# Durham and Gentrification:
# Assessing the Impact of Displacement in the Bull City

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# Contents

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**Abstract**

In this paper, I look to Durham, North Carolina, to demonstrate potential harms from gentrification. Using an expansive proprietary dataset, I come to two main conclusions: first, there is a significant link between gentrification and displacement, as low-income renters are constrained by increased prices and are forced to leave their neighborhoods. Second, displaced renters are significantly more likely to move into communities with higher crime rates, worse schools, and increased rates of poverty. These results suggest that the Durham government should enact policies protecting low-income renters and other at-risk groups while also balancing the benefits of gentrification.

*JEL classification*: R2, R3

Keywords: gentrification, displacement, poverty, school quality

## I. Introduction

Questions of neighborhood success and stability have been hot-button issues throughout the late 20th and 21st centuries. The ways in which neighborhoods cohere and the effects this cohesion has on the local populace have been questions of increasing relevance, as researchers have sought to understand how neighborhood dynamics predict a person's current wellbeing and future welfare. Policymakers have recognized that the ability of a community to survive – and ideally thrive – on its own is a necessary prerequisite to meaningful and lasting social and economic development (Ludwig, 2012).

Successful neighborhoods are often difficult to build: they require years of stabilizing public policy, favorable economic conditions, and active groundwork by community organizers. Many neighborhoods in the United States have had little to no access to these stabilizing mechanisms, exposing them to historic abuses, fluctuating housing prices, and long-lasting instability. This is troubling for these communities, as healthy neighborhoods provide considerable benefits to their residents, decreasing depression rates, lowering poverty rates, and generally leading to a higher quality of life (Ross et al., 2000). Healthy neighborhoods are vital for children's long-run outcomes in particular, as they connect children with increased opportunities and amenities that boost their high school and college graduation rates, which in turn increase those of their children (Chetty et al. 2016).

While the issue of neighborhood health can be broken up into many components – historical injustices, affordability, poverty, and evictions, among others – I choose to focus on the issue of gentrification, which is loosely defined as rapid increases in property values and shifts in neighborhood demographics. Gentrification is a contentious issue of study, as academics and politicians alike often cannot agree on whether it is an issue at all. To many, rising property

values constitute positive change, while to others, the rapid changes to the local economy are perceived as harmful. In this way, gentrification is a double-edged sword: while those who remain in gentrifying neighborhoods reap the benefits of improved amenities, rising home values, and decreased poverty, others are potentially pushed from their neighborhoods due to rising costs.

Neighborhoods in America's largest and smallest cities have all seen dramatic increases in their property values, household incomes, and proportion of college educated in-movers (Leefeldt, 2018). Over 20 percent of low-income neighborhoods in America's 50 largest cities were shown to have gentrified in the period between 2000 and 2015, compared to just 9 percent of similar neighborhoods throughout the 1990s (Maciag, 2015). In the United States, gentrification has impacted some of the nation's oldest neighborhoods in distinct and often unpredictable ways. These rapid shifts have benefited some cities considerably: higher property values, improved downtown desirability, and new businesses result in increased economic activity in city centers, counteracting the stagnation experienced in many metropolitan areas. Increased tax revenues from this economic activity lead to larger government budgets, potentially allowing cities to improve their infrastructure and better their public transportation. However, governments must weigh these benefits with the considerable costs: low-income residents could be displaced from their households as a result of gentrification, resulting in the loss of social networks and regional identity. In addition to the financial costs, those displaced by gentrification have been shown to face increased rates of depression and other mental health issues, largely because of the stress and alienation felt while moving (Lim et al., 2017). Additionally, gentrification has been shown to decrease the prevalence of black-owned businesses in neighborhoods, instead importing businesses from outside investors at the expense

of local entrepreneurship (Stringer, 2017). Lawmakers have attempted to counteract the harms of gentrifications – chiefly among them the perceived displacement caused by increasing property values – through means of rent control and other restrictions on housing supply; these policies have largely failed and have had adverse effects (Diamond et al., 2018). Thus, research on gentrification is vital as it can inform policy decisions on how best to promote neighborhood stability, identify at-risk groups, and promote the welfare of its residents.

The literature on gentrification is often sweeping in its scale, encompassing entire countries, looking at the movements of millions of people and the ways in which investments impact their wellbeing. The scope of this literature, while informative on a high level, is not always helpful when crafting policy, as individual cities and communities suffer from different circumstances that metanalyses cannot effectively contextualize. As such, this paper will focus specifically on the city of Durham, North Carolina. The past century has been tumultuous for Durham, yielding notable highs and lows unique to the city. The rise and fall of the tobacco industry, policies of redlining and urban renewal, and the biting economic stagnation of the late 20$^{th}$ century have colored the city's history and shaped the economic reality of its residents. Focusing on gentrification's impact on Durham, specifically the effects it has had on native Durhamites, will potentially paint a better picture of the city's issues and provide a roadmap for how the city should progress.

The two primary questions of this thesis are as follows: first, is displacement happening in Durham as a result of gentrification, and who are the groups most at risk of displacement? Second, are those displaced by gentrification being pushed into worse conditions? Section II discusses the history of gentrification and how specifically it has impacted the Bull City. Section III provides a snap shot of the existing literature on gentrification and displacement,

demonstrating where previous analyses have succeeded and failed and where this thesis hopes to contribute. Section IV discusses the theoretical underpinnings of my analysis. In Section V, I outline the data used in this study, where it comes from, its strengths and potential limitations. Section VI comments on the empirical methodology of this analysis, why it was chosen, and how these models will be used to address the research questions. Section VII provides results and discussion, and Section VIII concludes.

## II. Background

In recent years, Durham has experienced a sort of economic renaissance. Formerly abandoned factories have been remade into large apartment complexes, breweries and boutique shops have started to pepper the city streets, and investment has poured into the county as investors and families see a bright future in what was once a stagnating tobacco town. While this development has many excited, so too has it raised concerns of equity and local identity among its citizens (Yeoman, 2018). Indeed, Durham's modern economic disparity is unignorable. The rate of poverty among black households in the city of Durham was 23.5% and 32.4% for Hispanic families in 2016, while only 8.4% for white households, corresponding to 18.5% for the city in total. In that same year, white households were shown to have a home ownership rate of 72.7%, compared to 45.8% and 42.9% for black and Hispanic households, respectively. Even among homeowning black and Hispanic households, median home values are roughly 30% lower than those of white families (De Marco et al., 2018). It is these residents that are most exposed to the resulting instability from largescale investment into the city.

The driving force behind gentrification is the movement of younger, educated, wealthier individuals into the inner city, as these new residents seek employment and their tastes shift

towards urban settings (Freeman, 2005; Baum-Snow and Hartley, 2017). Such is also the case in Durham. Between 2010 and 2016, Durham county's population grew by 14%, and the city is estimated to attract 10,000 new residents per year. Home vacancy rates have virtually hit zero as the rate of new construction has not been able to keep up with the increased demand for housing. As such, housing costs have risen considerably. Between 2011 and 2017, median gross rents increased by upwards of 30% (De Marco et al., 2018). As costs increase and wages stagnate, 46% of all renters in Durham county have become rent burdened, meaning they spend 30% or more of their monthly income on rent. Currently, community activists and city officials fear that these new residents and increased costs will displace families from their longtime residencies.

Durham's current economic reality is complicated and undeniably inequitable. However, such was not always the case. In the early 20th century, Durham's economy teemed with potential as black-owned businesses slowly popped up along Parrish street in what grew to be known as Black Wall Street, then the "Mecca of Black Capitalism" (Yeoman, 2018). Foremost among those businesses was North Carolina Mutual Life, which to this day remains the largest black-owned life insurance company in the nation. This is not to say that the Durham economy was flourishing or fully equitable – racial disparities were just as pronounced and divisive – but rather that it had the potential for growth for both its black and white residents. However, this growth was largely stinted by government action. This is exemplified by two policy decisions: redlining and urban renewal.

Redlining refers to policies by the federal government in the mid-1930s aimed at assessing the lending risk levels of neighborhoods in cities throughout the United States based on criteria such as race and class. The Home Owners' Loan Corporation (HOLC) was tasked with the creation of residential maps, marking in color the risk level of each neighborhood. Those

deemed the riskiest were coded in red, and this demarcation carried with it long-lasting ramifications. The limitations placed on public and private lending and federal mortgages greatly reduced homeownership rates and home values in redlined communities, barring residents from accumulating generational wealth; redlining causally impacted both the racial composition and housing development of these neighborhoods (Aaronson et al., 2019). The legacy of redlining remains to this day, as these neighborhoods continue to struggle. Utilizing housing data provided by Zillow, Mikhitarian (2018) finds that formerly redlined census tracts have experienced considerably less growth over the course of the late 20th and early 21st centuries compared to non-redlined tracts, 203% vs. 230% respectively. In addition, she finds that these tracts have lower median home values, $270,000 vs. $640,000. Redlining has suppressed housing values in many inner-city neighborhoods, allowing investors to profit off the disparity between their current prices and how these properties should be valued. As such, formerly redlined neighborhoods have been shown to uniquely struggle with the forces of gentrification (Mitchell, 2018). In Durham, formerly redlined tracts are to this day among the most destressed, as some face poverty and unemployment rates double that of the city average. These neighborhoods, most of which are historically black in their composition, are now the communities most struggling with the forces of gentrification, as the historically depreciated property values are now rapidly appreciating, dramatically increasing rents and the cost of living (De Marco et al., 2018).

Urban renewal refers to a series of federal programs that intended to redevelop cities and combat perceived “urban decay”. Beginning in the 1950s, local governments could request funding to deal with what they designated to be “slums” in their cities, clearing these neighborhoods to make room for new development. Under this policy, the Durham government infamously targeted the Hayti district, the center of the black business community in Durham.

The success of the Hayti had inspired Durham's nickname as the "Capital of the Black Middle Class". However, by the late 1960s, plans had already been made to demolish the Hayti for construction of a freeway, and by the early 1970s it had been completed. This construction displaced over 4,000 black households and 500 black-owned businesses (De Marco et al., 2018).

Durham's history of deliberate disinvestment and targeting minority households has left the city's oldest residents vulnerable to the forces of gentrification. Powell and Spencer (2002) corroborate, writing that "segregated neighborhoods experience the 'double insult – a one-two knockout' of neglect and white flight in the 1950s through 1970s followed by the forces of gentrifying revitalization since the 1980s." Low housing values allow for investors to exploit the "rent gap" between what urban housing should be valued and its current price, reselling the homes for profit to younger residents with tastes for inner-city housing (Freeman, 2005). As such, Durham is a compelling case study for how gentrification impacts mid-sized cities, as its history of disinvestment, coupled with its sudden popularity and reinvestment, has shaken both the city's local economy and regional identity, challenging policy makers to balance the benefits of gentrification – increased property values, improved amenities, and heightened investment, among other factors – with the potential harms of displacement.

## III. Literature Review

In this section, I detail three areas of research in the current academic literature on gentrification. First, I discuss various definitions of gentrification and displacement, commenting on their strengths and weaknesses and ultimately deciding which one best fits my research questions. Second, I assess the literature linking gentrification and displacement and offer potential explanations behind discrepancies between the studies. Third and finally, I discuss the gap in the literature on displacement and amenity choice, highlighting whether current academic research concludes if people are moving to better, worse, or comparable conditions following displacement by gentrification.

### *Defining Gentrification and Displacement*

To analyze gentrification, researchers require precise definitions that best encapsulate the phenomenon. One of the primary difficulties of this research is finding a proper definition. Glass (1964) first defined the term, writing that gentrification is a direct reflection of class change. Developments brought in by upper- and middle-class residents into low-income communities challenge the identity of a given neighborhood, thus constituting gentrification. This provides a general understanding; however, the lack of specificity on economic and statistical criterion makes this definition difficult to use in research.

Banzhaf and McCormick (2007) define gentrification as a combination of three premises: rising property values and rental costs, new and renovated housing stock, and changes in the demographics of local populations. While this is a precise measure, it can be difficult to determine exactly how to quantify the renovation of housing stocks, which demographics to

consider, and the significance of rising property values. As such, many papers such as Atkinson (2000) opt instead to use proxies such as the proportions of high-income residents or the number of young professionals moving into a city to measure these phenomena. Bates (2013) defines it in terms of phases: early, middle, and late gentrification, each phase defined by specific rates of appreciating housing values. Bousquet (2017) demonstrates that this distinction between different phases of gentrification is commonly used in city mapping, as it allows local governments to preempt gentrification and to see which neighborhoods are beginning to feel its effects. Given all these definitions, it can be difficult to discern which is the most practical in answering my research questions. Among them, it is clear to see some overlap: most definitions recognize the importance of increases in the absolute value of property. For this reason, I use home value appreciation rates as my main definition of gentrification.

Just as with gentrification, displacement can be difficult to define. Grier and Grier (1978) define it along the following lines: households are displaced when they are forced to move for reasons outside of their control and related to the conditions of the surrounding neighborhood. Specifically, Grier and Grier (1978) divide displacement into three categories: disinvestment displacement (when properties are neglected, resulting in their deterioration and abandonment where residents must flee due to the poor condition of their residency), reinvestment displacement (when neighborhoods improve, resulting in increased rents), and displacement resulting from enhanced market competition (large shifts in the national or regional housing markets). They note the relationship between disinvestment and investment displacement, as housing is often neglected, resulting in it being undervalued and then later sold for a profit, creating a cycle of displacement for the residents living there.

