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Who Gentrifies Low-Income Neighborhoods?*

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Abstract

This paper uses confidential Census data, specifically the 1990 and 2000 Census Long Form data, to study demographic processes in neighborhoods that gentrified during the 1990's. In contrast to previous studies, the analysis is conducted at the more refined census-tract level, with a narrower definition of gentrification and more closely matched comparison neighborhoods. Furthermore, our access to individual-level data with census tract identifiers allows us to separately identify recent in-migrants and long-term residents. Our results indicate that, on average, the demographic flows associated with the gentrification of urban neighborhoods during the 1990's are not consistent with displacement and harm to minority households. In fact, taken as a whole, our results suggest that gentrification of predominantly black neighborhoods creates neighborhoods that are attractive to middle-class black households.

I. Introduction

Over the past several decades, there has been substantial gentrification of low-income neighborhoods in many U.S. urban areas. These neighborhoods typically experience large increases in household income and housing prices. Some laud the revitalization of decayed neighborhoods and others criticize the displacement of low-income, often minority, households. Despite the importance of gentrification in urban areas as an observed phenomenon and as a policy issue, there is a shortage of empirical evidence describing how gentrification occurs and its consequences for low-income and minority individuals.

This paper uses confidential Census data, specifically the 1990 and 2000 Census Long Form data, to study the demographic processes underlying the gentrification of low-income urban neighborhoods during the 1990's. We analyze the characteristics of the households moving

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into, moving out of and staying in these neighborhoods. These basic demographic facts of neighborhood gentrification are largely unknown due to a lack of suitable data, and it is difficult to discuss policy issues related to gentrification without establishing such facts. A key purpose of this analysis is to determine whether the demographic processes of neighborhood gentrification are consistent with the story of displacement and harm to low-income and minority families that currently dominates much of the popular press and policy discussion of gentrification.

Some recent studies have examined the issue of displacement, but with data sets that require they either define rather large neighborhoods (regions 100,000+ in population), use overly broad definitions of gentrification, and/or focus on a single location. Even less is known about the role of in-migration in gentrification and the impact of gentrification on residents who remain in neighborhoods that experience gentrification. While there have been some descriptive statistics reported on these two questions, there has been no formal multivariate analysis.

Using the 1990 and 2000 Census Long Form Data, we create a mapping of time-consistent census tracts between 1990 and 2000, identify a set of gentrifying tracts, and compare these neighborhoods to non-gentrifying tracts in the same metropolitan area that were similarly poor in 1990. We highlight two key benefits of using non-public data that allow us to provide a much more detailed analysis of gentrifying neighborhoods than previous studies. First, we have the refined geographic detail, geographic coverage, and sample size to better define the set of gentrifying neighborhoods and a set of comparison neighborhoods. Second, because we have individual data that identify census tract of residence, we can separately identify residents who are recent in-migrants and those who are long-time residents of the neighborhoods.

Our findings do suggest that neighborhood gentrification is associated with disproportionate in-migration of college graduates, particularly white college graduates under 40 without children. However, in the full sample, synthetic cohort analysis of out-migration finds no evidence of disproportionate exit of low-education or minority householders. A decomposition of the total income gains in a gentrifying neighborhoods attributes a substantial 33% of income gains to black high school graduates. This sizeable contribution results from the fact that black high school graduates make up a full 30% of the population of gentrifying neighborhoods in 2000 and that the average income of this demographic group in gentrifying neighborhoods increases substantially during the 1990's.

Our results indicate that, on average, the demographic flows associated with the gentrification of urban neighborhoods during the 1990's are not consistent with displacement and harm to minority households. In fact, taken as a whole, our results suggest that gentrification of predominantly black neighborhoods creates neighborhoods that are attractive to middle-class black households. While this does not rule out the possibility of negative effects in individual neighborhoods or other time periods, it does suggest that policy makers can approach discussions of gentrification with the knowledge that recent gentrification has not solely benefited high-income white households at the expense of lower-income or minority households.

II. Literature Review

Other work using public data has documented the income growth in low-income neighborhoods during the 1990's. Ellen and O'Regan (2008) analyze the Neighborhood Change Database (NCDB), which provides a panel of aggregate data for census tracts, and find a notable increase in the proportion of poor neighborhoods experiencing substantial income gains during the 1990's. They further document that this "reversal of fortunes" was pervasive throughout the

country, and that, unlike previous decades, these gains were most likely to occur in census tracts with high concentrations of poverty and black households.

There is a small literature that investigates the displacement of low-income minorities from gentrifying neighborhoods. Vigdor (2002) studies gentrification in the Boston metro area using American Housing Survey (AHS) data from 1974-93 that identify "zones" of 100,000 to 200,000 individuals. He finds no evidence that low-income households are more likely to exit the current housing unit if they are located in a gentrifying zone. Freeman and Braconi (2004) conduct a similar study of gentrification in New York City in the 1990's using data collected as part of the city's rent regulation policy. The data identify 55 subborough areas of approximately 131,000 persons each. Identifying seven neighborhoods in Manhattan and Brooklyn that gentrified during the 90's, they find that low-income households in the gentrifying neighborhoods were less likely to move than low-income households in non-gentrifying neighborhoods.

Freeman (2005) studies a sample of U.S. neighborhoods using the geo-coded version of the Panel Study of Income Dynamics (PSID), which identifies Census tract of residence. Census tracts generally contain between 1,000 and 8,000 people, with an optimum size of 4,000 people. Sample size constraints, however, require he take a rather broad definition of gentrification. It is probably a result of this broad definition that his set of gentrifying neighborhoods actually experience a $4,000 *decrease* in median household income during the 1990's.[1] He again finds little evidence that gentrification is associated with displacement of low-income households.

While not a study of displacement, related work by Bostic and Martin (2003) uses aggregate data to test whether black homeowners were associated with gentrification in the 1970's and 80's. They find that the presence of black homeowners was positively correlated with gentrification in the 1970's, but not the 1980's. They conclude that, "gentrification does not necessarily imply a race-based neighborhood transformation and can potentially involve a 'minorities moving in, minorities moving out' transitional process" (p.2428).

The above discussion highlights the data issues that plague research on residential mobility and gentrification. Some studies, such as Ellen and O'Regan (2008) and Bostic and Martin (2003), use aggregate data to identify and describe gentrifying tracts. These studies, however, are unable to examine the process of gentrification, because they lack the data to distinguish in-migrants, out-migrants and long-term residents. Most of the available micro-data sets that do allow analysis of flows into or out of gentrifying neighborhoods typically identify neighborhoods that are unsatisfactorily large in size or only cover an individual city. Our use of confidential Census Long Form data allows us to circumvent these data issues as we have a very large, nationally representative sample of individual-level data with census tract identifiers.

While most of the previous research has focused on which households exit gentrifying neighborhoods, we also investigate who moves *into* gentrifying neighborhoods and what happens to households that *remain* in gentrifying neighborhoods.[2] These two issues have received much less attention in the academic literature. Freeman and Braconi (2004) report the

[1]Freeman (2005) uses the requirements that the neighborhood 1) is center city, with 2) median income in previous census below the metro area's 40th percentile, 3) proportion housing built in last 20 years in the previous census below the metro area's 40th percentile, 4) above median growth in educational attainment in the intercensal period, and 5) increase in real housing prices in the intercensal period.

[2]Vigdor (2002) does some limited analysis of AHS respondents in the Boston Metro area who remain in the same housing unit 1985-89 or 1989-93. He reports how many of these "stayer" households report (1) increases in housing costs, (2) decreases in real income net of housing costs, (3) no improvements in housing quality, (4) no improvements in neighborhood satisfaction, and (5) no improvements in satisfaction with public services. This analysis, however, is conducted for *all* stayer households in the entire Boston Metro area. The sample of stayer households is too small for him to look specifically at households in gentrifying neighborhoods or make any sort of cross-neighborhood comparisons.

mean income, college graduation rate and poverty rate of in-movers to the seven gentrifying New York neighborhoods. Freeman (2005) estimates logit models of whether in-migrants choose gentrifying neighborhoods, estimating in *separate logit models*, rather than *jointly*, the effects of income, education and race. Both studies indicate that in-migrants to gentrifying neighborhoods are more likely to be white, college-educated, and higher income than in-movers to non-gentrifying neighborhoods, but there is no multivariate analysis to determine, for example, the independent, or interacted, effects of education and race. Wyly and Hammel's (2004) analysis of housing mortgages for 23 large cities can be thought of as an analysis of new (home-owning) arrivals to gentrifying neighborhoods. They find that the population of home mortgage recipients in gentrifying areas becomes higher-income and whiter between 1993 and 2000.

Conceptually, we know that households will choose neighborhood locations based on a comparison of the utilities they receive from the mix of amenities and costs available at different locations. In our analysis, we do not make any assumptions about which amenities are drawing new residents into gentrifying neighborhoods.[3] We can, however, speculate about who might move into gentrifying neighborhoods, given that these neighborhoods typically had disproportionately high concentrations of poverty and black households in 1990. The new higher income residents of these neighborhoods will be likely be more highly educated educated, middle class households who are choosing between predominantly white middle class neighborhoods and gentrifying neighborhoods that are more racially and economically diverse. Given this choice, as argued by Bayer, Fang and McMillan, 2005, middle-class black and Hispanic households may find the gentrifying neighborhoods particularly attractive. Among white householders, it seems reasonable that younger householders without children might bear fewer costs of moving into these evolving neighborhoods, as they may be more open to racially diverse neighborhoods and less concerned with school quality and crime rates. Conversely, for non-white householders, it is less obvious that youth and absence of children will predict the choice to locate in a gentrifying neighborhood, as there may be a desire to raise children among peers with similar racial or ethnic backgrounds that is weighed against concerns about school quality and crime rates.

