units (HUD, 2014). The data are for the years 2009 and 2012, and contain numerous variables describing the availability and affordability of subsidized housing units in each program, in census tracts across the country.

The ACS data describe the demographic, economic, and housing characteristics of U.S. residents across the country, grouped at the census tract level. I used the 2005-2009 and 2008-2012 five-year average datasets, which represent the average of data collected over 60 months, and offer the largest sample size, smallest geographic region, and most precise estimates available from the Census Bureau (Census Bureau, 2014). The Census Bureau designs census tracts to be small, relatively permanent geographic areas containing between 1,000 and 8,000 residents, and are the best approximation to study the neighborhood gentrification process (Census Bureau, 2010).

To examine changes in gentrification over time, I merged the ACS and HUD datasets for the two time periods, using each census tract’s unique census code.\(^3\) Because some census tracts split, merge, or are recoded due to population changes, I used a crosswalk file from the American Communities Project at Brown University to re-group census tracts to their census 2000 form (Logan, Xu, & Stults, 2012). After merging, I then subtracted the 2009 values from the 2012 values to get nominal changes for my 10 gentrification indicators. Because the ACS data are five-year averages over the 2005-2009 and 2008-2012 time periods, my final analysis compares the 2005-2007 and 2010-2012 time periods; data for 2008 and 2009 are included in both averages, and drop

\(^3\) The 2005-2009 ACS five-year average dataset was merged with the 2009 HUD dataset, while 2008-2012 ACS five-year average dataset was merged with 2012 HUD dataset.
out when differenced. In my final analysis, the gentrification indicators are nominal changes from 2005-2007 to 2010-2012, while the outcome variables measuring subsidized housing availability and affordability are points in time in 2012.

**Final Sample**

My final sample contains 65,190 census tracts spanning the 50 states and the District of Columbia. It is important to note that not all census tracts have subsidized housing units. When examining the *availability* of subsidized housing for both programs, as measured by total subsidized units, all 65,190 census tracts have data: either zero or some number of subsidized units. However, when examining *affordability* of subsidized housing, as measured by median monthly subsidized rent, the sample is limited to only those tracts with subsidized housing units. In the public housing program, 7,741 census tracts have subsidized housing units and data for the rent outcome variable - 1,458 in the high-gentrification sample, and 6,283 in the low-gentrification sample. In the housing choice voucher program, 29,616 census tracts have subsidized housing units and data for the rent outcome variable - 6,239 in the high-gentrification sample, and 23,377 in the low-gentrification sample. Table 1 outlines these programs and the number of census tracts in each.

**Missing Data**

In the 2000 decennial census there were 65,443 census tracts in the 50 states and the District of Columbia (Census Bureau, 2014). After merging and matching the datasets across years, my final sample of 65,190 was missing 0.4% of this total, likely due to limitations with the separate datasets or with the crosswalk file. While aggregating the gentrification index, 2,208 census tracts had missing data for one or more of the 10 gentrification indicators, but as this represents only 3.4% of the sample, no action was taken. Missing observations did not alter the final sample’s representativeness of the ACS and HUD data.
DESCRIPTIVE STATISTICS

Table 1 displays descriptive statistics for the high- and low-gentrification samples, as well as the outcome variables for the public housing and vouchers programs. In the ACS data several variables were censored and recoded at their upper limit: median monthly rent was censored at $2,000, median home value at $1,000,000, and median household income at $250,000. This censoring negatively affects the mean values for each of these variables, suggesting that the means would be higher had censoring not taken place. While this is true for both the high- and low-gentrification samples, it is more important for the high-gentrification sample which was designed to include large positive changes in the 10 gentrification indicators.

Additionally, due to the index construct there are numerous ways a census tract could see high- or low-gentrification. Census tracts in the low-gentrification sample may have large positive changes for one or two of the indicators, and census tracts in the high-gentrification sample may have large negative changes for one or two of the indicators. For example, one census tract in Honolulu County met only one of the 10 gentrification indicators, a high change in median household income, and is included in the low-gentrification sample despite this high income characteristic. While limited in scope, this variation may skew the means across the high- and low-gentrification samples. It is important to note that the differences between the high- and low-gentrification samples for the gentrification indicators are deliberate, resulting from the design of the high-gentrification sample. However, differences between the high- and low-gentrification samples for the outcome variables are not deliberate, and reflect the changing landscape of subsidized housing as it relates to gentrification.
Looking at the outcome variables of interest, *total number of subsidized units* declined and *median monthly subsidized rent* increased over time. This occurred for both subsidy programs and for both high- and low-gentrification samples. However, the magnitudes of these changes differed across the two samples: *total number of subsidized units* declined more in high-gentrification census tracts than in low-gentrification areas, for both public housing and housing choice vouchers units. In the public housing program, *median monthly subsidized rent* also increased more in areas with high-gentrification compared to areas with low-gentrification. Interestingly, the opposite was true for housing choice voucher rents: areas with low-gentrification had larger nominal changes in *median monthly subsidized rent*, compared to areas with high-gentrification. While the decline in the *total number of voucher units* will account for some of the increase in rental price, the larger increase in rent in low-gentrification census tracts could potentially reflect an increased demand for housing as low-income residents relocate from high-gentrification neighborhoods to low-gentrification neighborhoods. Residents using housing choice vouchers have this flexibility, while those in public housing projects do not. Recent research on the increasing numbers of voucher recipients in suburban areas suggest gentrification may be related (Covington, Freeman, & Stoll, 2011, Kneebone & Berube, 2013, Shaw, 2013).

