The Link between Gentrification and Displacement and the Effects of Displacement on Residents in Los Angeles County

Ashley J Qiang

Professor Christopher Timmins, Faculty Advisor
Professor Michelle Connolly, Seminar Advisor
Professor Alison Hagy, Seminar Advisor

Honors Thesis submitted in partial fulfillment of the requirements for Graduation with Distinction in Economics in Trinity College of Duke University.

Duke University
Durham, North Carolina
2017

Acknowledgements

I am incredibly grateful to my advisor Dr. Timmins for guiding me through my analysis, giving me advice about my datasets and empirical specifications, and providing me with constructive feedback. I would like to thank Dr. Hagy and Dr. Connolly as well for their valuable comments on my paper and for helping me improve my writing. I am also thankful to Wen Wang and the staff at SSRI for helping me clean and manage restricted data. Finally, I would like to thank my family and friends for constantly supporting me during this project.

Abstract

Over the past decades, gentrification has accelerated across the country. Along with this phenomenon comes growing concern about displacement, although limited research has been dedicated to examining gentrification's impact on displacement. This paper studies the link between gentrification and displacement, as well as who is more likely to be displaced and the effects on the displaced. The results show that lower-income renters are significantly more likely to be displaced from gentrifying neighborhoods, and they tend to move to worse neighborhoods with lower education quality and higher crime rates.

JEL classification: R1; R21; R23

Keywords: Gentrification, Displacement, Housing prices

I. Introduction

During the past couple of decades, gentrification, which is generally defined as a process where upper or middle-income families move in and transform lower-income neighborhoods, has increased quite substantially. While this phenomenon has been occurring in the United States since 1910, it really started to take off in the 1970s when, during a period of experimentation and grassroots activism, middle-class "pioneers" moved from the suburbs into poorer areas of cities. They rehabilitated houses and brought drastic changes to these neighborhoods, providing a countertrend to the "white flight" phenomenon from the 1950s to 1970s (Osman, 2016). Since then, most major cities have experienced some gentrification, and lately the trend has been accelerating. Between 2014 and 2015, the US Census Bureau found that all but one (Chicago) of the country's 20 largest cities experienced population growth, and the overall rate was double what it was from 2000 to 2010 (Madhani, 2016). As these cities grow, their demographics also change. Since the 1990s, the downtown areas of these cities have seen significantly higher numbers of younger, higher-income, and more educated residents, a telltale sign of gentrification (Juday, 2015).

With these demographic changes come both positive and negative effects. Rising property values, falling crime rates, and better public amenities and public services (e.g. street repair, sanitation) tend to coincide with gentrification (Atkinson, 2002). These positive changes, however, are sometimes accompanied by negative ones. As gentrifying neighborhoods change and new businesses and residents move in, gentrification can also lead to more expensive local services and even some population displacement as prices for rental housing increase (Atkinson, 2002).

As urban gentrification continues across the country, apprehensions about displacement have grown. Many organizations, such as the Brooklyn-based group Right to the City, claim that gentrification-induced displacement is now a human-rights violation (Knafo, 2015). Because of these concerns, many policymakers have focused their attention on gentrification. Several cities have adopted policies aimed at stemming gentrification-induced displacement such as subsidizing affordable housing, protecting current tenants by implementing stringent landlord-tenant laws, and dedicating new tax revenue to low-income residents (Kennedy & Leonard, 2001). Whether or not these policies target the right populations or are even necessary, however, is still up for debate since not much is actually known about the link between gentrification and displacement in many cities. A natural question arises: does gentrification actually lead to displacement, and if so, what types of individuals are more likely to be displaced, where do these people move after displacement, and what are the practical implications for their lives?

Studies on gentrification and displacement have mixed findings. Some have found that gentrification leads to a significant amount of displacement (Atkinson, 2000a; Newman & Wyly, 2006). Others have found only a small or even nonexistent link between the two (Vigdor, 2002; Freeman & Braconi, 2004; McKinnish, Walsh, & White, 2010). This lack of consensus is complicated by the fact that many of these studies concentrate their analyses on different cities (e.g. Boston or New York), study the phenomenon during different time periods, utilize different measures of gentrification, and tend to use data and empirical specifications that inaccurately measure displacement. Few also extend their displacement analyses to look at which segment of the population is more likely to be displaced and the effects on displaced residents.

This paper uses the Los Angeles Family and Neighborhood Survey (L.A. FANS) dataset to examine whether gentrification is associated with displacement and the effect of this

displacement on certain populations in Los Angeles. To investigate if there is a displacement effect, I focus on the exit rates of lower-income renters over a period of five years. I identify gentrifying neighborhoods using changes in housing prices and provide a new clear, quantitative measure of gentrification, which is one contribution of this paper. I then look at the demographics of renters who are more likely to be displaced and examine whether those who are displaced end up in worse neighborhoods in terms of education quality and crime rates. I find a positive and significant link between gentrification and displacement. While only age and renter status significantly predict displacement, those who are displaced as a result of gentrification are significantly more likely to move to neighborhoods with lower education quality and higher crime rates.

Section II reviews the current literature on gentrification. Section III provides a theoretical framework; Section IV presents my empirical specification; Section V describes the data used; and Section VI examines my results. Section VII discusses some of the policy implications of my findings, and Section VIII concludes.

II. Literature Review

As more policymakers and activists have focused on gentrification-induced displacement, there has been a growing body of research regarding this topic. While there are a fair number of studies that have examined the link between gentrification and displacement, few have looked at who is more likely to be displaced and what happens to the displaced.

Before reviewing the relevant literature, it is critical to discuss the definitions of gentrification used in the literature. Banzhaf and McCormick (2007) note that there are three main hallmarks of gentrification: (1) rising property values and rental costs; (2) renewal or creation of housing stock; and (3) changes in demographic composition, particularly income

levels. Most studies, however, do not incorporate such complex definitions when measuring and identifying gentrification. Rather, they use a variety of proxies for gentrification such as increases in the percentage of professionals or higher-income residents in a neighborhood (Atkinson, 2000a; Vigdor, 2002). Unlike previous studies, I use housing appreciation rates as my proxy for gentrification.