We can similarly ask who will be most likely to exit gentrifying neighborhoods. A standard filtering model (e.g. Muth, 1973; Smith, 1972; Sweeney, 1974) predicts that as the willingness-to-pay for residency by high-income households increases, current low-income residents will be quickly displaced.[4] On the other hand, there may be neighborhood amenities that retain current residents despite the increased costs, such as access to public transportation (see, for example, Glaeser, Kahn and Rappaport, 2008). Gentrification itself may provide amenities that are valued by existing residents. As Vigdor (2002) and Freeman and Braconi (2004) discuss, gentrification might bring new proximity to job opportunities, a larger tax base and better public services, improved retail environment, and other changes in neighborhood quality such as reductions in crime. Therefore, to the extent that the existing residents benefit sufficiently from a more economically diverse neighborhood, we may not observe disproportionate exit from gentrifying neighborhoods.

[3]There is a substantial literature on how current neighborhood characteristics predict neighborhood change, including Card, Mas and Rothstein (2008), Brueckner and Rosenthal (2009), Rosenthal (2008), Coulson and Bond (1990), and Clapp and Ross (2004). Brueckner and Rosenthal (2009) and Rosenthal (2008), for example, show that age of housing stock is a key determinant of neighborhood growth. Our paper addresses a related, but distinct question. Ours is a demographic study of the flows into and out of gentrifying neighborhoods, not a causal analysis of which characteristics, demographic or otherwise, predict neighborhood gentrification.

[4]Obviously the effects of higher prices will depend on whether the household rents or owns their home. Ideally, we would like to analyze displacement separately for renters and owners, but this requires longitudinal data, and is not possible with the cohort methods used in this paper.

III. Data

This section describes how the analysis sample and key variables are constructed using 1990 and 2000 Census data. The data are constructed in 2 stages. First, 1990 and 2000 Census tracts are linked and a sample of urban census tracts are selected. Next, tract-level variables are constructed. These tract-level characteristics are used to select the set of tracts in the analysis sample and to identify tracts that gentrified between 1990 and 2000. In the second stage, the sample of householders that reside in the tracts in the analysis sample is drawn from the 2000 data, and household-level variables are created.

A. Census Demographic Long Form Data

The analysis in this paper uses the 1990 and 2000 Decennial Census Long Form Data. These are confidential data products of the U.S. Census Bureau that can only be accessed from a Census Research Data Center (CRDC). The Long Form Data contain the population of households that respond to the Long Form survey in the Decennial Census, which is administered to a 1-in-6 sample of all households in the U.S. The samples include 14.3 million households and 38.6 million individuals in the year 1990 and 16.6 million households and 43.5 million individuals in the year 2000.

The analysis in this paper would not be possible with publicly available data. The Public Use Microdata Samples (PUMS) contain a random sample of the Decennial Long Form surveys, but only identify Public Use Microdata Areas (PUMAs), which are areas of at least 100,000 people. In contrast, the confidential Long Form data identify census tracts that, as described above, contain an average of 4,000 individuals.[5] There are also public Census data sets that report aggregate census tract-level characteristics, but they do not disaggregate by key variables such as the migration status of the household.

B. Census Geography and Sample Criteria

The U.S. Census Bureau attempts to maintain consistent census tract boundaries over time, but boundaries are sometimes changed as neighborhoods evolve and as tract populations increase or decrease.[6] Therefore, census tracts must be linked between the 1990 and 2000 Censuses. Census Tract Relationship Files from the U.S. Census Bureau show how 1990 census tracts relate to 2000 census tracts. Using this information, we developed a concordance file that aggregates tracts to create neighborhood definitions that are unique and consistent across the two census years.[7] If, for example, a 1990 tract split into two tracts in 2000, the two 2000 tracts were merged into a single neighborhood that would be consistent with the original 1990 tract. There were some cases of overlapping tract splits and merges, which required that we aggregate over several tracts to obtain one consistent neighborhood.[8] In this paper, the terms

[5]The census block, an even smaller geographic unit, is also identified. Because, however, CRDC researchers are not currently allowed to link census data over time at the block level, and because the tract more closely relates to our concept of neighborhood, we conduct our analysis at the tract level. Using survey data, Lee and Campbell (1990) find that self reported neighborhoods of residence on average cover 15 square blocks. This finding suggests that census tracts offer a reasonable neighborhood definition for urban areas.

[6]According to the U.S. Census Bureau, "Census tracts are small, relatively permanent statistical subdivisions of a county . . and, when first delineated, are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Census tract boundaries are delineated with the intention of being maintained over a long time so that statistical comparisons can be made from census to census. However, physical changes in street patterns caused by highway construction, new development, etc., may require occasional revisions; census tracts occasionally are split due to large population growth, or combined as a result of substantial population decline." See http://www.census.gov/geo/www/cen_tract.html.

[7]Specifically, for each 2000 Census Tract, these relationship files report the count of the 2000 population that resides in each 1990 Census Tract that either partially or completely overlaps the 2000 Census Tract Geography. Because our mapping only uses aggregation to arrive at time-consistent boundaries, we avoid the problem of allocating individuals from a single tract across multiple tracts - when for instance a 1990 Census Tract splits in 2000 or when multiple 1990 Census Tracts are aggregated to a single Census Tract in 2000. A different approach would have been to use the Census Relationship Files to develop weights for apportioning census counts in the face of mergers and/or splits. While our aggregation strategy was more computationally burdensome than a weighting approach, the end result avoids increased demographic measurement error that would arise if we had used this type of weighting scheme.

neighborhood and census tract will refer to these census tract groupings that we have linked between 1990 and 2000.

We select our sample of census tracts for analysis from Consolidated Metropolitan Statistical Areas (CMSAs) as defined by the Census Bureau. We start with the 72 CMSAs in the continental U.S. with populations of at least 500,000 in 1990. Because most CMSAs include some areas that are very rural and in which census tracts cover very large geographic areas, we further refine our sample. Using a Census Bureau list of incorporated places with populations of 100,000 or more in 1990, we only include tracts from the 72 CMSAs that are within a 5km buffer of one of these large incorporated places. This effectively selects off the more densely populated areas of the CMSAs, and excludes some of the less-populous CMSAs that do not contain a single census place. Our final sample consists of 15,040 linked tracts from 64 CMSAs, 72.5% of which are in central cities, as defined by the U.S. Census Bureau. A list of included CMSAs appears in Appendix A

C. Definition of Gentrification and Comparison Groups

Table 1 provides some descriptive statistics on income and income change for our sample of 15,040 urban area tracts, by quintile of average family income in 1990.[9] The construction of the family income variable is described below in section D. The most interesting result in Table 1 is that the bottom quintile of neighborhoods has median income growth substantially above that experienced by neighborhoods in the four richer quintiles, and the 90th percentile of income growth is only higher in the top quintile. This indicates that gentrification is an important phenomenon among the lowest-income neighborhoods during this period.

We take as our primary analysis sample the tracts that are in the bottom quintile of average family income in 1990.[10] These neighborhoods have average family income less than $30,079 (in 2000 dollars) in 1990. We refer to this set of neighborhoods as the low-income neighborhood sample.

Because the focus of our research is on the demographic trends in gentrifying neighborhoods, we do not want our definition of gentrification to determine the results. Some definitions of gentrification require educational up-skilling, racial turnover and even displacement, but our analysis of in-migration and exit will be much less interesting if we condition our sample on these outcomes. We instead take gentrifying neighborhoods to be those tracts in the low-income neighborhood sample that experience an increase in average family income between 1990 and 2000 of at least $10,000.[11] 15.2% of tracts in the bottom quintile experience income growth of this magnitude. Only 13.2% of tracts in the upper 4 quintiles experience absolute growth of

[8] 82% of the constructed time-consistent neighborhoods contain only one 2000 census tract, and 94% contain no more than two 2000 census tracts.

[9] All income figures are reported in year 2000 dollars.

[10] We also conducted alternative analysis in which we selected tracts from the bottom quintile of neighborhood income, calculated *within* each CMSA, and found this had little effect on the results. We chose not to report these results for 3 reasons: (1) The main effect of this exercise was to include more higher-income, whiter tracts in our low-income neighborhood sample, making it less comparable to the gentrifying neighborhoods. This was because some metro areas (e.g. San Francisco) have relatively few neighborhoods with average incomes below $30,000. (2) The selection of the appropriate middle-class neighborhoods sample becomes much trickier and arbitrary when done on a within CMSA basis. (3) All of our regression specifications include CMSA fixed effects, so while our sample is not selected based on within-CMSA comparisons, all of our estimates are based on within-CMSA comparisons of demographic and economic outcomes.