The location of high-gentrification census tracts varies across states and across the country. Figure 4 displays a map with each state’s proportion of high-gentrification census tracts relative to the total population of the state. Wyoming has the largest proportion of high-gentrification census tracts (56.7%), followed by Alaska (53.4%), the District of Columbia (52.7%), and North Dakota (39.6%), while Michigan has the smallest proportion (8.1%), followed by Ohio (11.8%), Wisconsin (12.3%), and Rhode Island (13.3%). States such as California, New York, and Texas have the largest number of high-gentrification census tracts, but because they also have the largest
number of total census tracts, their proportions were lower, at 23.1%, 30.5%, and 32.7%. The large proportion of high-gentrification census tracts in states such as Wyoming, Alaska, and North Dakota, likely stems from them having few total census tracts (127, 148, and 227 compared to the national average of 1,278 tracts per state), and growing shale gas and oil industries leading to economic development and new, high-income residents (Michels, 2013, Martin, 2014). In addition, the metropolitan area of the District of Columbia also has a large proportion of high-gentrification census tracts (52.7%), with few total census tracts (188). These trends demonstrate that gentrification as it is measured here, is not limited to solely dense, populous states, but can occur in cities across the country.

RESULTS

To measure the relationship between gentrification and subsidized housing availability and affordability I ran four regression models: one for each outcome variable, affordability and availability, for both the public housing and vouchers subsidy programs. The results are presented in Table 3. The variable of interest – a binary variable indicating whether a census tract had high-gentrification or not – was statistically significant in each model.

Models 1 and 2 look at the public housing sample. In Model 1 the outcome variable of interest is subsidized housing affordability in 2012, measured by the median monthly subsidized rent in 2012. In this model, a census tract that experienced high-gentrification had 2012 median monthly rent $3.66 higher on average, than areas that experienced low-gentrification. These results are consistent with my hypothesis that public housing projects would experience the rising costs of gentrification. In the second model, the outcome variable of interest is availability in 2012, measured by the total number of public housing units in a census tract in 2012. In this model,
census tracts that experienced high-gentrification had approximately one fewer subsidized units available in 2012, on average, compared to areas that experienced low-gentrification. These results are also consistent with my hypothesis that gentrified areas would have less availability in public housing units.

The third and fourth models look at the housing choice voucher program. In the third model, the outcome variable of interest is affordability in 2012, measured by median monthly subsidized rent. As with Model 1, this regression shows that high-gentrification census tracts had 2012 median monthly rent $3.23 higher on average, than areas with low-gentrification, in line with my hypothesis. In Model 4, the variable of interest is housing availability in 2012, measured by total subsidized units in 2012. As with Model 2, Model 4 shows that areas with high-gentrification had about 1.7 fewer subsidized housing units available on average, than areas with low-gentrification, consistent with my hypothesis.

These regression results are largely in line with my hypotheses, that gentrification negatively affects the availability and affordability of subsidized housing in neighborhoods across the country. Although the coefficients on my variable of interest, “high gentrification,” are small, they are meaningful relative to the total changes in subsidized rent and subsidized units over the 2009-2012 time period. In the affordability regressions (Models 1 and 3), areas that experienced high-gentrification had 2012 median monthly subsidized rents between $3.23 and $3.66 higher than areas with low-gentrification. Considering that the average median monthly subsidized rent across the whole sample increased between $6.50 and $11.00 over the 2009-2012 time period, the fact that gentrification is associated with about $3.50 in rent is significant. Similarly, in the availability regressions (Models 2 and 4), areas that experienced high-gentrification had 1.1 to 1.7 fewer total number of subsidized units in 2012 than areas that experienced low-gentrification. As the whole
sample saw declines between 1.9 and 3.0 subsidized units from 2009-2012, the association between high-gentrification and total number of subsidized units is meaningful.