The definition of displacement, like that of gentrification, varies throughout the literature, but most papers choose to use the definition from Grier and Grier (1978) who argue that "displacement occurs when any household is forced to move from its residence by conditions which affect the dwelling or its immediate surroundings, and which…are beyond the household's reasonable ability to control or prevent" (Newman & Owen, 1982, p. 137). As with gentrification, studies usually use a variety of proxies to measure displacement, such as moving out due to high rents, eviction, or housing being sold; decrease in the number of residents from vulnerable groups; and exit rates of lower-income residents, the latter of which I also use as my definition (Schill, Nathan, & Persaud, 1983; Atkinson, 2000a; Freeman & Braconi, 2004).

Several studies have looked at the relationship between gentrification and displacement. Atkinson (2000a) examines displacement patterns by examining the decrease in the number of residents from vulnerable groups (e.g. the working class) in four gentrifying areas in London. Using cross-sectional and longitudinal census data (Longitudinal Study), he finds that there is a significant link between gentrification and displacement. Vigdor (2002) uses data from the American Housing Survey (AHS) in Boston to regress residential stability (i.e. whether individuals exit their neighborhoods) on a gentrification dummy. Using a sample of 1,278 households, he finds that compared to poor neighborhoods in non-gentrifying zones, poor households in gentrifying neighborhoods are not significantly more likely to be displaced.

Freeman and Braconi (2004), McKinnish, Walsh, and White (2010), and Ellen and O'Regan (2011) use analogous methods to Vigdor (2002) and find similar results.[1]

One possible explanation for these mixed results is that these studies do not use the same measures of gentrification or utilize empirical specifications that accurately measure displacement. Residents, even from vulnerable groups, may move for reasons outside of displacement. While these studies attempt to implicitly control for this by isolating populations most susceptible to displacement, in their specifications they primarily control for demographic variables (e.g. race, income). Many other factors, however, are unrelated to displacement but are important to migration, such as housing characteristics or residential patterns. Consequently, this paper will build on the existing literature by attempting to more accurately measure displacement through controlling for other reasons why people might move.

A significant amount of research has clearly been devoted to gentrification and displacement, but few have examined who is more likely to be displaced by gentrification. Wyly, Newman, and Schafran (2010) find that those most susceptible to gentrification-induced displacement are families with high housing cost burdens (as a percentage of income), short durations of occupancy, and homes closer to the central city. Schill et al. (1983) find that crowded households, number of previous moves, unemployment, and marital status predict displacement while Ellen and O'Regan (2011) find that age, minority status, and renter status are the major determinants.

None of the recent literature has looked at the effects that gentrification-induced displacement has on the displaced. While Schill et al. (1983) find that displaced residents do not live in worse conditions after they move, this study is dated and has a somewhat flawed

[1] A couple other studies have examined the link between gentrification and displacement (Schill et al., 1983; Freeman, 2005; Newman &Wyly, 2006) but are not discussed due to lack of

methodology. The researchers primarily rely on interviews and surveys from out-movers in their analysis; however, because they use door-to-door canvassing to identify these movers, the most vulnerable and transient households were less likely to be detected, leading to undersampling and bias (Zuk et al., 2015). My paper will thus use more rigorous specifications to simultaneously look at whether gentrification is associated with displacement, which groups are most likely to be displaced after gentrification, and the effects displacement has on them.

Because the findings regarding gentrification and displacement are so mixed, this paper will also build on the existing gentrification and displacement literature by utilizing a new, more detailed dataset and studying a new city and time period. Gentrification can have very different effects on cities depending on their housing stock, vacancy rates, housing prices, and demographics, so it is critical to study gentrification across the country. Most of the literature also has not studied more recent effects of gentrification on displacement, having not looked at the phenomenon since the 1990s. This paper will thus provide an updated view on gentrification's impacts, especially as gentrification has accelerated recently.

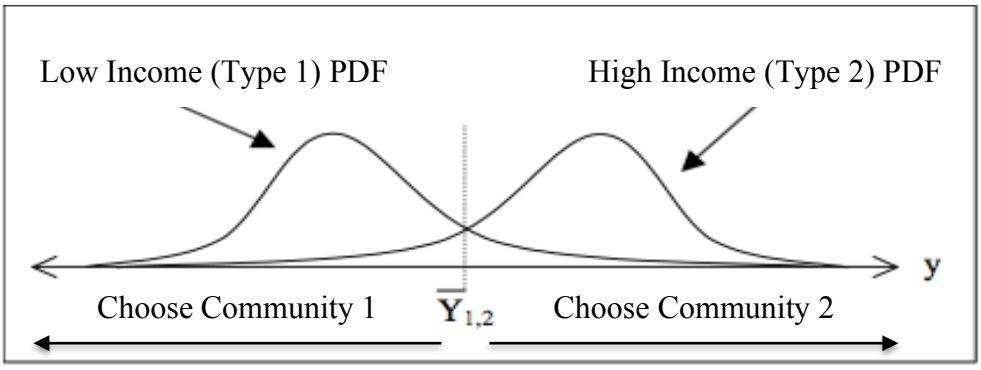
III. Theoretical Framework

Banzhaf and McCormick (2007) note that most of gentrification's important features can be captured by the Tiebout (1956) household choice model. This model predicts that households "vote with their feet" by moving into communities based on their preferred levels of amenities and housing costs, and it is thus useful in forecasting community impacts following changes in neighborhoods, such as those that accompany gentrification (Banzhaf & McCormick, 2007). Although this model principally looks at those who move into newly gentrified areas, it also provides insight into why displacement may occur in gentrified zones.

In this model households have different incomes and tastes for neighborhood public goods. As a result, they vary in their willingness to pay for bundles of goods. These households, however, do not differ in how they value particular public goods relative to others, and because of this, they agree on their rankings of which communities are the most desirable. Housing demand is highest in the most desirable communities, and consequently, housing prices in these areas are higher as well. Holding tastes constant, richer households will be in the nicer communities and poorer households will be in the less desirable ones.

Figure 1, taken from Banzhaf and McCormick (2007), illustrates this idea. The figure shows that there are two demographic types with two different income distributions. Their respective density functions are shown by the two curves. Type 2 on average is wealthier than Type 1. Holding tastes constant, there is an income threshold $\bar{Y}$ that separates these two groups into two different communities; those with incomes above $\bar{Y}$ are in the nicer community while those with incomes below $\bar{Y}$ are in the less desirable one.

