Splitting Tracts: The Impact of Neighborhood Racial Dynamics on Economic Opportunity

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Abstract

Racial inequality holds a longstanding position as one of the primary components contributing to economic inequality for Black residents. A well established literature has attempted to measure the impacts of urban racial separation on economic outcomes for minority residents; however less attention has been placed on developing channels through which racial unevenness reduces economic opportunity, and if these effects impact minorities differentially. This paper investigates the heterogeneous impacts of urban racial separation across several educational and labor market outcomes, and explores potential channels for the resulting relationships. Using variation in census tract boundaries from 1980 to 2010 Decennial Censuses to instrument for levels of urban racial separation, I find that tract-induced racial separation negatively impacts Black individuals across both income and skill distributions. Contributing factors include fewer local job opportunities in predominantly Black neighborhoods, and increased commuting costs for those with jobs. Further evidence suggests these increases in separation, in already predominantly Black neighborhoods, reduce economic and geographic mobilities into adulthood. These results have important implications for fostering equal economic opportunity in areas of high racial separation.

Keywords: census tracts, neighborhoods, urbanization, racial inequality, housing segregation, economic opportunity, economic demography

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1 Introduction

While the United States is the most diverse it's ever been, urban America continues to be racially and economically divided. Almost half of all Black families in the U.S. live in a neighborhood without a white presence, and the average white family lives in a neighborhood that is nearly 80 percent white (Abedin et al., 2017). This racial inequality holds a longstanding position as one of the prime components contributing to economic inequality for Black residents. A well established literature has attempted to measure the impacts of racial separation on economic outcomes for minority residents (e.g., Cutler and Glaeser (1997); Collins and Margo (2000); Cutler et al. (2008); Ananat (2011); Bayer and McMillan (2012); Owens (2016)); however, less attention has been placed on developing channels through which racial separation reduces economic opportunity.

This paper makes three contributions to this literature. First, using a novel identification strategy, I estimate the heterogeneous effects of racial separation on economic opportunities for minority residents spanning 30 years from 1980 to 2010. My strategy leverages variation in census tract boundaries resulting from the 1980 to 2010 Decennial Census boundary updates to measure changes in cumulative levels of urban racial separation. Specifically, I use this variation, conditional on population characteristics, as an instrument to estimate the effects of racial separation on educational, labor market, and social opportunities.[1] Second, using newly available data from Opportunity Insights, I test two hypotheses as potential explanations into why neighborhood racial composition plays an important role in shaping the opportunities residents enjoy: (1) labor market attachment and (2) peer influences. I conclude by examining the impacts tract-induced racial separation has on the ability to leave predominnantly Black neighborhoods into adulthood.

Using an instrumental variables (IV) strategy to estimate the impacts of racial separation on economic outcomes requires two conditions to be met. The first requires that the instrument be related to racial separation, or the relevancy condition. Why should we expect census tract delineation to be related to levels of urban racial separation? Census tract boundaries often reflect visible features of the landscape, and were historically used to aid census enumerators in visually depicting boundaries which enclosed their respective areas of data collection (U.S. Census Bureau, 1994). Thus, similar to analyses found in Hoxby (2000) and Ananat (2011), census tract boundaries reflect natural geographic barriers that serve as a technology for creating racial separation. That is, as populations grow and neighborhoods become increasingly space-constrained, new residents expand by "falling back" to the next natural geographic boundary, like a major roadway, railroad track, or tree line – also reflected and updated through additional census tract delineation.[2]

[1] The measure of racial separation I use is defined as the Index of Dissimilarity. This statistic indicates the proportion of the specified population that would have to relocate in order to create an equal distribution within the city.

[2] Ananat (2011) provides a detailed discussion of railroad delineation as a technology for racial separation. This approach generalizes technology for creating racial separation to any geographic boundary reflected through census tract delineation.

The second condtion for a valid instrument requires the instrument to affect the outcomes of interest only through the endogenous variable, or the exclusion restriction. In measuring the impacts of racial separation, the exclusion restiction requires that census tracts are designed, and split, orthogonal to observable, as well as unobservable, characteristics that may influence one's economic opportunities. While this assumption cannot be tested directly, I provide a falsification test that suggests the first-stage relationship is not driven by some unobservable characteristic also linked to racial separation that may influence economic outcomes.

To conduct this falsification exercise, I rely on a unique feature of census tract delineation. Upon their widespread implementation, census tracts of the 1970 and 1980 Decennial Censuses were intended to be relatively permanent statistical subdivisions delineating the entirety of the United States, while future delineations were expected to fall predominantly within initial boundaries (U.S. Census Bureau, 2008).[3] Using this "envelope" feature, the falsification exercise holds neighborhoods fixed to their original census tract boundaries and tests for a relationship between contemporaneous census tracts in a city and the measure of racial separation calculated using the outer, or original, "envelopes". The intuition behind this test is as follows: If additional census tract delineation is related to racial separation and the measure of racial separation is calculated using a fixed number of census tract envelopes, then there should be no correlation between the number of contemporaneous census tracts and the envelope-fixed racial separation index over time.[4] In fact, my results suggest there exists no relationship between these two variables.