Often studies will opt for proxies, analyzing displacement by comparing a community to its surrounding neighborhoods. Spain, Reid, and Long (1980) measure displacement by comparing the characteristics of in-movers to out-movers. If primarily low-income or minority renters are leaving a neighborhood while wealthy white households are moving in, Spain, Reid, and Long (1980) would argue that displacement is occurring. Desmond and Shollenberger (2015) look at the issue through the lens of evictions, noting that increases in formal or informal evictions are directly related to the macroeconomic forces impacting a neighborhood and are ultimately driven by things like increased prices and rent-seeking.[1] Wang et al. (2018) use a cocktail of proxies such as evictions, decreases in marginalized populations, and the exit rate of low-income individuals.

However, these definitions have their limitations. Freeman (2005) writes that these measures cannot fully explain displacement, as it is often difficult to determine exactly why people move, given that they do not directly convey their reasoning to researchers. Furthermore, it is hard to determine whether surrounding communities are comparable to the neighborhood being studied, thus making them questionable proxies. Therefore, definitions of displacement can harm the integrity of the research being conducted. Despite these potential shortcomings, I utilize a comparable definition of displacement to that of Spain, Reid, and Long (1980), looking to the exit rates of low-income renters and comparing them to the rates among low-income homeowners.

[1] Desmond and Shollenberger (2015) define formal evictions as the legal process of removing a tenant from their household. This requires the landlord to submit an eviction notice and pursue the notice through court if the tenant does not leave. Informal evictions are defined as under the table efforts by landlords to cheaply remove their tenants through coercion to avoid long court processes. This can include tactics such as harassment, bribery, and neglect. While it is possible to measure formal evictions, it is considerably harder to measure informal evictions. Thus, researchers may not fully know the extent to which displacement is happening.

*The Link Between Gentrification and Displacement*

Much of the modern literature on gentrification focuses on the link between gentrification and displacement, as researchers have sought to prove or disprove the link while also attempting to demonstrate causality in the relationship. Atkinson (2000) analyzes data from lower-income residents in the United Kingdom, finding that the link between gentrification and displacement is significant. Wang et al. (2018) find a similar result; looking to communities in Los Angeles county, they find that neighborhoods introduced to the forces of gentrification are statistically more likely to experience the displacement of low-income residents, specifically renters. Using the influx of highly educated individuals as their definition of gentrification, Brummet and Reid (2018) demonstrate causally that less-educated renters from gentrifying neighborhoods were 3-5% more likely to have moved between 2010 and 2014 than less-educated renters from non-gentrifying communities. Wyly et al. (2010) also find a significant link between the two phenomena, calculating that 10,000-20,000 households are displaced every year in New York City alone. They find that renters and low-income homeowners were upwards of twice as likely to be displaced. Furthermore, they find that households that are cost burdened – meaning they spend more than 30% of their income on housing – are more likely to be displaced, as are those who live closer to the central business district and those who have occupied a household for a shorter duration of time (given decreased sentimentality towards the house). Old age and minority status were also found to be significant factors effecting whether a household is displaced. However, Wyly et al. (2010) do not demonstrate causality in the relationship between gentrification and displacement. Desmond and Shollenberger (2015) study the issue of evictions and displacement in Milwaukee, finding that 11 percent of all moves in the year 2009 were

forced rather than voluntary. They find that the rate of displacement was 15% for black renters and 29% for Hispanic renters, compared to only 8% for white renters.

However, these are far from conclusive results. A slew of academic literature demonstrates that either no such link exists between gentrification and displacement, or that perhaps the relationship is non-causal. McKinnish et al. (2010) analyze data by census tract throughout the United States, using narrow definitions of gentrification and tailored racial, educational, and household characteristics to disaggregate the data. They find an opposite result, concluding that minority and low-educated individuals are not displaced in gentrifying neighborhoods. McKinnish et al. (2010) continue, saying that black residents with high school degrees and white college graduates receive the majority of the benefits of gentrification. However, they note that these benefits come primarily from gentrifying neighborhoods that were predominantly black to begin with. Communities with smaller black communities, when gentrified, result in the disproportionate exit of black residents with high school diplomas, as the benefits of gentrification do not completely offset the increases in housing and amenity prices. The story is convoluted, as the impacts of gentrification can vary based on education, race, and current economic standing. Vigdor (2002) finds a similar result, challenging the conclusion that low-income individuals are displaced by gentrifying forces. While he finds there is no significant link between gentrification and displacement in his case study of Boston, he recognizes theoretically that this can vary between cities depending on the rate at which property values increase and the costs associated with relocation. Freeman (2005), too, finds the link between gentrification and displacement to be muddled and far from conclusive, writing that while the two words are often used interchangeable, they are indeed very separate phenomena with a

tenuous connection. In his study, he finds that the rate of out-movement by low-income residents is only 1.6% higher than that of high-income residents, potentially dispelling any link.

This clear divide in the literature between those concluding there is a link and those explaining otherwise is best explained by Wang et al. (2018). They write that the disparity arises from two factors: first, differences in the definition of gentrification can make it challenging to compare between studies. Second, the use of aggregate data can make it difficult to find a link, given that many cities and rural areas experience gentrification differently. Aggregate data focuses more on shifts in populations and city-level trends, missing much of what is happening at the individual level. Regardless of these explanations, there is still a clear divide in the literature. The first component of my thesis is to conduct a similar analysis for Durham, assessing whether rising property values have led to the displacement of low-income residents and identifying at-risk groups.

*Conditions Following Displacement*

While many studies have focused on analyzing the link between gentrification and displacement, few have focused on where households move following their displacement and how they make their housing decisions. Schill et al. (1983) conduct their study in five American cities – Boston, Cincinnati, Denver, Richmond, and Seattle – finding that those displaced by gentrification ultimately end up in similar socioeconomic conditions to those they started in. Vigdor (2002) corroborates, casting doubt on the notion that displacement can be used as a proxy for wellbeing. He demonstrates that there are many potential benefits resulting from displacement, namely improved labor market opportunities, neighborhood quality, and

socioeconomic integration. He shows that there is no evidence of considerable harm resulting from displacement, and there may well be neighborhood improvements that increase overall wellbeing. Alternatively, Newman and Wyly (2006) studied displacement in New York City, finding that rates of displacement fluctuated between 6.2% and 9.9% in the period 1999 to 2002. They demonstrate that this displacement ultimately decreased household welfare, as displaced families were more likely to either become homeless or end up in crowded conditions. One main caveat is that these three studies rely on potentially inaccurate means of assessing displacement. Schill et al. (1983) utilize door to door surveys and in-person interviews, methods that they recognized likely missed those households most often on the move, mainly low-income families; these methods resulted in only a 35% response rate. Newman and Wyly (2006), too, rely on surveys as their primary means of analysis. Zuk et al. (2015) comment that the reliance on surveys can result in considerable under-sampling and bias, compromising the results of the aforementioned studies and making it difficult to truly gauge the wellbeing of households following gentrification.

Wang et al. (2018) circumvents this problem by instead using a longitudinal dataset that tracks the individual movements of households in Los Angeles county. They find that displaced families are significantly more likely to move into neighborhoods with higher levels of pollution, higher crime rates, and worse public education. Furthermore, these impacts of displacement tend to primarily impact low-income renters and minorities. However, Brummet and Reid (2018) show that while the link between gentrification and displacement is causal, the displacement does not necessarily cause harm. To conduct this study, they create a new longitudinal dataset using census microdata linking respondents from the 2000 census to their responses in the 2010-2014 American Community Survey (ACS), allowing them to analyze changes in household

characteristics over time. They come to three main conclusions: first, they corroborate earlier literature by showing that many residents who remain in their originally gentrifying neighborhood benefit considerably, as increased property values, new amenities, and improved school systems improve the wellbeing of most residents, especially children (Baum-Snow et al., 2018; Chetty et al., 2016). Second, they show that those displaced by gentrification are not made observably worse off according to their measures of wellbeing: neighborhood quality (crime, poverty rates, education systems, etc.), labor market outcomes, and commuting distance to their jobs. Lastly, they note the importance of considering the unobservable costs of displacement; pecuniary costs, measurable impacts such as moving fees and time spent searching for new housing, are shown to be insignificant for movers, while non-pecuniary costs, things like the benefits of living near family or the importance of a household's community, are unobservable and not measured in their study. Hence, while pecuniary costs are shown to be negligible, there may well be harms caused by displacement due to large, unmeasurable non-pecuniary costs.

This thesis intends to contribute mostly to this area of the literature, as the dearth of data and research on where displaced households move is considerable and a major limitation on public policy. By studying Durham with a unique and similarly disaggregated longitudinal dataset, I hope to find results that better inform the discussion on how displacement impacts the housing decisions of low-income households.

## IV. Theoretical Framework

This thesis relies on two different theoretical models of gentrification, the first assessing macro-level shifts in housing prices, and the second looking to how individual choices are made in gentrifying communities. Both frameworks are discussed in the following section.

### *Bid-Rent Theory*

The first component of my theory is determining how urban land should be valued and comparing it to the actual price, analyzing the potential discrepancy in pricing. Alonso (1960) explores this theory through use of the "bid-rent curve", which depicts the theoretical relationship between a plot of land's value and its distance from a city's central business district. This graphic is depicted in Figure 1.a below. Alonso (1960) emphasizes the negative relationship between rents and the distance from the central business district, and he demonstrates this through three different groups: retailers, manufacturers, and residential households. To maximize their profitability, retailers must operate in densely populated areas where they can increase foot traffic and have better access to distribution channels. Therefore, they are the group most willing to pay high rents to operate in a city's core. Industrial manufacturing, too, needs access to the supply chains available in city centers; however, they require less foot traffic and more land to build factories, hence their willingness to operate just outside of the city center. Lastly, residential households do not need to be surrounded by foot traffic, nor are they willing to pay large amounts for distribution channels. Hence, they tend to operate outside of the city center where land is cheaper and transportation to the city center is costlier. That is not to say, however, that all residential households operate on the outskirts of town. Low-income housing often exists in the inner-city, as people trade-off the increased availability of land in the suburbs for

proximity to employment opportunities and public transit in the city center. Additionally, wealthy households often choose to live in the suburbs, as they have the means to purchase more land at a cheaper price (Glaeser et al., 2007).

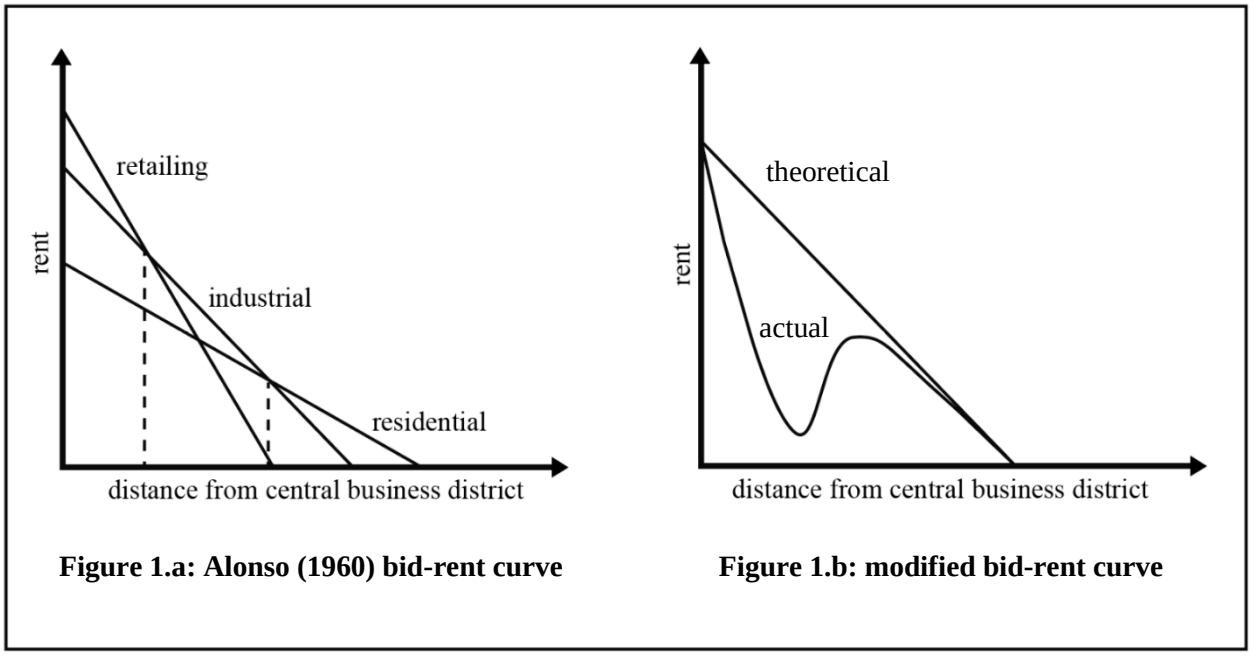


**Figure 1.a: Alonso (1960) bid-rent curve**

**Figure 1.b: modified bid-rent curve**

And yet, this theory does not accurately fit the reality of many American cities, as land in the inner-city is often valued at a lower price than land in the city's outskirts. Many poorer households tend to live in these low-valued households, and wealthier households often live in the suburbs. Explaining this paradox is central to the discussion on gentrification.[2] This discrepancy is depicted in Figure 1.b. One suggestion as to why this land may be undervalued comes from De Marco et al. (2018) and Mikhitarian (2018) who suggest that active policies of

[2] Naturally, the bid-rent theory of land pricing does not neatly fit the reality of many cities, both in the United States and elsewhere, as there is considerable heterogeneity across different urban spaces. Glaeser, Kahn, and Rappaport (2007) write that in some cities such as Paris, the inner-city contains the highest property values, modeled more accurately by the linear curves in Figure 1.a. However, many older American metropolitan areas such as Boston, Philadelphia, New York, and Chicago have a similarly U-shaped curve to that depicted in Figure 1.b.

disinvestment and segregation such as red-lining left these neighborhoods without access to credit and capital, thus stifling their growth. This is not necessarily the case in all cities, as prohibitive zoning policies and city specific factors may have also lowered inner-city property values. However, this framework provides a plausible explanation as to why values in Durham are undervalued. The difference between what Alonso's (1960) curve theoretically suggests and the actual value of land is explained by Freeman (2005) as a "rent gap", where investors now see arbitrage and an opportunity for reinvestment and profit. These investors sell these properties at a higher price to newer, educated households with tastes for urban settings.