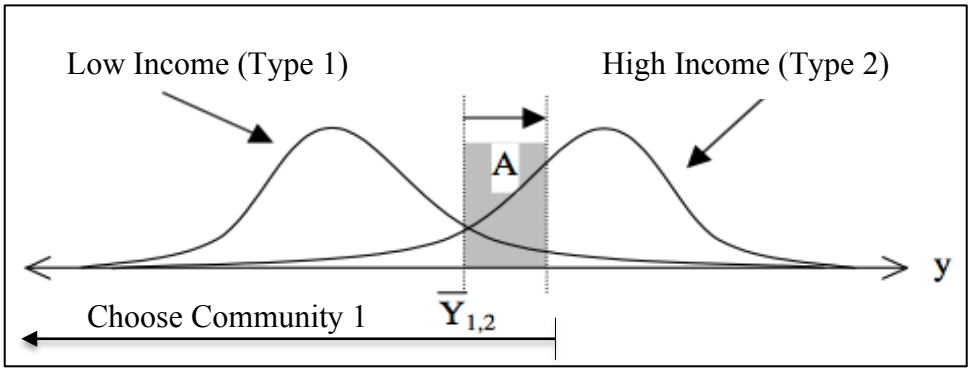
Figure 1. Income densities for two household types given a community income threshold



As gentrification begins to occur and a community's public goods shift, the income threshold $\bar{Y}$ changes as well. These newly gentrified neighborhoods (i.e. Community 1) become much more appealing to higher-income residents. Households that were previously indifferent between the two communities will now prefer Community 1. As shown in Figure 2, also used in

Banzhaf and McCormick (2007), $\bar{Y}$ will then shift to the right. All those who originally preferred Community 1 will still prefer it, but now additional people will also want to live in Community 1, which is represented by the shaded area in Figure 2.

Figure 2. Shift in community income threshold after a change in community 1



The demand for housing in Community 1 will thus increase, which will raise housing prices. If no new housing is created in these neighborhoods and the vacancy rates are low, current residents will be pushed out by these higher prices and displaced by new ones. This is a prediction that I will test empirically since big cities like Los Angeles often do not have high levels of new housing stock or high vacancy rates. Not all residents, however, will be pushed out; only those that rent housing units will be forced to move because homeowners are not negatively affected by price increases, especially since in California property taxes do not significantly increase with rising housing values.[2]

Since the new residents likely come from Community 2, those that will be displaced, if displacement does occur, will be from Community 1 who, as previously mentioned, will tend to be lower-income. This idea is consistent with my definition of displacement and provides the theoretical motivation for the selection of my population of interest, which is discussed more in Section IV. While there is also the possibility that the new residents will be additional Type 1

[2] This is due to the fact that in 1978 Californians passed Proposition 13, which instituted a limit on property taxes.

people, this does not affect which type of people leave the neighborhoods. Once I examine the link between gentrification and displacement, I move on with my displacement analysis to consider who is more likely to be displaced and what happens to them after displacement.

IV. Empirical Specification

My analysis is comprised of three different parts. The first step involves creating two systematic and quantitative proxies to measure gentrification, both of which involve housing prices. My first measure, adopted from one of the hallmarks of gentrification from Banzhaf and McCormick (2007), is housing appreciation rates, which I calculate from the CoreLogic dataset. I use the appreciation rates from 2001 to 2006 because they are between Waves 1 and 2 of the L.A. FANS dataset. Because the L.A. FANS dataset only records moves made between these two waves, using this time period ensures that displacements are not missed and minimizes measurement error.[3]

My other measure of gentrification is the change in rankings of average housing prices for each tract over time. I include this measure to rule out neighborhoods with both high appreciation rates and high initial housing values since gentrification only occurs in lower-income neighborhoods; for such neighborhoods there is likely another reason, unrelated to gentrification, why they experienced large increases in housing prices.[4] I choose these measures

[3] See the Appendix for an example and more detailed explanation of this measurement error.
[4] To be more specific, consider two tracts. Tract 1 has high initial housing prices while Tract 2 has lower prices. If both tracts' housing prices double, the change in housing price ranking for Tract 2 will be significantly more than that of Tract 1. This is because the tracts with lower housing prices are more compressed than those with higher housing prices (i.e. there are more tracts with lower housing prices) in the CoreLogic dataset, and there is more room for Tract 2 to move up since it started closer to the bottom. Consequently, Tract 1's low change in ranking reflects the fact that its housing price changes are likely not a result of gentrification, thus decreasing the chance that higher income tracts with rising housing values are included in my measure as gentrifying.

rather than gentrifying dummy variables, which the previous literature utilizes, because they are more nuanced and provide more variation.

Once I calculate my measures of gentrification, I use the L.A. FANS dataset to examine whether gentrification is associated with displacement and the characteristics of those likely to be displaced. I use a probit model to regress whether a household moved on my gentrification measure (i.e. housing appreciation rate or change in ranking), whether a person is a renter or owner, the interaction of these two variables, and control variables. The general format is shown in the following equation:

$$\mathbf{moved} = \beta_0 + \beta_1\mathbf{gentrification\_measure} + \beta_2\mathbf{renter} + \beta_3\mathbf{gentrification\_measure*renter} + \beta_4\mathbf{control1} + \beta_5\mathbf{control2} + \ldots \quad (1)$$

This interaction is critical and is my main variable of interest because it tells me if renters, as opposed to owners, are more likely to move from gentrifying neighborhoods. If renters are the only ones that have moved out of a gentrifying neighborhood, then gentrification is likely associated with displacement. However, if both owners and renters move, there is probably little link between gentrification and displacement, and something else must explain why people are moving (e.g. people may take advantage of higher asset values and sell their homes). This is because only renters are negatively impacted by the higher housing prices that accompany gentrification; owners, on the other hand, will likely benefit from higher housing prices, especially because of California's property tax limit, so there is little incentive for them to move from their current homes.

The control variables in this equation fall in four general categories: demographics (e.g., race, gender, marital status), neighborhood characteristics (e.g., education quality, crime rate, neighborhood satisfaction), housing characteristics (e.g. number of bedrooms and bathrooms),

and residential history (e.g., years in current residence, moved recently). Because the demographic variables tell me who is more likely to be displaced, I include certain ones based on results from the previous literature. For example, Schill et al. (1983) found that crowded households and employment status are determinants of displacement, so I include these in my regression.[5] Another demographic variable I include that is noteworthy is the interaction between whether one is single and the number of children one has. I include this because gentrification likely impacts single parents differently than those who are single with no children or who are married with children.

