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Labor Market Impacts of Exposure to Affordable Housing Supply: Evidence from the Low-Income Housing Tax Credit Program

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Abstract

Affordable housing programs as place-based programs in the United States have an impact on the neighborhoods, but little is known about the impact of affordable housing construction on individuals living in the neighborhoods hosting these projects. This paper investigates the effects of affordable housing construction under the Low-Income Housing Tax Credit (LIHTC) program on individuals' labor market outcomes and welfare dependence. We exploit the timing of changes in the LIHTC program leading to spatial changes in the affordable housing supply to compare labor market outcomes of individuals exposed to varying levels of housing construction. We overcome the empirical challenges posed by the selective sorting of individuals into neighborhoods by matching the timing of the change in housing supply to an individuals' neighborhood of residence. We find an average improvement in the labor market outcomes of individuals as a result of higher exposure to the supply of affordable housing in their neighborhood. In addition, we document significant heterogeneities by race and ethnicity and find evidence that these heterogeneities are likely explained by the program-induced and migration-induced changes in neighborhood quality.

JEL classification: I38, J15, J22, R23, R31, R38
Keywords: Low-income housing, Gentrification, Tax credits, Labor supply, Neighborhood changes

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1. Introduction

Affordable housing programs in the United States are an important tool for assisting low-income households. These programs usually work through the rental-housing markets to reduce the housing costs of low-income households by subsidizing their rents. Apart from the impact on the tenants housed in these projects, subsidized housing is also a place-based program that impacts the neighborhoods hosting the housing projects. These programs rely mainly on federal resources[1], and there is a considerable debate around their impact on the neighborhoods that hosts these programs. They are criticized on grounds of being inefficient, distorting housing choices and causing poverty concentration. On the other hand, it is argued that these programs generate positive spillovers and revitalize distressed and high-poverty areas. Another important but unexplored avenue of investigation is the impact of these programs on the residents of the host neighborhoods. The economics literature has documented the impact of an influx of affordable housing on various neighborhood characteristics, but its potential impact on the individual inhabitants has not received much attention.[2] Using Low-Income Housing Tax Credit (LIHTC), a large affordable housing construction program in the U.S., we study the impact of affordable housing construction on the labor market outcomes and self-sufficiency of residents living in the neighborhoods hosting these projects.

The LIHTC program was established as part of the Tax Reform Act of 1986 to encourage affordable rental housing for low-income households. Each year, Congress allocates federal tax credits to states based on population, which are usually disbursed to the private developers (through a competitive process) to construct and operate affordable housing projects. These tax credits effectively provide a 30 to 70 percent subsidy to the developers for the construction and maintenance of low-income units.[3] Since its inception in 1987, LIHTC has funded almost a third of the multifamily developments in the U.S. and accounts for about 7 percent of the total rental housing (Scally, Gold and DuBois 2018).

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[1] The federal budget in 2020 allocated approximately $45 billion to the Department of Housing and Urban Development (HUD) to be spent on housing assistance programs (HUD 2020).

[2] While discussing the recent literature on the economic impacts of place-based policies, Chyn and Katz 2021 identify "the impact of place-based revitalization policies on the pre-existing residents of the targeted areas" as an important but unexplored area of research.

[3] Under the federal guidelines, a certain minimum proportion of the housing units are reserved for low-income households, and the annual rent on these units is usually capped at 30 percent of the local area income.

A growing literature in economics has explored the impact of affordable housing construction under LIHTC on a wide range of outcomes that shape the quality of neighborhoods.[4] Another strand of economics literature has documented neighborhood quality as a strong determinant of socioeconomic outcomes for individual inhabitants.[5] It is, therefore, conceivable that the neighborhood changes induced by the affordable housing supply under LIHTC can shape the labor market outcomes and self-sufficiency of the inhabitants. These outcomes are an important ingredients into the general policy goal of achieving *upward mobility*.

A significant challenge while analyzing the impact of LIHTC on individual inhabitants stems from the change in the neighborhood itself. Individuals exposed to the changes in neighborhoods may migrate out of areas. In contrast, in some areas, the changes can incentivize individuals from other regions to migrate in.[6] In cross-sectional data, this selective sorting of individuals makes it harder to link any change in the labor market outcomes to a change in exposure to LIHTC housing. To overcome this challenge of selective sorting, we link these individuals to the locations of their residence at the time when these locations were undergoing changes in housing supply. This exercise gives us an intent-to-treat setup to evaluate the impact of the change in LIHTC housing supply on individuals exposed to these changes.

The setup of this study relies on a federal legislation in 1989 that allowed for a 30 percent increase in the tax credit allocated to the projects in the census tracts called "Qualified Census Tracts" (QCTs). The HUD assigned the qualified status to a census tract if 50 percent or more of its population had income below the 60 percent of the median area income. Previous studies[7], and the analysis later in this paper, shows that neighborhoods with a higher share of qualified census tracts received a higher supply of LIHTC housing. The first set of QCTs was assigned by the HUD in 1990 using the census tract boundary definitions from the 1980 census. In 1995, owing to the tract boundary changes in the 1990 census, HUD revisited the QCT status of the tracts.[8] This lead to a change in the status of several tracts from initially not-qualified to qual-

[4] See Baum-Snow and Marion 2009; Eriksen and Rosenthal 2010; Diamond and McQuade 2015; Ellen, Horn and O'Regan 2016; Freedman and Owens 2011; Di and Murdoch 2013 for the impact of LIHTC on property prices, area income, crowd-out of private investment, poverty concentration, crime and education.

[5] See Cutler and Glaeser 1997; Katz, Kling and Liebman 2001; Cutler, Glaeser and Vigdor 2008; Ludwig et al. 2012; Chetty, Hendren and Katz 2016 for some examples of seminal work in the area.

[6] Later in this paper, we document the change in migration due to the increased influx of LIHTC housing.

[7] See Baum-Snow and Marion 2009 and Freedman and Owens 2011 for a few examples.

[8] See Notice 1995

ified, and vice versa. The change in this QCT-status is used as the main explanatory variable in this paper. In the decennial census in 2000, the respondents who changed their residence between 1995 and 2000 were asked to report the place of residence in 1995. We combine the 1995 neighborhood of the respondents with the data measuring the change in QCT status of that neighborhood. This gives us a setup to explore the impact of an individual's exposure to increased affordable housing supply between 1995 and 2000 on their labor market outcomes in 2000.

However, the change in QCT share of an area is not exogenous. Neighborhoods with an increase in qualified status are more likely to be low-income areas with residents characterized by weaker labor market outcomes, resulting in a biased estimate from a reduced-form OLS regression of outcomes on the change in QCT-share. We take a few additional steps to remove this bias. Firstly, in an approach motivated by the control function method in Fletcher, Ross and Zhang 2020, we include the pre-1995 QCT-share of the neighborhoods as a control variable. Conditioning on the pre-1995 qualified share of a neighborhood, the 1995 reshuffling of QCT status results in a net change only due to the change in census tract boundaries in the 1990 census. The change in census tract boundaries is not entirely exogenous either. A part of the change in the boundary is likely due to the systematic economic and demographic changes that have taken place between 1980 and 1990, the changes that are correlated with the labor market outcomes of the residents. In the second step, we attempt to control for these systematic pre-1995 changes by including as controls the "change in key socioeconomic and demographic attributes between 1980 and 1990" for a 1995 neighborhood.

Conditional on these two sets of controls, the identification in a reduced-form OLS relies on a *quasi-random* change in the QCT status of a tract. We test the identifying assumption using the resulting reduced-form OLS to predict specific individual attributes in 2000 that should be orthogonal to the change in QCT-share in 1995 (the main explanatory variable) but correlated with the labor market outcomes. We successfully demonstrate that in the presence of the controls explained before, individual attributes like race, ethnicity, probability of completing a 4-year college degree (for adults 25 years or above in 2000), and probability of living in a gentrifying vs. non-gentrifying area are not predicted by the change in QCT-share of the 1995

neighborhood of the individual.[9]

For the main analysis, we use a reduced-form OLS equipped with the set of controls as described above. First, we confirm that an increase in QCT-share in 1995 is associated with an increase in the affordable housing supply under LIHTC in an area between 1995-2000. Reassuringly, this change in QCT-share does not predict the LIHTC housing developments before 1995. For the main results, we focus on the adults (18-64 years of age) living in metropolitan areas and find a significant increase in their labor-force participation, probability of being employed, working weeks, wage income, and poverty reduction. It is also accompanied by a slight increase in their income from welfare programs. Looking into the impacts by race, we find that the Whites are driving all positive labor market effects alongside negative impacts for the Hispanics and no effect for the Blacks. While Whites significantly reduce their dependence on the welfare programs while Hispanics demonstrate an increased dependency.

Looking into the potential mechanisms, we explore two channels - does an increase in housing supply induce migration across neighborhoods? If so, this movement could result in a change in the neighborhood quality, which may, in turn, drive these heterogeneous impacts across individuals from a specific race/ethnic group. Households that move into the new affordable housing units are low-income households and likely of minority race/ethnicity, which may trigger white flight upon their arrival (Shertzer and Walsh 2019 and Derenoncourt 2018). Consistent with this, we find that an increase in housing supply in gentrifying areas leads to a significant increase in the Whites moving out of these locations. We find that Whites move to areas that, as documented in related studies, are revitalized due to LIHTC program. On the other hand, low-income minorities that are likely found in non-gentrifying areas (Aliprantis, Carroll and Young 2021) may like to stay put in the same neighborhood due to the increased availability of affordable housing. We find that the Blacks and Hispanics are less likely to move out of stable areas that receive more LIHTC housing.[10]

[9] In the absence of the two sets of controls, an increase in QCT-share of a 1995 neighborhood is found to be negatively correlated with the white share of the population, probability of college education, the likelihood of residing in a gentrifying location, and positively correlated with the minority share of the population (combining Blacks & Hispanics) and living in a non-gentrifying area. These associations show that in the absence of the two sets of controls - regions that are non-gentrifying, high minority and low average college attainment undergo an increase in QCT-share in 1995.

[10] Even though there is potentially more affordable housing in high-income high property value areas, the minorities may not find it suitable to move due to potentially higher level of hostility from high-income neighbors (Anderson 2020; Harriot 2019) and/or due to the racial discrimination in the housing market (Turner et al. 2013).

Next, we examine the impact on change in neighborhood quality in 2000 for the individuals exposed to a high affordable housing construction. We find that Whites are surrounded by a higher number of college graduates and live in a higher quality neighborhood.[11] Hispanics from initially stable locations show weak labor market outcomes, and are exposed to a lower neighborhood quality and less own-race/ethnicity individuals. It is likely that they are are losing their own race network, which is documented as an essential ingredient for work opportunities, job referrals, etc.[12] Hispanics from the initially declining location are exposed to more educated neighbors, but no change in the racial/ethnic make-up of their neighborhood; they show a slight improvement in labor market outcomes and self-sufficiency.

The main contribution of this paper is towards extending the literature on understanding the affects of affordable housing and, in particular, the LIHTC program. A growing literature in this area has analyzed the impacts of LIHTC program on neighborhoods, and the results are largely mixed. Eriksen and Rosenthal (2010) document a significant crowd-out of private investment in areas hosting LIHTC housing while Baum-Snow and Marion (2009) and Diamond and McQuade (2015) document an increase in homeowner turnover, declining housing prices and median income in low-poverty neighborhoods. Contrary to that, LIHTC has been associated with the revitalization of low-income areas. Freedman and Owens (2011) find a reduction in violent crimes in areas hosting LIHTC housing, Ellen, Horn and O'Regan (2016) find no evidence of poverty concentration due to LIHTC, Freedman and McGavock (2015) find no evidence of reduction in nearby owner-occupied house values, and Ellen, O'Regan and Voicu (2009) find a positive impact on real estate prices near LIHTC housing. In addition to the negative impacts noted before, Baum-Snow and Marion (2009) and Diamond and McQuade (2015) also find positive "amenity" impacts in low-income areas such as an increase in housing prices, increased racial mix of people, and reduction in crime. While these previous studies highlight the important neighborhood level impacts of the LIHTC program, to the best of our knowledge, ours is the first paper to explore the impact of exposure to affordable housing construction under LIHTC on individuals residents.

The second contribution is to the literature analyzing the impact of changes in the neighbor-

[11] We measure neighborhood quality by an index combining the poverty rate, unemployment rate, college education rate, median area income, and median property prices.

[12] See Bayer and Ross 2006 and Bayer, Ross and Topa 2008.

hood on individuals. Seminal work in the area by Ludwig et al. 2012, Katz, Kling and Liebman 2001, and Chetty, Hendren and Katz 2016 demonstrates that an improvement in neighborhood quality has a positive economic impact on the children exposed to the changes, but not so much for the adults. Their findings are likely influenced by the fact that almost all individuals in their sample are eligible for public housing support. Therefore, they are predominantly low-income and belong to minority racial/ethnic groups. The sample in our study comprises all race/ethnic groups. While we find that adult minorities do not gain on average, there are net gains to improvement in neighborhood quality but are driven mainly by the White adult population. The findings in our study are more aligned with the recent literature analyzing the association between endogenously chosen neighborhoods (following a shock) and labor market gains (Deryugina, Kawano and Levitt 2018).