[11] We use average income rather than median income because in theory a neighborhood could experience substantial income growth and movement of the upper end of its income distribution with relatively little effect (in the absence of displacement) on the median. Further, the use of average income facilitates the decompositions we perform in Table 9. Additionally, we use an absolute, rather than percent, income change to identify gentrifying neighborhoods. Table 1 suggests that switching to a percentage change rule would only serve to identify as gentrifying more neighborhoods that have extremely low incomes in 1990 and therefore only require a small absolute increase to generate a large percentage gain during the 1990's. Further, a $10,000 gain is a very large gain in percentage terms for all of the neighborhoods in the bottom quintile.

this magnitude. 94.3% of tracts in our low-income neighborhood sample are located in central cities, as are 95.6% of gentrifying tracts in this sample.

Like Ellen and O'Regan (2008), we find that income growth in low-income neighborhoods was widespread during the 1990's. Only 6 of our 64 CMSAs do not contain a single gentrifying tract.[12] Among the remaining 58 CMSAs, the average gentrification rate of low-income tracts is 14.5%, with four CMSAs experiencing rates of at least 30%: Charlotte, NC, Austin, TX, Chicago, IL and Denver, CO.

Most of our analysis compares gentrifying neighborhoods to non-gentrifying neighborhoods in the low-income neighborhood sample. Because most gentrifying tracts exit the bottom quintile by 2000, we create a second sample of middle-class neighborhoods in 2000 and distinguish those that were low-income neighborhoods in 1990 from those that were not low-income in 1990. To be specific, we take as our middle-class neighborhood sample those tracts with average family income in 2000 between $33,000 and $47,000. This sample is comprised of neighborhoods from the very top of the first quintile through the middle of the 3rd quintile of average family income in 2000. These cut-off points for the middle-class neighborhood sample are chosen to maximize the concentration of gentrifying tracts. For analysis with the middle-class neighborhood sample, gentrification is still defined as those neighborhoods in the sample that were originally in the bottom quintile in 1990 and for whom average family income increased by at least $10,000 between 1990 and 2000. 5.8% of tracts in the middle-class sample are gentrifiers and 63.4% of gentrifying tracts in the low-income neighborhood sample (based on 1990 income) appear in the middle-class neighborhood sample (based on 2000 income).

D. Measurement of Key Variables

Having identified two samples of urban neighborhoods, the low-income neighborhood sample and the middle-class neighborhood sample, we then select the sample of all householders in the 2000 Long Form Census data who reside in these tracts.[13] Key variables in our analysis include family income and migration status of the householder. To create the family income measure, we sum all forms of income across all members of the householder's family.[14] Income from unmarried partners is included in family income, but we exclude income from individuals in the household who are otherwise not related to the householder (such as roommates or boarders).

We wish to distinguish those householders who moved into their current residence between 1990 and 2000 from those who lived there prior to 1990. The PUMS data report, for each household member, whether or not he or she lived in the same housing unit 5 years prior to the survey. The confidential data, fortunately, provide even more detailed information, which allows us to exactly identify whether or not the householder moved into the housing unit in the past 10 years. In this paper, householders who moved into their housing unit in the past 10 years are referred to as migrants. Unfortunately, there is no way to identify whether migrant householders previously lived in another housing unit in the same neighborhood or whether they moved in from another census tract.[15]

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[12]The 6 CMSA's with no gentrifying tracts are Allentown-Bethlehem-Easton, PA, Bakersfield, CA, Baton Rouge, LA, Fresno, CA, Richmond-Petersburg, VA, and Springfield, MA.

[13]We define "household" and "householder" the same way the Census Bureau does: a household refers to the people living in a housing unit, with the householder being the one in whose name the home is owned, being bought, or rented, in any kind of housing unit.

[14]The definition of family used by the Census Bureau is "two or more individuals related by birth, marriage, or adoption who reside together." Our definition of family income is similar to that used by the Census Bureau, the largest difference being that householders who do not reside with any relative are still included in our analysis as a family of size one. Unlike the definition of family income used by the Census Bureau, we include income from individuals designated as the unmarried partner of the householder. Individuals who do not live alone, but are not related to the householder, are not included in our analysis. Their income does not belong in the householder's family's income, but we do not have the migration information to create separate observations for them.

IV. Methods

A. Migrants to Gentrifying vs Non-Gentrifying Neighborhoods

We investigate the differences in characteristics between householders who moved into houses in neighborhoods that gentrified between 1990 and 2000 and those who moved into houses in low-income neighborhoods that did not gentrify. Restricting the analysis sample to only those householders who moved into a housing unit in the low-income neighborhood sample between 1990 and 2000, we estimate a logit model of the form:

$$\log\left(\frac{\Pr(G_i=1)}{\Pr(G_i=0)}\right)=\beta_o+\sum_{j=1}^{35}\beta_j D_{ij}+X_i\gamma+\sum_{m=1}^{64}\delta_m CMSA_{im}, \quad (1)$$

where G is an indicator variable that equals 1 if householder i moved into a gentrifying tract. The D_j's are 35 demographic group indicator variables created by crossing 3 race/ethnicity categories (non-Hispanic white, non-Hispanic black, and Hispanic) with 3 education categories (high school dropout, high school degree, college degree) and 4 lifecycle categories (age less than 40 without children, age less than 40 with children, age 40-60, age greater than 60).[16] Our omitted reference group is white high school dropouts under 40 without children, leaving 35 demographic group indicators. X contains controls for householder's relationship status (married, cohabitating with unmarried partner, or single) interacted with the 3 race/ethnicity indicators and the householder's immigrant status interacted with the 3 race/ethnicity indicators.

X includes a control for average 1990 income for the tract in which the householder is located in 2000. Suppose, for example, that white householders are more likely to move into neighborhoods in the upper-end of the bottom quintile of 1990 income. If 1990 tract income is positively correlated with gentrification status, then failure to control for 1990 income could wrongly attribute a tendency to locate in the higher-income neighborhoods with a preference for gentrifying neighborhoods. The model also includes CMSA fixed-effects.[17]

Our choice of specification warrants further explanation. We could have fully interacted race/ethnicity, education, age, family structure (marital status and presence of children), and immigration status, rather than including additional controls for marital status and immigration. Unfortunately, this creates an unwieldy number of coefficient estimates to report, and generates quite a few small cells, resulting in many imprecise estimates. Additionally, all of our empirical results must go through a review before they are publicly released, and these small cells present a disclosure risk.[18] We therefore determined which variables were the most important correlates of gentrifying mobility and which had the most interesting interactions with race and education. For example, we chose to include the interaction of presence of children with the youngest age category, but not with the 40-60 age category, because it was only for the younger householders that presence of children was such an important predictor of location choice. We also initially interacted marital status with age, education and race, but found that presence of children, rather than marriage or cohabitation, was the more important predictor and had more important interaction effects with race and education.[19]

[15] We do know whether the householder lived in the same county five years ago, information we use in some additional sensitivity analysis.

[16] Children must be under 18 and living in the same household.

[17] Some CMSAs contain multiple MSAs. We also tried a specification with MSA fixed effects, but the change did not significantly affect the results.

[18] It is because of this same concern with small cells that householders that report a race other than white or black are not included in the analysis reported in Tables 4, 5, 7 and 8. Once this "other race" category is sub-divided by age, education and family structure, the cells become very small. "Other Race" householders are included in the descriptive tables and in the decomposition in Table 9.

In equation (1), β_o measures the differential between the migration rate into the gentrifying tracts and non-gentrifying tracts for the reference demographic group. A positive $_j$ therefore indicates that this differential is larger for demographic group j than for the reference group. These estimates indicate which demographic groups act as gentrifiers, in other words, which groups have disproportionately high rates of migration into gentrifying neighborhoods relative to other low-income neighborhoods. To be clear, this is not a *causal* analysis. The purpose of equation (1) is not to *predict* gentrification, rather the purpose is to study the demographic flows associated with gentrification in the 1990's. Obviously, by definition, the migrants into gentrifying neighborhoods will be higher income than migrants to non-gentrifying poor neighborhoods. It is therefore quite possible that these migrants will also be disproportionately college-educated and white. With our analysis we seek to compare, for example, in-migration of college-educated black householders to college-educated white householders to white householders without a college degree. Furthermore, we can ask how these migration outcomes vary with age of householder and presence of children.

Estimation of equation (1) using the low-income neighborhood sample allows us to compare those moving into low-income neighborhoods that are gentrifying to those moving into low-income neighborhoods that are not gentrifying. In additional analysis, we estimate equation (1) on the sample of middle-class neighborhoods. As a reminder, our middle-class neighborhood sample is selected based on neighborhood income in 2000, rather than 1990. It therefore contains middle-class neighborhoods that were low-income in 1990 but gentrified during the 90's, as well as established middle-class neighborhoods that were not low-income in 1990. This allows us to compare those who moved into houses in recently-gentrified middle-class neighborhoods to those who moved into houses in neighborhoods that were already middle-class in 1990. When using our middle-class sample, the control for tract-level income in 1990 is replaced with a control for tract-level income in 2000.[20]

B. Cohort Regression Analysis of Out-Migration and Stayer Outcomes

We also consider out-migration. We would like to determine if there is any evidence of displacement of low-income minorities in gentrifying neighborhoods. The cross-sectional Census data cannot be used to create a sample of individuals who used to live in the gentrifying neighborhoods. We still, however, can study this issue by creating synthetic cohorts.

Consider all households in a single tract in 1990 with a householder who is age 20 to 29, white, and has a high school degree. Suppose there are 500 such households. Now, take all households in 2000 with a householder who is 30 to 39, white, has a high school degree, and has lived in the same housing unit for at least 10 years. If there has been no out-migration, there should be 500 such households. The observed changes in cohort size between 1990 and 2000 provide estimates of out-migration for different demographic groups in a neighborhood. Comparing changes in a cohort's size across neighborhoods produce estimates of relative out-migration from different types of neighborhoods for a particular demographic group.