The first set of key findings suggests that increased racial separation negatively impacts Black residents in terms of educational attainment, earnings, idleness in the labor market, and single parenthood. A one percentage point increase in racial separation reduces the probability a Black young person (ages 20-30) earns more than median income in the national income distribution by 0.12 percentage points. In terms of moving out of extreme poverty, an increase in racial separation, reduces the probability a Black individual moves beyond the first income decile by 0.26 percentage points relative to a non-Black individual. Additionally, a one percentage point increase in racial separation reduces the probabilities that a Black resident completes high school or college by 0.16 and 0.60 percentage points, respectively. Estimating the differential impacts for non-Black residents suggests little to no improvements in terms of educational and labor market outcomes – estimates are generally insignificant and an order of magnitude smaller than Black estimates in absolute value. Given the average difference between high and low racially separated cities in 2010 was 20.3 percentage points, these estimates indicate large reductions in economic opportunities for Black residents, and little to

[3]This was intended to simplify and enhance the tracking process of data at the census tract-level over time. A typical census tract would split prior to the Census if the population surpassed 8,000 residents, and merge if residential population fell below 1,200 (U.S. Census Bureau, 1994). These thresholds have not been updated since their introduction and continue to serve as a general guideline. Henceforth, I refer to census tracts originating in 1970 and 1980 as the census tract envelope.

[4]Alternatively, if a relationship did exist within this framework, it could be argued that the number of census tracts instead reflect some unobservable characteristic that also induces racial separation, rather than the boundaries themselves.

no benefit of racial separation for non-Black residents.[5]

Next, I examine potential causes and consequences of census tract-induced racial separation. To explore mechanisms behind the negative impacts Black residents face, I focus on two hypotheses: The first tests for weakened labor market attachment among Black residents. I provide evidence that not only are there more *high paying* job opportunities in non-Black neighborhoods, but more job opportunities in general. Further, conditional on having a job, Black residents usually work fewer hours per week. Attributable are longer commute times, and heavier reliance on public transportation in more racially separated cities relative to non-Black residents. The second hypothesis tests that Blacks have worse outcomes in more racially separated neighborhoods because they have less contact with positive peer influences. My evidence suggests in predominantly Black neighborhoods there are fewer interactions with educated individuals and higher likelihoods of incomplete families.

I conclude by examining the impact census tract-induced racial separation has on the ability to leave predominantly Black neighborhoods into adulthood. I find that a one percentage point increase in racial separation increases the proportion remaining in a predominantly Black childhood neighborhood into adulthood by 0.044 percentage points. This same increase reduces the proportion of individuals who move from a predominantly Black neighborhood in childhood to a neighborhood of affluence into adulthood by 0.245 percentage points relative to individuals who grew up in more integrated neighborhoods.[6]

Most broadly, this paper contributes to a large literature on the effects of racial or ethnic separation on economic outcomes (e.g., Cutler and Glaeser, 1997; Card et al., 2008; Cutler et al., 2008; Bayer and McMillan, 2012; Owens, 2016; Böhlmark and Willén, 2020). Seminal work by Cutler and Glaeser (1997) provide evidence of significant negative relationships between racial separation and economic outcomes for Black residents, as well as positive impacts for non-Black residents. Using data from the 1940 and 1950 Decennial Censuses, Collins and Margo (2000) find a reversed relationship for Black residents. Edin et al. (2003) and Cutler et al. (2008) empirically demonstrate there exists benefits for immigrants in ethnically concentrated areas. In contrast, my results suggest there are little-to-no benefits to separation for either minority or majority residents. I find there are large negative impacts on economic outcomes for Black residents in heavily racially separated cities, as well as no statistically significant impacts on labor market outcomes and small positive impacts on college-going rates for non-Black residents.

More narrowly focused, this paper contributes to understanding the link between urban racial separation and economic outcomes. The literature often focuses on the ways in which racial separation within schools, or within neighborhoods of limited schooling lead to worse outcomes later in life. The work of Card and

[5]High racially separated cities are cities with a racial separation index greater than the mean.
[6]A neighborhood of affluence is defined as a census tract in which the poverty rate is less than 10 percent in adulthood.

Rothstein (2007) and Hanushek et al. (2009) both find that the Black-white test score gap is higher in more racially separated cities and provide evidence that this gap is driven by neighborhood racial separation, rather than separation within schools themselves. Alternatively, Guryan (2004) finds that racial integration plans during the 1970s account for about half of the decline in dropout rates of Black students, and evidence suggests this may be driven through peer effects. Cutler and Glaeser (1997) deviate from this literature by instead focusing on transportation factors and peer influences in more racially separated cities. Additionally, Boustan and Margo (2009) examine whether employment decentralization isolated Black residents from work opportunities through the U.S. Postal Service. Using newly available data from Opportunity Insights, I not only causally test these mechanisms, but include more generally, labor market factors, a more robust channel of peer influences, and consequences for geographic mobility. Overall, my work provides strong empirical evidence of these mechanisms at play in contributing to economic inequality between races.[7]

The rest of this paper is organized as follows: Section 2 describes the data sources and their implementations; Section 3 formally introduces and discusses the measure of racial separation, as well as empirical evidence of a relationship with census tract delineation; Section 4 presents the main results and heterogeneous effects of census tract-induced racial separation. Section 5 explores different mechanism hypotheses and implications; Section 6 concludes.