*Neighborhood Selection Theory*

Tiebout (1956), in combination with Banzhaf and McCormick (2007), provides the theory on individual housing choices and displacement. Tiebout (1956) posits that the average resident in a community will "vote with their feet", meaning they self-organize into communities of their choice subject to their own preferences. Communities will vary in a given city, providing more or fewer public goods, and households will choose which community most appeals to them by comparing prices against their income and weighing the public goods with their own private interests. Banzhaf and McCormick (2007) demonstrate this community organization through construction of an indirect utility function for household $i$, expressed as:

$$U_i = U(y_i, P, G) \tag{1}$$

$y_i$ is household $i$'s income, $P$ represents housing price, and $G$ is the distribution of amenities in neighborhood $j$. This model assumes that household preferences act in accordance with the "single crossing" property, meaning that the slope of the indirect indifference curve in the $(G, P)$

plan is increasing in $y$. Single crossing means that communities are increasing in both $P$ and $G$; neighborhoods with lower home values also have fewer amenities, and neighborhoods with higher home values have more amenities. All households, owners and renters alike, have a ranking of communities based on their prices and amenities. This model assumes that households have the same preferences on public amenities, and that owners and renters will have the same rankings of which communities they find desirable and undesirable. As such, one should suspect that wealthier households will live in communities with more amenities, and poorer households will live in communities with fewer amenities. This model offers a simple look at community organization, and it can be expanded to better meet the needs of my analysis. In accordance with Wang et al. (2018), the indirect utility function is expanded to:

$$U_i = U(y_i, r, P, G) \tag{2}$$

Tenure $r$ demarcates whether a household is an owner or a renter. From this, housing supply for neighborhood $j$ is given as $S_j(P, r)$ and housing demand is $D_j(P, y, r)$.[3]

Given the ordering of communities, people will organize into neighborhoods of their choosing limited by their incomes and tenure. As such, there will exist boundary households who have an income level sufficient to live in either community $j$ or $j + 1$ and who are indifferent between the two of them. This boundary income is specified as $\bar{Y}_O$ for owners and $\bar{Y}_R$ for renters. If an owner has an income lower than $\bar{Y}_O$ then they will prefer the community with worse amenities, whereas if they have an income higher than $\bar{Y}_O$ they will prefer the community with better amenities. The same applies for renters, who will choose either the higher or lower order

[3] This model of household utility is limited to only four components and is deliberately simplified to meet the needs of this analysis. In other analyses, this model is expanded to better meet the needs of the discussion. Brummet and Reid (2018) instead look to wages, cost of rent, and idiosyncratic differences between households, as each of these factors relate to gentrification as they define it.

community based on if their income is higher or lower than $\bar{Y}_R$. The equilibrium housing price $P_j$ and the boundary incomes $\bar{Y}_{O,j,j+1}$ and $\bar{Y}_{R,j,j+1}$ are defined in accordance with the equilibrium conditions for owners ($O$) and renters ($R$):

$$U\left(\bar{Y}_{O,j,j+1}, O, P_j, G_j\right) = U\left(\bar{Y}_{O,j,j+1}, O, P_{j+1}, G_{j+1}\right) \quad \forall j \in \{1, \dots, J-1\}$$

$$U\left(\bar{Y}_{R,j,j+1}, R, P_j, G_j\right) = U\left(\bar{Y}_{R,j,j+1}, R, P_{j+1}, G_{j+1}\right) \quad \forall j \in \{1, \dots, J-1\}$$

$$M_O \int_{y \in C_j^O} D\left(P_j, y, O\right) f(y) dy + M_R \int_{y \in C_j^R} D\left(P_j, y, R\right) f(y) dy = S_j\left(P_j, O\right) + S_j\left(P_j, R\right) \quad (3)$$

$$\forall j \in \{1, \dots, J\}$$

$M_O$ is defined as the population of homeowners, $M_R$ is the population of renters, $C_j^O$ and $C_j^R$ are the sets of incomes in community $j$ for owners and renters, and $f(y)$ is the marginal distribution of income.

Gentrification is the process of younger, wealthier, better educated households moving into a community, increasing prices and potentially displacing existing residents. This is shown graphically in Figure 2 below, which is taken from Banzhaf and McCormick (2007) and Wang et al. (2018). Here, there are three communities, each with their own distribution of public goods, with Community 1 having the fewest amenities, Community 2 having more amenities, and Community 3 having the most, making it the most desirable and expensive of the three neighborhoods. Consider three types of residents: low income residents (type 1) mostly live in Community 1, as it is the least expensive of the three neighborhoods. Medium income (type 2) residents mostly live in Community 2, though some live in Communities 1 and Community 3. Lastly, high income residents (type 3) mostly live in Community 3, given its higher prices and increased public amenities. The population density of each type of household is given by the three curves.

The boundary incomes between Community 1 and Community 2 are given as $Y_{O,(1,2)}$ for owners and $Y_{R,(1,2)}$ for renters, and boundary incomes between Community 2 and Community 3 are given as $Y_{O,(2,3)}$ and $Y_{R,(2,3)}$. We would expect the boundary conditions to be different for homeowners and renters, as the effect of housing appreciation will impact both groups differently. Owners must balance the gains of appreciating housing values with the costs of increased property taxes; ultimately, the gains will be larger than the costs for these owners. Renters, alternatively, will face higher costs of living and increased rents, none of which will translate into capital gains; these costs will likely outweigh the improved amenities. This model assumed there are low vacancy rates in housing.

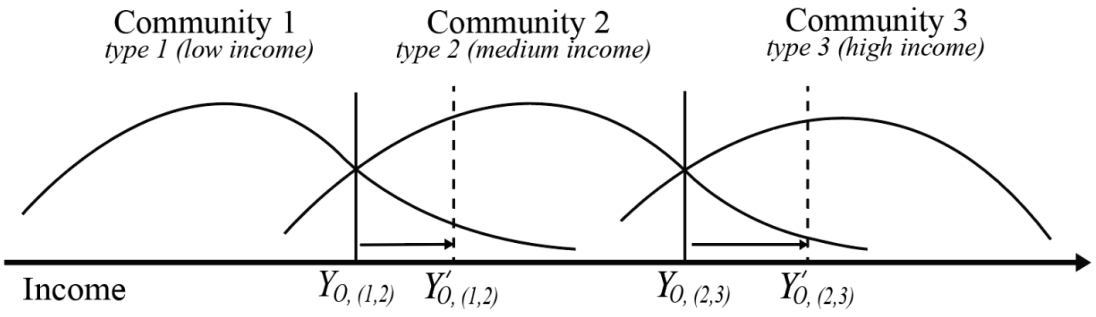


**Figure 2.a: displacement among <u>owners</u>**

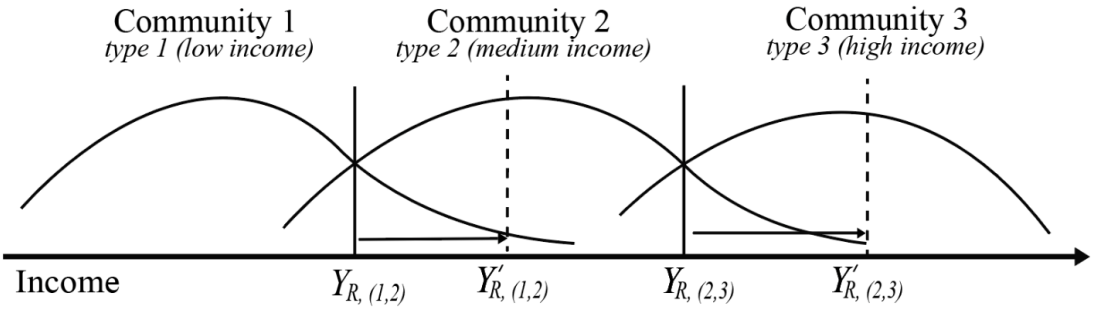


**Figure 2.b: displacement among <u>renters</u>**

As Community 2 improves – that is, amenities improve, or tastes shift to prefer the amenities already provided in Community 2 – those who were formerly indifferent between Community 2 and Community 3 will now prefer Community 2. The boundary incomes shift right, from $Y_{O,(2,3)}$ to $Y'_{O,(2,3)}$ for owners and $Y_{R,(2,3)}$ to $Y'_{R,(2,3)}$ for renters. Those who originally preferred Community 2 will still prefer this community, however, there will be a new, wealthier wave of households who also prefer Community 2, increasing the demand for housing and increasing home values and rents, assuming no new housing is built to meet this demand. These increased costs will impact the utilities of type 2 residents, and those who were formerly indifferent between Community 2 and Community 1 will now prefer Community 1. The boundary income between Communities 1 and 2 will shift from $Y_{O,(1,2)}$ to $Y'_{O,(1,2)}$ for owners and $Y_{R,(1,2)}$ to $Y'_{R,(1,2)}$ for renters. Those who have incomes between the old and new boundary incomes will therefore be displaced into the lower order community. We expect that the boundary income for renters will shift more to the right than for owners, as homeowners benefit from increased housing prices and are therefore less likely to be displaced, while renters do not benefit from capital gains and therefore have less reason to remain in their appreciating neighborhood.

The theory here would suggest that the influx of wealthier residents will push low-income residents, specifically renters, out of their original neighborhoods and into worse communities with fewer amenities. The following analysis empirically test this theory for Durham, breaking it into two parts: first, is it true that increasing home values disproportionately displace renters? And second, is it the case that those pushed out of their original neighborhoods are forced into lower-order communities with worse amenities? These questions will be addressed for Durham in the following sections. This model fits Durham well, as the influx of

wealthier residents has decreased vacancy throughout the county and challenged the city to increase its stock of housing. As the city struggles to meet increased demand, housing prices and rents have risen considerably, as previously discussed.

## V. Data

*Discussion of Data Sources and Cleaning*

The primary source of data for this study is provided by InfoUSA, a research company that compiles proprietary market data and resells it to large corporations for market research and strategy. Unlike the data used past studies on displacement like Schill et al. (1983) and Newman and Wyly (2006), InfoUSA provides longitudinal data on each household in the United States for every year from 2006 until 2017. These households are provided a unique family ID, allowing for the exact tracking of their movements over the 12-year timespan. Furthermore, the dataset contains detailed information on household characteristics (length of residence, number of children, ethnicity, marital status, etc.), household location (latitude and longitude, census block group, address, etc.), and the household's socioeconomic standing (estimated income, estimated home value, estimated wealth, purchasing power, etc.). [4] The dataset contains data for every zip code in the United States, but I only look to Durham's zip codes: {27701, 27702, 27703, 27704, 27705, 27706, 27707, 27709, 27712, 27713, 27715, 27717}. For the purpose of this analysis, all data before 2010 are dropped. This is for a few reasons: first, housing price appreciation rates are among the two most important independent variables in my analysis. As such, the largescale

[4] Additionally, InfoUSA contains an "age code" variable, which provides estimates for the age of the head of household. These values are coded A through M, with A meaning the head of household is younger than 25, B meaning they are between 25 and 30 years old, and so on until M, which implies 75 or older. I convert these values into binary variables. For example, any datapoint coded A will take the value one for my variable "Head Household Age < 25" and zero otherwise.

price fluctuations that occurred during the 2008 housing crisis would dramatically skew my results. Second, my theoretical framework is largely built around the recovery effort. Following the depression, investors began to purchase undervalued homes, reselling them for profit and accelerating the rate of gentrification in low-income communities (Hartly et al., 2014). This fits with the discussion of the bid-rent curve, as it constitutes a shift from the actual price of housing to the equilibrium theoretical price (Figure 1.b). Third and finally, my data reveals that housing prices hit their lowest point in 2010, following which they began to rise steadily. Therefore, the period between 2010 and 2017 will work best when conducting my analysis. After appending together all the data by year and zip code, this eight-year period provides 1,084,818 datapoints for 337,475 unique households throughout Durham.