Sensitivity Checks
Tables 4-7 display four sensitivity analyses demonstrating how the construction of the gentrification index influences the regression results. The first two sensitivity analyses adjust the thresholds used to determine whether or not a census tract met the 10 gentrification indicators or had high-gentrification. The third sensitivity analysis removes the weights of these 10 different gentrification indicators, and the fourth sensitivity analysis removes the baseline 2009 controls from the regressions. Like the primary analysis, the “high gentrification” variable of interest is statistically significant across all four sensitivity analyses. However, the economic magnitudes of “high gentrification” vary according to the index construct. In the first three sensitivity analyses, the coefficient on “high gentrification” ranges from $2.00 to $5.14 on the affordability regressions, and 0.5 to 3.0 units on the availability regressions. In the fourth sensitivity analysis, high-gentrification census tracts saw $12.35 higher 2012 median monthly subsidized rent and 6.8 fewer total subsidized units than low-gentrification census tracts. While these coefficients are more economically meaningful, the models in the fourth sensitivity analysis have very little explanatory power without controlling for external influences.

Clearly, the design of “high gentrification” influences the relationship between high-gentrification and subsidized housing availability and affordability. Importantly, however, the direction and significance of the “high gentrification” coefficients are consistent across the primary analysis and the four sensitivity analyses, indicating that a negative relationship exists between high-gentrification and subsidized housing availability and affordability.
DISCUSSION

My variable of interest, “high gentrification,” was statistically significant across each of the regression models. Although the relationships between “high gentrification” and total number of subsidized units and median monthly subsidized rent are meaningful in the context of the total changes in these variables over time, the magnitudes are somewhat small. That a census tract with high-gentrification has a median monthly subsidized rent a few dollars higher than a census tract with low-gentrification is not much cause for concern. Similarly, a high-gentrification census tract having one-to-two fewer subsidized housing units than a low-gentrification census tract, does not merit policy involvement. However, these results provide empirical evidence of the negative relationship between high-gentrification and subsidized housing availability and affordability, which is an important addition to the research debate on gentrification’s overall effect on the poor. In addition, these results have important implications for housing choice voucher programs in suburban and low-gentrification neighborhoods, as federal funding increasingly moves toward tenant-based housing and away from project-based housing programs (DeFilippis & Wyly, 2008, Edson, 2011). Documenting this direct relationship may assist policymakers and affordable housing advocates in designing and implementing policies to improve low-income housing in response to gentrification.

Caveats and Potential Limitations

The largest potential limitation to my analysis comes from the specific way gentrification is defined and measured. The gentrification process is very complex and difficult to quantify, as households naturally ebb and flow through homes and neighborhoods over time. In order to perform this analysis, my definition and timespan were necessarily narrow, which may have prevented me from analyzing larger trends over longer periods of time. In addition, my analysis
precluded me from determining a neighborhood’s stage of gentrification, which is important to consider with regard to price and demographic changes.

Secondly, it is possible that my narrowly defined analysis may have omitted influential variables. Numerous historical, cultural, political, and economic factors work together and in opposition to influence gentrification and the availability and affordability of subsidized housing, often in immeasurable ways. Limited in scope and data, my analysis may incorrectly attribute differences in subsidized housing to gentrification, omitting or overlooking the true drivers of these changes.

A third limitation to my analysis considers the thresholds for the 10 gentrification indicators. As the sensitivity analyses demonstrate, these thresholds have a measurable impact on the outcome of interest. Lacking prior research of a similar nature, I was unable to rely on any literature consensuses or precedents when constructing my gentrification index.

Conclusion

My thesis contributes meaningful empirical analysis to the research literature, documenting the negative relationship between gentrification and subsidized housing availability and affordability. In the context of shifting demographic preferences in society and fundamental changes to the housing market, understanding this relationship can shed light on the changing role that housing plays in American society. While households of all income levels struggle to find adequate, safe, and affordable housing in the depressed economy and imbalanced housing market, the nation’s lowest income populations are most vulnerable to the shifting patterns of others. Gentrification can have positive consequences for neighborhoods, from reducing concentrated poverty, to generating new business revenue, to enhancing diversity and culture, but it can also have negative
consequences for the lowest income residents of a neighborhood, including those in subsidized housing units.

Tools such as strong rent and eviction controls, tax increment financing, zoning requirements, inclusionary housing, and property tax reliefs await policy makers looking to combat large rent increases and availability shortages in gentrifying areas (McUsic, 1988, Newman & Wyly, 2005, Cohen & Salomon, 2010, Ugenyi, 2011, Hickey, 2013). In addition, replacing lost subsidized housing units by including low-income housing in new buildings or expanding voucher subsidies may help mitigate resident displacement (Ugenyi, 2011). As urban areas across the country grapple with increasing housing demand, more renters, and higher housing costs, metropolitan leaders should use new and existing policies to ensure that urban areas remain affordable and available to their lowest-income residents. Understanding the complex nature of the gentrification process can help policymakers in cities and metropolitan areas work toward spreading the positive effects of gentrification while mitigating the negative effects, ensuring their cities and communities are vibrant, diverse, and economically stable.
FIGURE 1: Average Monthly Rent, by Year (Real 2013 Dollars)