We consider 4 cohorts:

	1990	2000
Cohort 1:	20-29	30-39 and in housing unit for at least 10 years

[19]These restrictions have been made for parsimony and our key findings are robust to a more fully interactive model

	1990	2000
Cohort 2:	30-39	40-49 and in housing unit for at least 10 years
Cohort 3:	40-49	50-59 and in housing unit for at least 10 years
Cohort 4:	50-59	60-69 and in housing unit for at least 10 years

We divide each cohort into our 3 race/ethnicity groups crossed with our 3 education groups. We therefore use 4×3×3=36 cohorts in our analysis.

Our first cohort regression model is:

$$\%\Delta Pop_{ct}=\alpha_o+\sum_{c=1}^{35}\alpha_c C_{ct}+\sum_{c=1}^{36}\beta_c\,(C_{ct}{}^{*}G_t)+X_t\gamma+\sum_{m=1}^{64}\delta_m CMSA_{mt}+\varepsilon. \quad (2)$$

For cohort c in tract t, $\%\Delta Pop_{ct}$ is the percent change in cohort population between 1990 and 2000. The C_c's are indicator variables for each of the 36 cohorts. The coefficients on the interaction of the cohort indicators with the gentrification dummy indicate whether the out-migration for that particular demographic group is higher or lower in gentrifying tracts compared to non-gentrifying tracts. A negative estimate for β_c indicates that the population loss for cohort c was on average greater in gentrifying tracts, which would be consistent with displacement. Because the variables of interest in this specification are interactions with the gentrification status of the tract, we cluster the standard errors at the tract level. We also control for tract income in 1990 and CMSA fixed effects, as we did in the in-migration analysis.

In the 2000 Census, 67.3 % of householders in our sample of urban tracts changed houses in the past 10 years, and 68.8% of householders in the low-income neighborhood sample have done so. The average %ΔPOP for cohorts in the estimation sample is -66.3%, and reflects the natural mobility of households in the U.S. This exercise measures *differential* mobility out of different types of neighborhoods for different demographic groups.

There is a concern that the change in cohort population will be measured with error, because cohorts are based on a random sample, different individuals in the household could list themselves as the householder in successive censuses, and individuals could change or misreport their age, education or race/ethnicity in successive censuses. This can generate attenuation bias in our estimates and cause us to underestimate the displacement effects. We discuss this issue further in our results section.

We also use synthetic cohorts to study changes in income among *pre-existing* residents with the following model:

$$\%\Delta Inc_{ct}=\sum_{c=1}^{36}\alpha_c C_{ct}+\sum_{c=1}^{36}\beta_c\,(C_{ct}{}^{*}G_t)+X_t\gamma+\sum_{m=1}^{64}\delta_m CMSA_{mt}+\varepsilon. \quad (3)$$

Where %ΔInc is the percent change in average family income for cohort c between 1990 and 2000. A positive coefficient for β_c, for example, indicates that there was a greater increase in average family income for cohort c in gentrifying neighborhoods than non-gentrifying

[20]We do not want to wrongly attribute a tendency for a group to locate in higher-income or lower-income middle-class neighborhoods with a preference for gentrifying neighborhoods. Because the middle-class tracts are selected based on 2000 income, it is appropriate to control for average family income in 2000, rather than 1990.

neighborhoods. A positive coefficient therefore indicates that average family income increased for families that *already* lived in the neighborhood in 1990. Such a positive effect of gentrification could result from two very different causes. One is that in gentrifying neighborhoods, the households in a particular cohort that migrate out are disproportionately low-income compared to those in the same cohort leaving non-gentrifying neighborhoods. This would cause an increase in average family income due to a composition effect. The other explanation is that gentrification causes an increase in family income in that demographic group, for example by improving employment opportunities in the local area. Unfortunately, there is no way to formally test between these two interpretations with the data at hand.

V. Results

Table 2 provides a preliminary description of the differences between the gentrifying and non-gentrifying tracts in our low-income neighborhood sample. The first two columns report average tract-level characteristics in 1990 by gentrification status. Consistent with Ellen and O'Regan (2008), the low-income neighborhoods that gentrify between 1990 and 2000 have lower average income and a smaller proportion of white households in 1990 than those low-income neighborhoods that do not gentrify, although the proportion of householders with a college degree is marginally higher. We also note that the average income of householders who moved into the gentrifying neighborhoods between 1980 and 1990 is lower than for those who moved into the non-gentrifying neighborhoods. There is little evidence that the gentrifying neighborhoods were already improving prior to 1990.

The remaining two columns report average tract-level characteristics in 2000 by gentrification status. By definition, the gentrifying tracts have much higher average income in 2000. The most striking feature is the increase in householders with a college degree from 9.0 to 15.8 percent, compared to an increase from 8.2 to 10.1 percent for non-gentrifying neighborhoods. We confirm the finding of Ellen and O'Regan (2008) that the composition of gentrifying tracts actually becomes less white over the decade (although to a lesser extent than other low-income neighborhoods). The final rows of the table indicate that the average incomes of both migrants and non-migrants increase in gentrifying tracts.

A. Migration Logit, Low-Income Neighborhood Sample

Table 3 provides sample means for the householders who moved into a housing unit in the low-income neighborhood sample in the 1990's, stratified by whether the householder moved into a housing unit in a gentrifying versus a non-gentrifying tract. Not surprisingly, the gentrifying migrants are much higher income, with mean family income of $36,524 compared to $25,835 for non-gentrifying migrants. It is also not surprising that they are more likely to be college educated, 19.7% for gentrifying migrants compared to 12.2% for non-gentrifying migrants. While the gentrifying migrants are more likely to be white (28.9% vs 25.1%), they are also more likely to be black (42.9% vs 41.1%), and therefore less likely to be Hispanic (23.0% vs 27.8%). At the bottom of the table, we see that gentrifying migrants are a little younger, less likely to have children, and less likely to be immigrants. There is little difference in marital status.

In the first 3 columns of Table 4, we present the results from estimating equation (1) on the low-income neighborhood sample. Column 1 reports the logit coefficient estimates of the β_j's from equation (1). To better illustrate the magnitudes of the effects, we also report the predicted probability that a migrant has located in a gentrifying neighborhood (P(Gentrify)) for all 36 demographic groups in column 3. As a point of comparison, 11.2% of the migrants in the estimation sample locate in a gentrifying tract. Therefore demographic groups with predicted probabilities above 0.112 have above average rates of gentrification. The most obvious finding in Table 4 is the high gentrification rate of college-educated householders,

particularly young college-educated householders without children and particularly white college-educated householders. The gentrification rates of householders in all race/ethnicity groups with less than a college degree are remarkably similar and typically range from 10 to 11 percent.

The estimates in column 1 of Table 4 do *not* indicate which groups are most likely to live in a gentrifying neighborhood. They tell us which householders are more likely to move into a gentrifying neighborhood *conditional* on the fact they have chosen to move into a neighborhood that was low-income in 1990. For example, statistics reported later in Table 8 of this paper will show that a 2000 householder in a gentrifying neighborhood is much more likely to be a black high school dropout than a white college graduate. This is because black high school dropouts are overall much more likely to move into neighborhoods that were low income in 1990 than white college graduates. The black high school dropouts are more likely than average to move into a non-gentrifying low-income neighborhood than a gentrifying low-income neighborhood, In contrast, if a white college graduate moves into a neighborhood that was low income in 1990, it is much more likely than average that it is a gentrifying neighborhood. The influx of white college graduates is a feature that is associated with gentrifying neighborhoods, compared to low-income neighborhoods in general.

The above discussion is relevant for the comparison of the results for white college-educated householders to black college-educated householders. White college graduates have a higher probability of locating in a gentrifying neighborhood than black college graduates *conditional* on being in the sample of migrants to low-income neighborhoods. This does not mean that black college graduates are *unconditionally* less likely to move into gentrifying neighborhoods. Rather, this likely reflects in part the fact that black college graduates are more likely to move into a non-gentrifying low-income neighborhood than white college graduates.

B. Migration Logit, Middle-Class Neighborhood Sample

The last 3 columns of Table 5 report the results obtained estimating equation (1) on the middle-class neighborhood sample.[21] The gentrification rate in the estimation sample is 4.2%. When the sample is limited to those householders who have moved into a housing unit in a middle-class neighborhood in the past 10 years, it is not surprising that black and Hispanic householders with less than a college degree are disproportionately likely to have moved into the recently-gentrified, rather than established, middle-class neighborhood. It is also not surprising that white householders typically have lower than average gentrification rate, but it is quite striking that the one exception is for white college-educated householders who are under 40 without children.

Among white householders, having less than a college degree, the presence of children, or elderly status all substantially diminish the probability the householder will choose a gentrifying neighborhood over an established middle-class neighborhood. These same patterns are substantially diminished, or even reversed, for most of the black and Hispanic demographic groups. The results in Tables 4 point to in-migration of young, college-educated white householders without children as a particular hallmark of gentrifying neighborhoods. The results also indicate that among white householders, presence of children, age and education play a different role in determining the choice to locate in a gentrifying neighborhood than they do for black and Hispanic householders.