Not all of these datapoints are viable for my analysis, and some cleaning and editing is required. First, I remove all data outside the city of Durham, as my theoretical framework primarily looks to urban spaces and amenity distributions in cities. Next, I remove individuals identified as living in nursing homes, retirement homes, trailers, or undefined units from the dataset, as these living arrangements do not constitute an active choice by the head of the household but rather a forced housing decision on their behalf, thus not fitting in my theoretical model of neighborhood selection based on maximizing utility. Lastly, I remove all households marked as vacant properties. This leaves 1,002,729 datapoints for 311,622 unique households.

Next, I correct the geo-IDs in the dataset. Often, InfoUSA either omits or fails to properly record census block group identifiers for each household. This is important because my entire analysis takes place on the block group level; each block group roughly contain between 600 to 3,000 individuals, thus approximately modeling the size of a small neighborhood or community. To fix this, I recode these identifiers through GIS using each household's latitude and longitude.

If a datapoint lacks any sort of location identifier – address, latitude/longitude, census block group or otherwise – then this value is dropped. This leaves 999,847 datapoints for 310,893 unique households.

Using InfoUSA's *owner/renter status* variable, I make a determination on how best to identify homeowners and renters. This variable does not definitively state whether a household owns or rents their domicile; rather, the variable estimates it on a scale from 0-9, with 0 representing confirmed renters, 1-3 meaning likely renters, 4-6 meaning no determination can be made, 7-8 meaning likely home owners, and 9 meaning confirmed home owners. Given the importance of distinguishing between owners and renters in this study, this lack of a clear distinction between the two groups complicates my analysis. I created a new binary variable, *renter*, which equals one if *owner/renter status* is 0-3 and zero if *owner/renter status* equals 7-9; I then remove all households with values 4-6 to remove potential ambiguity.[5,6] With these datapoints removed, there are 791,409 datapoints remaining for 251,650 unique households, all of which are spread over 148 block groups in Durham. From here, I generate a new variable, *moved*, which equals one if a household is shown to have moved from one block group to another in a given year and zero if they do not move. Of the remaining households, 18,227 were

[5] Even considering this lack of clarity, changes to the definition of a renter yield similar results to those presented in Appendix A. When renters are only defined as 0 and homeowners 9, removing all ambiguity from the definitions, the data yields a similar outcome, albeit with less statistically significant coefficients. Furthermore, splitting the scale in half – that is, defining renters as 0-4 and owners as 5-9, again produces a similar conclusion. These results could not be shared given the page restriction. More work should be done in the future with the InfoUSA dataset to confirm using census data exactly who the owners and renters are to produce more accurate results.

[6] Similarly, the *marital status* variable included in InfoUSA is not binary. Rather, it is a 0-9 scale. However, this is less concerning, as InfoUSA is less ambiguous about the distinctions. Here, 0 indicates the household is confirmed single, with values 1-4 meaning they were deduced to be single through their model. Values 5-8 mean a household is married according to their model, with 9 meaning they are confirmed married by marriage certificate. I generate a new variable, *married*, which takes the value zero if *marital status* is equal to 0-4, and equal to one if *marital status* takes the value 5-9.

shown to have moved at one point between 2010 and 2017, with some households moving more than once in that period.

While the InfoUSA dataset provides data on individual home values and appreciation rates, these values are self-reported by each household, potentially biasing the data and making it unreliable. This is particularly consequential, as appreciation rates are critical to my analysis. For this reason, I utilize the CoreLogic dataset in addition to InfoUSA. CoreLogic is better equipped to report home values, as it reports sales transactions data as opposed to self-reported estimates. This data is used to calculate average home values and home value appreciation rates per census block group. Just as with the InfoUSA data, I generated block group identifiers for each observation in the CoreLogic dataset through GIS using their corresponding latitude and longitude values. Next, I remove all values in the dataset under $1,000, as often times family members will sell property to their relatives at low prices just to pass ownership, thus not truly reflecting the property's value. Then, I generate a new variable, *CoreLogic Percent Increase*, which reflects the year-to-year percentage change in average home values by census block group; this variable is one of my most important independent variables. The CoreLogic dataset does not include data on rents; however, Wang et al. (2018) calculates the correlation between the CoreLogic housing appreciation rates and census reports of rent appreciation to be 0.6, commenting that the CoreLogic dataset is a good proxy for estimating the impact gentrification has on renters.

To account for neighborhood amenities and the housing decisions made by families apart from just prices, I consider four additional amenities: air pollution, crime rates, school quality,

and poverty rates.[7] To measure neighborhood pollution, I look to the EPA's Risk-Screening Environmental Indicators (RSEI) dataset, which provides air toxicity concentration rates by census block group. One limitation of the RSEI data is that it only provides data from 2010 to 2014. However, given that air-toxicity rates are usually steady, and that Durham has not had any major event impacting the overall toxicity of the city, this is not a concern. As such, the 2015, 2016, and 2017 values are set to equal the mean value of air toxicity between 2010 and 2014 per block group.

For crime, I use publicly available data from the Durham Neighborhood Compass which compiles information from the Durham Sheriff's Department on property, drug, and violent crimes committed in each census block group. These values are divided by the size of each block group to create a measure of crimes committed per square mile. One caveat here is that the Sheriff's data provides information on criminal charges, not formal incidents following adjudication. As such, some police stations may be stricter and charge locals more often even if the result of these charges is acquittal. This data on violent, drug, and property related crimes will be used as a proxy for the overall safety of a neighborhood.[8] Just as with the RSEI dataset, the Durham Sheriff's Department's data only runs until 2016, and so the 2017 values are set to equal the mean value of 2010 through 2016.

For school quality, I use publicly available data from the Durham Public School System, providing a school quality rate for each elementary school in Durham based on grade-level

[7] These are not the only amenities that could be analyzed. Factors such as nightlife, proximity to parks and recreation, and the aesthetic of neighborhoods are amenities that people value and that influence housing decisions. However, the ones selected for here tend to be the amenities that people consider most important, as factors such as safety and schooling are often families' first consideration when determining where to move.

[8] The Durham Neighborhood Compass is a nonprofit collecting data for Durham county and displaying it graphically to inform public discourse and policy. More here: https://compass.durhamnc.gov/#P_SQM/blockgroup/.

proficiency. Using GIS shapefiles from Durham Open Data, each of the 251,650 households is paired with its nearest three elementary schools as well as the school it is assigned to by catchment zone.[9] Given Durham's high number of magnet schools, an average of the three nearest elementary schools acts as a better proxy for overall school quality than a household's school assignment by catchment zone. In addition to these datasets, five-year estimates from the Census's American Community Survey are used to provide block group information on total population, the proportion of college educated individuals in each community, and the proportion of those living in poverty per block group, among other factors.

These datasets – RSEI, Durham Sheriff Department, Durham Public School, and American Community Survey – are all merged by census block group to the original InfoUSA dataset. The sum of these datasets and proxies gives a rough overview of each household in Durham and the health of their community. Before conducting my analysis, I generate six variables – *School Quality Difference*, *Pollution Difference*, *Violent Crime Difference*, *Property Crime Difference*, *Drug Crime Difference*, and *Poverty Difference* – which compare every household's neighborhood quality to the year before. If, for example, pollution in a neighborhood goes up, we would expect the *Pollution Difference* variable to be positive for that year. If a household moves, we would expect these variables to convey the difference in amenities between their old and new neighborhoods for that year. These variables will act as the dependent variables when assessing the changes in neighborhood conditions.

[9] Durham Open Data is a website created by the Durham government that provides access to city GIS shapefiles such as school catchment zones, city boundaries, and landmarks of interests. More here: http://gis-durhamnc.opendata.arcgis.com/.

*Summary Statistics*

Primarily utilizing the cleaned InfoUSA dataset, Table 1 provides descriptive statistics for homeowners in Durham. There are a few points worth highlighting from this table. First, 49.3% of the households studied are or were at some point renters. Studying renter households is particularly insightful for this thesis, as their actions following gentrification will help determine whether displacement is occurring, as will be discussed further in the empirical specifications. Second, the plurality of households in this dataset are black, followed then by white households, Hispanic, and Asian.[10] Third, renters have a far smaller length of residency mean than homeowners, meaning they are more prone to moving. Fourth, it is worth noting that the wealth estimates for Durham households are unreasonably large. InfoUSA reports that the poorest household in Durham has total assets of roughly $126,000, and the median such household has $1,860,000, which defies any sort of reasoning. And while an accurate wealth measurement could be a powerful indicator of how gentrification impacts households of different means in Durham, this variable will be ignored in favor of the income estimates, which are more accurately reported. InfoUSA shows that the median household income in Durham is roughly $54,000, which is not far off the $56,000 census estimate. Lastly, between 2010 and 2017 only ~7% of all households in Durham were reported to have moved from their original residency. In

[10] Another limitation of the InfoUSA dataset is its treatment of race. Rather than providing a race identifier, it provides ethnicity codes. There are roughly 150 codes, each one of which had to be manually converted to its corresponding race. For example, if a household was coded as "NG", this corresponds in the codebook to Nigerian, which I would then code as black in my race identifier. However, there are areas of ambiguity. For example, households coded as South African are not necessarily black or white. At times I had to make assumptions on the relationship between race and ethnicity, and this potentially detracts from my findings. Another such concern is that the proportion of Hispanic households seems unreasonably low for Durham. The census reports that the actual rate is roughly 14%, whereas InfoUSA reports only 5.2%. This may be the result of faulty data or perhaps my own error when converting ethnicity to race. Furthermore, many households are missing ethnicity codes for some years – this is an easy fix, as I just set those missing values equal to the codes from earlier years – and some households were never given codes. This prevalence of missing values is another limitation of the dataset.

general, the potential shortcomings of the dataset are outweighed by its strengths, as the ability to track households by time and location is invaluable in the study on gentrification and displacement.[11] In 2010, InfoUSA reports that 89,224 households lived in the city of Durham. By 2017, there were 121,337. All in all, 251,650 unique households lived in Durham over the eight-year period of study.

Table 1: Summary Statistics of Durham Households

| | (1) Mean | (2) Median | (3) Std. Dev | (4) Min | (5) Max |
|---|---|---|---|---|---|
| Income (x1,000) | 70.99 | 54 | 65.35 | 5 | 500 |
| Total Wealth (x1,000) | 1838.44 | 1860 | 850.94 | 128 | 8867 |
| Married | .300 | 0 | .483 | 0 | 1 |
| Has Children | .165 | 0 | .381 | 0 | 1 |
| Number of Children | 1.30 | 1 | 1.03 | 0 | 7 |
| Moved | 0.073 | 0 | .158 | 0 | 1 |
| White | .288 | 0 | .412 | 0 | 1 |
| Black | .449 | 0 | .498 | 0 | 1 |
| Hispanic | .052 | 0 | .226 | 0 | 1 |
| Asian | .038 | 0 | .170 | 0 | 1 |
| Renter | .493 | 0 | .457 | 0 | 1 |
| Length of Residence (renters) | 3.39 | 11 | 3.90 | 1 | 52 |
| Length of Residence (owners) | 13.93 | 2 | 11.23 | 1 | 58 |
| Observations | 251,650 | | | | |

As per the CoreLogic dataset, Table 2 reveals that housing values in Durham increased significantly. Between 2010 and 2017, the 148 block groups in Durham experienced an average housing appreciation rate of 29%. 37 block groups saw values drop, with the most severe case being a 67% reduction in home values, and two block groups experienced no increase in home values whatsoever. The remaining 114 block groups all experienced considerable increases in prices, as 37 such block groups saw home values increase by 50% or more, and 16 block groups

[11] While the InfoUSA dataset is a powerful tool for analysis, it also contains missing data that would be valuable for future analysis. At times, household characteristic data for random years is omitted. For example, a household will have data for 2012 and 2016, and the length of residency variable in 2016 will reveal that they did not move in that timeframe; however, in 2015 they may have a missing value for their length of residency. Omitted datapoints are infrequent, but it is worth noting for future analysis.

had home values more than double; the most extreme such case resulted in a 238% increase in average home values over the eight-year span.

Table 2: Summary Statistics on Gentrification in Durham

| | (1) Mean | (2) Median | (3) Std. Dev | (4) Min | (5) Max |
|---|---|---|---|---|---|
| Home Value Appreciation | 0.292 | 0.149 | 0.502 | -0.627 | 2.38 |
| Observations | 148 | | | | |

Lastly, as per the Sheriff's Department, Public School, RSEI, and ACS datasets, Table 3 below demonstrates changes in neighborhood amenities for households that moved between 2010 and 2017. The 20,328 total moves of 18,277 unique households indicate that movers in Durham tend to move into neighborhoods with higher home values, less crime, less toxicity, better schools, and lower poverty rates.[12] Naturally, this is a considerable generalization. The large standard deviations demonstrate that not all movers transition into all around healthier communities. In the following analyses, this reality will be tested for high- and low-income households as well for renters and homeowners.