The variables from the other three categories, many of which are not used in the previous literature, control for reasons why households may choose to move outside of gentrification-induced displacement. These variables were determined from classic migration models, which note that former residential experiences, house/neighborhood dissatisfaction, attrition/movement of kin and friends, social and community participation, and amenities are some of the general determinants of moving (Wiseman, 1980). My regression attempts to control for all of these things. For example, neighborhood characteristics include satisfaction with the neighborhood, whether the person has participated in a block meeting, and the number of friends and family in the neighborhood while residential characteristics include years in current residence.

Given the fact that L.A. FANS has so many variables related to these categories (for example, there are over ten variables on neighborhood quality alone), and I am not particularly interested in their coefficients, I use principal component analysis (PCA) to condense the housing, neighborhood, and residential categories into their respective components. I do not

[5] For crowded households, I use the total number of people in a household as the variable since that measures whether or not a household is crowded.

condense the demographics because the coefficients of these variables will help me determine who is more likely to be displaced.

In this part of my analysis I also use an income/asset threshold to better identify households susceptible to displacement. This idea builds off the previous literature, which measures displacement as exit rates of lower-income populations. By limiting my dataset to this population, I implicitly exclude those who are likely to move for reasons outside of displacement. I eliminate all the observations with family incomes higher than $74,000 since this is the amount required for a family of four (i.e. the average household size in my sample) to live a "modest but adequate" life in Los Angeles (Gould, Cooke, & Kimball, 2015). In other words, those who make less than $74,000 in Los Angeles may struggle to make ends meet despite high absolute incomes and are thus susceptible to displacement. Although this is a somewhat high threshold, it is appropriate given the fact that Los Angeles is a large city with a high cost of living.

This threshold is also more appropriate than other ones because it is specific to Los Angeles. While I also considered using income cutoffs for state social safety net programs (e.g. Medicaid) as my threshold, these numbers do not fully take into account economic security and tend to be state-level cutoffs, failing to consider the fact that Los Angeles has a higher standard of living than other parts of California. Federal poverty guidelines are also an inadequate threshold for this reason, and these guidelines tend to be measured inaccurately.[6] These measures would have eliminated households who have slightly higher incomes but are still susceptible to displacement in Los Angeles, so a higher threshold is more suitable. Further, because most of the

[6] Many experts believe that the federal poverty line is outdated because the current methodology used to determine this line was designed in 1963 and has only been updated to adjust for inflation (Gould et al., 2015).

people in my sample are already very low-income, my analysis still primarily focuses on this population. I also drop households with assets over $300,000; this eliminates those who may not make much income, but have a lot of wealth and thus are not likely to be displaced.

After establishing whether there is a link between gentrification and displacement and examining the characteristics of those likely to be displaced, I look at what happens to residents after displacement. I use OLS regression to examine whether renters from gentrifying neighborhoods move into neighborhoods with higher crime rates and lower school quality. I accomplish this by first isolating those who moved from the rest of the population. My dependent variable is the difference in educational quality/crime rates between the original and new tract for 2007 (i.e. Wave 2 of L.A. FANS), and like in part 2 of my specification, I regress this on the gentrification measure, whether a person is a renter, and the interaction of the two. The interaction term is again my main variable of interest because it tells me what happens to renters who moved from gentrifying neighborhoods (i.e. the displaced). I include the same demographic characteristics as controls. I continue to use the interaction between whether one is single and the number of children one has because the education quality and crime rate of a neighborhood will likely matter more to a single person with kids than someone without them.

V. Data

The data for this study come predominantly from the Los Angeles Family and Neighborhood Survey (L.A. FANS). The dataset surveyed adults, teens, and children from 65 out of over 2,000 tracts (i.e. neighborhoods) in Los Angeles County.[7] The tracts were selected using a stratified random sampling design, with 20 designated as very poor, 20 as poor, and 25 as non-

[7] A census tract is formally defined as a small, fairly permanent statistical subdivision of a county. These areas are roughly the size of a neighborhood and contain populations between 1,200 and 8,000 people.

poor (Peterson et al., 2004). This dataset intentionally oversamples poor neighborhoods. Since gentrification only occurs in poorer areas, this aspect of the data could be particularly useful for my research because it may provide more insight into the effects of gentrification, and it gives me more observations for my main population of interest (i.e. lower-income renters). The survey was conducted in two waves; Wave 1 lasted from 2000-2001, and the second wave was from 2006-2008 (Peterson et al., 2011).

In Wave 1, an average of 41 households were randomly selected within each neighborhood, yielding a total of 3,085 selected households (Peterson et al., 2004). Both adults and children were sampled and interviewed within each household. Children were also given cognitive assessments. While 3,085 randomly selected adults and 3,682 children were selected for the sample, only 2,543 adults and 3,054 children fully completed the interviews; seventy-seven adults and 107 children partially completed them while the rest refused to be interviewed (Peterson et al., 2004). In Wave 2, each person was interviewed again regardless of whether they stayed in the same neighborhood or moved. Of the 3,085 adults selected from Wave 1, 2,766 of them were selected again in Wave 2, and 3,307 of the 3,682 children were also re-selected (Peterson et al., 2011).[8] Only 1,251 adults and 1,624 children in this wave completed interviews; the rest refused to be interviewed or could not be contacted/located (Peterson et al., 2011).

The main strength of this dataset is that it follows households over time, even if they left their original neighborhoods. This dataset records moves households made between the two waves, even if they only moved small distances. This is a stark difference from the previous

[8] In Wave 2, the remaining 319 and 375 adult and children cases respectively were not picked primarily because these households did not complete a single interview in Wave 1 (Peterson et al., 2011). All of the respondents that lived in Los Angeles County were interviewed in person using questions similar to those in Wave 1. Those that no longer lived in Los Angeles County were interviewed by telephone with a shorter survey questionnaire (Peterson et al., 2011).

datasets used in the gentrification and displacement literature; most prior studies tend to use data from the American Housing Survey (AHS) or New York Housing and Vacancy Survey (NYCHVS). The AHS, however, only focuses on changes occurring within households (e.g. changes in the houses' rents and in the people living in the homes), while the NYCHVS only measures changes in vacancy rates. Because they do not track those that have moved, these datasets cannot precisely measure displacement or even verify that households moved in the first place. By providing a more accurate measure of displacement, the L.A. FANS dataset will allow me to fill in the gaps of some of the previous studies and add more insight into the mixed displacement findings. This dataset is also valuable because of its level of detail. Since the interview questions are so comprehensive, I can better control for variables that are associated with moving but are unrelated to displacement, which the previous literature has not quite accomplished.