[21]There is little change in results if the middle-class sample is restricted only to central city tracts.

C. Collapsed and Stratified In-Migration Results, Low-Income Neighborhood Sample

Table 5 reports in-migration analysis for a number of subsets of the low-income neighborhood migrant sample. In order to avoid the problem of small cells, and to manage the number of reported estimates, the demographic groups are collapsed into 9 education-race groups. As a baseline, the first column of Table 5 reports the results of the collapsed specification for the full low-income neighborhood sample of migrants. These results are therefore directly comparable to columns 1-3 of Table 4. As we found in Table 4, the differential in-migration into gentrified neighborhoods is significantly higher among college-educated householders. Additionally, the collapsed specification does find a statistically significant, although smaller, differential in-migration of black households with less than a college degree.

The second column of Table 5 estimates the same specification, but only on householders in the low-income neighborhoods sample who moved into their current residence in the previous year. The results in columns 1 and 2 are surprisingly similar. It is particularly striking that there is no decrease in the differential in-migration among non-college educated black householders. While these results do not formally test for displacement, they are not consistent with the belief that the gentrifying neighborhoods are becoming unavailable to lower-skilled minorities. We do have to caution that we only observe those households that moved in during the past 10 years and stayed until the 2000 Census. To the extent that earlier in-migrants were different than current in-migrants, but that those differences have been erased by differential exit, the comparison in columns 1 and 2 will not pick this up.[22]

There is a substantial literature on neighborhood evolution, including recent work by Card, Mas and Rothstein (2008) and Clapp and Ross (2004), suggesting that the process of neighborhood change depends on its racial composition. In columns 3 and 4 of Table 5, we report in-migration results stratified by whether the tract was at least 50% black in 1990. There are 199 gentrifying tracts that were less than 50% black in 1990 and the remaining 259 gentrifying tracts were at least 50% black in 1990. The patterns are fairly similar across the two sub-samples. The results do indicate that when limiting the sample to tracts that were predominantly black in 1990, college-educated white householders have a particularly strong preference for gentrifying tracts. This is not surprising, as this group is probably particularly unlikely to move into a predominantly black low-income neighborhood that is not gentrifying.

D. Cohort Regression Results

Table 6 provides some preliminary evidence regarding who *exits* gentrifying neighborhoods relative to non-gentrifying neighborhoods. Table 6 reports descriptive statistics for the sample of non-migrants, householders who have lived in their housing unit for at least 10 years, in the low-income neighborhood sample in 2000. Because all non-migrants lived in the same housing unit in 1990, we know their 1990 census tract. We can therefore report the average 1990 tract-level characteristics for this sample. Columns 1 and 3 report average 1990 tract-level characteristics of non-migrants in gentrifying and non-gentrifying neighborhoods, respectively. Columns 2 and 4 report average householder characteristics for non-migrants in 2000.

In column 3 we see that the average non-migrant “stayer” in a non-gentrifying tract lives in a neighborhood that was 51.4% black in 1990. In column 4, we see that 52% of the stayers in non-gentrifying neighborhoods in 2000 are black. Therefore, the stayers are not

[22]Because we cannot identify whether the in-migrant originated from inside or outside the current census tract of residence, we also estimated our in-migration specification separately on the subsample of migrants who lived in a different county 5 years ago, which contains 20.3% of the full sample of movers to low-income neighborhoods. In these results, the differential migration effects for college-educated householders are even more pronounced. This is not too surprising given the selection into cross-county migration by education level.

disproportionately black or non-black compared to the population in their neighborhoods in 1990. If there is racial displacement in gentrifying neighborhoods, we would expect to see a substantial decrease in percent black between columns 1 and 2. For the racial/ethnic and educational composition variables, however, there is little evidence to suggest that black or Hispanic householders are disproportionately exiting the gentrifying neighborhoods. There is, however, modestly higher exit of low-education households and retention of high-education households in the gentrifying neighborhoods. There is also a much bigger increase in average income between columns 1 and 2, compared to columns 3 and 4, suggesting that the "stayers" in gentrifying neighborhoods either experience disproportionate income gains or are disproportionately selected from the higher income households within each demographic group.

The results from the cohort regression in equation (2), using the low-income neighborhood sample, are reported in the first two columns of Table 7. We report coefficient estimates for the interactions of cohort group with tract gentrification status. Standard errors are clustered at the tract level. Recall that a large, negative and significant coefficient is evidence that a particular cohort lost more population in gentrifying areas than non-gentrifying low income neighborhoods, and is therefore consistent with displacement. The results in Table 7 provide little evidence of displacement. Most of the coefficients are statistically insignificant, very small in magnitude, and equally likely to be negative or positive. The only statistically significant coefficient is a negative effect for elderly college-educated Hispanic householders.

The remaining two columns report the results for the income change regression described in equation (3).[23] The most striking finding is that average incomes in cohorts of black householders with high school degrees increase at least 20% more in gentrifying than non-gentrifying neighborhoods. We cannot formally test whether this is because gentrification improves the earnings of these householders, or disproportionately reduces exit of the highest earning householders in these cohorts. We do point out, however, that we do not see any evidence of displacement of lower-income cohorts in Table7. We feel that this makes it less likely that this result is driven *entirely* by displacement of lower-income households *within* cohort. We emphasize, however, that we have no way to formally test how much of the increase in average cohort income is compositional as opposed to household-level income growth.

E. Collapsed and Stratified Cohort Regression Results

As mentioned above, one concern about the displacement analysis in Table 7 is the potential for attenuation bias due to measurement error in the cohort population counts. In column 1a of Table 8, we report results from a version of equation (2), in which the 36 race x educ x age cohort are collapsed into 9 race x educ cohorts. Aggregating up to larger cohort groups should reduce the measurement error bias, yet we do not find any greater evidence of displacement in this specification either. In contrast, in column 1b, we report results from a collapsed version of the income change specification in equation (3). We find larger increases in income in the collapsed specification, perhaps due to the reduction in measurement error. Average income in the cohort of black high school dropouts increases 20% and in the cohort of Hispanic dropouts increases 15%. Average income in the cohort of black high school graduates increases a full 35%.

[23]The sample of cohorts used to estimate this regression is smaller than that used in column 1 for two reasons. First, because many of these tract-level cohorts are relatively small in population in 1990, and because the average mobility rate is quite high, almost 40% of the tract-level cohorts have zero population in 2000. Because these cohorts with zero population in 2000 have no 2000 income information, they are dropped from the analysis. In addition, for some of the smaller cohorts that have non-zero population in 2000, the income change is calculated on such a small number of observations that the percentage change in income can be quite dramatic. For this reason, we trim another 3% of the sample that has greater than 400% change in average income.

In columns 2 and 3, we stratify our cohort analysis into tracts that were predominantly black and predominantly non-black in 1990. In the non-black gentrifying tracts, we do find evidence of displacement of high school educated black householders and the coefficient on black college graduates is also sizeable and negative (although insignificant), but there is little indication of displacement of black high school dropouts. In contrast, for gentrifying tracts that were predominantly black in 1990, all of the coefficients for black householders are positive (although insignificant), suggesting retention rather than displacement.

Average income of black high school graduates increases substantially in both the predominantly black and non-black tracts. The income increase is actually slightly larger in the neighborhoods that were predominantly black in 1990. If the income increases are entirely due to differential exit of low-income households within the cohort, we would expect to see larger income increases for the tracts with stronger evidence of displacement.

F. Decompositions

We wish to summarize our results in a way that indicates how much of the gentrification is due to each demographic group. In other words, how much of the increase in average family income in gentrifying neighborhoods is generated by each demographic group?

To answer this question, we make use of the following expression:

$$\Delta \bar{I} = \bar{I}^{00} - \bar{I}^{90} = \sum_{j=1}^{36} \left(P_j^{00} \bar{I}_j^{00} - P_j^{90} \bar{I}_j^{90} \right) \tag{4}$$

where $\Delta \bar{I}$ is the change in average family income from 1990 to 2000 for the group of low income neighborhoods that gentrify, $\bar{I}_j$ is the average family income for demographic group j in the gentrifying neighborhoods, and P_j is the fraction of householders in the gentrifying neighborhoods that belong to demographic group j. Using equation (4), we decompose the total amount of gentrification into the part due to each individual demographic group.

We make two adjustments to our demographic categories from those used in tables 4 and 7. First, in order to avoid a small cell that would not meet Census Bureau confidentiality guidelines, we combine the two oldest age groups for Hispanic householders with a college degree. Second, we include a single “Non-Hispanic Other Race” category. While we excluded other race householders from the analysis in tables 4, 5, 7 and 8, and we cannot disaggregate the contribution of other race householders by age or education, we can report an aggregate income contribution for all other race householders.

The decomposition results for gentrifying neighborhoods are reported in Table 9. Column 4 reports the income change contributed by each of the 36 demographic groups using equation (4). Column 5 divides column 4 by the total average income change of $16,901. A demographic group can contribute a large fraction of total income change either by being a large fraction of the population, having a large intercensual average income change, or both. The first 3 columns of Table 9 report the population proportions for 1990 and 2000 and the average income change for each demographic group so that we can distinguish these cases.