Table 3: Changes in Amenities for Movers

| | (1) Mean | (2) Median | (3) Std. Dev | (4) Min | (5) Max |
|---|---|---|---|---|---|
| Percentage Change in Home Value | .233 | 0.052 | .779 | -.917 | 10.95 |
| Change in Property Crime | -20.25 | -19.81 | 207.28 | -1009.28 | 952.77 |
| Change in Drug Crime | -5.17 | 45.82 | -1.01 | -429.47 | 429.17 |
| Change in Violent Crime | -3.65 | -2.79 | 71.84 | -400.84 | 402.10 |
| Change in Air Toxicity | -65.43 | -8.70 | 1129.14 | -8141.18 | 8133.70 |
| Change in School Quality | .663 | 0.00 | 12.34 | -46.8 | 47.57 |
| Change in Poverty Rate | -.020 | -0.020 | .186 | -.811 | .756 |
| Observations | 20,328 | | | | |

[12] It is worth noting that 20,328 is not the total number of moves over the eight-year span. Rather, it is the number of moves from one block group to another in the city of Durham. Future studies should also track households moving in and out of the city. It would be interesting to see whether households are made worse off following a move out of the city, or if leaving Durham increases a family's wellbeing. Furthermore, future studies should also account for moves within block groups, as they can also be consequential.

## VI. Empirical Specifications

*Specifications of Displacement Model*

For the empirical analysis, this study is broken up into two components: first, I assess whether there is a link between gentrification and displacement. Second, I analyze whether those displaced by gentrification are pushed into worse conditions. To begin, I create a measure of gentrification. Using the CoreLogic dataset, I generate a continuous variable of housing appreciation rates by census block group per year. This variable is calculated for neighborhood $j$ using the following equation:[13]

$$gent_j = \frac{P_{t+1} - P_t}{P_t} \tag{4}$$

Here, $P_t$ reflects the average price of housing in a given block group in year $t$, and $gent_j$ measures the percentage change in household values between years $t$ and $t+1$. With this measure of gentrification, I utilize a probit model in conjunction with the merged InfoUSA dataset to determine whether there is a link between gentrification and displacement and which groups are most vulnerable. A probit model is most appropriate here given that my dependent variable is binary.[14] The regression for household $i$ is specified as:

[13] Changes in property values are my primary measure of gentrification. However, in addition to housing appreciation rates and to check for robustness, the same specifications were run using the change in the college educated population of a given block group as my measure of gentrification (Brummet & Reid, 2018). This is calculated as: $gent_j = \frac{bachelors_{t+1} - bachelors_t}{population_t}$. $bachelors_t$ is the population of college-educated individuals living in a census block group in year $t$, and $gent_j$ reflects the change in the population of college educated people year-to-year. While this measure yielded comparable results, the coefficients were found to be less significant. This could be in part because of the data, which was taken from the American Community Survey's five-year estimates. These estimates take averages of the past five years, potentially decreasing the amount of year-to-year variance and resulting in less significant coefficients. This may also be because my bachelors data only runs from 2013-2017, thus limiting the variance over time. These results are shared in Appendix B.

[14] There are two reasons why I chose a probit as opposed to a logit model. First, the literature on gentrification and displacement generally uses the probit model, as it is easier to contextualize and interpret the results. Second, probit

$$moved_{ij} = \beta_0 + \beta_1 gent_j + \beta_2 renter_i + \beta_3 gent_j \times renter_i + \beta_4 X'_i + \beta_5 control_1 + \beta_6 control_2 + \cdots + \epsilon_{ij} \quad (5)$$

$X'_i$ is a vector of household individual characteristics, including the number of children in a household, marriage status, race, length of residency, and the age of the head of the household. $renter_i$ is a binary variable marking whether the household owns their house or rents. $\beta_0$ through $\beta_5$ are the coefficients. The key variable of interest is the interaction term between $gent_j$ and $renter_i$. My neighborhood selection theory on gentrification would suggest that renters are more likely to be displaced following an increase in property values, as they are unable to benefit from capital gains and are subject to more immediate tradeoffs. If the results show that renters are more likely to move following gentrification, then this would suggest that gentrification and displacement are firmly linked. However, if there is no significant difference between owners and renters, then the link between gentrification and displacement is likely tenuous at best.

In previous literature, displacement is understood to be the exit of low-income populations. However, it is difficult to discern this impact looking at the data at a macro-level, as there is both an income and substitution effect resulting from gentrification. As property values increase, low-income individuals may be displaced because they cannot afford these increased prices, while high-income individuals may move because they see an opportunity to sell their house or rent it out for profit. As such, the probit model is run by income quartile, analyzing the

models avoid the issue of the Independence of Irrelevant Alternatives. Regardless of these differences, conducting my analysis using a logit model largely yields the same results and the same degree of statistical significance. There is ultimately little difference between the models.

link between gentrification and displacement for four different income groups in Durham.[15] According to InfoUSA's estimates of income, the bottom 25% of the income distribution in Durham are those households making $20,000 of less per year, with $48,000 being the 50% cutoff, and $92,000 being the 75% cutoff. It is worth noting that the InfoUSA dataset does not note all household incomes exactly. If a household is making $5,000 or less a year, then the value is reported as $5,000; similarly, if a household makes $500,000 or more, that value is only counted as $500,000. As such, the tails of the distribution may not be skewed enough. However, given that the values reported by InfoUSA roughly match census estimates, they are reliable measures for distinguishing between income quartiles.

Given the model specifications and corresponding theory, we would expect the following results: first, the coefficient for the interaction term between renter status and home value appreciation rate ($\beta_3$) should be positive and statistically significant for low-income households, indicating that these households are more vulnerable to displacement. As households get wealthier, renters should become less vulnerable to displacement, and the coefficient will likely decrease in value or become statistically insignificant. Second, the coefficients for housing value appreciation alone ($\beta_1$) will likely be statistically significant and negative for low-income homeowners, as those living in neighborhoods with increasing home values will likely not move, instead staying to reap the benefits of their newfound wealth. The effect on wealthier households is less clear, as they may either move to immediately reap the benefits of increased home values or stay to benefit from those values in the future.

[15] Ideally this analysis would be run by wealth quartile as opposed to income, as the wealth divide is much more expansive than the income divide in the United States (Shularick & Kuhn, 2017). However, given the unreliable nature of InfoUSA's wealth estimates, I opt instead to use income quartiles.

*Specifications of Amenity Choice Model*

Following the determination of a link between gentrification and displacement, I then analyze how individuals are impacted following their displacement and what housing choices they make. Whereas the first analysis uses data for every households in the city of Durham, the second analysis looks only to households that have moved over the eight-year period. I use a seemingly unrelated regression, as changes in amenities are often correlated with one another, meaning the error terms for each regression are correlated. Following displacement, we would expect a low-income household to move into a neighborhood with worse amenities; however, some households will opt for amenities of one kind at the expense of another, for example trading off worse pollution rates for better school quality, thus correlating the independent variables.[16] Running the system of equations as a seemingly unrelated regression will account for this correlation. Furthermore, I run the regression for low- and high- income groups, analyzing the bottom and top 50% of incomes separately. The bottom 50% of households had 12,096 moves for 10,906 unique households. For top 50%, there were 8,232 moves for 7,881 households. The model is specified as:

[16] The full list of correlations between independent variables is available in Appendix A, Table 5.

$$\begin{cases} C(h) = \theta_{1,0} + \alpha_1 gent_j + \beta_1 renter_i + \gamma_1 gent_j \times renter_i + X'_i\theta_{1,0} + \epsilon_{1,i} \\ C(p) = \theta_{2,0} + \alpha_2 gent_j + \beta_2 renter_i + \gamma_2 gent_j \times renter_i + X'_i\theta_{2,0} + \epsilon_{2,i} \\ C(s) = \theta_{3,0} + \alpha_3 gent_j + \beta_3 renter_i + \gamma_3 gent_j \times renter_i + X'_i\theta_{3,0} + \epsilon_{3,i} \\ C(c) = \theta_{4,0} + \alpha_4 gent_j + \beta_4 renter_i + \gamma_4 gent_j \times renter_i + X'_i\theta_{4,0} + \epsilon_{4,i} \\ C(v) = \theta_{5,0} + \alpha_5 gent_j + \beta_5 renter_i + \gamma_5 gent_j \times renter_i + X'_i\theta_{5,0} + \epsilon_{5,i} \end{cases} \quad (6)$$

$C(h)$ represents the change in housing price, $C(p)$ represents the change in air toxicity, $C(s)$ measures the change in elementary school proficiency of the nearest three schools, $C(c)$ is the change in crime, measured using drug, property, and violent crimes, and $C(v)$ is the change in the poverty rate.

We would expect the coefficient on the interaction term between gentrification and renter status ($\gamma_1$) be negative for housing price changes for low-income households, as displaced renters will likely struggle to pay moving fees and settle into less valuable housing. We expect the coefficients $\gamma_2$, $\gamma_4$, and $\gamma_5$ be positive for low-income renters, as increased costs will likely push them into neighborhoods with higher rates of pollution, worse all-around crime, and higher rates of community poverty. Lastly, we would expect the value $\gamma_3$ to be negative, as these displaced renters will likely move into lower-order communities with worse overall school quality. And while some households may trade off certain amenities for others subject to their preferences (that is to say, household A may prioritize moving into a community with better schools and worse crime, while household B may choose less crime at the expense of higher pollution), in general we would expect these results to hold for low-income renters.

## VII. Results and Discussion

*Linking Gentrification and Displacement*

The results of the probit model are shown in Table 4 below. Column 1 of the table depicts regression output for the bottom 25% of earners in Durham, with columns 2, 3, and 4 representing the following three quartiles. For the bottom 75% of the income distribution in Durham, the results are consistent with the theory: there is a significant link between gentrification and displacement. That is to say, low-income renters in gentrifying neighborhoods are significantly more likely to be displaced than low-income homeowners. For low-income homeowners, housing appreciation by itself is shown to decrease movement, as households stay in their communities to benefit from this newfound wealth. In addition, there are a few at-risk groups worth highlighting. For the bottom 50% of the income distribution, black households are shown to significantly more likely to move. The coefficients for Hispanic households are at times positive and negative, and they are largely insignificant, likely a result of InfoUSA's inaccurate ethnicity indicator. Asian households are shown to be less likely to move generally. Those with children are shown to move more often, as it is may be difficult to manage both childcare costs and high housing prices, or perhaps because families with children move to find communities with better schools or larger houses. The number of children is shown to be statistically insignificant, meaning the presence of children generally increases the odds of displacement.[17] Married households, too, are shown to be significantly more likely to move regardless of income quartile, likely due to the added benefit of having a combined income and a desire to move into larger spaces, or perhaps because one income must now cover the expenses

[17] Desmond (2016) finds a similar result, writing that households with children, specifically renters, are more likely to be displaced in part because of child care costs, and in part because these families are more likely to be evicted by landlords.

of two individuals. Those who lived in a household for longer are less likely to move, potentially because they would prefer not to move away from their family homes.

Table 4: Probit Results by Income Quintile

| | (1) 0%-25% | (2) 25%-50% | (3) 50%-75% | (4) 75%-100% |
|---|---|---|---|---|
| Moved | | | | |
| Renter | 0.0567* | -0.0171 | -0.157*** | -0.175** |
| Housing Appreciation | -0.543*** | -0.106** | 0.531*** | 1.678*** |
| Renter × Housing Appreciation | 0.821*** | 1.078*** | 0.978*** | 0.00203 |
| Length of Residence | -0.134*** | -0.112*** | -0.121*** | -0.173*** |
| Children | 0.302*** | 0.160*** | 0.119*** | 0.0471 |
| Married | 0.301*** | 0.201*** | 0.130*** | 0.105*** |
| Black | 0.133*** | 0.0835*** | 0.0510*** | 0.0406* |
| Latinx | -0.0339 | -0.0812** | -0.0635 | -0.0211 |
| Asian | -0.0773* | -0.115** | -0.163*** | -0.142*** |
| Constant | -1.878*** | -1.711*** | -1.589*** | -1.503*** |
| Observations | 187215 | 179306 | 198276 | 226584 |
| Pseudo R2 | 0.1105 | 0.1722 | 0.1988 | 0.3234 |
| LR chi2(24) | 6457.03 | 8225.94 | 8192.85 | 12911.61 |
| Prob >chi2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

$t$ statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Shown in Appendix A, Table 1, families with a younger head of household are generally less likely to move than older households. This makes sense, considering that displacement is understood to be the influx of younger, better educated individuals entering older communities. These results largely corroborate the findings of Atkinson (2000), Wyly et al. (2010), and Brummet and Reid (2018), among others. The coefficients themselves are shown to be jointly significant by a chi-squared test.

The results presented in Table 4 are mostly intuitive considering the logic of the model. Even for households in the bottom 25% of the income distribution, the benefits of gentrification are clear: increased property values, improved amenities, and general increases in neighborhood wellbeing make a community a better place to live for those who can afford it. As such, homeowners who directly benefit from these capital gains and are willing to deal with increased property taxes are very likely to stay in a gentrifying community. However, among the 50%-100% income percentiles, increased housing values result in a statistically significant rate of

moving. Given that these populations are likely not constrained to their neighborhoods and have more financial freedom, their movements from one neighborhood to another are not necessarily the result of forced displacement. In addition, there is an income effect to consider, where wealthier households will move to a new neighborhood to realize the profits of their appreciated home values or to rent out their old domicile (Wang et al., 2018). However, for renters the picture is much clearer: staying in a gentrifying neighborhood yields the benefits of improves amenities, but at the expense of increased rents and a higher cost of living, none of which translate to personal wealth. As such, their rate of displacement is higher than that of homeowners.