Source: U.S. Census Bureau, and the U.S. Bureau of Labor Statistics
Note: Grey areas represent recessions

FIGURE 2: Conceptual Model

Notes: The three phases of the Gentrification process move from left to right.
The gentrification process unfolds from left to right over time. Once the neighborhood's reputation spreads and new amenities, such as banks and restaurants appear, the gentrification process reaches an inflection point and prices rise rapidly due to high demand. Over time, the neighborhood may become saturated, and if housing supply increases from new development, prices should theoretically begin to decline. However, this decline in price does not always occur, especially when supply is limited by geographic, landscape, or zoning restrictions (Goodyear, 2013).
### Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Gentrification Variables</th>
<th>High-Gentrification Sample</th>
<th>Low-Gentrification Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Monthly Rent</td>
<td>15,496</td>
<td>$921</td>
</tr>
<tr>
<td>Median Home Value</td>
<td>15,460</td>
<td>$279,122</td>
</tr>
<tr>
<td>Total Number of Units</td>
<td>15,624</td>
<td>2,317</td>
</tr>
<tr>
<td>Multi-unit Structures</td>
<td>15,624</td>
<td>577</td>
</tr>
<tr>
<td>Residents w/ Bachelor's Degree</td>
<td>15,624</td>
<td>743</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>15,619</td>
<td>$60,299</td>
</tr>
<tr>
<td>Number of White Residents</td>
<td>15,624</td>
<td>4,250</td>
</tr>
<tr>
<td>Total Number of Households</td>
<td>15,624</td>
<td>2,060</td>
</tr>
<tr>
<td>Number of Unmarried Households</td>
<td>15,624</td>
<td>104</td>
</tr>
<tr>
<td>Median Resident Age</td>
<td>15,623</td>
<td>37.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public Housing Variables</th>
<th>2009</th>
<th>2012</th>
<th>Nominal Change</th>
<th>2009</th>
<th>2012</th>
<th>Nominal Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Sub. Units</td>
<td>15,624</td>
<td>13.5</td>
<td>11.4</td>
<td>-2.10</td>
<td>49,566</td>
<td>18.4</td>
</tr>
<tr>
<td>Median Monthly Sub. Rent</td>
<td>1,458</td>
<td>$282</td>
<td>$290</td>
<td>$9.08</td>
<td>6,283</td>
<td>$263</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vouchers Variables</th>
<th>2009</th>
<th>2012</th>
<th>Nominal Change</th>
<th>2009</th>
<th>2012</th>
<th>Nominal Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Sub. Units</td>
<td>15,624</td>
<td>30.6</td>
<td>27.7</td>
<td>-2.91</td>
<td>49,566</td>
<td>34.9</td>
</tr>
<tr>
<td>Median Monthly Sub. Rent</td>
<td>6,239</td>
<td>$344</td>
<td>$353</td>
<td>$10.4</td>
<td>23,377</td>
<td>$323</td>
</tr>
</tbody>
</table>

Notes: All definitions are per census tract. n = number of census tracts with data for each variable. High-gentrification sample is based on 80th percentile thresholds. Values may not sum due to rounding and averaging. Nominal changes for Gentrification Variables are over 2005-2007 and 2010-2012. Nominal changes for Public Housing and Vouchers variables are over 2009-2012.

**Gentrification Variables:**
- Median Monthly Rent is the median asking rental price for all rental units (occupied/unoccupied);
- Median Home Value is the median estimated sale value of all homes (occupied/unoccupied);
- Total Number of Units is the total number of housing units (occupied/unoccupied);
- Multi-Unit Structures are all those structures with two or more household units (apartments, condominiums, etc.) (occupied/unoccupied);
- Residents with a Bachelor's Degree is the total population over age 18 whose highest educational attainment is a bachelor's degree (excludes those with a higher degree);
- Median Household Income is the median estimated household income for all householders over age 15 over the 12 months prior to the survey;
- Number of White Residents is the population self-identifying as one race, white;
- Total Number of Households is the total number of individuals living together in one housing unit (may include one or more families, partners, unmarried partners, or unrelated individuals living together);
- Number of Unmarried Households is the total number of households with a nonrelative, unmarried partner, age 15 or older, including same-sex spouses;
- Median Resident Age is the median whole-number age for all persons in the household, at the time of the survey.

**Public Housing Variables:**
- Total Number of Sub. Units is the total number of Public Housing Project units subsidized through HUD (occupied/unoccupied);
- Median Monthly Sub. Rent is the median monthly rental price for all Public Housing Project units subsidized through HUD (occupied/unoccupied).