Finally, we also find that the neighborhood quality and exposure to own-race neighbors are critical for any labor market gains, at least for the minorities. It is likely because exposure to racially similar neighbors is essential for the referral mechanism to work towards labor market improvements. To that end, our paper also contributes to the literature examining the importance of social interactions and gains from it for individuals (Bayer and Ross 2006 and Bayer, Ross and Topa 2008), and even the larger economic entities like firms (Ananat, Fu and Ross 2021).

2. Background

2.1 About the LIHTC program

The Low-Income Housing Tax Credit (LIHTC) program was created as a part of The Tax Reform Act of 1986. This program was set up to encourage private investments in the development and rehabilitation of affordable rental housing. Every year, the states receive an allocation of federal tax credit from the Internal Revenue Service (IRS) based on population. These credits are then competitively allocated to the projects proposed by the developers for ten years. Developers can use these tax credits against their tax liability each year or sell in the market to raise equity capital, reducing their market borrowings for capital. This program has cost the U.S. government an average of $8 billion per year, which is a project to cross $10 billion in 2021 (Keightley 2021). Between its inception in 1987 and 2015, approximately 46,000 projects and close to 3 million affordable housing units have been placed in service, which accounts for about 7 percent of all rental housing in the U.S. in 2014-15 (Scally, Gold and DuBois 2018).

To be eligible for this tax credit, federal guidelines require that the rental projects proposed by the developers meet one of the two criteria. Either at least 20 percent of the units in a project should be housed by individuals with incomes 50 percent or less than the area median gross income (AMGI), or at least 40 percent of the units be housed by individuals with incomes less than 60 percent of AMGI.[13] These units are called "low-income" units. The number of proposals usually exceeds the available tax credits, and hence the developers typically go beyond the minimum requirements to be attractive to the state agencies. As a result, more than 90% of the units constructed under this program have been low-income units.

To further encourage these developments in low-income areas, Congress passed a legislation in 1989 to increase the tax credit by 30 percent for the projects in "qualified census tracts" (QCTs). A census tract counts as qualified if at least 50% of its households have incomes below 60% of AMGI with a restriction that no more than 20% of the population of any metropolitan area may live in a qualified tract.[14] The QCTs are assigned by the Department of Housing

[13] The actual allocation rule for individuals assigns per-capita income cutoff for families applying for these units.

[14] Census tracts are the geographic boundaries designated by the Census Bureau. Their average population is approximately 4,000 individuals. Census tracts are contained within a state. Figure A1 demonstrates the division of entire contiguous United States into smaller census tracts.

and Urban Development (HUD) using the census tract boundary definitions from the available decennial census. Figure 1 shows the timeline of the adoption of and changes in the QCT status. The first QCTs were assigned in 1990 using the 1980 census tract definitions (see Notice 1990). This assignment was revisited in 1994, where the new definitions from 1990 decennial were used to reassign the QCT status. Due to a publication error in the 1994 reshuffling of QCTs, they were correctly reassigned in mid-1995 (see Notice 1995). The tracts with a qualified status attract a higher number of projects and low-income units than their non-qualified counterparts.[15]

2.2 Linking the 1995 QCT reshuffling to the individuals in 2000

In every decennial census, a fraction of census tracts undergoes a boundary change. These changes may include splitting a large tract into smaller tracts, merging a few tracts to make one tract, or redrawing the boundary of a tract that overlaps with the previous boundary of other tracts (s).[16] New tract boundaries may change the average economic characteristics of the previously defined tract. Therefore, a few tracts may gain or lose the qualified status after the latest census definitions are used, and that changes the supply of new affordable housing under LIHTC in those tracts. The reshuffling in 1995 had a similar impact where a fraction of previously non-qualified tracts became qualified, and a few previously qualified tracts lost the qualified status. A change in qualified status of a specific tract cannot be predicted by the developers and, more importantly, by the individuals residing in these tracts. It can hence be regarded as an exogenous shock.

Evaluating the impact of change in QCT status (and hence, the supply of housing) on an individual's labor market outcomes is only possible with the knowledge of the individual's residence when that place underwent a change in QCT status. The 2000 census records the address of the respondent's residence 5-years before the survey, i.e., in 1995, and 1995 is also when the 1990 tract definitions were used to reassign QCT status. This allows us to link a 2000 census respondent to their area of residence 5-years back and precisely calculate the exposure

[15] Results discussed later in this paper and existing literature (e.g., Baum-Snow and Marion 2009, Freedman and Owens 2011) show that QCT status is associated with a higher number of projects and units being constructed/operated under LIHTC.

[16] See Figure A3 for an example of tract boundary changes between 1990 and 2000 census.

to change in QCT status they underwent in 1995. This connection is discussed and refined in Section 4 to constitute the main identification strategy for this paper.

3. Data & Variables

3.1 Data on Labor Market Outcomes

The data on labor market outcomes and self-reliance comes from the publicly available 5% sample of the 2000 census. This data is obtained from the Integrated Public Use Microdata Series - (IPUMA) USA (Ruggles et al. 2021). We use the data on approximately 13.5 million individuals across the 50 states and Washington D.C. We use labor-force participation, employment status, the number of weeks worked in the past year (if worked last year), income from wages, income from welfare programs, total pre-tax personal income, and total income as a fraction of the poverty line as main outcome variables. Labor-force participation, employment status, and weeks worked in the past year are reported for respondents aged 16 or more. The income from welfare (public assistance) includes – aid to families with dependent children (AFDC), general assistance (G.A.), and federal/state supplemental security income (SSI) to elderly (age 65+), blind, or disabled persons with low income. Table 1 provides descriptive statistics related to key variables from the census data.

3.2 Data on QCT status & Housing under LIHTC

The primary explanatory variable is constructed using the qualified census tract status (QCT). This data comes from the federal registers in 1990 and 1995 that include notices from the United States Department of Housing and Urban Development (HUD) designating the "qualified census tracts" (QCTs) for purposes of the LIHTC program. These notices contain a list of census tracts assigned the QCT status for the first time in 1990 and then revised in 1995. Each census tract is assigned a value of 1 if it was given a QCT status and 0 otherwise for the two QCT assignment/revision rounds in 1990 and 1995. Table 1 shows that about a quarter of the total units operated under LIHTC in the year 1995 were in census tracts with a QCT status. We also use the data on the number of projects and low-income units constructed and operated under LIHTC

before and after 1995. Yearly data on housing construction and operation under LIHTC comes from HUD. As observed in Table 1, since its inception in 1987 till 1995, the LIHTC program has provided approximately 300,000 low-income units. The program picked pace post-1995 and provided an additional 429,000 low-income units.

3.3 Geography of Analysis - *Neighborhood in 1995*

The QCT status is at the census tract level, which is not available in the publicly available 5% sample of the 2000 census. The primary geographic level in publicly available data is the public use micro area (PUMA). PUMAs are the geography defined by the Census Bureau for providing statistical and demographic information. Each PUMA contains at least 100,000 people and is contained within a state.[17] Since the reshuffling of QCT status happened in 1995, the geography of interest for this study is the location where the respondent to the 2000 census lived 5-years back, i.e., in 1995. For individuals staying in the same house between 1995 and 2000, their current PUMA is their residence 5-years back. However, the 1995 residence of the respondents who moved between 1995 and 2000 is identified by the migration-PUMA (called MIGPUMA) in the 5% sample of 2000 census. The MIGPUMAs either map one-to-one with the PUMA or combines smaller PUMAs to form one MIGPUMA. The MIGPUMAs constitute a geographic unit in 1995, which is standard across movers and non-movers, and therefore serves as the main geographic level of analysis for this study. There are 1,024 MIGPUMAs in the 2000 census.

The QCT status of a MIGPUMA is calculated as a fraction between 0 and 1 by using the population weighting to combining the qualified status of the census tracts within a MIGPUMA. The QCT status in 1990 and 1995 was assigned using the tract boundary definitions of the 1980 and 1990 census, respectively. Therefore, to calculate a change in the fraction of MIGPUMA under qualified status in 1995, we need the QCT fraction of MIGPUMA both by the 1980 and 1990 tract definitions. Census tracts and their respective QCT status from 1980 and 1990 are aggregated up to the MIGPUMA level using the population-weighted crosswalk files provided by the Diversity & Disparities project at the Brown University.[18] This process gives us two sets of

[17] Figure A2 shows the PUMA boundaries of the entire contiguous United States.

[18] See Logan, Xu and Stults 2012 for the procedures used in the LTDB project for generating the weighted crosswalks. The general method links 1970, 1980, 1990, and 2000 census tract boundaries to the 2010 tract boundaries. A backward-LTDB crosswalk then interpolates between 2010 and 2000, which is the intended year for this paper.

"fraction under qualified status" - one in 1990 (using 1980 tract definition) and the other in 1995 (using 1990 tract definition) for each MIGPUMA. The difference between these two fractions gives us the *change in QCT share* of a MIGPUMA in 1995. Figures A4 and A5 show, as examples, the change in QCT share of the MIGPUMAs in the state of New York and Connecticut.

Finally, for ease of use, we refer to the MIGPUMA as a *"neighborhood in 1995"* or *"1995 neighborhood"* in the rest of this paper.

3.4 Other Data

The empirical strategy in this paper relies on controlling for the economic and demographic make-up of the 1995 neighborhoods before they undergo a reshuffling in QCT status (discussed in the next section). For this, we use economic and demographic characteristics from the Summary Files of the 1980 and 1990 decennial census. Diversities & Disparities project provides a range of such variables after converting and aggregating the census tract definitions from 1980 and 1990 to 2000. These variables are at the census tract level and are therefore aggregated up to the 1995 neighborhood using the process described before. The set of variables we use are - log of population, fraction white, fraction black, fraction Hispanic, a fraction under poverty, fraction unemployed, a fraction under 18 years of age, a fraction over 60 years of age, fraction high-school graduate, fraction 4-yr college graduate, the fraction of housing units vacant, median housing prices and the median area income.[19]

Following the literature in the field, we explore heterogeneous impacts by the *gentrification level* of the 1995 neighborhood. For this, we follow the definition of *gentrification* used in in Baum-Snow and Marion 2009. For each neighborhood in 1995, we take the difference between the real median housing prices in 1980 and 1990 and divide it into terciles. Neighborhoods falling in the third tercile (above 67th percentile) are called *Gentrifying* while their counterparts in second and first tercile are called *Stable* and *Declining* respectively.

[19] Income and prices are represented in 2000-dollar value using the Consumer Price Index - Retrospective Series.

4. Empirical Strategy

The intuition behind the empirical strategy is centered around the QCT-share of the neighborhoods in 1995 where the respondents of the 2000 census lived. Neighborhoods with higher QCT-share are likely to receive more affordable housing under LIHTC, while areas with lower QCT-share are likely to receive less affordable housing. However, the QCT status of a census tract, and therefore, the QCT-share of a 1995 neighborhood, is not exogenous. E.g., a poorer tract is more likely to be a QCT, and hence, a neighborhood with higher poverty is likely to have a higher QCT-share. The poverty status of a neighborhood, in turn, is correlated with the labor market outcomes, giving rise to a correlation between these outcomes and the QCT-share. Therefore, before using the QCT-share as a predictor of the supply of new affordable housing, we need to adequately account for the factors that are determinants of QCT-share and are also correlated with the labor market outcomes.

4.1 Estimating equation

The QCT-share of a 1995 neighborhood is a predictor of the supply of LIHTC units, but it does not fully represent the shock to LIHTC housing supply post-1995. Areas with a higher (lower) QCT-share before 1995 are likely to be already exposed to a higher (lower) LIHTC housing supply. A shock to the housing supply is better represented by a *change in QCT-share* in 1995, which would result in a change in housing supply post-1995. Let $\Delta Share_{ps}^{95}$ denote the change in QCT-share of a neighborhood p in state s in the reshuffling conducted by HUD in 1995. The empirical exercise then aims to measure the change in labor market outcome Y of an individual i living in neighborhood p in state s in 1995, as follows:

$$Y_{ips} = \alpha + \beta\ \Delta Share_{ps}^{95} + \theta_s + \epsilon_{ips} \tag{1}$$

However, the change in QCT-share $\Delta Share_{ps}^{95}$ is also determined in parts by the factors that influence the labor market outcomes of individuals in 2000. Thus, inadequate controls for these factors will result in an endogenous relationship between the change in QCT-share and the outcomes of interest.

Firstly, $\Delta Share_{ps}^{95}$ is related to the pre-1995 QCT-share of a neighborhood. E.g., a more impoverished area would likely have a high pre-1995 QCT-share and may retain a higher QCT-share in the reshuffling in 1995. Furthermore, more impoverished areas are also likely to have lower labor market opportunities, thereby establishing a correlation between their pre-1995 QCT-share and the labor market outcomes of the individuals who lived in these neighborhoods in 1995.

Secondly, $\Delta Share_{ps}^{95}$ is also likely influenced by the systematic changes in the economic and demographic attributes of an area between the first time QCTs were assigned (in 1990) and their reshuffling in 1995. Systematic changes in the area attribute like education, race/ethnicity share, unemployment, poverty, etc., not only influence the eligibility of an area to have QCT status and shape the labor market outcomes of the individuals. The QCT-shares before 1995 were assigned in 1990 using the 1980 census and therefore represent the 1980 level area attributes, while the 1995 reshuffling used the 1990 census and consequently represented 1990 level area attributes. Thus, the change in area attributes between 1980 and 1990 censuses determine a part of the change in QCT-share in 1995.