*Changes in Neighborhood Conditions*

With the knowledge that there is a strong link between gentrification and displacement in Durham, I analyze how this displacement impacts the amenity choices of movers. The theory on displacement would suggest that following a move, homeowners are more likely to end up in better conditions, as they are able to realize the benefits of gentrification, selling off their old homes in favor of new domiciles in comparable or healthier neighborhoods. The opposite is suggested for renters, who are pushed from their old communities into worse conditions, given they incur the costs of moving without any benefits from the capital gains of selling their homes. To measure welfare, I look to changes in crime, school quality, pollution, and poverty rates between movers' old and new communities.

The changes in amenities are shown in Appendix A, Table 3, which details the results of the seemingly unrelated regression for the bottom 50% of earners in Durham. Appendix A, Table

4 shows these results for the top 50% of earners. There are a few major takeaways from these results: first, as shown in the first row of Appendix A, Table 3, homeowners moving from gentrifying neighborhoods generally move to communities with increased home values, lower crime, and lower rates of poverty, especially if the rate of home value appreciation is higher in their original community. This makes sense, as homeowners moving from wealthier communities can sell their homes, moving to higher order neighborhoods with these newfound profits. However, the results do not perfectly reflect the theory, as these homeowners are also shown to move into communities with some worse amenities. Looking to school quality, low-income homeowners from gentrifying communities are shown to move into neighborhoods with worse schools. For example, if a household moves from a neighborhood with a 30% increase in average property values, the model would predict $C(s) = -10.09 + 6.971\ (0.3) = -8.00$, constituting a net decrease in school quality. This does not neatly fit the theory; however, it does speak to how these low-income homeowners make tradeoffs. These households tend to prioritize moving into communities with lower rates of poverty and crime, even if it means living near worse schools, as safety may be more of a priority for them and their families. As shown in Appendix A, Table 4, this tradeoff is less apparent for higher-income homeowners, as they tend to choose communities with all-around better amenities. Looking to changes in pollution, my results suggest that homeowners moving from gentrifying neighborhoods are selecting more polluted communities. While this initially appears to be a faulty outcome, it makes sense upon further thought. Homeowners leaving their original communities may choose to move to newer neighborhoods downtown, as these areas may have better all-around amenities. However, living downtown could result in increased exposure to air toxicity, even if that exposure is seemingly

negligible.[18] With some exceptions, we see low-income homeowners moving from gentrifying communities choosing neighborhoods with mostly better amenities.

Second, my results show that low-income renters moving from gentrifying neighborhoods consistently move to communities with worse amenities than homeowners. This is demonstrated in the third row of Appendix A, Table 3. The interaction term between housing appreciation and renter status shows that renters from gentrifying neighborhoods generally move into cheaper homes in communities with higher rates of crime, higher rates of poverty, and worse schools than homeowners; this is the case for both low- and high-income renters. Ignoring pollution, these coefficients are all statistically significant. It is important to recognize that this is not necessarily an absolute change in amenities, but rather a relative position to homeowners. While these households are often shown to move into communities with worse amenities, this is not always the case, as it is contingent on the rate of housing appreciation in their original neighborhoods. However, that these renters are shown to consistently move into relatively worse conditions than their homeowning counterparts demonstrates the inequitable nature of displacement on a household's amenity choices.[19] These results mostly corroborate the findings of Wang et al. (2018) and Newman and Wyly (2006). Vigdor (2002) is also partially corroborated, as my results do show improvements in some select amenities depending on the degree to which the original neighborhoods were gentrifying. Unlike these studies, my contribution shows that households are likely pushed into communities with increased rates of

[18] The pollution proxy is taken from Wang et al. (2018), which explores gentrification and displacement in Los Angeles County. L.A. has long suffered from high degrees of air toxicity. This pollution significantly influences which neighborhoods families choose to live in. Durham, however, has not struggled from a pollution problem in the same way, and the air toxicity that exists in the city is likely minimal. As such, this proxy may not have been proper for analyzing Durham, as this city differs considerably in its distribution of amenities from Los Angeles.

[19] These coefficients, too, show pollution to be decreasing for renting households, which is explained in footnote 18.

poverty, which is particularly consequential given how neighborhood poverty rates negatively impact children's long run educational outcomes (Chetty et al., 2016).

The results of this seemingly unrelated regression are difficult to generalize for groups other than renters. Low-income black households are shown to be at risk of some worse amenities (worse schools, lower home values, and increased violent crime) but not others (decreased drug and property crime, lower poverty, and decreased pollution). Low-income households with children are shown to move into communities with higher rates of most crimes, higher poverty, and worse schools, potentially because it is difficult to balance the costs of childcare with neighborhood amenities. Married households, too, are shown to move into neighborhoods with all around worse amenities, potentially because some of these households rely on one income to cover two individuals.[20] However, given the statistical insignificance of most of these values, it is difficult to make sweeping claims about these groups and their movements in Durham to the same degree as I do with renters. The coefficients are shown to be jointly significant through a chi-squared test.

*Policy Implications*

A city cannot prosper without investment and development, and the city of Durham fully recognizes this. The local government has taken steps in recent years to reshape its economy and attract new investment, taking the form of million-dollar apartments in looming new high rises, and historic tax credits to incentivize the redevelopment on longstanding communities. Indeed,

[20] It is also worth considering that this marriage outcome may be inaccurate, as InfoUSA never gives a binary marriage variable, instead opting for a 0-9 scale that I personally split for the purpose of this analysis. Perhaps this ambiguity skewed the results.

this gentrification is not a wholly bad phenomenon, as it carries with it new development that can empower cities and promote long-run stability. However, despite these long-run benefits, it is vital for cities to consider the short-run implications of this rapid growth. As demonstrated in the results section, many residents in Durham have struggled to keep up with the tide of gentrification, subjecting them to increased risk of displacement and pushing them into communities with worse overall amenities. Specifically, low-income renters, households with children, black households, and older households were found to be at risk of displacement.

In recent years, policy makers have proposed a few different solutions to curb the harms of gentrification. First, some have opted for policies of inclusionary zoning, meaning developers must set aside a certain portion of their housing to be affordable or pay a fee to subsidize other affordable housing projects (Mock, 2016). Second, governments have sought to expand housing, both affordable units and luxury condominiums, thereby sorting wealthier residents into newer units to prevent the displacement of lower-income households. Third, voucher programs have been explored whereby low-income residents are allowed to stay in their original apartments by paying only 30% of their income towards housing, the rest of which is then subsidized by the government (Desmond, 2016). Fourth, governments can incentivize ownership by providing subsidies to low-income renters so they can purchase their homes at a lower price and reap the benefits of gentrification (Wang et al., 2018). Lastly, governments may seek to not address displacement itself, but rather the conditions following displacement by investing in struggling communities, improving school districts, and lowering crime. There is no one blueprint for how cities should proceed; however, if Durham is to tackle these issues in the coming years, it must directly target those groups most at risk of displacement, specifically renters, ensuring that they are not pushed into less healthy neighborhoods.

*Future Research*

This thesis has a few notable limitations. First, InfoUSA has many variables that are either faulty or omitted. The race indicator, while comprehensive for other cities, leaves much to be desired in Durham. As such, it is difficult to fully determine whether other communities – Hispanic, Middle Easterner, Asian, or otherwise – are at risk. Furthermore, there are a number of other factors excluded from this study that would likely further inform local policy. Demographics such as education level, occupation, and exact age values would help determine other groups that are at risk of displacement. Second, this analysis uses the percentage change in average block group housing prices as its primary measure of gentrification. While this continuous variable is established in the literature, it is not the only measure of gentrification. Future studies should look to other definitions of gentrification. Specifically, creating three-year averages of price changes, lagging price variables, and looking to other measures such as demographic changes or the proportion of rent-burdened households could increase the legitimacy of this study by demonstrating robustness in its findings.[21] Third, studies should assess both pecuniary and non-pecuniary costs. This study looks to measurable costs: moving fees, decreases in amenities, and monthly rents, to name a few. However, I do not assess non-pecuniary costs, like how a household's utility changes when they're forced to move away from their family, or how families are hurt when they lose their social networks. Understanding non-pecuniary phenomena such as social cohesion and neighborhood organization is imperative if policymakers hope to create effective and regionally sensitive policies. Lastly, one of the

[21] As stated in footnote 13, this study did conduct analyses using education as the measure of gentrification. Furthermore, I attempted to use lagged prices and three-year averages. However, given the eight-year size of my data, lagging variables considerably decreased my sample size, resulting in insignificant values and omitted results. As such, future studies should use potentially larger datasets to see how long-standing shifts in prices influence housing decisions.

primary shortcomings of the probit model is its inability to account for endogeneity. It is difficult to discern if gentrification is causing displacement, as the theory would suggest, or if displacement and movement initiates the process of gentrification. This is important, as one finding would have considerably different policy implications than the other. Future research should seek to firmly establish causality between gentrification and displacement, thus further verifying my results.

## IX. Conclusion

This study intends to demonstrate a link between gentrification and displacement and to analyze the amenity choices of displaced households in Durham, North Carolina. I come to two main conclusions: first, there is indeed a significant link between gentrification and displacement in Durham, as low-income renters disproportionately move following increases in neighborhood housing prices. Second, low-income renters are more likely to make difficult tradeoffs following displacement, often moving into communities with decreased property values at the expense of increased crime and poverty rates and decreased school quality. Specifically, I identify a few at risk groups, namely renters, minorities, the elderly, and households with children.

There are some notable limitations to this study. First, I opt to use proxies throughout my analysis. I measure gentrification using average block group housing appreciation rates, displacement through comparing the exit rates of low-income homeowners and renters, and neighborhood amenities through measures of air toxicity, elementary school grade-level proficiency, three different types of crime, and poverty rates. These proxies, while useful when conducting this analysis, may not fully capture the effect of gentrification and the impact of

displacement. For example, if some households moved for reasons other than home value appreciation rates, my model would fail to capture it.[22] As such, future research should be done using a different cocktail of amenities to proxy for these phenomena and to verify the integrity of my results. Second, it may be difficult to apply these results to cities other than Durham. While they may inform discussion in smaller southern cities and the larger Triangle area, it may be worthwhile to assess the unique conditions of other cities to better inform their policy decisions. Furthermore, future research should look to which policies best mitigate the aforementioned harms, ways in which legislatures can intervene in the gentrification process, and how best governments can ensure long-term stability in America's oldest cities.

[22] I attempt to account for this by looking at the results by income quartile. However, even the most financially constrained income groups may still move for reasons apart from gentrification.

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## Appendix A: Full Results [23]

Table 1: Appendix A - Full Probit Results by Income Quartile

| | (1) 0%-25% | (2) 25%-50% | (3) 50%-75% | (4) 75%-100% |
|---|---|---|---|---|
| Moved | | | | |
| Renter | 0.0567* | -0.0171 | -0.157*** | -0.175** |
| | (2.09) | (-1.07) | (-7.06) | (-2.74) |
| Housing Appreciation | -0.543*** | -0.106** | 0.531*** | 1.678*** |
| | (-6.85) | (-2.80) | (20.83) | (51.77) |
| **Renter × Housing Appreciation** | **0.821*** ** | **1.078*** ** | **0.978*** ** | **0.00203** |
| | (10.28) | (24.21) | (13.50) | (0.01) |
| Length of Residence | -0.134*** | -0.112*** | -0.121*** | -0.173*** |
| | (-48.39) | (-49.51) | (-56.89) | (-63.13) |
| Children Present | 0.302*** | 0.160*** | 0.119*** | 0.0471 |
| | (8.07) | (4.78) | (3.87) | (1.55) |
| Children Count | 0.0280 | 0.0358 | 0.0638*** | 0.0381* |
| | (1.12) | (1.71) | (3.41) | (2.23) |
| Age 25-29 | 0.263*** | 0.275*** | 0.277*** | 0.213** |
| | (13.71) | (9.60) | (6.12) | (2.74) |
| Age 30-34 | 0.242*** | 0.326*** | 0.290*** | 0.300*** |
| | (11.60) | (11.20) | (6.51) | (4.01) |
| Age 35-39 | 0.247*** | 0.259*** | 0.241*** | 0.240** |
| | (10.32) | (8.13) | (5.27) | (3.20) |
| Age 40-44 | 0.261*** | 0.186*** | 0.214*** | 0.261*** |
| | (9.95) | (5.40) | (4.56) | (3.45) |
| Age 45-49 | 0.260*** | 0.220*** | 0.166*** | 0.233** |
| | (9.59) | (6.30) | (3.48) | (3.04) |
| Age 50-54 | 0.350*** | 0.245*** | 0.213*** | 0.238** |
| | (12.71) | (6.75) | (4.38) | (3.09) |
| Age 55-59 | 0.317*** | 0.316*** | 0.314*** | 0.226** |
| | (10.38) | (8.43) | (6.39) | (2.90) |
| Age 60-64 | 0.347*** | 0.356*** | 0.296*** | 0.243** |
| | (10.68) | (8.86) | (5.75) | (3.05) |
| Age 65-69 | 0.344*** | 0.311*** | 0.306*** | 0.0980 |
| | (9.74) | (6.99) | (5.72) | (1.14) |
| Age 71-75 | 0.480*** | 0.325*** | 0.370*** | 0.199* |
| | (10.48) | (5.71) | (5.95) | (2.12) |
| Age >75 | 0.527*** | 0.366*** | 0.310*** | 0.325*** |
| | (14.09) | (8.70) | (5.58) | (3.56) |
| Married | 0.301*** | 0.201*** | 0.130*** | 0.105*** |
| | (9.46) | (10.58) | (8.42) | (5.60) |
| Black | 0.133*** | 0.0835*** | 0.0510*** | 0.0406* |
| | (10.52) | (5.92) | (3.33) | (2.42) |
| Hispanic | -0.0339 | -0.0812** | -0.0635 | -0.0211 |
| | (-1.25) | (-2.65) | (-1.90) | (-0.47) |
| Middle Eastern | 0.00407 | 0.0297 | 0.0886 | 0.0931 |
| | (0.07) | (0.47) | (1.34) | (1.33) |
| Asian | -0.0773* | -0.115** | -0.163*** | -0.142*** |
| | (-2.18) | (-3.02) | (-3.89) | (-3.46) |
| Native American | 0.399 | 0.0574 | -0.485 | 0.456* |
| | (1.71) | (0.18) | (-1.12) | (1.97) |
| Constant | -1.878*** | -1.711*** | -1.589*** | -1.503*** |
| | (-52.07) | (-40.10) | (-27.40) | (-19.93) |
| Observations | 187,215 | 179,306 | 198,276 | 226,584 |
| Pseudo R2 | 0.1105 | 0.1722 | 0.1988 | 0.3234 |
| LR chi2(24) | 6457.03 | 8225.94 | 8192.85 | 12911.61 |
| Prob >chi2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