**Vouchers Variables:**
- Total Number of Sub. Units is the total number of housing units subsidized through HUD's Housing Choice Voucher Program (occupied/unoccupied);
- Median Monthly Sub. Rent is the median monthly rental price for all housing units subsidized through HUD's Housing Choice Voucher Program (occupied/unoccupied).
Figure 4: Number of High-Gentrification Census Tracts as a Percent of Total Tracts per State

Not Pictured: AK: 53.4%; HI: 37.5%

Note: Darker-shading indicates states have a higher population, as measured by total number of census tracts. Percentages shown are the proportion of High-Gentrification census tracts of each state’s total number of census tracts. High-Gentrification Census Tracts are based on the 80th percentile threshold for the 10 Gentrification Indicators and the 80th percentile threshold for the aggregated Gentrification Index.
Table 2: Criteria and Weights

<table>
<thead>
<tr>
<th>Gentrification Variables</th>
<th>80th Percentile Threshold</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Change in Housing Stock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median Monthly Rent</td>
<td>$150.00</td>
<td>20%</td>
</tr>
<tr>
<td>Median Home Value</td>
<td>$11,800.00</td>
<td>10%</td>
</tr>
<tr>
<td>Total Number of Units</td>
<td>141 units</td>
<td>5%</td>
</tr>
<tr>
<td>Multi-unit Structures</td>
<td>73 units</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40%</td>
</tr>
<tr>
<td>Nominal Change in Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residents w/ Bachelor's Degree</td>
<td>107 people</td>
<td>17.5%</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>$6,538.14</td>
<td>17.5%</td>
</tr>
<tr>
<td>Number of White Residents</td>
<td>331 people</td>
<td>10%</td>
</tr>
<tr>
<td>Total Number of Households</td>
<td>128 people</td>
<td>5%</td>
</tr>
<tr>
<td>Number of Unmarried Households</td>
<td>42 people</td>
<td>5%</td>
</tr>
<tr>
<td>Median Resident Age</td>
<td>1.5 years</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60%</td>
</tr>
</tbody>
</table>

Table 3: Regression Results

<table>
<thead>
<tr>
<th>(1) Public Housing</th>
<th>(2) Public Housing</th>
<th>(3) Vouchers</th>
<th>(4) Vouchers</th>
</tr>
</thead>
</table>
| Median Monthly 
Subsidized Rent 2012 | Total Number of 
Subsidized Units 2012 | Median Monthly 
Subsidized Rent 2012 | Total Number of 
Subsidized Units 2012 |
| High Gentrification | 3.656** (1.126) | -1.165*** (0.241) | 3.229*** (0.722) | -1.700*** (0.250) |
| Median Monthly Subsidized Rent 2009 | 0.808*** (0.012) | 0.705*** (0.008) | -0.019* (0.010) | -0.110*** (0.011) |
| Nominal Change in Subsidized Units (2009-2012) | -0.019* (0.010) | -0.110*** (0.011) | |
| Median Household Income 2009 | 0.0006** (0.0002) | 0.001*** (0.0002) | |
| Total Number of Subsidized Units 2009 | 0.896*** (0.001) | 0.803*** (0.002) | |
| Percent of Total Subsidized Units Occupied 2009 | 0.011** (0.004) | 0.006* (0.004) | |
| Median Number of People per Subsidized Unit 2009 | -0.438** (0.190) | 1.889*** (0.098) | |
| Median Number of Months Waiting for a Subsidized Unit 2009 | -0.376*** (0.017) | 0.004 (0.006) | |
| n | 7,741 | 65,190 | 29,616 | 65,190 |
| R-Squared | 0.8040 | 0.8857 | 0.6791 | 0.7420 |

Notes: Standard errors are in parentheses.

High Gentrification is based on those census tracts above the 80th percentile of the Gentrification Index. The Gentrification Index is based on nominal changes in 2009-2012 above the 80th percentile for the following variables: Median Monthly Rent, Median Home Value, Total Number of Units, Number of Multi-Unit Structures, Number of Residents with a Bachelor's Degree (as the highest educational attainment), Median Household Income, Number of White Residents, Total Number of Households, Number of Unmarried Households, as well as the nominal change below the 20th percentile for Median Resident Age.

Outcome Variables: Median Monthly Subsidized Rent 2012 is the median monthly rental price for all units in each HUD subsidy program in 2012 (occupied/unoccupied). Total Number of Subsidized Units 2012 is the total number of units in each HUD subsidy program in 2012 (occupied/unoccupied).