Finally, $\Delta Share_{ps}^{95}$ is also determined by the change in census tract boundaries between two consecutive decennial censuses in 1980 and 1990. In a few cases in every decadal census, the census tract boundaries are redrawn by the census bureau, resulting in changes in the average demographics/economic attributes of an area. These changes in attributes could result in a tract gaining/losing the QCT status, and therefore induce a change in the QCT-share of a 1995 neighborhood. Census tracts undergo a change in boundaries mainly to accommodate the changes in racial composition and population growth[20], which are similar to the systematic changes discussed before and are therefore a source of endogeneity. Assuming that these systematic changes are accounted for adequately, the changes in tract boundaries in some cases may result in the tract *marginally* gaining/losing the QCT status during the reshuffling and therefore inducing a change in QCT-share of a 2000 census area. This change in QCT-share can be regarded as quasi-random.

The resulting relation between $\Delta Share_{ps}^{95}$ and its determinants is expressed below:

[20] See Census Bureau 2000 for a discussion around the procedures followed by the U.S. Census Bureau for assigning and changing tract boundaries.

$$\Delta Share_{ps}^{95} = f(Share_{ps}^{90},\ \Delta X_{ps}^{90-80},\ \mu^{90}) \tag{2}$$

Where, $Share_{ps}^{90}$ represents the QCT-share of a neighborhood p in 1990, ΔX_{ps}^{90-80} represents the change in attributes of neighborhood p between 1990 and 1980 censuses, and μ^{90} represents the fraction of the neighborhood p that underwent a boundary change in 1990 census. The OLS estimation of equation (1) results in parameter estimation as follows:

$$\begin{aligned} E[Y_{ips} \mid \Delta Share_{ps}^{95},\ \theta_s] &= E[Y_{ips} \mid (\Delta Share_{ps}^{95} | Share_{ps}^{90},\ \Delta X_{ps}^{90-80},\ \mu^{90}),\ \theta_s] \\ &= (\gamma + \delta + \beta_c)\ \Delta Share_{ps}^{95} + \theta_s \end{aligned} \tag{3}$$

Where, β_c represents the impact of the quasi-random change in tract boundaries μ^{90}, and is the parameter of interest. γ and δ represent the impact of $Share_{ps}^{90}$ and ΔX_{ps}^{90-80}, and results in a bias $(\gamma + \delta)$.

To account for the impact of pre-1995 QCT-share, we augment the rudimentary reduced form in equation (1) with $Share_{ps}^{90}$ as a control. This is akin to a control function identification strategy in Fletcher, Ross and Zhang 2020 and removes the component γ from the aggregate bias. To further account for the systematic changes between 1980 and 1990, we control for a set of vectors of attributes that explains the economic and demographic status of the 2000 census area using data from the 1980 and 1990 census, respectively. These vectors control for the 1980 level attributes of the 2000 census area and any changes in attributes between the 1980 and 1990 census and therefore remove the component δ of the aggregate bias. The final estimation equation is as follows:

$$Y_{ips} = \alpha + \beta_c\ \Delta Share_{ps}^{95} + \gamma Share_{ps}^{90} + \delta(X_{ps}^{90} + X_{ps}^{80}) + \theta_s + \varepsilon_{ips} \tag{4}$$

β_c is the parameter of interest that is estimated using a reduced-form OLS regression. The main explanatory variable $\Delta Share_{ps}^{95}$ is a standard normal version of the change in QCT-share, with a mean 0 and standard deviation of 1. The set of labor market outcomes Y include - labor-force participation, the fraction of total personal income coming from welfare, income from welfare, probability of being employed, number of weeks worked in the past year, log of wage income, and income as a fraction of poverty line. The vector X includes - log of population,

racial/ethnic shares, a fraction under poverty, fraction unemployed, fraction 18 years of age or below, fraction 60 years of age or above, median area house value, median area income, fraction completed high-school & 4-year college, and the number of vacant housing units in an area. All regressions include state fixed effects θ. The standard errors are clustered at the level of 2000 census area where the individuals lived in 1995 at the time of reshuffling of the QCT-shares. All the regressions at the individual level use the person weights provided in the 5% sample of the 2000 census.

4.2 Identifying assumption

The estimation strategy used in equation (4) works under the assumption that conditional on the pre-1995 QCT-share, and 1980 and 1990 level of economic & demographic attributes of a 1995 neighborhood, the change in QCT-share post-1995 is *random*. An ideal test of this identifying assumption requires individual-level panel data for testing the statistical balance in economic and demographic attributes between the individuals who were living in a 1995 neighborhood with high QCT-share *versus* those living in areas with low QCT-share. Unfortunately, this is not possible in this study as the 2000 census's 5% sample provides only a cross-sectional snapshot of an individual's demographic and labor market outcomes.

However, a few individual attributes are either immutable over time or are unlikely to vary in a time window that includes both post-1995 and a part of the pre-1995 time. The race/ethnicity of an individual is one such immutable attribute that does not change over time and is orthogonal to any shock to the local housing supply. Therefore, the race/ethnicity of an individual in 2000 and the racial/ethnic composition of an area in 1995 should also be orthogonal to the change in QCT-share in 1995. Other such attributes are - reported 4-year college completion for individuals aged 30 or above in 2000 (25 or above in 1995) and being a parent to children above 5 years of age in 2000. In addition to that, the quality of the neighborhood where an individual stayed in 1995 should also be orthogonal to the change in QCT-share in 1995. All these individual and neighborhood attributes are suitable candidates for a balance test as they are all correlated with an individual's labor market outcomes, and under a valid identification assumption, should be unrelated to the change in QCT-share of an area.

We start by using these attributes as dependent variable in a version of equation (4) that

excludes $X_{ps}^{90} + X_{ps}^{80}$, thereby leaving a potential bias δ in the strategy. Panel A of Table 2 shows the results. Absent the controls for systematic changes, the change in QCT-share shows a strong association with all the attributes it should be orthogonal to, indicating the presence of a bias. Whites are less likely to live in areas that gain QCT-share, while Blacks and Hispanics are more likely to live in these areas. Inhabitants of the areas that undergo an increase in QCT-share are less likely to be college-educated, less likely to live in gentrifying neighborhoods, and more likely to live in declining or stable neighborhoods.

On the face of it, the results indicate that these areas are likely poorer (hence pre-disposed to a higher QCT-share in 1995) and have worse labor market outcomes. In reality, however, the estimated coefficients are likely picking up the bias induced by the systematic changes between 1980 & 1990, which results in a higher QCT-share for an area that has evolved to have poorer economic conditions between 1980-90, and vice versa. Panel B of Table 2 includes $X_{ps}^{90} + X_{ps}^{80}$, and that results in a clean balance in all attributes across areas with varying levels of change in QCT-share. It strengthens the validity of the identification strategy by demonstrating that change in QCT-share, conditional on all the relevant controls, is *random* to the pre-existing (in 1995) economic and demographic conditions of the 1995 neighborhoods.

4.3 First-stage results

It remains to see if an increase in QCT-share of an area resulted in an increase in the construction/operation of low-income housing units from 1995 to 2000. Figure 2 shows the result from equation (4) with the number of low-income housing units under LIHTC (per 10k area population) put in place on or after 1995 as a dependent variable (panel on left). As observed, a one s.d. increase in QCT-share results in additional 4 low-income housing units per 10k population. The rural areas have different rules for the allocation of tax credits and are likely unaffected by incentives for a change in housing supply. As observed in Figure 2, the 1995 neighborhoods that are classified as metropolitan account for all the additional development as a result of increased QCT-share, while non-metropolitan areas demonstrate no change in low-income units.

Under the valid identification strategy, a change in QCT-share in 1995 should be uncorrelated to low-income units constructed and operated before 1995. The second panel (on the right) of figure 2 shows the coefficients from equation (4) when the number of low-income units

constructed before 1995 is used as a dependent variable. As expected, the change in QCT-share does not appear to predict the number of housing units constructed before the reshuffling in 1995.

5. Results

5.1 Impact on the Neighborhoods exposed to the reshuffling in 1995

Before looking at the impact on individual labor market outcomes, we start by analyzing the aggregate effect on economic and demographic characteristics of the 1995 neighborhoods themselves. Although the neighborhood-level impacts of the LIHTC program have been explored at length in the existing literature, this exercise is an attempt to test the validity of the setup in this paper and compare the results vis-a-vis existing studies.

Table 3 summarizes the results of estimating equation (4) with the 1995 neighborhood's average attributes in 2000 as dependent variables. Only metropolitan areas are included in this analysis. Panel A summarizes the overall impact on all neighborhoods and demonstrates a small shift in racial shares from Whites to minorities (combined share of Blacks and Hispanics). Impacts on other attributes are very small in size and statistically insignificant. However, there is substantial heterogeneity by the gentrification status of neighborhoods in 1995. Panel B-D summarizes the impacts for gentrifying, stable and declining neighborhoods. Areas that were gentrifying in 1995 (Panel B) undergo a significant shift in racial/ethnic composition of the area as Whites move out and the minority share increases. Although this is statistically insignificant, there is a small negative impact on area median income and median home value. Unemployment and poverty rate increase by 0.3 p.p. in response to a one s.d. change in the QCT-share of the neighborhood. Stable areas (Panel C) undergo a slight decrease in minority population, small increases in median income and home value, and small reductions in unemployment and poverty rates. However, all these impact sizes are not statistically precise. Declining areas (Panel D) show no impacts.

This analysis is conducted after collapsing all census tracts to 669 metropolitan neighborhoods and therefore is likely statistically underpowered compared to the studies in this area

that use much granular geography. However, the broader pattern from Table 3 is consistent with the findings in these studies.

5.2 Impact on Resident's Labor Market Outcomes

We now analyze the impact of an increase in QCT-share of a 1995 neighborhood on the labor market outcomes of individuals that resided in these locations. Table 4 summarizes the results from estimating equation (4) with the labor market attributes using 2000 census for the residents of 1995 neighborhoods as dependent variables. Panel A uses only the sample of respondents in the 2000 census who resided in metropolitan neighborhoods in 1995. In this sample, a one s.d. increase in QCT-share on a neighborhood in 1995 is associated with approximately 0.4 p.p. increase in labor-force participation and a similar increase in employment probability. Higher willingness to work and employment are accompanied by small increments in average weeks worked, wage income, and distance from the poverty line. There is also a 2.8 percentage increase in income from welfare programs with no change in welfare dependence (measured as the fraction of total personal income coming from welfare programs). The results in panel A demonstrate a small but definite improvement in labor market outcomes but no reduction in dependency on welfare programs, which is puzzling. As seen before, Table 4 demonstrates differential impacts by type of neighborhood, and the change in racial/ethnic shares indicates potential heterogeneous impacts by race/ethnicity. We will explore these heterogeneities in detail, which may help resolve the puzzle around welfare dependence.

Non-metropolitan areas have different rules around the tax credit under LIHTC and hence are likely not affected directly by a change in QCT-shares in 1995. Therefore, the respondents to the 2000 census who lived in a non-metro area in 1995 constitute a reasonable falsification sample. Panel B shows the results for individuals living in non-metro areas. Consistent with the expectation, there is no discernible impact on labor market outcomes in the non-metro sample.

5.3 Heterogeneity - *By Race/Ethnicity*

Table 5 shows the results by dividing the metropolitan only sample into three groups of race/ethnicity: Non-Hispanic Whites (called Whites), Non-Hispanic Blacks (called Blacks), and All Hispanics

(called Hispanics). As observed in Panel A, Whites seem to drive the entire labor market gains observed in Table 4 before. A one s.d. increase in QCT-share of neighborhood lead Whites to a 0.7 p.p. increase in labor-force participation and a similar (0.8 p.p.) increase in employment probability. The size of the impact on both these variables is almost 1% of the mean value. Whites are observed to be working an additional 0.16 weeks in the past year and earn 1% more than the mean value from wages. Distance from the poverty line increases by an average of 1%, suggesting a small decline in the poverty rate among Whites. Looking at columns 6 & 7, the labor market gains result in a reduction in dependence on welfare programs. The income from welfare falls by an average of $7.5 per person (5.5% of the mean value), and the fraction of total income from welfare programs goes down by 10% of the mean value. A larger effect size in column 7 compared to column 6 depicts a result of both a reduction in income from welfare (numerator) and an increase in personal income (denominator).

While Whites observe labor market gains from an increase in housing supply in the neighborhood, there is no impact on the outcomes for Blacks (Panel B). There is a hint of reduction in labor-force participation and employment probability, although they are very small and statistically insignificant. Employed people appear to work 0.12 of a week more, but this does not translate into higher income from wages or any decline in the average poverty rate. They demonstrate a slightly higher inclination towards welfare programs, but it is statistically insignificant.

Hispanics observe a negative impact on their labor market outcomes (Panel C). They are 0.8 p.p. less likely to be employed, employed people are working fewer weeks on average, and poverty seems to worsen by about 1.5% of the mean (although not statistically significant). Consequently, the dependence on welfare programs increases and is the highest for any race/ethnic group. Hispanics draw a lesser proportion of their income from welfare in comparison to Blacks (3.9% in comparison to 6.1% for Blacks), but the impact of increase QCT-share leads Hispanics to increase the fraction of income from welfare by 18% of the mean in comparison to 3.5% for Blacks. The average per-person income from welfare also goes up by $44.5.