Black householders with a high school degree contribute a substantial 33% of the total income gain in gentrifying tracts. This sizeable contribution results from the fact that black householders with a high school degree are a large fraction of the population in gentrifying tracts in 1990, increase as a fraction of the population in the 90’s, and display particularly large increases in average income. This is in contrast with black householders with less than a high school degree, who are also a sizeable fraction of the population in gentrifying low-income

neighborhoods in 1990. These households, however, fall as a fraction of the population and experience much smaller changes in average income, resulting in a contribution of only 7% of the total income gain. The second largest contribution to the total income gain is by white householders with a college degree, who contribute 20% of the total gain, with over half of this gain coming from young householders without children. This is in direct contrast to the minute contribution of less than 3% by white householders with less than a college degree.

It is important to reconcile the results of this decomposition with the in-migration results presented in Tables 4 and 5. Those results pointed to the in-migration of college-educated households as an important feature of gentrification, while the decomposition indicates that the largest portion of the income gains are from black householders with a high school degree. The first two columns of Table 8 show that despite the differential in-migration of college-educated householders, black householders with a high school degree remain a much larger fraction of the population in gentrifying neighborhoods, a full 29.8% in 2000. That combined with the substantial change in average income for this demographic group is why they ultimately are responsible for the larger share of the income growth.

We cannot determine to what extent this growth in average income for black high school graduates is due to increases in income among original residents and how much is due to compositional changes as lower-income black high school graduates exit and higher-income black high school graduates are retained and enter. At a minimum, these results suggest that a large part of the income gains in gentrifying neighborhoods should be attributed to the fact that these neighborhoods disproportionately retain and attract middle class high-school educated black households, which is very different from the standard narrative of racial displacement.

The findings in Table 9 mask some important heterogeneity by tract racial composition. Among the 199 gentrifying tracts that were predominantly non-black in 1990, 38% of the income gain is due to college-educated whites, and only 9.1% is due to high school educated blacks. In these tracts, college-educated householders grew from 8.6% to 14.7% of the population between 1990 and 2000, while black high school graduates grew from 7.8% to 9.2%. In contrast, in the 259 gentrifying tracts that were predominantly black in 1990, only 12.6% of the income gains come from college-educated whites, and a full 45.4% came from high school educated black householders. College educated whites only grew from 1.8 to 3.8% of the population in these tracts, while black high school educated householders grew from 38.5% to 45.7%.

We point out that despite the fact that in Table 8 we found displacement effects for high school educated blacks in the predominantly non-black gentrifying tracts, high school educated blacks do grow as a fraction of the population of these same tracts, from 7.8% to 9.2%. If there was disproportionate exit of this group, there was sufficient replacement in-migration. This is consistent with the in-migration results reported in Table 5.

VI. Conclusions

Our findings suggest that rather than dislocating non-white households, gentrification of predominantly black neighborhoods creates neighborhoods that are attractive to middle-class black households, particularly those with children or with elderly householders. One reasonable interpretation, particularly given recent work by Bayer and McMillan (2006) and Bayer, Fang and McMillan (2005), is that because these neighborhoods are experiencing income gains, but also more racially diverse than established middle-class neighborhoods, they are desirable locations for black middle-class households.

In contrast, for the gentrifying tracts with low black populations, we find evidence of disproportionate exit of black high school graduates. It is possible that in these neighborhoods, for black high school graduates, the rising housing costs are not offset by the same benefits of

gentrification as in the predominantly black neighborhoods. Despite the exit of black high school graduates, in-migration of this group is sufficient to increase its proportion of the population slightly in these tracts, suggesting some sorting among households in this group with different neighborhood preferences.

Perhaps even in the predominantly black neighborhoods, displacement has not occurred yet, but will in the future. It is of course, impossible for us to address this empirically. However, we point out that the neighborhoods we define as gentrified have already experienced massive income growth (in absolute and percentage terms), yet still have very sizeable fractions of non-white and non-college educated households, and sizeable in-migration of these same demographic groups. These facts alone suggest that the stark gentrification-displacement story was not the norm during the 1990's.

Another concern could be that the census tract is too aggregate a geographic unit to detect displacement. Perhaps gentrification is causing displacement within census tracts. Given the very large increases income experienced in our gentrifying census tracts, if the displacement is sufficiently localized within Census tract that it only generates sorting within census tract and no disproportionate exit from the census tracts, this still indicates that the consequences of gentrification for existing residents are milder than generally described.

Our findings highlight the benefits of richly disaggregating by demographic characteristic in studies of neighborhood choice and mobility. Specifications with basic controls for race, education, age and family structure, but without interactions, would not have uncovered many of the interesting findings of this paper. The very divergent experiences of black householders with and without high school degrees, for example, would be unlikely to emerge. Our analysis also demonstrates the benefits of studying not only out-migration but also in-migration and outcomes for stayers. Finally, this study benefited enormously from data that allowed careful comparisons of neighborhoods at the census tract level.

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Appendix A

Appendix A

MSA/CMSAs used in the urban neighborhoods sample (Table 1)

Code	MSA/CMSA Name
0200	Albuquerque, NM
0240	Allentown-Bethlehem-Easton, PA
0520	Atlanta, GA
0640	Austin-San Marcos, TX
0680	Bakersfield, CA
0760	Baton Rouge, LA
1000	Birmingham, AL
1122	Boston-Worcester-Lawrence, MA--NH--ME--CT
1280	Buffalo-Niagara Falls, NY

Code	MSA/CMSA Name
1520	Charlotte-Gastonia-Rock Hill, NC-SC
1602	Chicago-Gary-Kenosha, IL-IN-WI
1642	Cincinnati-Hamilton, OH-KY-IN
1692	Cleveland-Akron, OH
1840	Columbus, OH
1922	Dallas-Fort Worth, TX
2000	Dayton-Springfield, OH
2082	Denver-Boulder-Greeley, CO
2162	Detroit-Ann Arbor-Flint, MI
2320	El Paso, TX
2840	Fresno, CA
3000	Grand Rapids-Muskegon-Holland, MI
3120	Greensboro--Winston-Salem--High Point, NC
3280	San Diego, CA
3362	Houston-Galveston-Brazoria, TX
3480	Indianapolis, IN
3760	Kansas City, MO
3840	Knoxville, TN
4120	Las Vegas, NV
4400	Little Rock-North Little Rock, AR
4472	Los Angeles-Riverside-Orange County, CA
4520	Louisville, KY-IN
4920	Memphis, TN-AR-MS
4992	Miami-Ft. Lauderdale, FL
5082	Milwaukee-Racine, WI
5120	Minneapolis-St. Paul, MN-WI
5360	Nashville, TN
5560	New Orleans, LA
5602	New York-Northern New Jersey-Long Island, NY--NJ--CT--PA
5720	Norfolk--Virginia Beach--Newport News, VA--NC
5880	Oklahoma City, OK
5920	Omaha, NE--IA
5960	Orlando, FL
6162	Philadelphia--Wilmington--Atlantic City, PA--NJ--DE--MD
6200	Phoenix--Mesa, AZ
6280	Pittsburgh, PA
6442	Portland--Salem, OR--WA
6480	Providence--Fall River--Warwick, RI--MA
6640	Raleigh--Durham--Chapel Hill, NC
6760	Richmond--Petersburg, VA

Code	MSA/CMSA Name
6840	Rochester, NY
6922	Sacramento--Yolo, CA
7040	St. Louis, MO--IL
7160	Salt Lake City--Ogden, UT
7240	San Antonio, TX
7320	San Diego, CA
7362	San Francisco--Oakland--San Jose, CA
7602	Seattle--Tacoma--Bremerton, WA
8000	Springfield, MA
8160	Syracuse, NY
8280	Tampa--St. Petersburg--Clearwater, FL
8400	Toledo, OH
8520	Tucson, AZ
8560	Tulsa, OK
8872	Washington--Baltimore, DC--MD--VA--WV

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Table 1

Census Tract-Level Income and Income Change, by Quintile of 1990 Income

	1990 Average Family Income				
	1st Quintile	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**
1990 Income:					
Min	2,679	30,079	39,227	48,140	61,115
Average	23,434	34,766	43,628	54,043	85,287
Max	30,079	39,221	48,134	61,112	370,891
Income Change 1990 to 2000:					
10th Percentile	-1,857	-3,943	-5,615	-7,580	-13,406
Median	3,725	1,739	829	234	468
90th Percentile	11,908	9,568	9,607	10,634	20,870

Notes: Table divides sample of 15,040 urban linked tracts into 5 quintiles based on 1990 average family income. All income numbers reported in 2000 dollars.

Table 2

Tract-Level Characteristics by Gentrification Status, Low-Income Neighborhood Sample, 1990 and 2000 Census

	1990 Tract Characteristics		2000 Tract Characteristics	
	Gentrifying Tracts	**Non-Gentrifying Tracts**	**Gentrifying Tracts**	**Non-Gentrifying Tracts**
Mean Family Income	21,738 (5,477)	23,734 (4,889)	38,294 (10,399)	26,408 (5,824)
% White	0.240	0.283	0.229	0.221
% Black	0.574	0.504	0.553	0.515
% Hispanic	0.156	0.182	0.179	0.219
% No H.S. Degree	0.499	0.485	0.366	0.415
% H.S Degree	0.412	0.433	0.476	0.485
% College Degree	0.090	0.082	0.158	0.101
% Age<40	0.414	0.416	0.412	0.403
% Age 40-60	0.301	0.305	0.361	0.354
% Age 60+	0.285	0.279	0.227	0.243
Migration Rate	0.667	0.661	0.694	0.685
Mean Family Income of Migrants	20,133 (6,105)	21,756 (5,314)	36,547 (14,236)	24,680 (6,046)
Mean Family Income of Non-Migrants	24,718 (10,187)	27,740 (8,437)	38,993 (20,399)	30,289 (9,699)
N	458	2,550	458	2,550

Notes: Low-income neighborhood sample consists of urban tracts in bottom quintile of 1990 average family income. Gentrifying neighborhoods are those who experience at least a $10,000 increase in average family income between 1990 and 2000. Migrant is defined as a householder who did not live in the current residence 10 years ago. All income figures reported in 2000 dollars. Standard deviations are in parentheses.