Control Variables: Median Monthly Subsidized Rent 2009 is the median monthly rental price for all units in each HUD subsidy program in 2009 (occupied/unoccupied). Nominal Change in Subsidized Units (2009-2012) is the nominal change in the Total Number of Subsidized Units in each HUD subsidy program from 2009-2012 (occupied/unoccupied). Percent of Total Subsidized Units Occupied 2009 is the percent of Total Subsidized Units in each HUD subsidy program, that were occupied in 2009. Median Number of People per Subsidized Unit 2009 is the median number of people per subsidized unit in each HUD subsidy program in 2009. Median Number of Months Waiting for a Subsidized Unit 2009 is the median number of months eligible residents waited for a subsidized unit in each HUD subsidy program in 2009.
### Regression Results for Sensitivity Analysis 1

#### Gentrification Indicator Thresholds Set at 70th Percentile

<table>
<thead>
<tr>
<th></th>
<th>Public Housing</th>
<th>Vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median Monthly Subsidized Rent 2012</td>
<td>Total Number of Subsidized Units 2012</td>
</tr>
<tr>
<td>High Gentrification</td>
<td>2.893*** (0.967)</td>
<td>-1.104*** (0.219)</td>
</tr>
<tr>
<td>Median Monthly Subsidized Rent 2009</td>
<td>0.808*** (0.012)</td>
<td>0.705*** (0.009)</td>
</tr>
<tr>
<td>Nominal Change in Subsidized Units (2009-2012)</td>
<td>-0.019* (0.002)</td>
<td>0.0005*** (0.002)</td>
</tr>
<tr>
<td>Median Household Income 2009</td>
<td>0.896*** (0.001)</td>
<td>0.803*** (0.002)</td>
</tr>
<tr>
<td>Total Number of Subsidized Units 2009</td>
<td>0.011** (0.004)</td>
<td>0.007* (0.004)</td>
</tr>
<tr>
<td>Percent of Total Subsidized Units Occupied 2009</td>
<td>-0.435** (0.190)</td>
<td>1.897*** (0.098)</td>
</tr>
<tr>
<td>Median Number of People per Subsidized Unit 2009</td>
<td>-0.376*** (0.017)</td>
<td>0.004 (0.006)</td>
</tr>
<tr>
<td>Median Number of Months Waiting for a Subsidized Unit 2009</td>
<td>7,741</td>
<td>65,190</td>
</tr>
<tr>
<td>R²</td>
<td>0.8042</td>
<td>0.8857</td>
</tr>
</tbody>
</table>

*** denotes P-value < 0.001  ** denotes P-value < 0.05  * denotes P-value < 0.10

**Notes:** Standard errors are in parentheses.

This sensitivity analysis sets thresholds at the 70th percentile, to determine whether or not a census tract has met any of the 10 gentrification indicators. In the primary regression, these thresholds were set at the 80th percentile. The same change was made for the “High Gentrification” cutoff in determining the cutoff point.

*The Gentrification Index* is based on nominal changes in 2009-2012 above the 80th percentile for the following variables: Median Monthly Rent, Median Home Value, Total Number of Units, Number of Multi-Unit Structures, Number of Residents with a Bachelor's Degree (as the highest educational attainment), Median Household Income, Number of White Residents, Total Number of Households, Number of Unmarried Households, as well as the nominal change below the 20th percentile for Median Resident Age.

*Outcome Variables:* Median Monthly Subsidized Rent 2012 is the median monthly rental price for all units in each HUD subsidy program in 2012 (occupied/unoccupied). Total Number of Subsidized Units 2012 is the total number of units in each HUD subsidy program in 2012 (occupied/unoccupied).

*Control Variables:* Median Monthly Subsidized Rent 2009 is the median monthly rental price for all units in each HUD subsidy program in 2009 (occupied/unoccupied). Nominal Change in Subsidized Units (2009-2012) is the nominal change in the Total Number of Subsidized Units in each HUD subsidy program from 2009-2012 (occupied/unoccupied). Median Household Income 2009 is the median estimated household income for all householders over age 15 over the 12 months prior to the ACS survey. Total Number of Subsidized Units 2009 is the total number of units in each HUD subsidy program, in 2012 (occupied/unoccupied). Percent of Total Subsidized Units Occupied 2009 is the percent of total subsidized units in each HUD subsidy program, that were occupied in 2009. Median Number of People per Subsidized Unit 2009 is the median number of people per subsidized unit in each HUD subsidy program in 2009. Median Number of Months Waiting for a Subsidized Unit 2009 is the median number of months eligible residents waited for a subsidized unit in each HUD subsidy program in 2009.
#### Table 5: Sensitivity Analysis 2

Regression Results for Sensitivity Analysis 2
Gentrification Indicator Thresholds Set at 90th Percentile