For the convenience of exploring and interpreting results, we combine all the seven variables to form a standard normal index with mean 0 and s.d. 1. We start by converting each attribute to a standard normal version of itself. In the second step, we add the standard normal version

of positive attributes and subtract the standard normal version of negative attributes. Labor-force participation, being employed, weeks worked last year, and log of wage income is used as positive attributes while income from welfare enters as a negative attribute. In the final step, we make a standard normal index of the resulting sum. It is called the *Self-Sufficiency Index*.

Figure 3 shows the results using self-sufficiency index as a dependent variable. Whites demonstrate an improvement of 0.02 of a SD, while Hispanics show a reduction in self-sufficiency of 0.03 of a SD. There are no significant impact on Blacks, both by the magnitude and by statistical relevance. Following Freedman and Owens (2011), we also explore the results by instrumenting the construction of low-income unit by the main explanatory variable $\Delta Share^{95}$ from equation 4. Figure 4 shows the results from the two stage least squares estimation, and the results are very similar to the reduced form results in figure 3.[21] Since Blacks do not demonstrate any meaningful impacts in either estimation method, we restrict rest of the analysis to NH-Whites and Hispanics.

5.4 Heterogeneity - *By Race/Ethnicity & Gentrification*

Inhabitants of the 1995 neighborhoods have demonstrated significant heterogeneity in their labor market response to an increase in housing supply by race and ethnicity. Therefore, it is conceivable that different racial/ethnic groups in other initial gentrification statuses could respond differently to increased housing supply. We explore this in this sub-section.

Figure 5 shows the impact on a single self-sufficiency index divided by race/ethnicity and the gentrification status of the 1995 neighborhood of an individual. Whites observe gains in self-sufficiency irrespective of the gentrification level of their 1995 neighborhood. The improvements range from 0.012 to 0.023 of a standard deviation. On the other hand, Hispanics demonstrate significant heterogeneity conditional on the gentrification status of their neighborhood in 1995. Hispanics from gentrifying neighborhoods have no impact, while their counterparts from stable neighborhoods significantly decrease their self-sufficiency. However, Hispanics from initially declining neighborhoods gain self-sufficiency of 0.025 of an s.d. (p-value = 0.12).

[21] The first stage coefficient is 4.03 units for each SD increase in QCT share. The associated F-statistic is 15.88 with $Prob > F$ equal to 0.0001.

6. Mechanisms

In the discussion around the main results, we observed that the gentrifying neighborhoods in 1995 exhibit a negative impact of an increased influx of new affordable housing. Stable and declining neighborhoods show small signs of improvements or no effect at the least. When we analyze the impact on individuals who lived in these neighborhoods, the 1995 inhabitants of gentrifying areas show improved labor market outcomes. Inhabitants from declining areas demonstrate higher improvements than those from gentrifying or stable areas. These results suggest that people might have moved from their initial neighborhoods. People moving from their initial neighborhood are exposed to a new neighborhood themselves and change the demographic and economic make-up of their initial neighborhood.

Any resulting migration due to a change in the supply of affordable housing is likely to cause a change in the neighborhood characteristics for not only the mover but also for the stayers. Therefore, the migration and associated changes in the neighborhoods for individuals could constitute a reasonable mechanism to impact the labor market outcomes. These mechanisms would operate both from the change in own neighborhood and the change in the neighborhood for others induced by own move (and the move of other similar individuals).

6.1 Impact on Migration

The movement itself is likely conditional on the individual characteristics and the features of the initial location, and therefore may differ across race/ethnicity and initial gentrifying status. To quantify migration from the 1995 neighborhood, we use the variable in census 2000, which reports if the respondent's current residence (in 2000) is the same as their residence 5-years back (i.e., in 1995). A dummy variable is constructed with a value of 0 if the respondent lived in the same house 5-years back and 1 if their residence was different 5-years back. This variable is used as a dependent variable in equation (4).

Figure 6 reports the results by race/ethnicity of a respondent. As observed, Whites tend to migrate as a result of higher construction in their neighborhood, while Hispanics show opposite (but statistically insignificant) impact. Figure 7 reports the migration probability by race/ethnicity and the gentrification level of the respondents' neighborhood in 1995. Only

the respondents who lived in a gentrifying location in 1995 show a likelihood of moving out of their neighborhood (although insignificant for Hispanics). There is no selective migration by Whites from other gentrification levels while Hispanics tend to stay back in stable locations as a result of higher LIHTC construction. It is likely that the potential beneficiaries of low-income units are Hispanics (as opposed to Whites) and Hispanics are likely to be concentrated in non-gentrifying locations in 1995. Therefore, Hispanics *staying-back* in stable locations could be driven by individuals who are the direct beneficiaries of affordable housing.

The *'neighborhood'* in this study is a MIGPUMA (Migration-PUMA) from the 2000 census. As seen before, this is the reported geography where the respondents to the 2000 census lived in 1995. While the migration indicator records if the person is living in the same house as 5-years back, it could also include moving to a new house within a MIGPUMA. A MIGPUMA combines one or more PUMAs and, in that sense, is larger geography and such close moves are possible. Such moves, however, cannot be linked to a change in the neighborhood for an individual since they are still residing within a MIGPUMA. If the majority of moves were within a single MIGPUMA, it would dilute any potential role of migration as a mechanism for the results in this study. Similarly, if the movers were moving within a certain gentrifying status, it cannot be linked to differential impacts across the gentrifying status of 1995 neighborhoods. To explore this, we analyze the likely destinations of movers (in 2000) in terms of the destination's gentrification status in 1995. Figure 8 shows the results. Irrespective of the race, the movers are less likely to be found in a location that was gentrifying in 1995. Instead, they are more likely to be found in the stable or declining neighborhoods in 1995, with a higher probability of being found in declining neighborhoods.

6.2 Change in Exposure to Neighborhood

Migration induced by the change in QCT-share changes the neighborhoods of migrants and also the neighborhoods of stayers. Another source of change in the neighborhood is the overall impact of a higher supply of affordable housing in the original neighborhood. All of these changes are happening almost simultaneously during the period 1995-00. Without a geographic panel of outcome variables, it is hard to tease out the likely impact of each of these sources of neighborhood changes in shaping individual labor market outcomes. However, an aggregate

result of these changes should show up in the change in the *neighborhood exposure* of individuals in 2000, 5-years post the change in the supply of affordable housing.

6.2.1 Measuring the Change in Neighborhood Exposure

For the individuals who migrate from their 1995 neighborhood, the change in neighborhood exposure can be measured by the difference in the 1995 economic and demographic characteristics of their initial location and the location in 2000. An individual moving to a location with higher employment rates, lower poverty, higher average education, etc., in 1995 is likely to demonstrate better labor market outcomes in 2000. While an individual moving to a location with worse characteristics in 1995 is likely to show no/smaller labor market gains in 2000. We proxy for the 1995 economic and demographic characteristics of the neighborhoods by their 1990 characteristics using the 1990 census[22], and measure changes in key variables between an individual's neighborhood in 2000 and their reported neighborhood in 1995. We measure changes in racial/ethnic shares, unemployment rate, poverty rate, rate of 4-yr college education, real median area income, and real median housing prices. For the ease of reporting, we combine all the variables except the racial/ethnic shares into a standard normal index called *"neighborhood quality index"*.

The change in the neighborhood as above is only applicable for individuals who migrate. Another way of calculating neighborhood change that applies to all individuals is by calculating the difference between the average economic and demographic characteristics of the individuals who stayed in the respondent's reported neighborhood in 2000 and the mean characteristics of the individuals who remained in the respondent's reported neighborhood in 1995. For migrants, this change represents the difference between the features of their 1995 and 2000 neighborhoods. For non-migrants, this represents the neighborhood changes they are exposed to due to individuals of various characteristics moving in and out of their neighborhood, thereby inducing the changes in the first place. One challenge with this method is that we only observe the individual's outcomes in 2000, which have likely undergone changes due

[22] Although there might be changes in the location attributes between 1990-95, we do not have any available data to measure. More importantly, under the identification strategy, any changes between 1990-95 are orthogonal to the change in QCT-share in 1995. Also, the 1995 reshuffling of the QCTs was based on the economic characteristics and boundary definitions from the 1990 census.

to changes in affordable housing supply and are endogenous. This method, therefore, restricts the set of variables we can use to measure change to the ones that are likely not impacted by the 1995 reshuffling but are correlated with the labor market outcomes. Similar to Table 2, these variables are race/ethnicity and education attainment for ages 25 years and above. We measure education attainment using a mean 4-year college completion and a standard normal variable that assigns a higher positive value to each completed higher education category.

The role of being exposed to a better neighborhood likely varies by the access to labor market opportunities. Social interactions and referrals are an essential set of factors facilitating access to jobs and work opportunities (see Bayer, Ross and Topa 2008). A change in neighbors' racial/ethnic composition may impact the outcomes of interest in this study. This impact may, in part, be influenced by the socioeconomic gap between the residents and their new neighbors. More educated and not-own race neighbors, e.g., are not ideal for the interactions and referrals mechanism to generate positive labor market outcomes (see Bayer and Ross 2006). We attempt to measure this change in the socioeconomic gap by the change in the education gap between the three racial/ethnic groups. First, we calculate the White-Hispanic education gap in a neighborhood using its residents in 1995 and then using its residents in 2000. Similarly, we calculate the White-Black education gap. The difference between these two inter-temporal gaps constitutes the measure for the change in the average education of Whites as compared to that of other minority race in a neighborhood, and vice versa. The changes in gaps are computed for both the 4-year college completion and the standardized education index and only for individuals who were 25 years of age or above in 1995.

6.2.2 Results

Table 6 and 7 show the change in neighborhood characteristics for Whites, Blacks and Hispanics respectively (using equation 4). They are split into three panels by the initial gentrifying status in 1995. Column 1 shows the impact on self-sufficiency index (from Figure 5). Columns 2-8 show the change in characteristics as per the second method applicable to all individuals. Columns 9-14 show the change in characteristics as per the first method, only for the individuals who migrate in 1995-00.

Table 6 summarizes the results for Whites. Those from the gentrifying neighborhood ob-

serve a small increase in Whites around them and a slight reduction in Blacks (they closely miss a 10% significance mark). There is an increase in average college graduates and a widening of the education gap between Whites and Blacks. Migrant Whites observe a 0.055 s.d. increase in neighborhood quality and widening education gaps with respect to both Blacks and Hispanics. In summary, the neighborhood exposure for Whites improves, and they face relatively less educated Black and Hispanic counterparts. These are favorable features for improvements in labor market outcomes and self-sufficiency, as shown in Column 1. Panel B shows the results for Whites coming from initially stable neighborhoods. In both the set of results (for all and specific to migrants), Whites observe favorable neighborhood conditions but a slight reduction in the share of Whites around them. This is likely due to the reduction in migration by Hispanics shown in figure 7. However, the education gap does not reduce, and Whites gain self-sufficiency. Although less than Panel A. Panel C shows no change in racial/ethnic composition, there is an improvement in neighborhood quality with a slight reduction in White-Black education gaps. The resulting impact on self-sufficiency is positive but slightly smaller than Panel A that had the most favorable set of changes in neighborhoods.

Hispanics coming from initially gentrifying locations (Panel A of Table 7) face no change in neighborhood quality of average education index, but the education gap for Blacks has widened (for migrants). It shows up as a very small, negative, and statistically insignificant impact on the self-sufficiency index. Hispanics from initially stable locations (Panel B) face fewer people of their race and a slightly higher number of Whites and Blacks (although statistically insignificant). Column 8 shows a widening education gap with respect to Blacks, and migrant Hispanics face lower quality neighborhoods. These unfavorable changes in neighborhoods and the higher presence of neighbors from other races are likely to reduce self-sufficiency in Column 1. Hispanics from initially declining areas (Panel C) do not change neighborhood racial/ethnic make-up but observe a slight increase in education attainments. There is likely no other competition from other races as the education gaps show no statistically significant changes. As a result, the self-sufficiency improves in magnitude but closely misses the statistically insignificant mark.

7. Conclusion

There is a long-standing debate about the efficiency and economic impacts of affordable housing provision in the U.S. While the effects of affordable housing on neighborhoods are well documented, there is a gap in understanding its impact on individuals. This paper explores the impact of new affordable housing construction under the Low-Income Housing Tax Credit (LIHTC) program on the individuals' labor market outcomes and dependence on welfare programs. Using the timing of changes in the program that lead to varying levels of affordable housing construction across the U.S., we compare the labor market outcomes of individuals exposed to high or low levels of new affordable housing. We overcome the challenge of selective sorting into neighborhoods due to new housing construction by linking the individuals in the 5 percent sample of the 2000 decennial census to their location of residence before the program underwent changes.

We find an average improvement in labor market outcomes and self-reliance of individuals exposed to more LIHTC housing construction in their neighborhood. However, these improvements are driven entirely by Whites with no impact on Blacks and a negative impact on Hispanics. This finding highlights the crucial yet unexplored aspect of the exposure to affordable housing construction that can lead to heterogeneous effects for different racial and ethnic groups. Exploring the plausible mechanisms, we find that Whites migrate to better neighborhoods in response to higher affordable housing construction and are exposed to better neighborhood quality. On the other hand, Hispanics face neighborhoods that are worse in quality.

This paper contributes to understanding the impacts of affordable housing programs like LIHTC and the literature exploring the effects of change in the neighborhood on adult socioeconomic outcomes. In addition, the findings in this paper further our understanding of the spillovers of affordable housing programs and are relevant for policymakers aiming to design optimal housing assistance programs.