Table 3

Characteristics of In-Migrants by Gentrification-Status of Tract, Low-Income Neighborhood Sample, 2000 Census

	Migrants to Gentrifying Tracts	Migrants to Non-Gentrifying Tracts
Mean Family Income	36,524 (71,664)	25,835 (38,269)
% White	0.289	0.251
% Black	0.429	0.411
% Hispanic	0.230	0.278
% No H.S. Degree	0.339	0.384
% H.S. Degree	0.464	0.494
% College Degree	0.197	0.122
% Age<40	0.578	0.562
% Age 40-60	0.305	0.307
% Age 60+	0.117	0.132
% with Children in Household	0.371	0.407
% Married	0.292	0.295
% Cohabitating	0.084	0.079
% Immigrant	0.235	0.288
N	38,308	316,355

Notes: Sample of migrant householders in the low-income neighborhood sample. Low-income neighborhood sample, gentrifying tract, and migrant householder are defined in notes to Table 2. All income figures reported in 2000 dollars. Standard deviations are in parentheses.

Table 4

Logit Results, Migrants to Gentrifying vs Non-Gentrifying Neighborhoods, 2000 Census

			Low-Income Neighborhoods			Middle-Class Neighborhoods		
			β	(s.e.)	P(G)	β	(s.e.)	P(G)
			(1)	(2)	(3)	(4)	(5)	(6)
White								
No H.S.	20-40	No Child			0.101			0.032
	20-40	Child	-0.024	(0.091)	0.099	-0.088	(0.099)	0.029
	40-60		-0.003	(0.084)	0.101	-0.088	(0.094)	0.029
	60+		-0.035	(0.084)	0.098	-0.156	(0.092)	0.027
H.S.	20-40	No Child	-0.019	(0.070)	0.100	-0.042	(0.077)	0.030
	20-40	Child	-0.182*	(0.080)	0.087	-0.771***	(0.087)	0.015
	40-60		0.092	(0.072)	0.109	-0.401***	(0.079)	0.022
	60+		-0.131	(0.082)	0.091	-0.528***	(0.089)	0.019
College	20-40	No Child	0.750***	(0.069)	0.182	0.532***	(0.076)	0.051
	20-40	Child	0.492***	(0.098)	0.150	-0.142	(0.105)	0.028
	40-60		0.642***	(0.075)	0.168	0.072	(0.082)	0.034
	60+		0.145	(0.100)	0.114	-0.298**	(0.111)	0.024
Black								
No H.S.	20-40	No Child	0.014	(0.080)	0.102	1.04***	(0.092)	0.080
	20-40	Child	-0.085	(0.073)	0.094	1.08***	(0.082)	0.083
	40-60		-0.005	(0.072)	0.101	1.13***	(0.081)	0.086
	60+		0.067	(0.073)	0.107	1.33***	(0.083)	0.101
H.S.	20-40	No Child	0.050	(0.072)	0.106	0.553***	(0.080)	0.052
	20-40	Child	0.042	(0.070)	0.105	0.664***	(0.077)	0.058
	40-60		0.100	(0.070)	0.110	0.713***	(0.077)	0.060
	60+		0.078	(0.078)	0.108	0.999***	(0.089)	0.077
College	20-40	No Child	0.430***	(0.083)	0.143	0.386***	(0.095)	0.045

			Low-Income Neighborhoods			Middle-Class Neighborhoods		
			β	(s.e.)	P(G)	β	(s.e.)	P(G)
			(1)	(2)	(3)	(4)	(5)	(6)
	20-40	Child	0.303***	(0.095)	0.129	0.375***	(0.108)	0.044
	40-60		0.370***	(0.082)	0.136	0.509***	(0.094)	0.050
	60+		0.220	(0.129)	0.121	0.736***	(0.151)	0.061
Hispanic								
No H.S.	20-40	No Child	0.061	(0.080)	0.107	0.418***	(0.090)	0.046
	20-40	Child	0.147*	(0.076)	0.112	0.576***	(0.084)	0.053
	40-60		0.198**	(0.077)	0.117	0.609***	(0.085)	0.055
	60+		0.038	(0.086)	0.106	0.518***	(0.098)	0.051
H.S.	20-40	No Child	0.060	(0.079)	0.108	0.158	(0.088)	0.036
	20-40	Child	0.049	(0.077)	0.100	0.182*	(0.085)	0.037
	40-60		0.098	(0.081)	0.111	0.097	(0.090)	0.034
	60+		0.136	(0.126)	0.125	0.164	(0.146)	0.037
College	20-40	No Child	0.408***	(0.097)	0.173	0.382***	(0.107)	0.045
	20-40	Child	0.092	(0.124)	0.107	0.108	(0.140)	0.035
	40-60		0.424***	(0.115)	0.147	0.177	(0.128)	0.037
	60+		-0.453	(0.323)	0.076	-0.535	(0.394)	0.019
N				323,693			557,673	

Notes: Column 1 reports estimates of βj's from estimating the logit model in equation (1) on the sample of migrant householders in the low-income neighborhood sample. Column 3 reports the predicted value of the probability a migrant in the low-income neighborhood sample locates in a gentrifying neighborhood. Columns 4-6 replicate the same analysis on the middle-class neighborhood sample.

* p-value<0.05

** p-value<0.01

*** p-value<0.001

Table 5

In-Migration Logit Results, Sensitivity Analysis, Low-Income Neighborhood Sample, 2000 Census

	10 year migration		**1-Year Migration**		**Predominantly Non-Black Tract in 1990**		**Predominantly Black Tract in 1990**	
	(1a)	**(1b)**	**(2a)**	**(2b)**	**(3a)**	**(3b)**	**(4a)**	**(4b)**
White								
<HS		0.094		0.088		0.095		0.115
HS	-0.057		-0.083		-0.099**		0.138	
	(0.034)	0.089	(0.057)	0.082	(0.038)	0.088	(0.087)	0.128
College	0.612***		0.668***		0.486***		1.05***	
	(0.035)	0.153	(0.059)	0.150	(0.040)	0.140	(0.089)	0.245
Black	0.174***		0.297**		0.179*		0.179	
<HS	(0.047)	0.108	(0.096)	0.112	(0.073)	0.110	(0.105)	0.132
HS	0.259***		0.343***		0.164*		0.260*	
	(0.048)	0.116	(0.098)	0.116	(0.076)	0.109	(0.106)	0.140
College	0.551***		0.637***		0.308***		0.622***	
	(0.055)	0.146	(0.111)	0.146	(0.095)	0.122	(0.111)	0.183
Hispanic	0.200**		0.320*		0.128		-0.050	
<HS	(0.064)	0.111	(0.131)	0.114	(0.070)	0.106	(0.179)	0.110
HS	0.125		0.200		0.072		-0.150	
	(0.065)	0.104	(0.133)	0.104	(0.072)	0.101	(0.184	0.102
College	0.379***		0.437**		0.318***		0.317	
	(0.078)	0.127	(0.150)	0.125	(0.086)	0.123	(0.213)	0.146
N	323,784		116,493		183,132		121,200	

Notes: Columns 1a, 2a, 3a, 4a report β_j's from a collapsed version of equation (1), with 9 race x education categories. Columns 1b, 2b, 3b and 4b report the predicted probabilities a migrant in the relevant subsample of the low-income neighborhood sample locates in a gentrifying neighborhood. Column 1 uses the same sample of migrants to low-income neighborhoods used in column 1 of Table 4. Column 2 uses only those migrants in the low-income neighborhood sample who moved into their current house in the year prior to the census. Columns 3 and 4 stratify the low-income neighborhood sample into tracts that were at least 50% black in 1990 and those that were not.

Table 6

Stayer Characteristics by Gentrification Status of Tract, Low-income Neighborhood Sample, 1990 and 2000 Census

	Gentrifying Tracts		Non-Gentrifying Tracts	
	(1) 1990 Tract Characteristics	(2) 2000 Non-Migrants	(3) 1990 Tract Characteristics	(4) 2000 Non-Migrants
Mean Family Income	23,520 (4,488)	40,730 (82,374)	24,840 (4,070)	31,643 (46,321)
%White	0.214	0.200	0.250	0.238
%Black	0.600	0.605	0.514	0.520
%Hispanic	0.163	0.170	0.211	0.213
% No H.S. Degree	0.498	0.438	0.499	0.466
% H.S Degree	0.426	0.463	0.431	0.453
%College Degree	0.076	0.098	0.070	0.081
%Age<40	0.393	0.112	0.384	0.115
%Age 40-60	0.307	0.385	0.321	0.377
%Age 60+	0.300	0.502	0.295	0.508
N		16,927		144,034

Notes: Sample of non-migrant householders in the low-income neighborhood sample. Low-income neighborhood sample, gentrifying tract, and migrant householder are defined in notes to Table 2. Columns 1 and 3 report tract-level characteristics, averaged over sample of non-migrant householders. Columns 2 and 4 report householder-level characteristics, averaged over sample of non-migrant householders. All income figures reported in 2000 dollars.