<table>
<thead>
<tr>
<th></th>
<th>Public Housing</th>
<th>Vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median Monthly</td>
<td>Total Number of</td>
</tr>
<tr>
<td></td>
<td>Subsidized Rent 2012</td>
<td>Subsidized Units 2012</td>
</tr>
<tr>
<td>High Gentrification</td>
<td>4.662***</td>
<td>-1.309***</td>
</tr>
<tr>
<td></td>
<td>(1.893)</td>
<td>(0.352)</td>
</tr>
<tr>
<td>Median Monthly Subsidized Rent 2009</td>
<td>0.808***</td>
<td>(0.012)</td>
</tr>
<tr>
<td></td>
<td>-0.019*</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Nominal Change in Subsidized Units (2009-2012)</td>
<td>0.0006**</td>
<td>0.001***</td>
</tr>
<tr>
<td></td>
<td>Median Household Income 2009</td>
<td>0.896***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
</tr>
<tr>
<td></td>
<td>0.011**</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Total Number of Subsidized Units 2009</td>
<td>-0.376***</td>
<td>0.004</td>
</tr>
<tr>
<td>Percent of Total Subsidized Units Occupied 2009</td>
<td>7.741</td>
<td>29,616</td>
</tr>
<tr>
<td></td>
<td>65,190</td>
<td>65,190</td>
</tr>
<tr>
<td>Median Number of People per Subsidized Unit 2009</td>
<td>0.8039</td>
<td>0.6791</td>
</tr>
<tr>
<td></td>
<td>-0.8857</td>
<td></td>
</tr>
<tr>
<td>Median Number of Months Waiting for a Subsidized Unit 2009</td>
<td>7,741</td>
<td>29,616</td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parentheses.

This sensitivity analysis sets thresholds at the 90th percentile, to determine whether or not a census tract has met any of the 10 gentrification indicators. In the primary regression, these thresholds were set at the 80th percentile. The same change was made for the "High Gentrification" cutoff in determining the cutoff point.

The Gentrification Index is based on nominal changes in 2009-2012 above the 80th percentile for the following variables: Median Monthly Rent, Median Home Value, Total Number of Units, Number of Multi-Unit Structures, Number of Residents with a Bachelor's Degree (as the highest educational attainment), Median Household Income, Number of White Residents, Total Number of Households, Number of Unmarried Households, and the nominal change below the 20th percentile for Median Resident Age.

Outcome Variables: Median Monthly Subsidized Rent 2012 is the median monthly rental price for all units in each HUD subsidy program in 2012 (occupied/unoccupied). Total Number of Subsidized Units 2012 is the total number of units in each HUD subsidy program in 2012 (occupied/unoccupied).

Control Variables: Median Monthly Subsidized Rent 2009 is the median monthly rental price for all units in each HUD subsidy program in 2009 (occupied/unoccupied). Nominal Change in Subsidized Units (2009-2012) is the nominal change in the Total Number of Subsidized Units in each HUD subsidy program from 2009-2012 (occupied/unoccupied). Median Household Income 2009 is the median estimated household income for all householders over age 15 over the 12 months prior to the ACS survey. Total Number of Subsidized Units 2009 is the total number of units in each HUD subsidy program, in 2012 (occupied/unoccupied). Percent of Total Subsidized Units Occupied 2009 is the percent of total subsidized units in each HUD subsidy program, that were occupied in 2009. Median Number of People per Subsidized Unit 2009 is the median number of people per subsidized unit in each HUD subsidy program in 2009. Median Number of Months Waiting for a Subsidized Unit 2009 is the median number of months eligible residents waited for a subsidized unit in each HUD subsidy program in 2009.

*** denotes P-value < 0.001  ** denotes P-value < 0.05  * denotes P-value < 0.10
### Table 6: Sensitivity Analysis 3

**Regression Results for Sensitivity Analysis 3**

<table>
<thead>
<tr>
<th>Equal Gentrification Indicator Weights</th>
<th>Public Housing</th>
<th>Vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Gentrification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median Monthly Subsidized Rent 2012</td>
<td>3.344**</td>
<td>1.999**</td>
</tr>
<tr>
<td>(0.964)</td>
<td>(0.625)</td>
<td>(0.228)</td>
</tr>
<tr>
<td>Total Number of Subsidized Units 2012</td>
<td>-0.560**</td>
<td>-0.908***</td>
</tr>
<tr>
<td>(0.219)</td>
<td>(0.228)</td>
<td></td>
</tr>
<tr>
<td><strong>Nominal Change in Subsidized Units (2009-2012)</strong></td>
<td>-0.019**</td>
<td>-0.110***</td>
</tr>
<tr>
<td>(0.012)</td>
<td>(0.009)</td>
<td></td>
</tr>
<tr>
<td><strong>Median Household Income 2009</strong></td>
<td>0.0006**</td>
<td>0.001***</td>
</tr>
<tr>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
- Standard errors are in parentheses.
- *** denotes P-value < 0.001
- ** denotes P-value < 0.05
- * denotes P-value < 0.10

This sensitivity analysis sets weights equal for the 10 different gentrification indicators when forming the gentrification index.

The Gentrification Index is based on nominal changes in 2009-2012 above the 80th percentile for the following variables: Median Monthly Rent, Median Home Value, Total Number of Units, Number of Multi-Unit Structures, Number of Residents with a Bachelor's Degree (as the highest educational attainment), Median Household Income, Number of White Residents, Total Number of Households, Number of Unmarried Households, as well as the nominal change below the 20th percentile for Median Resident Age.