The fact that L.A. FANS consists of survey data presents complications that could affect my findings. With survey data, there is often the issue of attrition. As previously mentioned, several households were selected in Wave 1 but not selected for Wave 2, and there were a number of participants in both waves that refused to be interviewed. Of those that completed interviews, some did not answer all the questions, so I have missing data for important control variables. For example, distance from work is considered an important control variable because people may be hesitant to move if they live close to work, but there are only 20 observations for this variable. Failing to include this variable in my regression may cause omitted variables bias, but this is unavoidable given the data available. Some observations also got dropped due to the format in which the data were collected. The L.A. FANS dataset is actually made up of 14 different data files. When merging these files to create one cohesive dataset, some of the

observations could not be matched and had to be dropped from the dataset. After merging all of the data, I only have 1,078 observations left. Because there are multiple ways observations were not included, it could potentially bias my results, especially if any missing observations differ systematically from the observations I have. Further, the results I have may be biased even more if the respondents did not answer the questions accurately; they may have been inclined to answer the question based on what they believe is true or what they think they should answer.

I supplement the L.A. FANS dataset with CoreLogic housing data, which provide housing price information over time. I use the average housing prices from 2001 to 2006 to examine both housing appreciation rates and changes in housing price rankings for each census tract. While the CoreLogic dataset does not include rental prices, it should still have enough information for me to investigate whether gentrification has occurred in certain neighborhoods. To verify this, I examine the correlation between housing and rental appreciation rates from Census data and find the correlation to be very high at .88. Because I need average housing values for part 1 of my analysis, and CoreLogic observations consist of individual housing transactions, I had to clean this dataset a bit, eventually creating another dataset with average housing values for each year in each census tract. Since the CoreLogic data utilizes 2010 census tracts, I merge this dataset with 2000-2010 tract relationship files from the Census Bureau to convert these tracts to those used in the L.A. FANS dataset (i.e. 2000 census tracts).

Table 1 presents descriptive statistics for the variables of interest for each part of my empirical specification, and the variables are broken down by part. Part 1 of my specification involves creating the gentrification measures from housing prices. Consequently, Table 1 consists of the average housing appreciation rates, which are adjusted for inflation (2000 is the

base year), from CoreLogic. As we see in this table, the average housing price increased over the time period.

Once I calculate my gentrification measures, I merge this information with the L.A. FANS data for the second part of my specification, which examines the link between gentrification and displacement and the characteristics of those most likely to be displaced. Table 1 only includes statistics on the population that I consider (i.e. those with family income less than $74,000 and assets less than $300,000). I assess whether a person is an owner or renter by the variable that signifies whether a person makes rent payments. While this is not a completely accurate measure of whether or not a person rents or owns their home, the percentage of people who claim they make rent payments is very similar to the number who claim they do not own a house, so this is sufficient for estimating the percentage of renters and owners. In Table 1 we see that the majority of people in my population of interest did not move between Waves 1 and 2 and are renters, female, not single, employed, and Latino. The average education level is about grade 11, average number of children is about 2, average household size is 4, average age is 39, and average income is $23,330, which is not surprising given that there is an oversampling of poor tracts and I implemented an income/asset ceiling.

For part 3 of my specification the dependent variables are the difference in education quality and crime rates between the original and new census tracts. The education quality is measured by the academic performance index (API), whereas the crime rate is measured by the crime index rate. The average difference of these for those who moved is shown in part 3 of Table 1. As shown in Table 1, on average those who moved between Waves 1 and 2, which includes renters and owners, moved to better neighborhoods with better education quality and lower crime rates. Later I explore if this differs between renters and owners.

Table 1 Descriptive Statistics

Variable	Mean	Min	Max
Part 1:			
Variable			
Housing appreciation rate (2001-2006)	.899 (.518)	-.979	5.271
Part 2:			
Dependent Variable			
Whether they moved	.474		
Independent Variable			
Renter	.664		
Total family earnings	23329.63 (19362.06)	0	74000
Female	.701		
Single	.394		
Total number of children	1.742 (1.314)	0	9
Amount of school completed	11.323 (4.405)	0	19[a]
Employed	.632		
Age	38.899 (12.487)	9	85
Race: Latino	.669		
Race: African American	.100		
Race: Asian	.046		
Total number of people in household	4.349 (2.051)	1	15
Part 3:			
Dependent Variable			
Education quality difference	5.780 (53.268)	-146.974	247.707
Crime rate difference	-13.336 (504.030)	-2126.247	1766.843

Note: Standard deviations are in parentheses.
[a]Value of 19 means completed graduate/professional degree.

VI. Results

After calculating my measures of gentrification (e.g. housing appreciation rates and changes in housing price rankings), I proceed to the probit model from the second part of my specification. The results of this analysis are shown in Table 2. The regression that uses housing

appreciation rates as the gentrification measure is in Column 1 and the one using changes in housing price rankings is in Column 2.