$t$ statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[23] To avoid the issue of collinearity, I omit the variable for heads of household under the age of 25. The age coefficients are all presented relative to an under 25 household

Table 2: Appendix A - Amenity Choices for Low-Income Movers

| | (1) Price Difference | (2) Violent Crime Difference | (3) Property Crime Difference | (4) Drug Crime Difference | (5) Pollution Difference | (6) School Difference | (7) Poverty Difference |
|---|---|---|---|---|---|---|---|
| Housing Appreciation | 132072.8*** | -54.29*** | -80.86*** | -30.82*** | 69.94 | 6.971*** | -0.101*** |
| | (54.59) | (-17.21) | (-8.96) | (-14.62) | (1.63) | (14.24) | (-13.15) |
| Renter | 18561.3*** | 6.299** | 58.39*** | 0.597 | -77.08* | 7.705*** | 0.0190*** |
| | (10.80) | (2.81) | (9.11) | (0.40) | (-2.53) | (22.16) | (3.47) |
| **Renter × Housing Appreciation** | **-38743.9***** | **23.80***** | **41.23***** | **11.44***** | **-19.63** | **-3.089***** | **0.0585***** |
| | (-15.49) | (7.30) | (4.42) | (5.25) | (-0.44) | (-6.10) | (7.33) |
| Length of Residence | 269.9 | 0.578** | 1.914** | -0.0179 | -28.44*** | 0.0577 | 0.0000574 |
| | (1.61) | (2.64) | (3.06) | (-0.12) | (-9.58) | (1.70) | (0.11) |
| Children | 4370.7 | 1.556 | 4.128 | -1.284 | -22.77 | -0.375 | 0.0151 |
| | (1.51) | (0.41) | (0.38) | (-0.51) | (-0.45) | (-0.64) | (1.64) |
| Child Count | 313.5 | -0.283 | 0.694 | 0.548 | 26.12 | 0.446 | -0.00266 |
| | (0.17) | (-0.12) | (0.10) | (0.34) | (0.79) | (1.18) | (-0.45) |
| Age 25-29 | 2170.0 | 10.52*** | 23.46** | 4.127* | 32.09 | -1.843*** | 0.0262*** |
| | (1.09) | (4.07) | (3.17) | (2.39) | (0.91) | (-4.59) | (4.14) |
| Age 30-34 | 982.5 | 12.45*** | 32.23*** | 4.811** | -16.73 | -1.114** | 0.0313*** |
| | (0.47) | (4.62) | (4.18) | (2.67) | (-0.46) | (-2.66) | (4.74) |
| Age 35-39 | 1648.1 | 7.845** | 18.61* | 1.252 | -34.03 | -1.380** | 0.0147* |
| | (0.71) | (2.59) | (2.15) | (0.62) | (-0.83) | (-2.94) | (1.99) |
| Age 40-44 | -1597.7 | 10.76** | 19.05* | 2.461 | -68.87 | -1.350** | 0.0345*** |
| | (-0.63) | (3.24) | (2.01) | (1.11) | (-1.53) | (-2.62) | (4.25) |
| Age 45-49 | 1184.9 | 9.816** | 22.88* | 4.227 | 4.567 | -1.410** | 0.0293*** |
| | (0.45) | (2.88) | (2.35) | (1.86) | (0.10) | (-2.66) | (3.52) |
| Age 50-54 | -1556.4 | 0.998 | 9.503 | -2.186 | 24.18 | -0.666 | 0.0188* |
| | (-0.59) | (0.29) | (0.96) | (-0.95) | (0.51) | (-1.24) | (2.23) |
| Age 55-59 | -1737.1 | 8.075* | 28.88** | 1.806 | -22.86 | -1.872** | 0.0195* |
| | (-0.61) | (2.18) | (2.72) | (0.73) | (-0.45) | (-3.25) | (2.15) |
| Age 60-64 | -1618.5 | 4.745 | 8.710 | -0.530 | 63.01 | 0.177 | 0.0223* |
| | (-0.53) | (1.20) | (0.77) | (-0.20) | (1.17) | (0.29) | (2.30) |
| Age 65-69 | 7906.9* | -0.0735 | 25.70* | -4.009 | 55.65 | 1.923** | 0.0105 |
| | (2.31) | (-0.02) | (2.01) | (-1.34) | (0.92) | (2.77) | (0.96) |
| Age 70-74 | 8541.6* | 8.404 | 14.14 | 3.174 | 96.03 | 0.0738 | 0.0154 |
| | (1.98) | (1.49) | (0.88) | (0.84) | (1.26) | (0.08) | (1.12) |
| Age >75 | 3240.9 | -4.811 | -6.372 | -5.107 | 47.49 | 1.178 | 0.0126 |
| | (0.97) | (-1.11) | (-0.51) | (-1.76) | (0.81) | (1.75) | (1.19) |
| Married | -4619.6* | 16.20*** | 41.37*** | 6.880*** | 36.33 | -1.641*** | 0.0489*** |
| | (-2.50) | (6.71) | (6.00) | (4.27) | (1.11) | (-4.38) | (8.29) |
| Black | -2490.8* | 0.0424 | -7.457 | -1.276 | -23.92 | -0.00483 | -0.00298 |
| | (-2.17) | (0.03) | (-1.74) | (-1.28) | (-1.18) | (-0.02) | (-0.81) |
| Hispanic | -2598.3 | 0.0485 | -11.24 | -2.401 | -30.80 | -0.387 | -0.0238** |
| | (-1.03) | (0.01) | (-1.19) | (-1.09) | (-0.69) | (-0.76) | (-2.94) |
| Asian | 1770.0 | 1.856 | 22.08 | 1.739 | 20.03 | 0.183 | 0.00838 |
| | (0.54) | (0.43) | (1.80) | (0.61) | (0.34) | (0.27) | (0.80) |
| Constant | -45477.8*** | 24.80*** | 6.223 | 9.087*** | 66.49 | -10.09*** | 0.0654*** |
| | (-16.44) | (6.87) | (0.60) | (3.77) | (1.36) | (-18.03) | (7.42) |
| Observation | 12,096 | 12,096 | 12,096 | 12,096 | 12,096 | 12,096 | 12,096 |
| R2 | 0.6767 | 0.1605 | 0.0648 | 0.1201 | 0.0111 | 0.1433 | 0.1130 |
| chi2 | 25320.84 | 2312.67 | 838.32 | 1651.15 | 135.59 | 2022.82 | 1541.37 |
| P >chi2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

$t$ statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Appendix A - Amenity Choices for High-Income Movers

| | (1) Price Difference | (2) Violent Crime Difference | (3) Property Crime Difference | (4) Drug Crime Difference | (5) Pollution Difference | (6) School Difference | (7) Poverty Difference |
|---|---|---|---|---|---|---|---|
| Housing Appreciation | 124151.2*** | -30.80*** | -63.84*** | -18.16*** | 8.712 | 5.216*** | -0.0711*** |
| | (125.08) | (-35.52) | (-20.59) | (-34.40) | (0.35) | (23.67) | (-24.52) |
| Renter | 13147.3*** | 3.701* | 47.85*** | 2.547* | 23.08 | 3.550*** | 0.0231*** |
| | (6.28) | (2.02) | (7.32) | (2.29) | (0.44) | (7.64) | (3.78) |
| **Renter × Housing Appreciation** | **-36777.4***** | **7.970***** | **26.59***** | **5.296***** | **25.28** | **-1.367**** | **0.0382***** |
| | (-16.09) | (3.99) | (3.73) | (4.36) | (0.45) | (-2.69) | (5.73) |
| Length of Residence | -399.4** | 0.0813 | 0.288 | 0.00454 | -3.822 | 0.0577 | 0.00103* |
| | (-2.84) | (0.66) | (0.66) | (0.06) | (-1.10) | (1.85) | (2.51) |
| Children Present | -3650.3 | 3.249 | 27.27*** | 0.720 | 30.04 | 0.388 | 0.0181** |
| | (-1.67) | (1.70) | (4.00) | (0.62) | (0.55) | (0.80) | (2.84) |
| Children Count | 1681.4 | 0.377 | 1.587 | 0.746 | -19.67 | -0.116 | -0.000432 |
| | (1.34) | (0.34) | (0.40) | (1.12) | (-0.63) | (-0.42) | (-0.12) |
| Age 25-29 | -6741.3 | -3.427 | -20.58 | -3.275 | -38.36 | 1.705 | -0.00180 |
| | (-1.61) | (-0.94) | (-1.57) | (-1.47) | (-0.37) | (1.84) | (-0.15) |
| Age 30-34 | -677.7 | -1.584 | -7.364 | -2.146 | -94.81 | 0.992 | 0.0191 |
| | (-0.17) | (-0.44) | (-0.58) | (-0.99) | (-0.94) | (1.10) | (1.61) |
| Age 35-39 | -2769.3 | 1.440 | 1.530 | -1.059 | -161.8 | 0.662 | 0.0256* |
| | (-0.67) | (0.40) | (0.12) | (-0.48) | (-1.58) | (0.72) | (2.12) |
| Age 40-44 | -6093.4 | 0.459 | 3.789 | -1.398 | -152.2 | 0.797 | 0.0215 |
| | (-1.46) | (0.13) | (0.29) | (-0.63) | (-1.47) | (0.86) | (1.76) |
| Age 45-49 | -6969.9 | -2.466 | 2.149 | -4.148 | -144.4 | 1.408 | 0.0189 |
| | (-1.63) | (-0.66) | (0.16) | (-1.82) | (-1.36) | (1.48) | (1.52) |
| Age 50-54 | -7534.1 | -2.555 | -6.600 | -4.111 | -42.99 | 1.240 | 0.0314* |
| | (-1.74) | (-0.67) | (-0.49) | (-1.78) | (-0.40) | (1.29) | (2.48) |
| Age 55-59 | -7332.0 | -2.514 | -1.767 | -3.721 | 14.46 | 1.263 | 0.0165 |
| | (-1.67) | (-0.66) | (-0.13) | (-1.59) | (0.13) | (1.30) | (1.28) |
| Age 60-64 | -4060.9 | 0.908 | 7.624 | -2.122 | -1.109 | 1.684 | 0.0329* |
| | (-0.88) | (0.23) | (0.53) | (-0.87) | (-0.01) | (1.65) | (2.46) |
| Age 65-69 | -6714.0 | 1.553 | 15.53 | -1.680 | -60.39 | 1.286 | 0.0177 |
| | (-1.37) | (0.36) | (1.01) | (-0.64) | (-0.50) | (1.18) | (1.24) |
| Age 70-74 | 732.0 | 2.337 | 29.49 | -0.508 | -77.54 | 2.842* | 0.0175 |
| | (0.13) | (0.47) | (1.66) | (-0.17) | (-0.55) | (2.24) | (1.05) |
| Age >75 | 6953.9 | 0.178 | 6.701 | -1.004 | -118.4 | 1.241 | 0.0166 |
| | (1.36) | (0.04) | (0.42) | (-0.37) | (-0.93) | (1.09) | (1.11) |
| Married | 1026.0 | 3.006** | 10.15** | 1.045 | -121.6*** | -0.595* | 0.00676 |
| | (0.85) | (2.85) | (2.69) | (1.63) | (-4.06) | (-2.22) | (1.92) |
| Black | -1919.9 | -1.487 | -0.324 | -1.337* | -71.69* | -0.297 | -0.00347 |
| | (-1.66) | (-1.47) | (-0.09) | (-2.17) | (-2.49) | (-1.16) | (-1.02) |
| Hispanic | -7645.6** | -4.484 | -14.29 | -2.260 | 58.22 | -0.0206 | -0.0152 |
| | (-2.70) | (-1.81) | (-1.62) | (-1.50) | (0.83) | (-0.03) | (-1.84) |
| Middle Eastern | 1077.8 | -12.06** | -22.55 | -6.857** | 159.1 | 3.134** | -0.0461*** |
| | (0.23) | (-2.89) | (-1.51) | (-2.70) | (1.34) | (2.96) | (-3.31) |
| Asian | 5475.2 | 1.789 | 3.069 | -0.0140 | -24.82 | 0.586 | 0.00224 |
| | (1.76) | (0.66) | (0.32) | (-0.01) | (-0.32) | (0.85) | (0.25) |
| Native American | 966.6 | 3.480 | 20.00 | -1.150 | 1275.9* | -0.778 | 0.00606 |
| | (0.05) | (0.20) | (0.31) | (-0.11) | (2.52) | (-0.17) | (0.10) |
| Constant | -20229.9*** | -16.31*** | -80.51*** | -5.791** | 115.2 | -3.014*** | -0.0912*** |
| | (-4.98) | (-4.59) | (-6.34) | (-2.68) | (1.14) | (-3.34) | (-7.69) |
| Observations | 8232 | 8232 | 8232 | 8232 | 8232 | 8232 | 8232 |
| R2 | 0.6941 | 0.1521 | 0.0684 | 0.1424 | 0.0067 | 0.0899 | 0.0808 |
| chi2 | 18681.69 | 1476.29 | 604.62 | 1366.87 | 55.46 | 813.33 | 723.17 |
| P >chi2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0000 |