**Outcome Variables:** Median Monthly Subsidized Rent 2012 is the median monthly rental price for all units in each HUD subsidy program in 2012 (occupied/unoccupied). Total Number of Subsidized Units 2012 is the total number of units in each HUD subsidy program in 2012 (occupied/unoccupied).

**Control Variables:** Median Monthly Subsidized Rent 2009 is the median monthly rental price for all units in each HUD subsidy program in 2009 (occupied/unoccupied). Nominal Change in Subsidized Units (2009-2012) is the nominal change in the Total Number of Subsidized Units in each HUD subsidy program from 2009-2012 (occupied/unoccupied). Median Household Income 2009 is the median estimated household income for all householders over age 15 over the 12 months prior to the ACS survey. Total Number of Subsidized Units 2009 is the total number of units in each HUD subsidy program, in 2012 (occupied/unoccupied). Percent of Total Subsidized Units Occupied 2009 is the percent of total subsidized units in each HUD subsidy program, that were occupied in 2009. Median Number of People per Subsidized Unit 2009 is the median number of people per subsidized unit in each HUD subsidy program in 2009. Median Number of Months Waiting for a Subsidized Unit 2009 is the median number of months eligible residents waited for a subsidized unit in each HUD subsidy program in 2009.
### Table 7: Sensitivity Analysis 4

**Regression Results for Sensitivity Analysis 4**

<table>
<thead>
<tr>
<th>Public Housing</th>
<th>Vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Monthly Subsidized Rent 2012</td>
<td>Median Monthly Subsidized Rent 2012</td>
</tr>
<tr>
<td>Total Number of Subsidized Units 2012</td>
<td>Total Number of Subsidized Units 2012</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Gentrification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Monthly Subsidized Rent 2012</td>
<td>11.327***</td>
</tr>
<tr>
<td>Total Number of Subsidized Units 2012</td>
<td>-6.595***</td>
</tr>
<tr>
<td>n</td>
<td>9,729</td>
</tr>
<tr>
<td>R²</td>
<td>0.3843</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public Housing</th>
<th>Vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Monthly Subsidized Rent 2012</td>
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</tr>
<tr>
<td>Total Number of Subsidized Units 2012</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Gentrification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Monthly Subsidized Rent 2012</td>
<td>12.347***</td>
</tr>
<tr>
<td>Total Number of Subsidized Units 2012</td>
<td>-6.795***</td>
</tr>
<tr>
<td>n</td>
<td>65,190</td>
</tr>
<tr>
<td>R²</td>
<td>0.3255</td>
</tr>
</tbody>
</table>

*** denotes P-value < 0.001
** denotes P-value < 0.05
* denotes P-value < 0.10

**Notes:** Standard errors are in parentheses.

This sensitivity analysis removes the 2009 baseline controls from the regression equation.

**High Gentrification** is based on those census tracts above the 80th percentile of the Gentrification Index.

The Gentrification Index is based on nominal changes in 2009-2012 above the 80th percentile for the following variables: Median Monthly Rent, Median Home Value, Total Number of Units, Number of Multi-Unit Structures, Number of Residents with a Bachelor's Degree (as the highest educational attainment), Median Household Income, Number of White Residents, Total Number of Households, Number of Unmarried Households, as well as the nominal change below the 20th percentile for Median Resident Age.

**Outcome Variables:** Median Monthly Subsidized Rent 2012 is the median monthly rental price for all units in each HUD subsidy program in 2012 (occupied/unoccupied). Total Number of Subsidized Units 2012 is the total number of units in each HUD subsidy program in 2012 (occupied/unoccupied). Percent of Total Subsidized Units Occupied 2009 is the percent of total subsidized units in each HUD subsidy program, that were occupied in 2009. Median Number of People per Subsidized Unit 2009 is the median number of people per subsidized unit in each HUD subsidy program in 2009.

**Control Variables:** Median Monthly Subsidized Rent 2009 is the median monthly rental price for all units in each HUD subsidy program in 2009 (occupied/unoccupied). Nominal Change in Subsidized Units (2009-2012) is the nominal change in the Total Number of Subsidized Units in each HUD subsidy program from 2009-2012 (occupied/unoccupied). Median Household Income 2009 is the median estimated household income for all householders over age 15 over the 12 months prior to the ACS survey. Total Number of Subsidized Units 2009 is the total number of units in each HUD subsidy program, in 2012 (occupied/unoccupied). Percent of Total Subsidized Units Occupied 2009 is the percent of total subsidized units in each HUD subsidy program, that were occupied in 2009. Median Number of People per Subsidized Unit 2009 is the median number of people per subsidized unit in each HUD subsidy program in 2009.
REFERENCES