Table 7

Cohort Regression Results, Low-Income Neighborhood Sample, 1990 and 2000 Census

		% Change in Population		%Change in Income	
		(1) β	(2) (s.e.)	(3) β	(4) (s.e.)
White					
No H.S.	Cohort 1	-0.028	(0.017)	0.054	(0.341)
	Cohort 2	0.012	(0.027)	-0.021	(0.172)
	Cohort 3	0.009	(0.040)	0.096	(0.165)
	Cohort 4	0.002	(0.041)	0.003	(0.126)
H.S.	Cohort 1	0.025	(0.020)	0.011	(0.112)
	Cohort 2	-0.009	(0.024)	0.174*	(0.088)
	Cohort 3	-0.031	(0.039)	0.158	(0.099)
	Cohort 4	0.038	(0.051)	0.060	(0.082)
College	Cohort 1	0.034	(0.022)	-0.067	(0.204)
	Cohort 2	0.049	(0.033)	0.254*	(0.115)
	Cohort 3	0.032	(0.051)	0.367**	(0.141)
	Cohort 4	0.012	(0.046)	0.209	(0.176)
Black					
No H.S.	Cohort 1	0.019	(0.028)	-0.371***	(0.116)
	Cohort 2	-0.008	(0.023)	0.103	(0.104)
	Cohort 3	-0.025	(0.033)	0.028	(0.083)
	Cohort 4	0.006	(0.034)	0.309***	(0.074)
H.S.	Cohort 1	-0.027	(0.025)	0.203*	(0.088)
	Cohort 2	0.008	(0.021)	0.237***	(0.066)
	Cohort 3	0.056	(0.031)	0.237***	(0.067)
	Cohort 4	0.013	(0.045)	0.198**	(0.063)
College	Cohort 1	-0.015	(0.047)	0.084	(0.326)
	Cohort 2	0.012	(0.050)	0.035	(0.121)
	Cohort 3	0.060	(0.065)	-0.216*	(0.096)

		% Change in Population		%Change in Income	
		(1) β	**(2) (s.e.)**	**(3) β**	**(4) (s.e.)**
	Cohort 4	-0.062	(0.083)	-0.067	(0.129)
Hispanic					
No H.S.	Cohort 1	-0.008	(0.027)	0.212	(0.138)
	Cohort 2	0.056	(0.053)	0.096	(0.119)
	Cohort 3	-0.041	(0.038)	0.055	(0.094)
	Cohort 4	-0.040	(0.046)	0.072	(0.089)
H.S.	Cohort 1	-0.009	(0.031)	-0.116	(0.137)
	Cohort 2	0.066	(0.043)	0.201	(0.120)
	Cohort 3	0.047	(0.065)	0.213	(0.125)
	Cohort 4	-0.037	(0.074)	0.107	(0.144)
College	Cohort 1	0.016	(0.045)	-0.401	(0.573)
	Cohort 2	0.029	(0.057)	0.292	(0.294)
	Cohort 3	-0.082	(0.061)	-0.084	(0.262)
	Cohort 4	-0.141*	(0.067)	0.437**	(0.154)
N		50,983		27,219	

Notes: Column 1 reports estimates of β_C's from estimation of equation (2) on the low-income neighborhood sample. Column 2 reports estimates of β_C's from estimation of equation (3) on the low-income neighborhood sample. Unit of observation is a synthetic cohort in a census tract. Cohort 1 consists of householders ages 20-29 in 1990, Cohort 2 of householders ages 30-39 in 1990, Cohort 3 of householders ages 40-49 in 1990, and Cohort 4 of householders ages 50-59 in 1990. Standard errors are clustered at the tract level.

* p-value<0.05

** p-value<0.01

*** p-value<0.001

Table 8

Cohort Regression Results, Sensitivity Analysis, Low-Income Neighborhood Sample, 2000 Census

	Full Sample		**Predominantly Non-Black Tracts in 1990**		**Predominantly Black Tracts in 1990**	
	(1a)	**(1b)**	**(2a)**	**(2b)**	**(3a)**	**(3b)**
White	-0.015	0.081	0.008	0.075	-0.033	0.095
<HS	(0.022)	(0.079)	(0.028)	(0.086)	(0.037)	(0.186)
HS	0.005	0.109	0.020	0.164*	-0.004	-0.012
	(0.025)	(0.063)	(0.032)	(0.074)	(0.040)	(0.119)
College	0.005	0.115	0.013	0.149	0.013	0.007
	(0.029)	(0.082)	(0.035)	(0.098)	(0.035)	(0.153)
Black	-0.013	0.200***	-0.017	0.006	0.022	0.256***
<HS	(0.017	(0.057)	(0.033)	(0.086)	(0.019)	(0.069)
HS	-0.002	0.351***	-0.060*	0.302**	0.024	0.347***
	(0.016)	(0.052)	(0.027)	(0.111)	(0.018)	(0.058)
College	0.044	0.158	-0.055	0.135	0.051	0.161
	(0.044)	(0.083)	(0.055)	(0.166)	(0.056)	(0.095)
Hispanic	-0.000	0.149*	0.039	0.133	-0.051	0.175
<HS	(0.025)	(0.074)	(0.031)	(0.080)	(0.043)	(0.203)
HS	0.034	0.073	0.047	0.041	0.026	0.204
	(0.028)	(0.070)	(0.034)	(0.070)	(0.053)	(0.209)
College	0.038	0.060	0.030	0.067	0.091	0.097
	(0.052)	(0.151)	(0.059)	(0.162)	(0.101)	(0.415)
N	17,951	12,334	10,238	6,911	7,713	5,423

Notes: Column 1a replicates the population change analysis in column 1 of Table 7, with cohorts aggregated into 9 racexeducation groups. Column 1b replicates the income change analysis in column 2 of Table 7 with same aggregation of cohorts. Columns 2a, 2b, 3a, 3b stratify the population change and income change analysis into tracts that were at least 50% black in 1990 and those that were not.

Table 9

Decomposition of Total Income Change, Gentrifying Tracts in Low-Income Neighborhood Sample, 1990 and 2000 Census

			(1)	(2)	(3)	(4)	(5)
			P^{90}	P^{00}	$I^{-00} - I^{-90}$	$P^{00}I^{-00} - P^{90}I^{-90}$	Fraction of Total
White							
No H.S.	20-40	No Child	0.006	0.004	1056	-23	-0.002
	20-40	Child	0.011	0.005	2399	-10	-0.002
	40-60		0.018	0.012	1815	-68	-0.007
	60+		0.049	0.022	3626	-263	-0.018
H.S.	20-40	No Child	0.031	0.031	3850	308	0.013
	20-40	Child	0.017	0.010	1383	-120	-0.010
	40-60		0.027	0.037	9331	743	0.051
	60+		0.030	0.020	6744	24	0.002
College	20-40	No Child	0.027	0.052	10620	2178	0.109
	20-40	Child	0.005	0.004	7535	157	0.007
	40-60		0.011	0.024	18156	1459	0.077
	60+		0.004	0.006	9109	207	0.011
Black							
No H.S.	20-40	No Child	0.021	0.015	6139	68	0.004
	20-40	Child	0.056	0.036	6085	127	0.010
	40-60		0.081	0.060	8776	315	0.014
	60+		0.140	0.097	10819	845	0.043
H.S.	20-40	No Child	0.036	0.039	8748	379	0.027
	20-40	Child	0.088	0.081	7210	657	0.045
	40-60		0.083	0.122	13311	2635	0.165
	60+		0.044	0.056	17060	1329	0.092
College	20-40	No Child	0.006	0.015	9273	494	0.025
	20-40	Child	0.006	0.007	5383	124	0.006
	40-60		0.010	0.021	15880	753	0.046
	60+		0.006	0.007	12284	256	0.018
Hispanic							

			(1)	(2)	(3)	(4)	(5)
			P^{90}	P^{00}	$I^{-00} - I^{-90}$	$P^{00}I^{-00} - P^{90}I^{-90}$	Fraction of Total
No H.S.	20-40	No Child	0.009	0.010	6755	160	0.013
	20-40	Child	0.038	0.038	5425	565	0.043
	40-60		0.037	0.038	7926	733	0.051
	60+		0.022	0.020	4467	196	0.016
H.S.	20-40	No Child	0.008	0.012	7158	228	0.017
	20-40	Child	0.021	0.022	5398	301	0.022
	40-60		0.013	0.022	7008	631	0.037
	60+		0.003	0.006	5372	120	0.008
College	20-40	No Child	0.002	0.004	8111	133	0.009
	20-40	Child	0.002	0.003	4701	67	0.005
	40+		0.002	0.005	12889	247	0.015
Other Race			0.030	0.039	16029	944	0.060
Total			1.00	1.00		16,901	1.00

Notes: Table reports results of decomposition described in equation (4) on the sample of gentrifying low-income neighborhoods. Columns 1-3 report individual components of the expression in equation (4). Column 4 reports each demographic groups total contribution to the average income growth of $16,901 in the gentrifying neighborhoods using the expression in equation (4). Column 5 divides Column 4 by 16,901. All income figures reported in 2000 dollars.