*t* statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Appendix A - Correlation Table of Independent Variables

| | (1) Price Difference | (2) Violent Crime Difference | (3) Property Crime Difference | (4) Drug Crime Difference | (5) Pollution Difference | (6) School Difference | (7) Poverty Difference |
|---|---|---|---|---|---|---|---|
| Price Difference | 1.00 | | | | | | |
| Violent Crime Difference | -0.0641 | 1.00 | | | | | |
| Property Crime Difference | -0.0417 | 0.4205 | 1.00 | | | | |
| Drug Crime Difference | -0.0627 | 0.3808 | 0.3286 | 1.00 | | | |
| Pollution Difference | -0.0219 | -0.0257 | -0.0534 | -0.0045 | 1.00 | | |
| School Difference | 0.0830 | -0.2338 | -0.1469 | -0.1962 | 0.0673 | 1.00 | |
| Poverty Difference | -0.0035 | 0.2969 | 0.2646 | 0.2093 | -0.0461 | -0.2045 | 1.00 |

## Appendix B: Full Results with Education

Table 1: Appendix B - Full Probit Results with Education

| | (1) 0%-25% | (2) 25%-50% | (3) 50%-75% | (4) 75%-100% |
|---|---|---|---|---|
| Moved | | | | |
| Renter | 0.160*** | 0.0884*** | -0.0338 | -0.182* |
| | (5.27) | (5.07) | (-1.40) | (-2.53) |
| Education difference | 0.215** | -0.0998 | -0.0949 | 0.0765 |
| | (2.99) | (-1.81) | (-1.83) | (1.13) |
| **Renter × Education difference** | **-0.142** | **0.148*** | **0.392*** | **0.482** |
| | (-1.89) | (2.01) | (2.06) | (0.76) |
| Length of Residence | -0.124*** | -0.109*** | -0.118*** | -0.173*** |
| | (-42.72) | (-45.84) | (-52.40) | (-57.60) |
| Children Present | 0.271*** | 0.151*** | 0.0919** | 0.0243 |
| | (6.95) | (4.42) | (2.89) | (0.77) |
| Children Count | 0.0268 | 0.0227 | 0.0598** | 0.0424* |
| | (1.07) | (1.10) | (3.14) | (2.51) |
| Age 25-29 | 0.313*** | 0.285*** | 0.377*** | 0.334*** |
| | (14.41) | (8.86) | (7.18) | (3.75) |
| Age 30-34 | 0.344*** | 0.379*** | 0.414*** | 0.424*** |
| | (14.52) | (11.67) | (8.01) | (4.96) |
| Age 35-39 | 0.346*** | 0.350*** | 0.397*** | 0.363*** |
| | (12.66) | (9.83) | (7.52) | (4.24) |
| Age 40-44 | 0.306*** | 0.285*** | 0.361*** | 0.386*** |
| | (9.72) | (7.38) | (6.65) | (4.49) |
| Age 45-49 | 0.345*** | 0.304*** | 0.300*** | 0.354*** |
| | (10.93) | (7.75) | (5.43) | (4.05) |
| Age 50-54 | 0.416*** | 0.317*** | 0.373*** | 0.296*** |
| | (13.05) | (7.80) | (6.71) | (3.35) |
| Age 55-59 | 0.370*** | 0.379*** | 0.454*** | 0.278** |
| | (10.62) | (9.10) | (8.03) | (3.12) |
| Age 60-64 | 0.374*** | 0.390*** | 0.413*** | 0.297** |
| | (10.11) | (8.69) | (6.99) | (3.27) |
| Age 65-69 | 0.409*** | 0.381*** | 0.401*** | 0.123 |
| | (10.61) | (7.92) | (6.57) | (1.25) |
| Age 71-75 | 0.518*** | 0.347*** | 0.473*** | 0.296** |
| | (10.49) | (5.67) | (6.90) | (2.81) |
| Age >75 | 0.546*** | 0.377*** | 0.449*** | 0.437*** |
| | (13.17) | (8.08) | (7.09) | (4.12) |
| Married | 0.283*** | 0.171*** | 0.0933*** | 0.0946*** |
| | (8.14) | (8.39) | (5.50) | (4.41) |
| Black | 0.0148 | 0.0377* | 0.0263 | 0.0151 |
| | (1.00) | (2.42) | (1.55) | (0.79) |
| Hispanic | -0.144*** | -0.143*** | -0.115** | -0.0742 |
| | (-4.79) | (-4.38) | (-3.18) | (-1.43) |
| Asian | -0.248*** | -0.199*** | -0.198*** | -0.229*** |
| | (-6.16) | (-4.92) | (-4.45) | (-5.09) |
| Constant | -1.857*** | -1.675*** | -1.652*** | -1.407*** |
| | (-45.10) | (-35.48) | (-25.01) | (-16.34) |
| Observations | 129595 | 127125 | 137377 | 137867 |
| Psuedo R2 | 0.0983 | 0.1337 | 0.1757 | 0.2630 |
| LR chi2(24) | 4391.32 | 5164.31 | 5947.14 | 7813.37 |
| Prob >chi2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

$t$ statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Appendix B - Amenity Choices for Low-Income Movers with Education

| | (1) Price Difference | (2) Violent Crime Difference | (3) Property Crime Difference | (4) Drug Crime Difference | (5) Pollution Difference | (6) School Difference | (7) Poverty Difference |
|---|---|---|---|---|---|---|---|
| Education difference | 18916.8 | 14.79 | -2.738 | -7.305 | -142.7 | -0.959 | 0.0133 |
| | (1.78) | (1.82) | (-0.12) | (-1.46) | (-1.25) | (-0.74) | (0.67) |
| Renter | 51662.3*** | -3.131 | 45.00*** | -5.589*** | -132.3*** | 8.897*** | 0.00775 |
| | (16.02) | (-1.27) | (6.53) | (-3.68) | (-3.82) | (22.64) | (1.29) |
| **Renter × Education difference** | **-36189.2**** | **19.37*** | **11.82** | **19.86***** | **0.698** | **-1.311** | **0.0425*** |
| | (-3.18) | (2.22) | (0.49) | (3.71) | (0.01) | (-0.95) | (2.01) |
| Length of Residence | -487.2 | 0.799*** | 2.331*** | 0.0928 | -31.02*** | 0.0462 | 0.000458 |
| | (-1.59) | (3.41) | (3.57) | (0.65) | (-9.46) | (1.24) | (0.81) |
| Children Present | 2252.2 | 3.914 | 10.22 | 1.178 | -36.15 | -0.707 | 0.0193* |
| | (0.43) | (0.97) | (0.91) | (0.48) | (-0.64) | (-1.10) | (1.97) |
| Children Count | 4961.7 | -2.128 | -2.612 | -0.889 | 34.24 | 0.630 | -0.00671 |
| | (1.48) | (-0.83) | (-0.36) | (-0.56) | (0.95) | (1.54) | (-1.07) |
| Age 25-29 | -7288.1 | 14.91*** | 33.15*** | 6.833*** | 35.76 | -2.478*** | 0.0277*** |
| | (-1.88) | (5.01) | (4.00) | (3.74) | (0.86) | (-5.24) | (3.84) |
| Age 30-34 | -7855.5 | 18.17*** | 42.78*** | 7.939*** | -7.526 | -1.852*** | 0.0337*** |
| | (-1.95) | (5.89) | (4.98) | (4.20) | (-0.17) | (-3.78) | (4.51) |
| Age 35-39 | -2407.5 | 11.37** | 28.42** | 3.286 | -26.36 | -2.087*** | 0.0126 |
| | (-0.53) | (3.28) | (2.95) | (1.55) | (-0.54) | (-3.79) | (1.49) |
| Age 40-44 | -9208.1 | 17.16*** | 29.74** | 6.564** | -97.78 | -2.390*** | 0.0419*** |
| | (-1.81) | (4.39) | (2.73) | (2.74) | (-1.79) | (-3.85) | (4.42) |
| Age 45-49 | 330.8 | 12.96** | 29.86** | 6.204* | -6.530 | -2.389*** | 0.0277** |
| | (0.06) | (3.29) | (2.72) | (2.56) | (-0.12) | (-3.81) | (2.89) |
| Age 50-54 | -7525.4 | 4.198 | 15.86 | -1.434 | 46.98 | -1.220 | 0.0199* |
| | (-1.44) | (1.05) | (1.42) | (-0.58) | (0.84) | (-1.92) | (2.05) |
| Age 55-59 | -1055.7 | 9.443* | 36.07** | 2.612 | -15.25 | -2.169** | 0.0153 |
| | (-0.19) | (2.23) | (3.05) | (1.00) | (-0.26) | (-3.22) | (1.49) |
| Age 60-64 | -3219.8 | 6.151 | 8.337 | -0.117 | 90.13 | -0.165 | 0.0163 |
| | (-0.54) | (1.35) | (0.66) | (-0.04) | (1.42) | (-0.23) | (1.48) |
| Age 65-69 | 8499.4 | 4.838 | 34.96* | 0.0817 | 75.19 | 1.717* | 0.0138 |
| | (1.33) | (0.99) | (2.56) | (0.03) | (1.09) | (2.20) | (1.16) |
| Age 70-74 | 13911.9 | 11.10 | 18.53 | 4.536 | 90.08 | -0.726 | 0.0124 |
| | (1.74) | (1.80) | (1.08) | (1.20) | (1.05) | (-0.74) | (0.83) |
| Age ¿>75 | 7270.5 | -0.235 | 5.173 | -0.164 | 67.01 | 0.392 | 0.0138 |
| | (1.14) | (-0.05) | (0.38) | (-0.05) | (0.98) | (0.50) | (1.16) |
| Married | -8822.5* | 14.07*** | 33.83*** | 4.863** | 67.93 | -1.570*** | 0.0470*** |
| | (-2.53) | (5.25) | (4.54) | (2.96) | (1.81) | (-3.69) | (7.23) |
| Black | 2169.5 | -2.362 | -10.29* | -2.945** | -7.720 | 0.361 | -0.00584 |
| | (0.97) | (-1.38) | (-2.16) | (-2.80) | (-0.32) | (1.33) | (-1.40) |
| Hispanic | 6374.5 | -2.800 | -19.85 | -3.554 | 14.00 | 0.158 | -0.0300*** |
| | (1.33) | (-0.76) | (-1.94) | (-1.58) | (0.27) | (0.27) | (-3.37) |
| Asian | -2328.4 | 4.803 | 36.71** | 3.109 | 55.95 | 0.216 | 0.0123 |
| | (-0.37) | (1.00) | (2.73) | (1.05) | (0.83) | (0.28) | (1.05) |
| Constant | -58017.3*** | 22.62*** | 4.167 | 6.190* | 121.2* | -10.21*** | 0.0617*** |
| | (-10.87) | (5.52) | (0.37) | (2.47) | (2.12) | (-15.69) | (6.22) |
| Observations | 9820 | 9820 | 9820 | 9820 | 9820 | 9820 | 9820 |
| R2 | 0.0340 | 0.0617 | 0.0404 | 0.0200 | 0.0128 | 0.0680 | 0.0742 |
| chi2 | 345.26 | 646.24 | 412.91 | 200.85 | 127.69 | 716.86 | 787.58 |
| P >chi2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

*t* statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$