Table 2 Probit Results for Moves among Lower-Income/Asset Households

Measure of Gentrification Used	(1) Housing Appreciation Rate	(2) Change in Housing Price Ranking
Gentrification measure	-.330	-.001**
	(.220)	(.0003)
Renter	.041	.518***
	(.302)	(.161)
Gentrification measure*Renter	.454*	.001**
	(.251)	(.0003)
Family earnings	-.0000009	-.000001
	(.000004)	(.000004)
Single (i.e. not married or cohabitating)	.201	.208
	(.189)	(.190)
Gender	.010	.004
	(.132)	(.132)
Number of children	-.023	-.026
	(.077)	(.077)
Single*number of children	-.043	-.044
	(.090)	(.090)
Race: Hispanic	-.054	-.033
	(.178)	(.178)
Race: African American	.120	.129
	(.219)	(.217)
Race: Asian	.102	.120
	(.283)	(.285)
Age	-.023***	-.023***
	(.006)	(.006)
Employed	.033	.034
	(.136)	(.136)
Highest education level	-.003	-.003
	(.016)	(.016)
Number of people in household	.040	.042
	(.047)	(.047)
Housing component 1	.020	.029
	(.053)	(.053)
Neighborhood component 1	.018	.018
	(.023)	(.023)
Neighborhood component 2	-.054**	-.052**
	(.027)	(.027)
Neighborhood component 3	.041	.040
	(.029)	(.029)

Neighborhood component 4	-.038	-.039
	(.032)	(.032)
Residential component 1	.154***	.156***
	(.055)	(.055)
Number of observations	578	578
Pseudo R^2	.13	.13

Notes: Standard errors are in parentheses. Multiple neighborhood components were included because of the high number of variables and therefore high eigenvalues (i.e. variation) of the components.
* denotes p < .1. ** denotes p < .05. *** denotes p<.01.

These results show a significant link between gentrification and displacement for both measures of gentrification, which is expected and consistent with the theory. In other words, lower-income renters are significantly more likely to leave gentrifying neighborhoods, which is a sign of displacement. This finding is similar to Atkinson (2000a) but differs from Vigdor (2002), Freeman and Braconi (2004), McKinnish, Walsh, and White (2010), and Ellen and O'Regan (2011) who do not find a significant link between the two.

Young people and renters (for one measure of gentrification) are more likely to be displaced, but no other demographic characteristic is significant, which is unexpected and for the most part does not align with previous findings.[9] In Table 2 Column 2 one can also see that the gentrifying measure alone (change in housing price ranking) is negative and significant. While this may initially seem counterintuitive, upon closer inspection it actually makes sense. People in neighborhoods with high housing appreciation rates, specifically owners, may have less incentive to move because their property values are rising and they do not have to pay more in taxes in California. This is why the interaction term is more informative when it comes to displacement since it only applies to renters.

[9] The residential component and one of the neighborhood components is also significant, but they cannot be interpreted because of PCA.

Despite these interesting findings, there are limitations to my results. Many of my control variables, such as the neighborhood characteristics, are missing about 25 percent of the data points, which is why my regressions have a little fewer than 600 observations. Using a t-test, I calculated the difference in means of important demographic variables for observations with and without the missing data. Unfortunately, these groups differed significantly by age, marital status, and race, where significance is defined as $p<.05$. Consequently, the external validity of my findings is very limited, and my parameter estimates can only apply to the subgroup that answered the questions. My income/asset threshold also limits the external validity of my findings since they may not apply to groups with a wider range in income.

The results of where the displaced end up are shown in Table 3. In this case, I use housing appreciation rates from 2001 to 2006 as my proxy for gentrification. I find that, as expected, renters in gentrifying neighborhoods (i.e. the displaced) are significantly more likely to end up in neighborhoods with worse education quality and higher crime rates. This directly contradicts the findings from Schill et al. (1983). It also provides a stark contrast to others who leave gentrifying neighborhoods (i.e. owners); in general, people who leave gentrifying areas, which is represented by the housing appreciation rate variable, are significantly more likely to move to areas with higher education quality and lower crime rates. Owners likely benefit from the higher property values that result from gentrification, so if they choose to move and sell their assets, they have more money to relocate to a nicer neighborhood.

Single people, those from crowded households, and Hispanic and African American residents are also significantly more likely to move into neighborhoods with lower educational quality while this is the opposite for single parents, who may care more about education quality and are thus intent on finding a neighborhood with good schools. This insight is particularly

interesting because it means that although gentrification-induced displacement does not particularly affect one group, the negative effects of displacement are concentrated among certain populations.

Table 3 OLS Results for Effects of Displacement on the Displaced

Dependent variable	(1) Improvement in education quality	(2) Improvement in crime rate
Housing appreciation rate (from 2001-2006) (for original neighborhood)	31.479***	298.472***
	(11.891)	(114.529)
Renter	15.674	74.623
	(14.927)	(143.767)
Appreciation rate*renter	-25.745**	-215.774*
	(13.024)	(125.439)
Family earnings	.000004	.001
	(.0002)	(.002)
Single (i.e. not married or cohabitating)	-25.858***	-67.528
	(9.275)	(89.328)
Gender	-1.999	32.219
	(6.062)	(58.385)
Number of children	-2.232	-31.435
	(3.445)	(33.181)
Single*number of children	12.979***	57.654
	(4.092)	(39.413)
Race: Hispanic	-17.117**	-35.862
	(8.077)	(77.792)
Race: African American	-32.960***	-24.779
	(10.418)	(100.344)
Race: Asian	1.961	-54.458
	(13.371)	(128.779)
Age	-.077	1.644
	(.261)	(2.520)
Highest education level	.523	4.844
	(.731)	(7.043)
Number of people in household	-3.680*	-5.221
	(1.901)	(18.307)
Employed	-8.913	26.842
	(5.845)	(56.299)
Number of observations	429	429
Adjusted R^2	.05	.02

Notes: Standard errors are in parentheses. The table only shows results when the gentrifying measure is housing appreciation rates. When the change in the housing price ranking is used, the results are quite similar. They have been excluded for brevity.
* denotes p < .1. ** denotes p < .05. *** denotes p<.01.

VII. Policy Implications

Although my findings only apply to the subgroup that answered the L.A. FANS survey questions, they provide important insights into potential policies. As rapid gentrification, and the higher housing prices that accompany it, continue across the country policymakers may want to consider implementing policies aimed at reducing gentrification-induced displacement, especially because displacement has been associated with the breakdown of close-knit communities, an increase in mental health problems for the displaced, higher levels of need among the displaced since they are farther away from indispensable services, and even homelessness (Atkinson, 2000b).

Some policymakers argue that an appropriate response to this potential problem is to increase the supply of affordable housing. Over the past decade demand for rental units has increased, but the supply of affordable units has not kept pace with this demand. Most new rental units are designed for higher-income residents because the costs of development are so high, and many currently affordable rental units are being permanently removed from the housing stock due to unsuitability (Joint Center for Housing Studies). The Low Income Housing Tax Credit (LITC), which is the main mechanism for subsidizing affordable development, is not sufficient to overcome large development costs, and developers often have to combine multiple subsidies in order to keep rents affordable (Joint Center for Housing Studies). Consequently, some policymakers argue that increasing these subsidies, along with subsidies like Section 8 and HOME program vouchers, which subsidize private-market housing, may have a positive impact on displacement.