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8. Figures

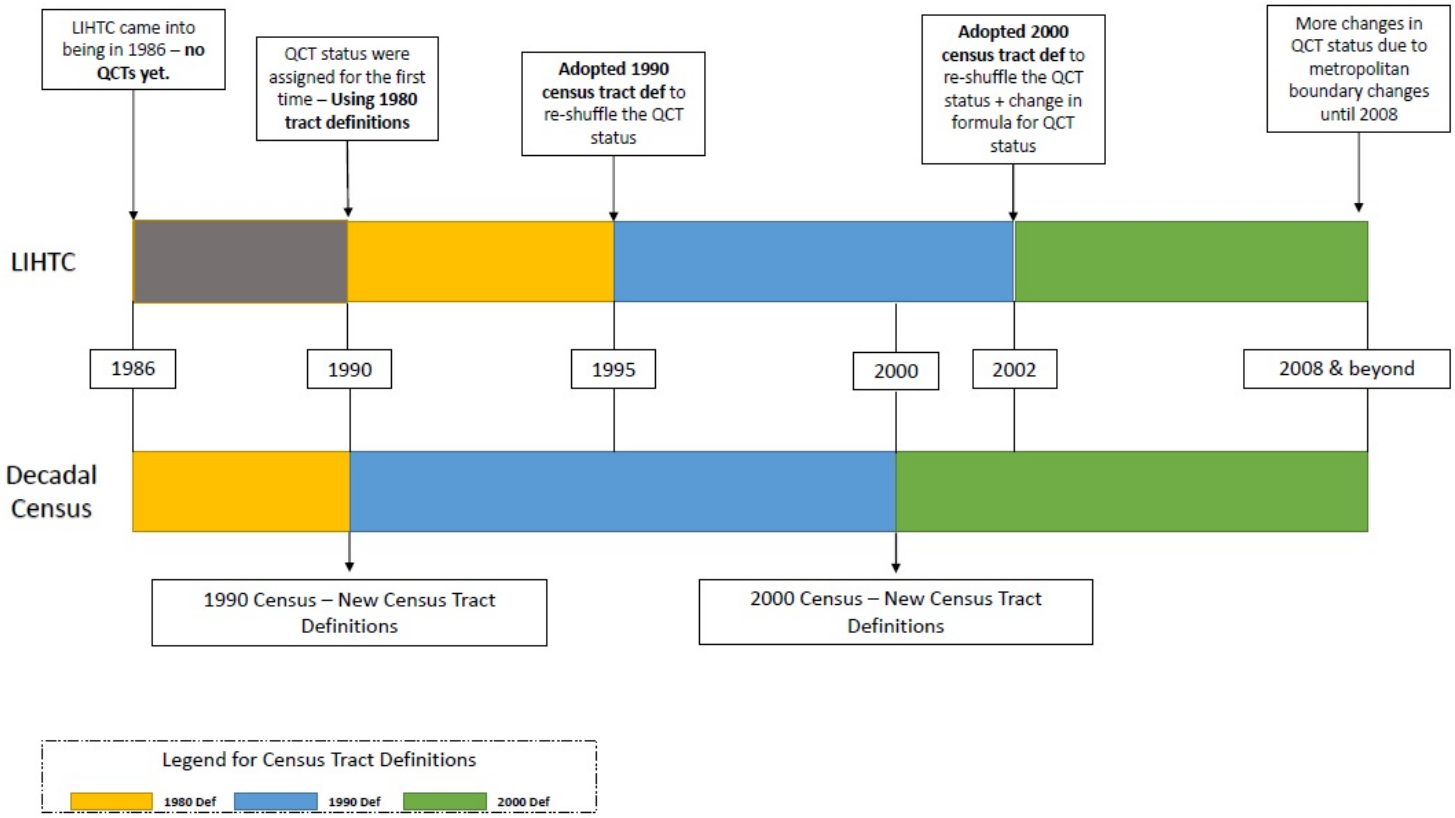

Figure 1: TIMELINE OF LIHTC PROGRAM & ASSOCIATED CHANGES

Notes: This figure shows the timeline associated with the beginning of LIHTC program and the changes in the program and QCT assignment rules until 2008. in addition to that, it matches the timeline of changes with the decennial census data of 1990 and 2000. 90% confidence intervals are reported.

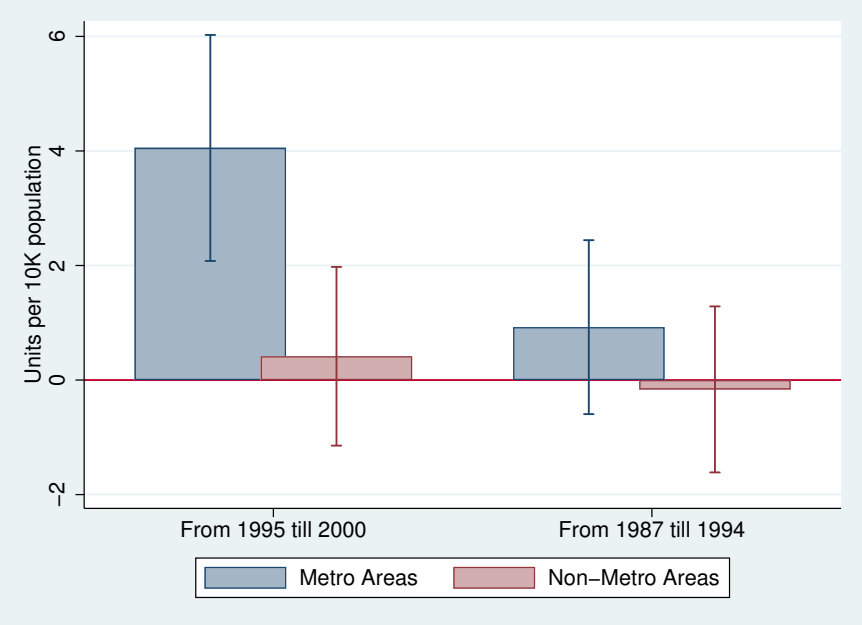

Figure 2: FIRST-STAGE IMPACT OF INCREASE IN QCT-SHARE ON LIHTC HOUSING.

Notes: This figure plots the coefficients from regressions using equation (4) with the number of low-income units constructed under the LIHTC program (per 10,000 population) as an explanatory variables. The sample is further divided into metropolitan and non-metropolitan neighborhoods. Standard errors are clustered at the level of 1995 neighborhood. 90% confidence intervals are reported.

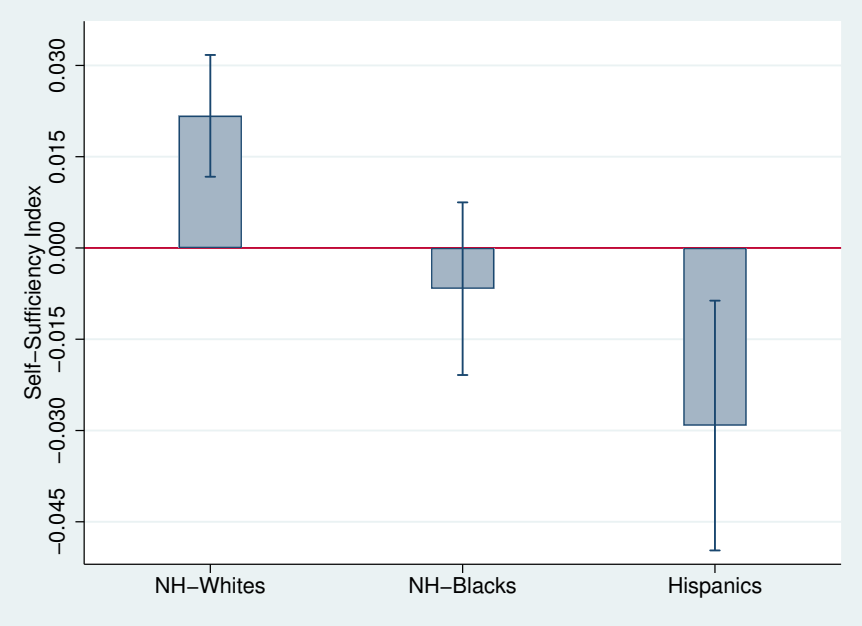

Figure 3: SELF-SUFFICIENCY INDEX - *By Race*

Notes: This figure plots the coefficients from regressions using equation (4) with the *self-sufficiency index* as a dependent variable. These regressions are estimated at the individual level. The index is a standard normal variable combining labor-force participation, employment status, number of weeks worked in the past year, log of wage income and the income from welfare programs. Standard errors are clustered at the level of 1995 neighborhood. 90% confidence intervals are reported.

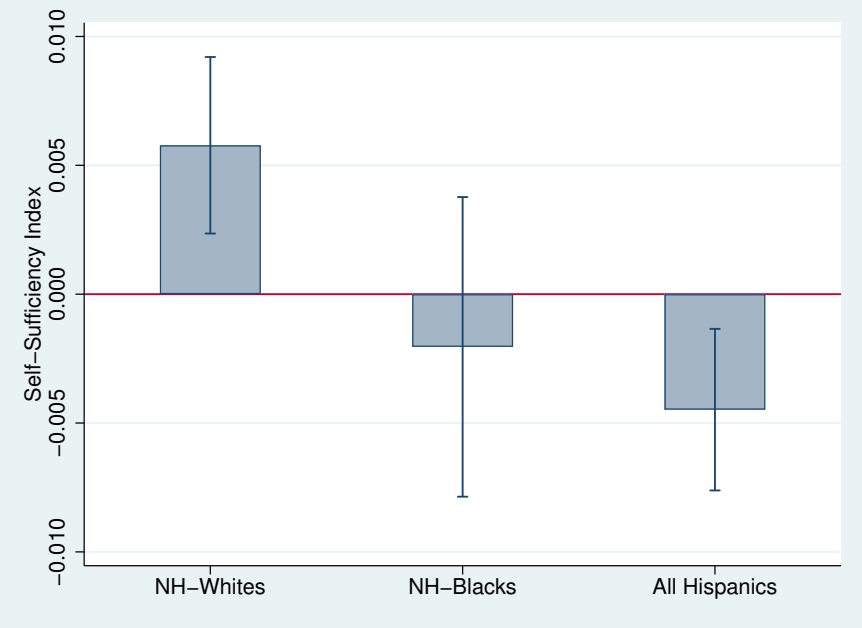

Figure 4: SELF-SUFFICIENCY INDEX - *By Race* (2-SLS)

Notes: This figure plots the coefficients from a regressions instrumenting the number of LIHTC units constructed between 1995-2000 (per 10,000 people) by the $\Delta Share_{ps}^{95}$ from equation (4), and with *self-sufficiency index* as a dependent variable. These regressions are estimated at the individual level. The index is a standard normal variable combining labor-force participation, employment status, number of weeks worked in the past year, log of wage income and the income from welfare programs. Standard errors are clustered at the level of 1995 neighborhood. 90% confidence intervals are reported.

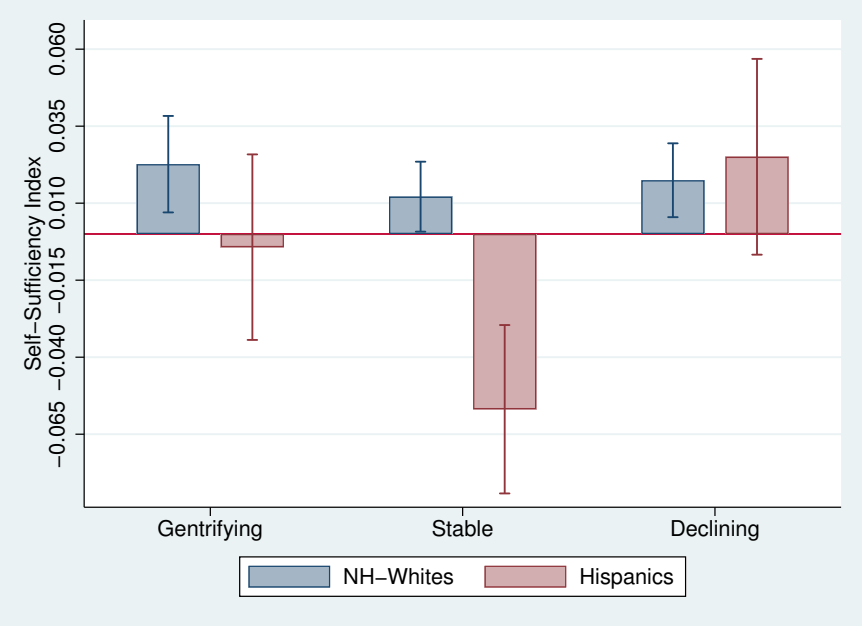

Figure 5: SELF-SUFFICIENCY INDEX - *By Race & Initial Gentrification Status*

Notes: This figure plots the coefficients from regressions using equation (4) with the *self-sufficiency index* as an explanatory variables as an explanatory variable. These regressions are estimated at the individual level. The index is a standard normal variable combining labor-force participation, employment status, number of weeks worked in the past year, log of wage income and the income from welfare programs. Standard errors are clustered at the level of 1995 neighborhood. 90% confidence intervals are reported.