Other policymakers have proposed policies aimed at allowing lower-income renters to stay in their apartments (e.g. stricter landlord-tenant laws, rent controls) or giving lower-income

people the means to keep up with rising rent (e.g. a higher minimum wage, stronger social protection programs). Other suggestions include adopting policies that seek to mitigate the negative effects of displacement. For instance, if policymakers considered investing more in low-performing public schools, then the neighborhoods the displaced moved to may not end up being worse. Pursuing policies that allow displaced children to attend higher performing schools rather than poor local ones may also help alleviate this problem. More research, however, needs to be done so that policymakers know the exact effects of displacement in their specific cities, which types of policies would be most appropriate, if any, and whether the benefits of these policies outweigh the costs.

VIII. Conclusion

This paper studies the link between gentrification and displacement and the effects of displacement on lower-income residents in Los Angeles. My research expands on the previous gentrification and displacement literature by researching a new city, using a new dataset, and studying a new time period. Moreover, I introduce a new, more quantitative measure of gentrification, utilize an empirical specification that better controls for other reasons why households may have moved, and extend my analysis to examine what happens to people after they have been displaced.

I find that there is a positive and significant link between gentrification and displacement of lower-income renters. Those who are displaced are significantly more likely to move to worse neighborhoods with lower education quality and higher crime rates. While age and renter status are the only predictors of who gets displaced, the negative effects of displacement tend to be concentrated among single people, those from crowded households, African Americans, and Hispanics as they tend to move into these worse neighborhoods.

As previously mentioned, there are limitations to my findings. The external validity of my results is limited because individuals with missing observations in the L.A. FANS dataset differed significantly from those without missing observations. Further, if those who did not answer any questions in the L.A. FANS survey or who were dropped from my dataset differed systematically from those included, it would restrict my results even more. My empirical specification is also not as precise as preferred. For instance, some of the control variables that I wanted to include were reasons for moving, which would have explicitly controlled for reasons why households moved outside of gentrification. However, these variables had too many missing observations, so I was unable to use them. Additionally, because my measures of gentrification and displacement are proxies, they may not have measured each phenomenon as precisely as possible. For example, because my definition of displacement included all lower-income renters who moved out of gentrifying neighborhoods, it is possible that some of the movers I included in my analysis moved for reasons outside of displacement. This would make my link between gentrification and displacement imprecise and would bias it in my favor. Omitting other critical control variables may further bias my results.

Future studies will hopefully build on my analysis by examining gentrification and displacement in cities across the country. Most of the gentrification literature has focused on large, crowded metropolises, but gentrification may have different impacts in smaller cities that have lower population densities, more available land for new housing, and higher vacancy rates. It would also be interesting if more studies examined the impact of more recent gentrification, especially since the phenomenon has accelerated recently. Finally, future studies should consider implementing alternative but more standardized and precise measures of gentrification and displacement. For instance, UCLA has recently developed a neighborhood database that

identifies which neighborhood tracts have gentrified and which are vulnerable to gentrification.[10] It would be interesting to see whether results differ using this measure of gentrification. Research on gentrification-induced displacement should continue because the topic has such important policy implications. More research on this topic could provide policymakers with better ideas about the appropriate policy responses to this problem whether that is subsidizing affordable housing, implementing rent controls, or providing more benefits to lower-income residents, to name just a few.

[10] This database can be found at http://www.urbandisplacement.org/map/la#.

Appendix

In my analysis I also use the GeoLytics dataset to obtain measures of gentrification. This dataset consists of U.S. Census data from 1970 to 2000.[11] I calculate housing appreciation rates and changes in housing price rankings (i.e. my gentrification measures) between 1990 and 2000. This is around the time when people in the L.A. FANS dataset begin to move, so these prices may impact households' moving patterns. The results from this analysis are shown in Table 4.

Table 4 Probit Results for Moves among Lower-Income/Asset Households using the GeoLytics Dataset

Measure of Gentrification Used	(1) Housing Appreciation Rate	(2) Change in Housing Price Ranking
Gentrification measure	.131	.0003
	(.104)	(.0003)
Renter	.522***	.486***
	(.162)	(.164)
Gentrification measure*Renter	-.011	-.0001
	(.166)	(.0003)
Family earnings	-.000002	-.000002
	(.000004)	(.000004)
Single (i.e. not married or cohabitating)	.181	.168
	(.189)	(.189)
Gender	.027	.018
	(.132)	(.131)
Number of children	-.022	-.018
	(.077)	(.077)
Single*number of children	-.033	-.030
	(.090)	(.090)
Race: Hispanic	-.076	-.062
	(.179)	(.178)
Race: African American	.100	.132
	(.217)	(.217)
Race: Asian	.125	.113
	(.282)	(.282)
Age	-.022***	-.023***
	(.006)	(.006)
Employed	.061	.050
	(.136)	(.135)

[11] More information about GeoLytics and my specific dataset (Neighborhood Change Database) can be found at http://www.geolytics.com/.

Highest education level	-.0001	-.003
	(.017)	(.016)
Number of people in household	.040	.038
	(.047)	(.047)
Housing component 1	.026	.024
	(.053)	(.054)
Neighborhood component 1	.013	.014
	(023)	(.023)
Neighborhood component 2	-.051*	-.049*
	(.027)	(.026)
Neighborhood component 3	.042	.042
	(.029)	(.029)
Neighborhood component 4	-.038	-.036
	(.032)	(.032)
Residential component 1	.152***	.152***
	(.055)	(.055)
Number of observations	578	578
Pseudo R^2	.13	.13

Notes: Standard errors are in parentheses. Multiple neighborhood components were included because of the high number of variables and therefore high eigenvalues (i.e. variation) of the components.
* denotes p < .1. ** denotes p < .05. *** denotes p<.01.

In this case I do not find a statistically significant link between gentrification and displacement. This, however, is not surprising because a lot of measurement error arises when using housing prices from 1990 to 2000. For one, households who move after 2001 may not have housing prices from 1990 to 2000 on their mind, so current higher housing prices resulting from gentrification are much more relevant. Further, it is possible that much of the displacement occurred before I actually measured displacement. If gentrification started in 1990, for instance, the bulk of displacement may occur shortly after. Those who remain in a gentrifying neighborhood may then be more likely to stay because of the positive effects of gentrification, which would explain why the interaction terms in my regressions are negative. Consequently, using housing prices from 2001 to 2006, which is the exact period when L.A. FANS tracks moves, is the best measure to use because it minimizes the chances of missing any displacements and is more relevant to residents' displacement patterns than prices from other years.

References

Atkinson, R. (2000a). Measuring Gentrification and Displacement in Greater London. *Urban Studies, 37*(1), 149-165.

Atkinson, R. (2000b). The hidden costs of gentrification: Displacement in central London. *Journal of Housing and the Built Environment, 15*, 307-326.

Atkinson, R. (2002). Does Gentrification Help or Harm Urban Neighbourhoods? An Assessment of the Evidence-Base in the Context of the New Urban Agenda. *ESRC Centre for Neighbourhood Research*, 1-26.

Banzhaf, H.S., & McCormick, E. (2007). Moving Beyond Cleanup: Identifying the Crucibles of Environmental Gentrification. *National Center for Environmental Economics (EPA)*, 1-51. Retrieved from https://www.epa.gov/environmental-economics/working-paper-moving-beyond-cleanup-identifying-crucibles-environmental.

Ellen, I.G., & O'Regan, K.M. (2011) How low income neighborhoods change: Entry, exit, and enhancement. *Regional Science and Urban Economics, 41*(2), 89-97.

Freeman, L. (2005). Displacement or Succession? Residential Mobility in Gentrifying Neighborhoods. *Urban Affairs Review, 40*(4), 463-491.

Freeman, L., & Braconi, F. (2004). Gentrification and Displacement: New York City in the 1990s. *Journal of the American Planning Association, 70*(1), 39-52.

Gould, E., Cooke, T., & Kimball, W. (2015). What Families Need to Get By. *Economic Policy Institute.* Retrieved from http://www.epi.org/publication/what-families-need-to-get-by-epis-2015-family-budget-calculator/.

Grier, G., & Grier, E. (1978). *Urban Displacement: A Reconnaissance.* Bethesda, MD: The Grier Partnership.

Joint Center for Housing Studies (2015). America's Rental Housing: Expanding Options for Diverse and Growing Demand. *Joint Center for Housing Studies at Harvard University*, 1-44. Retrieved from http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/americas_rental_housing_2015_web.pdf.

Juday, L.J. (2015). The Changing Shape of American Cities. *Demographics Research Group Weldon Cooper Center for Public Service*, 1-20. Retrieved from http://www.coopercenter.org/sites/default/files/node/13/ChangingShape-AmericanCities_UVACooperCenter_March2015.pdf.

Kennedy, M., & Leonard, P. (2001). Dealing with Neighborhood Change: A Primer on Gentrification and Policy Choices. *The Brookings Institution Center on Urban and Metropolitan Policy*, 1-70. Retrieved from https://www.brookings.edu/wp-content/uploads/2016/06/gentrification.pdf.

Knafo, S. (2015, September 2). Is Gentrification a Human-Rights Violation? *The Atlantic*. Retrieved from http://www.theatlantic.com/business/archive/2015/09/gentrification-brooklyn-human-rights-violation/402460/.

Madhani, A. (2016, May 19). Census shows big U.S. cities continue to grow. *USA Today*. Retrieved from http://www.usatoday.com/story/news/2016/05/19/census-shows-big-us-cities-continue-grow/84552378/.

McKinnish, T., Walsh, R., & White, T.K. (2010). Who gentrifies low-income neighborhoods? *Journal of Urban Economics, 67,* 180-193.

Newman, K., & Wyly, E.K. (2006). The Right to Stay Put, Revisited: Gentrification and Resistance to Displacement in New York City. *Urban Studies, 43*(1), 23-57.

Newman, S.J., & Owen, M.S. (1982). Residential Displacement: Extent, Nature, and Effects. *Journal of Social Issues, 38*(3), 135-148.

Osman, S. (2016). Gentrification in the United States. *Oxford Research Encyclopedias: American History.* Retrieved from http://americanhistory.oxfordre.com/view/10.1093/acrefore/9780199329175.001.0001/acrefore-9780199329175-e-135.

Peterson, C.E., Pebley, A.R., Sastry, N., Yuhas, K., Ghosh-Dastidar, B., Haas, A.C., Gregory, J., Bitler, M.P. (2011). The Los Angeles Family and Neighborhood Survey, Wave 2. *Rand Corporation*, 1-122.

Peterson, C.E., Sastry, N., Pebley, A.R., Ghosh-Dastidar, B., Williamson, S., & Lara-Cinisomo, S. (2004). The Los Angeles Family and Neighborhood Survey Codebook. *Rand Corporation,* 1-798.

Schill, M.H., Nathan, R.P., & Persaud, H. (1983). *Revitalizing America's Cities: Neighborhood Reinvestment and Displacement*. Albany, NY: State University of New York Press.

Tiebout, C. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy, 64*(5), 416-424.

Vigdor, J. (2002). Does Gentrification Harm the Poor? [with Comments]. *Brookings-Wharton Papers on Urban Affairs*, 133-182.

Wiseman, R.F. (1980). Why Older People Move. *Research on Aging, 2*(2), 141-154.

Wyly, E.K., Newman, K., Schafran, A., & Lee, E. (2010). Displacing New York. *Environment and Planning A, 42*(11), 2602-2623.

Zuk, M., Bierbaum, A.H., Chapple, K., Gorska, K., Loukaitou-Sideris, A., Ong, P., & Thomas, T. (2015). Gentrification, Displacement and the Role of Public Investment: A Literature

Review. *Federal Reserve Bank of San Francisco*, 1-75. Retrieved from http://www.frbsf.org/community-development/publications/working-papers/2015/august/gentrification-displacement-role-of-public-investment/.

Data Sources

CoreLogic. (2000). *CoreLogic* [Data file].

GeoLytics, Inc. (2000). *Neighborhood Change Database 1970-2000* [Data file]. Retrieved from http://demographics.geolytics.com/NCDB/default.aspx.

RAND Corporation. (2008). *Los Angeles Family and Neighborhood Survey* [Data file]. Restricted dataset.