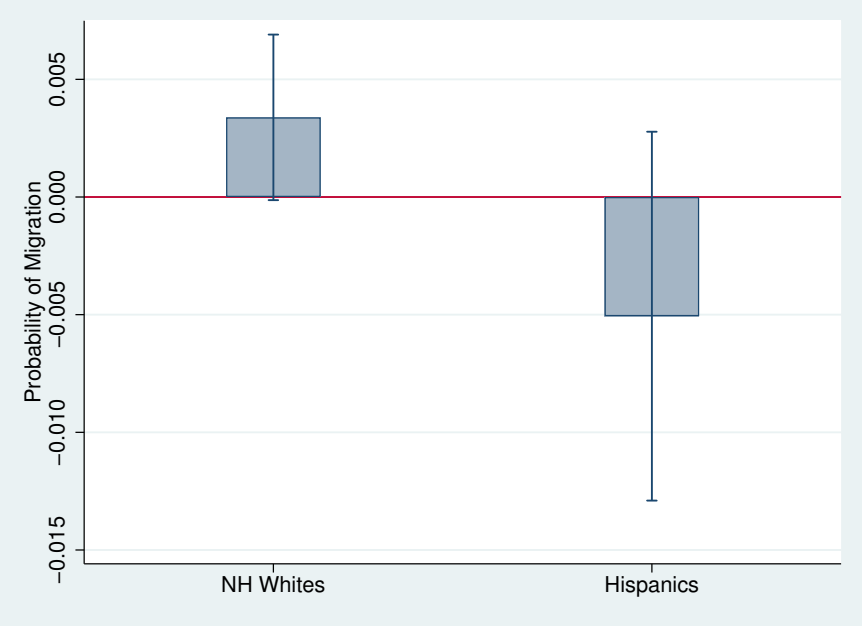

Figure 6: PROBABILITY OF MIGRATION - BY RACE

Notes: This figure reports the results of estimating equation (4) with the migration status between 1995-00 of all individuals between 18-64 years of age in the 5 percent sample of 2000 census as a dependent variable. This migration variable takes on the value 1 if the individual in 2000 reports living in a different house from their 1995 residence, and 0 if they have stayed in the same house between 1995 and 2000. The sample is further divided by race/ethnicity. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of the 1995 neighborhood. 90% confidence intervals are reported.

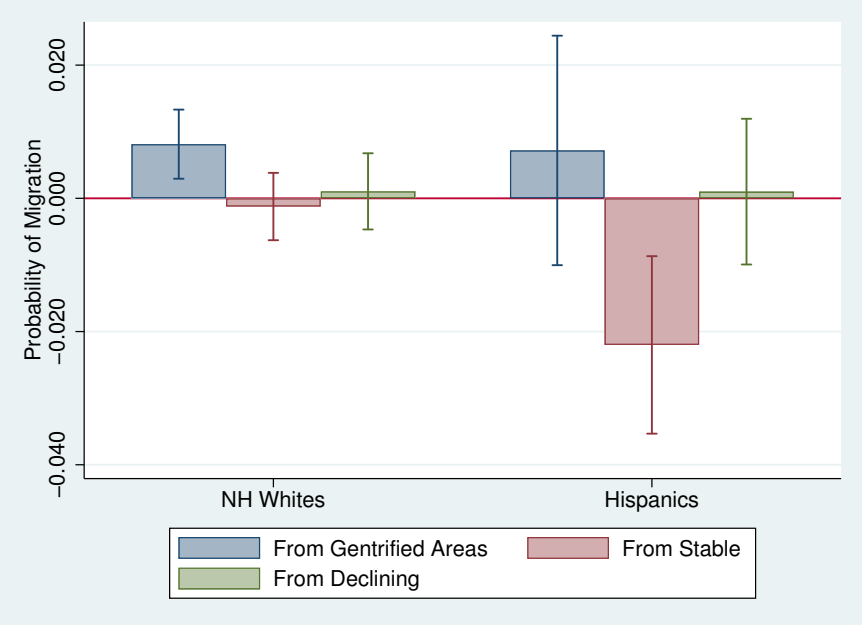

Figure 7: PROBABILITY OF MIGRATION - BY RACE & INITIAL GENTRIFICATION

Notes: This figure reports the results of estimating equation (4) with the migration status between 1995-00 of all individuals between 18-64 years of age in the 5 percent sample of 2000 census as a dependent variable. This migration variable takes on the value 1 if the individual in 2000 reports living in a different house from their 1995 residence, and 0 if they have stayed in the same house between 1995 and 2000. The sampe, is further divided by race/ethnicity and the gentrification status of the 1995 neighborhood. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of the 1995 neighborhood. 90% confidence intervals are reported.

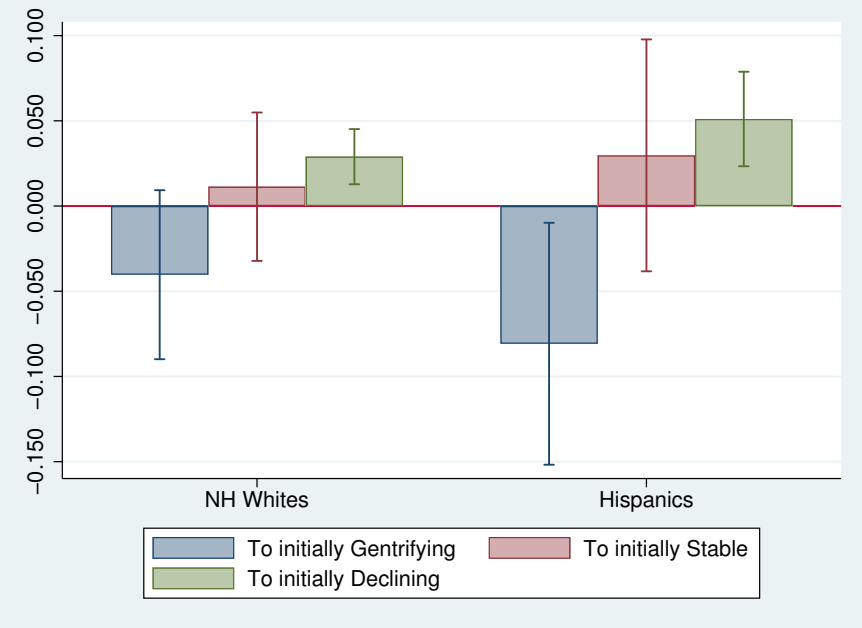

Figure 8: DESTINATION OF MIGRANTS

Notes: This figure reports the results of estimating equation (4) on the *destination* of the sample of *only migrants* from figure 7. The destination is a dummy variable with value equal to 1 for each of the 1995 level gentrification categories (gentrifying/stable/declining) of the destination neighborhood, and 0 for other categories. The sample, is further divided by race/ethnicity and the gentrification status of the 1995 neighborhood. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of the 1995 neighborhood. 90% confidence intervals are reported.

9. Tables

Table 1: Descriptive Statistics

Variable	Value	SD
Census 2000 (5% Sample)		
Race: *White*	0.78	0.42
Race: *Black*	0.11	0.32
Race: *Other*	0.11	0.31
Gender: *Female*	52%	-
Labor Force Participation Rate	0.63	0.48
Mean Personal Income ($)	$27,076	$39,638
Mean Welfare Income ($)	$210	$1298
Low Income Housing under LIHTC		
Units between 1987-1994	300,726	-
Units between 1995-2000	428,735	-
% units in QCT tracts in 1995	25%	-

Notes: This table shows the descriptive statistics from the 5 percent sample of 2000 census and the housing data under LIHTC program from the Department of Housing and Urban Development (HUD).

Table 2: Test for the validity of Identification Strategy

	(1) NH-White (= 1)	(2) NH-Black (= 1)	(3) Hispanic (= 1)	(4) 4-yr college completed ($\geq$ 25*yrs*)	(5) Living in a Gentrified Area	(6) Living in a Stable/Declining Area	(7) Child above 5 yrs of age
	Panel A: Balance Test (Systematic changes b/w 1980-90 NOT controlled)						
$\Delta Share^{95}$	-0.0388***	0.0252***	0.0165***	-0.0128***	-0.0550***	0.0548***	0.0000
	(0.0059)	(0.0047)	(0.0064)	(0.0039)	(0.0128)	(0.0128)	(0.0004)
Obs.	13,330,676	13,330,676	13,330,676	7,855,606	13,310,074	13,330,676	13,330,676
	Panel B: Balance Test (Including control for systematic changes b/w 1980-90)						
$\Delta Share^{95}$	-0.0001	0.0007	0.0013	-0.0002	0.0049	-0.0049	0.0000
	(0.0013)	(0.0006)	(0.0011)	(0.0007)	(0.0128)	(0.0127)	(0.0003)
Obs.	13,330,676	13,330,676	13,330,676	7,855,606	13,310,074	13,330,676	13,330,676

Notes: This table reports the results of estimating equation (4) with the socio-demographic characteristics of all individuals in the 5 percent sample of 2000 census as dependent variable. Panel A excludes the control for systematic changes between 1980 and 1990 census. Panel B is the full model including the controls for systematic changes. Only the individuals living in non-group quarters are included. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of 1995 neighborhood. Significance levels: * 10%, ** 5%, ***, 1%.

Table 3: Impact on Neighborhood level Economic & Demographic Characteristics

	(1) Fraction NH-White	(2) Fraction NH-Black	(3) Fraction Hispanic	(4) Fraction Minority	(5) Median Area Income ($)	(6) Median Home Value ($)	(7) Fraction Unemployed	(8) Fraction Poor	(9) Fraction College Educated
				Panel A: All Metropolitan Areas					
$\Delta Share^{95}$	-0.0049*	0.0022	0.0007	0.0029**	-71.2	-882.5	0.0011	0.0001	-0.0005
	(0.0027)	(0.0013)	(0.0010)	(0.0014)	(226.9)	(1,085.2)	(0.0007)	(0.0010)	(0.0017)
No. of Areas	669	669	669	669	669	669	669	669	669
Outcome Mean	0.773	0.108	0.079	0.188	45,860	116,000	0.056	0.114	0.238
Effect Size	0.006	0.02	0.009	0.015	0.002	0.004	0.02	0.001	0.002
				Panel B: Gentrifying Metro Areas					
$\Delta Share^{95}$	-0.0106***	0.0021	0.0065***	0.0087***	-366.3	-1,570.7	0.0028***	0.0029*	0.0024
	(0.0037)	(0.0023)	(0.0024)	(0.0031)	(346.4)	(1,904.1)	(0.0010)	(0.0016)	(0.0036)
No. of Areas	225	225	225	225	225	225	225	225	225
Outcome Mean	0.759	0.114	0.081	0.196	50,887	141,625	0.05	0.102	0.274
Effect Size	0.014	0.019	0.081	0.044	0.007	0.003	.056	0.028	0.009
				Panel C: Stable Metro Areas					
$\Delta Share^{95}$	0.0054	0.0004	-0.0045*	-0.0041	307.9	1,825.4	-0.0008	-0.0024	0.0003
	(0.0052)	(0.0023)	(0.0023)	(0.0027)	(391.1)	(2,133.3)	(0.0011)	(0.0015)	(0.0022)
No. of Areas	211	211	211	211	211	211	211	211	211
Outcome Mean	0.792	0.101	0.073	0.174	44,609	109,154	0.056	0.115	0.228
Effect Size	0.007	0.004	0.061	0.023	0.007	0.03	0.014	0.021	0.001
				Panel D: Declining Metro Areas					
$\Delta Share^{95}$	-0.0029	-0.0010	-0.0010	-0.0019	-87.89	785.6	0.0009	0.0006	0.0004
	(0.0031)	(0.0029)	(0.0016)	(0.0033)	(213.56)	(1,008.9)	(0.0012)	(0.0014)	(0.0020)
No. of Areas	208	208	208	208	208	208	208	208	208
Outcome Mean	0.766	0.117	0.082	0.2	42,541	98,184	0.061	0.125	0.21
Effect Size	0.004	0.008	0.012	0.01	0.002	0.014	0.015	0.004	0.002

Notes: This table reports the results of estimating equation (4) with the economic and demographic characteristics of all metropolitan 1995 neighborhoods in 1995 as dependent variable. These regressions are estimated at the level of neighborhood. Panel B, C and D divide the sample of all areas from Panel A into gentrifying, stable and declining. Only the individuals living in non-group quarters are included. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of state. Significance levels: * 10%, ** 5%, ***, 1%.

Table 4: Impact on Labor-market Outcomes and Dependence on Welfare - *By Metropolitan Status*

	(1) Labor-force Participation (= 1)	(2) Employed (= 1)	(3) Weeks Worked Last Year	(4) Log of Income from Wages	(5) Total Income as fraction of Poverty Line	(6) Income from Welfare ($)	(7) Fraction of Income from Welfare
				Panel A: Living in a Metropolitan Area in 1995			
$\Delta Share^{95}$	0.0035***	0.0033**	0.0629**	0.0451***	2.1829***	5.3443*	0.0003
	(0.0012)	(0.0013)	(0.0280)	(0.0129)	(0.7541)	(3.0071)	(0.0005)
Observations	6,252,986	6,252,986	5,125,205	6,252,986	6,252,986	5,614,409	5,614,409
Outcome Mean	0.765	0.728	45.6	7.7	339.3	188.2	0.025
Effect Size	0.005	0.005	0.001	0.006	0.006	0.028	0.012
				Panel B: Living in a Non-Metropolitan Area in 1995			
$\Delta Share^{95}$	-0.0004	-0.0015	-0.0343	0.0015	-0.5330	5.8075	0.0005
	(0.0022)	(0.0023)	(0.0413)	(0.0215)	(0.7156)	(5.3768)	(0.0009)
Observations	1,520,372	1,520,372	1,222,962	1,520,372	1,520,372	1,369,419	1,369,419
Outcome Mean	0.754	0.716	45.2	7.3	297.3	202.3	0.029
Effect Size	0.001	0.002	0.001	0	0.002	0.029	0.016

Notes: This table reports the results of estimating equation (4) with the labor market outcomes and welfare dependence indicators of all individuals between 18-64 years of age in the 5 percent sample of 2000 census as dependent variable. Panel A includes only the individuals residing in a metropolitan neighborhood in 1995. Panel B includes only the individuals living in a non-metro neighborhood in 1995. Only the individuals living in non-group quarters are included. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of 1995 neighborhood. Significance levels: * 10%, ** 5%, ***, 1%.

Table 5: Impact on Labor-market Outcomes and Dependence on Welfare - *By Race/Ethnicity*

	(1) Labor-force Participation (= 1)	(2) Employed (= 1)	(3) Weeks Worked Last Year	(4) Log of Income from Wages	(5) Total Income as fraction of Poverty Line	(6) Income from Welfare ($)	(7) Fraction of Income from Welfare
				Panel A: Non-Hispanic Whites			
$\Delta Share^{95}$	0.0069***	0.0078***	0.1562***	0.0869***	3.9975***	-7.45**	-0.0017***
	(0.0020)	(0.0021)	(0.0279)	(0.0184)	(0.8558)	(3.7422)	(0.0006)
Observations	4,405,682	4,405,682	3,704,706	4,405,682	4,405,682	4,028,033	4,028,033
Outcome Mean	0.791	0.763	46.23	7.96	366.67	136.4	0.017
Effect Size	0.009	0.01	0.003	0.011	.011	.055	0.101
				Panel B: Non-Hispanic Blacks			
$\Delta Share^{95}$	-0.0036	-0.0028	0.1241*	-0.0360	-0.0167	14.27	0.0021*
	(0.0022)	(0.0027)	(0.0656)	(0.0237)	(1.7834)	(8.9048)	(0.0012)
Observations	690,416	690,416	526,156	690,416	690,416	610,049	610,049
Outcome Mean	0.713	0.641	44.1	7.25	271.2	414.2	0.061
Effect Size	0.005	0.004	0.003	0.005	0	0.034	0.035
				Panel C: All Hispanics			
$\Delta Share^{95}$	-0.0051	-0.0078*	-0.3209**	-0.0201	-3.7594	44.45***	0.0071***
	(0.0035)	(0.0044)	(0.1574)	(0.0322)	(3.3396)	(10.0837)	(0.0016)
Observations	777,691	777,691	593,682	777,691	777,691	649,046	649,046
Outcome Mean	0.678	0.621	43.9	7.1	250.1	271.1	0.039
Effect Size	0.008	0.012	0.007	0.003	.015	0.164	0.181

Notes: This table reports the results of estimating equation (4) with the labor market outcomes and welfare dependence indicators of all individuals between 18-64 years of age in the 5 percent sample of 2000 census as dependent variable. Panel A, B and C include only the Non-Hispanic Whites, Non-Hispanic Blacks and Hispanics, respectively. Only the individuals living in non-group quarters are included. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of 1995 neighborhood. Significance levels: * 10%, ** 5%, ***, 1%.

Table 6: Change in the Neighborhood for NH-Whites

	For All NH-Whites							For Migrant NH-Whites					
	(1) Self-Eff Index	(2) Fraction White	(3) Fraction Black	(4) Fraction Hispanic	(5) Completed College	(6) Yrs Edu. (Std.)	(7) Edu. Gap W-B	(8) Edu. Gap W-H	(9) Fraction White	(10) Fraction Black	(11) Fraction Hispanic	(12) Neigh. Qual Index	(13) Edu. Gap W-B	(14) Edu. Gap W-H
Panel A: Living in Gentrifying Neighborhoods in 1995														
$\Delta Share^{95}$	0.0227***	0.0025	-0.0022	0.0007	0.0023*	0.0012	0.0181***	0.0163	0.0017	-0.0008	-0.0002	0.0549**	0.0244***	0.0273*
	(0.0080)	(0.0018)	(0.0015)	(0.0007)	(0.0014)	(0.0025)	(0.0069)	(0.0111)	(0.0022)	(0.0020)	(0.0012)	(0.0222)	(0.0090)	(0.0153)
Obs.	1,779,305	1,779,305	1,779,305	1,779,305	1,779,305	1,779,305	1,778,450	1,779,213	821,468	821,468	821,468	821,468	820,613	821,376
Panel B: Living in Stable Neighborhoods in 1995														
$\Delta Share^{95}$	0.0121**	-0.0023	0.0016	-0.0004	0.0018*	0.0045**	0.0052	0.0129	-0.0031*	0.0021	0.0004	0.0526***	0.0066	0.0009
	(0.0058)	(0.0015)	(0.0012)	(0.0009)	(0.0011)	(0.0021)	(0.0092)	(0.0147)	(0.0018)	(0.0015)	(0.0012)	(0.0145)	(0.0103)	(0.0187)
Obs.	1,243,334	1,243,334	1,243,334	1,243,334	1,243,334	1,243,334	1,242,581	1,243,292	560,213	560,213	560,213	560,213	559,460	560,171
Panel C: Living in Declining Neighborhoods in 1995														
$\Delta Share^{95}$	0.0174***	0.0009	0.0011	-0.0006	0.0003	0.0040**	-0.0170*	-0.0130	0.0008	-0.0001	-0.0002	0.0454**	-0.0181	-0.0170
	(0.0061)	(0.0016)	(0.0013)	(0.0010)	(0.0009)	(0.0019)	(0.0088)	(0.0114)	(0.0021)	(0.0017)	(0.0015)	(0.0176)	(0.0116)	(0.0143)
Obs.	1,383,043	1,383,043	1,383,043	1,383,043	1,383,043	1,383,043	1,381,795	1,382,978	638,514	638,514	638,514	638,514	637,266	638,449

Notes: This table reports the impact on the neighborhood for NH-Whites living in a 1995 neighborhood that received a change in QCT-status. The sample is divided by the gentrification status of the initial 1995 neighborhood in panels A, B, and C, respectively. Column 1 reports the impact on the self-sufficiency index shown in the figure 5. Columns 2-8 report the change in neighborhood characteristics for the full sample of NH-Whites. These variables represent a change in the average characteristics of a location by taking a difference between the mean characteristic using the 1995 residents and the mean characteristics using the 2000 residents. Column 9-14 includes a wider range of variables measuring the change in the neighborhood, but only for the NH-Whites those who migrated between 1995 and 2000. These variables represent the change in average characteristics of the location a migrant is exposed to and are calculated by taking a difference between the mean 1990 level characteristics of the 1995 neighborhood and the 2000 neighborhood of the migrant individual. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of the 1995 neighborhood. Significance levels: * 10%, ** 5%, ***, 1%.

Table 7: Change in the Neighborhood for Hispancis

		For All Hispanics							For Migrant Hispanics					
	(1) Self-Eff Index	(2) Fraction White	(3) Fraction Black	(4) Fraction Hispanic	(5) Completed College	(6) Yrs Edu. (Std.)	(7) Edu. Gap W-H	(8) Edu. Gap B-H	(9) Fraction White	(10) Fraction Black	(11) Fraction Hispanic	(12) Neigh. Qual Index	(13) Edu. Gap W-H	(14) Edu. Gap B-H
Panel A: Living in Gentrifying Neighborhoods in 1995														
$\Delta Share^{95}$	-0.0043	0.0011	-0.0001	0.0020	-0.0006	-0.0033	0.0288***	-0.0036	-0.0030	0.0032	0.0015	-0.0007	0.0022	0.0412***
	(0.0153)	(0.0031)	(0.0017)	(0.0017)	(0.0023)	(0.0033)	(0.0084)	(0.0099)	(0.0041)	(0.0025)	(0.0028)	(0.0488)	(0.0129)	(0.0138)
Obs.	412,553	412,553	412,553	412,553	412,553	412,553	412,553	412,519	211,502	211,502	211,502	211,502	211,468	211,502
Panel B: Living in Stable Neighborhoods in 1995														
$\Delta Share^{95}$	-0.0569***	0.0018	0.0038	-0.0067***	0.0004	0.0038	-0.0001	0.0124**	0.0029	0.0025	-0.0051**	-0.0424*	-0.0244	-0.0274
	(0.0139)	(0.0034)	(0.0021)	(0.0020)	(0.0017)	(0.0034)	(0.0049)	(0.0057)	(0.0041)	(0.0026)	(0.0025)	(0.0241)	(0.0174)	(0.0166)
Obs.	155,456	155,456	155,456	155,456	155,456	155,456	155,456	155,427	80,445	80,445	80,445	80,445	80,416	80,445
Panel C: Living in Declining Neighborhoods in 1995														
$\Delta Share^{95}$	0.0251	0.0037	0.0000	-0.0010	0.0019	0.0086***	-0.0003	0.0062	-0.0006	-0.0027	0.0012	0.0132	0.0129	0.0059
	(0.0161)	(0.0025)	(0.0021)	(0.0017)	(0.0014)	(0.0026)	(0.0099)	(0.0162)	(0.0036)	(0.0027)	(0.0021)	(0.0211)	(0.0190)	(0.0140)
Obs.	209,682	209,682	209,682	209,682	209,682	209,682	209,682	209,642	110,913	110,913	110,913	110,913	110,873	110,913

Notes: This table reports the impact on the neighborhood for Hispanics living in a 1995 neighborhood that received a change in QCT-status. The sample is divided by the gentrification status of the initial 1995 neighborhood in panels A, B, and C, respectively. Column 1 reports the impact on the self-sufficiency index shown in the figure 5. Columns 2-8 report the change in neighborhood characteristics for the full sample of NH-Whites. These variables represent a change in the average characteristics of a location by taking a difference between the mean characteristic using the 1995 residents and the mean characteristics using the 2000 residents. Column 9-14 includes a wider range of variables measuring the change in the neighborhood, but only for the Hispanics who migrated between 1995 and 2000. These variables represent the change in average characteristics of the location a migrant is exposed to and are calculated by taking a difference between the mean 1990 level characteristics of the 1995 neighborhood and the 2000 neighborhood of the migrant individual. Person-weights from the census data are used in all regressions. Standard errors are clustered at the level of the 1995 neighborhood. Significance levels: * 10%, ** 5%, ***, 1%.

10. Appendix

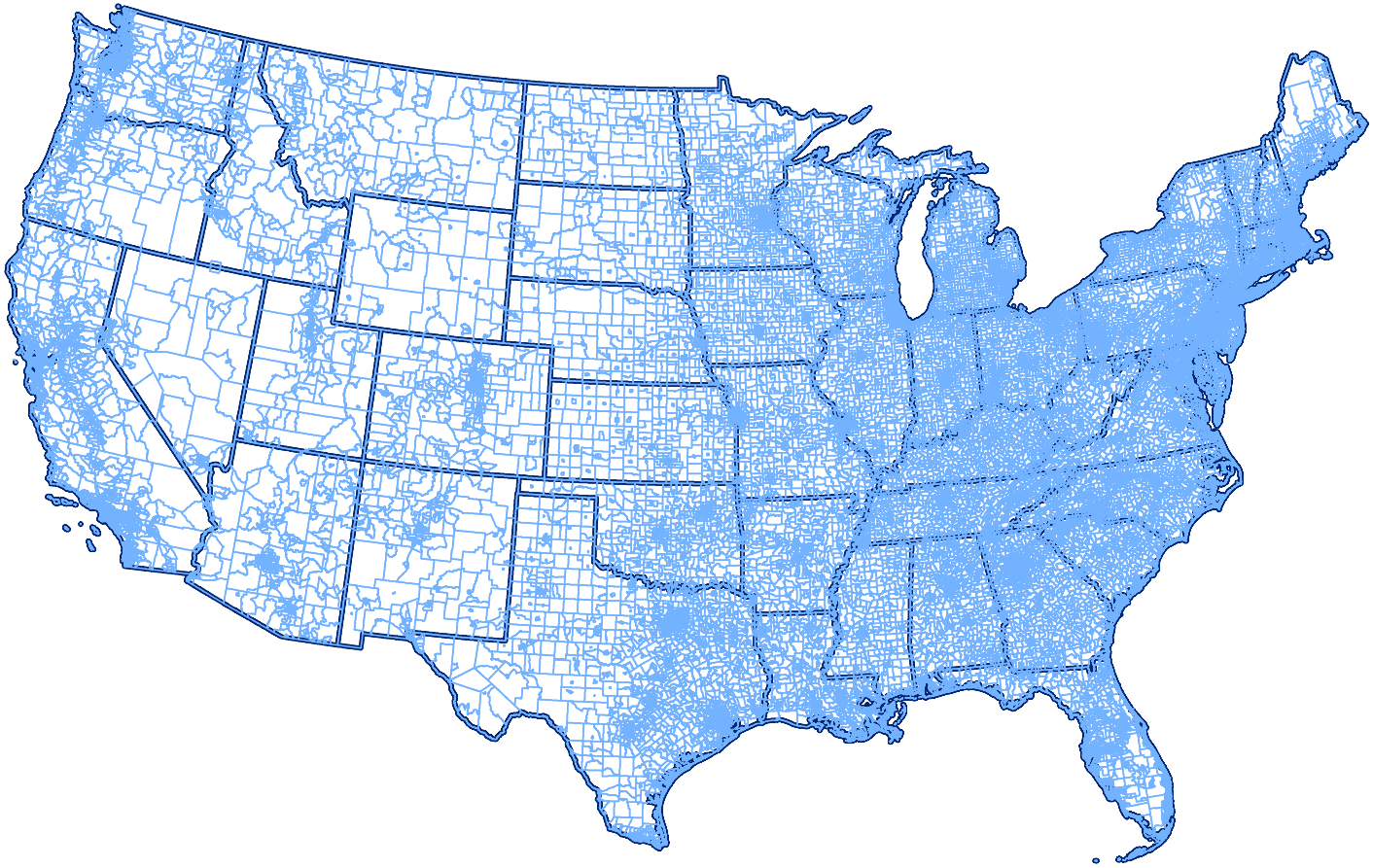

Figure A1: CENSUS TRACTS

Notes: This figure shows a map of contiguous United States with 2000 decennial census tract boundaries within each state. The thicker outline represents state and thinner outline represents census tract boundaries. The boundary files are obtained from Manson et al. (2021) and the map is compiled using ArcGIS software.

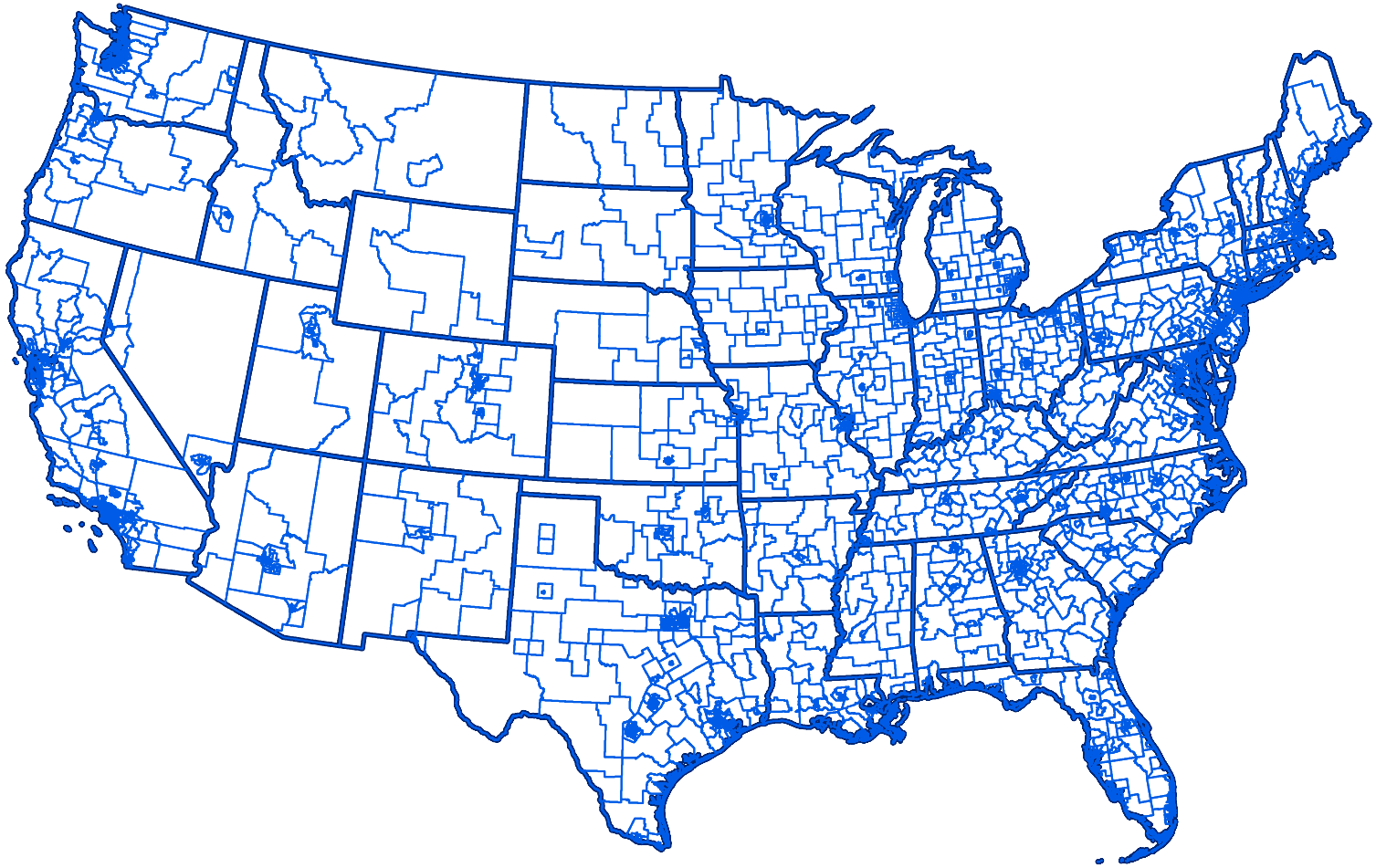

Figure A2: PUBLIC-USE MICRODATA AREA (PUMA)

Notes: This figure shows a map of contiguous United States with 2000 Public Use Microdata Area (PUMA) boundaries within each state. The thicker outline represents state and thinner outline represents PUMA boundaries. The boundary files are obtained from Manson et al. (2021) and the map is compiled using ArcGIS software.

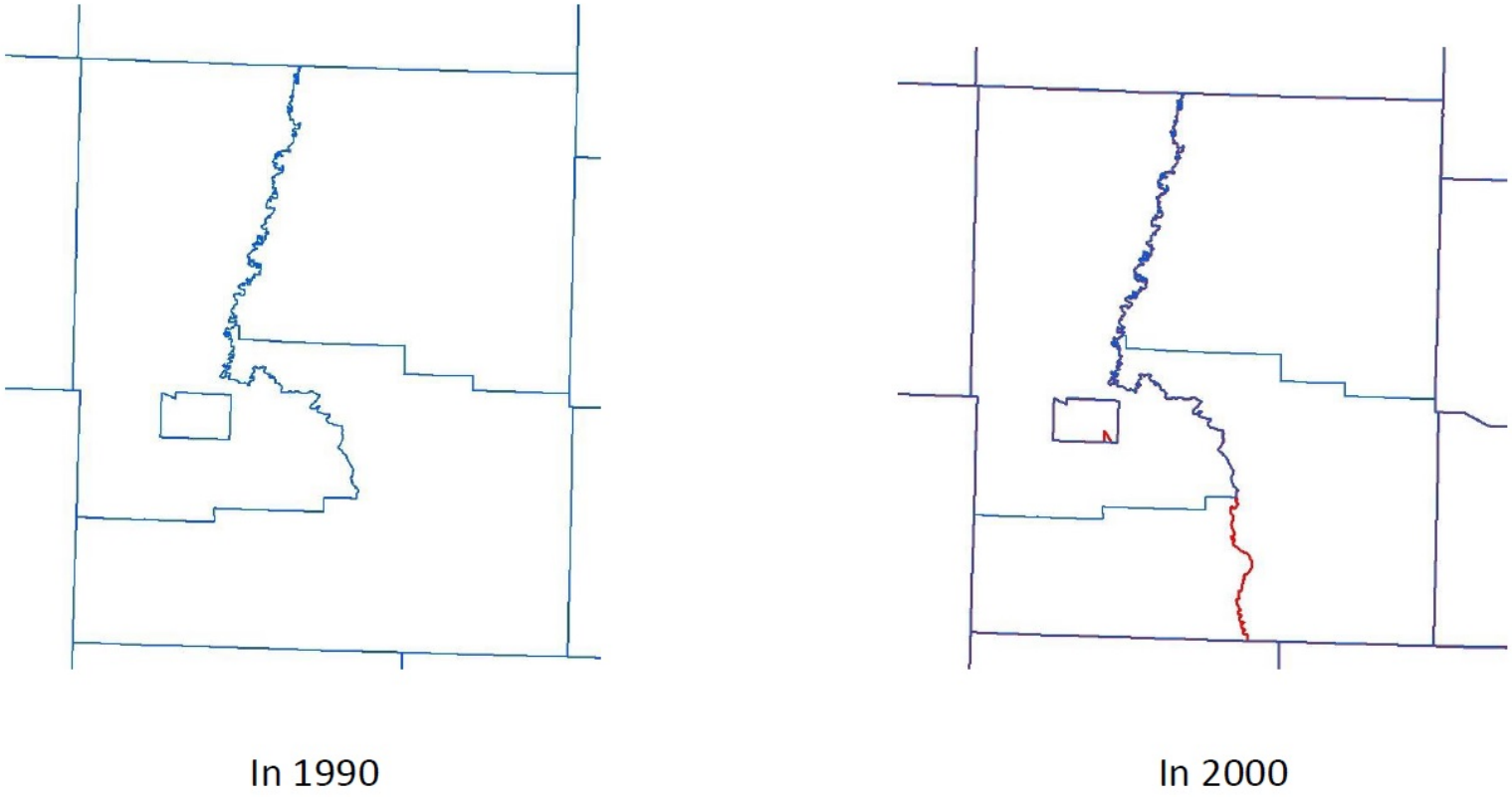

Figure A3: CHANGES IN CENSUS TRACT BOUNDARIES

Notes: This figure shows an example of tract boundary changes between 1990 and 2000 decennial census. A census tract is represented by the area contained between the continuous boundary. The new boundary in *red* represents the boundary change implemented in 2000 census. The boundary files are obtained from Manson et al. (2021) and the map is compiled using ArcGIS software.

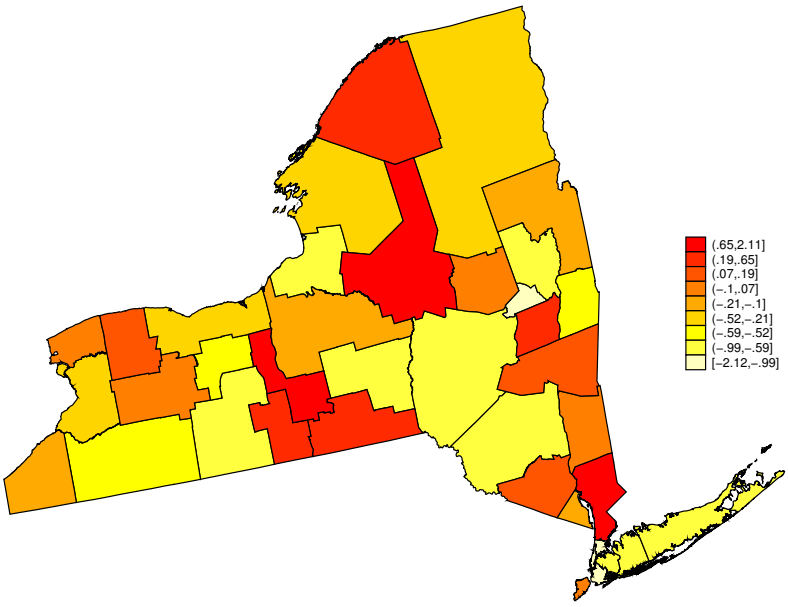

Figure A4: CHANGE IN QCT SHARE IN 1995 AT MIGPUMA LEVEL - *State of New York*.

Notes: This figure represents the change in QCT share of MIGPUMAs between 1990 and 1995 in the state of New York. The change is represented by a variable with mean 0 and standard deviation 1. The boundary files are obtained from Manson et al. (2021) and the map is compiled using STATA software.

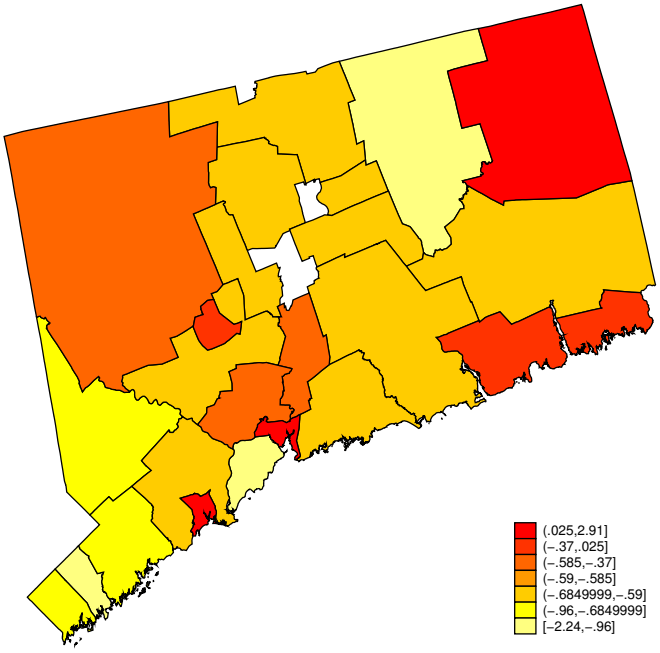

Figure A5: CHANGE IN QCT SHARE IN 1995 AT MIGPUMA LEVEL - *State of Connecticut*.

Notes: This figure represents the change in QCT share of MIGPUMAs between 1990 and 1995 in the state of Connecticut. The change is represented by a variable with mean 0 and standard deviation 1. The boundary files are obtained from Manson et al. (2021) and the map is compiled using STATA software.