2 Data Background and Usage

The datasets used in the analysis include individual data from the Decennial Censuses and American Community Survey (ACS), census tract data from the Longitudinal Tract Data Base (LTDB) and National Historical Geographic Information System (NHGIS), and further-detailed census tract data from Opportunity Insights. In this section I describe each dataset and individual sampling criteria in further detail and place them into context of the analysis.

2.1 Decennial Census and American Community Survey Individual Data

Individual data used in the analysis come from the 1980 1% Decennial Census sample, 1990 1% Decennial Census sample, 2000 5% Decennial Census sample, and the 2010 1-year American Community Survey (ACS) sample available through IPUMS (Ruggles et al., 2019). To place my results in context with the literature (e.g., Cutler and Glaeser, 1997; Collins and Margo, 2000; Cutler et al., 2008), I limit my analysis to individuals ages 20 to 30, not incarcerated or institutionalized, exclude those born in a foreign country, and limit to

[7] A recent discussion of these factors contributing to racial inequality is available in the New York Times: https://www.nytimes.com/2020/05/11/opinion/coronavirus-us-cities-inequality.html#click=https://t.co/nHFRil2tZe

those individuals who list one race or ethnicity: non-Hispanic white, non-Hispanic Black, Hispanic, Asian, and Native American.[8] Additionally, I focus on individuals that list a Metropolitan Statistical Area (MSA) as place of residence. Reasons for such restrictions include that theories of sorting most readily apply to young people in large urban areas, and issues of differential mobility patterns are minimized when focusing on people who have had the least amount of time to choose their place of residence (Cutler and Glaeser, 1997). Bayer et al. (2014) validate this idea empirically by showing the effects of sorting are reduced as individuals age because they become increasingly mobilized in choosing a location to live. The resulting main analysis sample consists of 1,592,503 observations in 1,019 MSAs over 40 years, spanning 1980 to 2010.[9] Statistics comparing individual outcomes between whites and Blacks are available in Table A.1.

2.2 Longitudinal Tract Data Base

Census tract-level data come from the Longitudinal Tract Data Base (LTDB) (Logan et al., 2014), and allow researchers to construct a variety of data that stem from full count and sample data in the 1980-2000 Decennial Censuses and the 2008-2012 ACS 5-year data file. These census tract-level data include variables on population, race, income, education, and workforce characteristics. The key advantage in using the LTDB lies in its choice of census tract boundaries. Datasets are available to reflect either longitudinally consistent boundaries fixed to a single point in time, or the use of temporally-dependent census tract boundaries. Additionally, because the data are provided as raw population counts I am able to construct the characteristic of interest through aggregation of count data, rather than weighting proportions to fit within larger levels of aggregation.[10] Using the Historical Delineation Files available from U.S. Census Bureau (2011), I aggregate the detailed raw census tract data up to the MSA in order to construct various city-level characteristics.[11] I merge these MSA-aggregated neighborhood characteristics to the individual data from IPUMS. MSA summary statistics are available in Table A.2.

2.3 Opportunity Insights Data

The last data used in this study come from Opportunity Insights, a collaborative between researchers at the Census Bureau, Harvard University, and Brown University. The goal of Opportunity Insights focuses on reducing economic inequalities using anonymized tax data on millions of individuals. The data are publicly

[8] Hispanic refers to individuals who identify as Mexican, Puerto Rican, Cuban, or other Hispanic, and excludes those who list their race as white.

[9] All subsequent analyses are limited to these MSAs.

[10] For example, I am able to construct census tract-level proportions using the raw census tract data. I can also aggregate the raw data to higher levels of geography, such as the MSA-level, without having to weight census tract proportions by their population, for instance.

[11] Census tracts are designed to fall entirely within counties, and counties fall entirely within MSA boundaries. Thus, census tracts aggregate nicely within MSAs.

available at aggregated levels through the Opportunity Atlas and contain more than 7,000 variables.[12] I make use of census tract aggregated data which include variables on local job growth and opportunities by income level, incarceration rates, family completeness, geographic mobility, and intergenerational mobility measured in varying years from 2010-2015. The chosen variables reflect the unconditional mean, pooled by race and gender. It is important to also note that the Opportunity Insights data contain information on children born between 1978 and 1983, and measures outcomes for these individuals into adulthood. My interests in these variables lie within their geographic mobility tracking. With such measures, I estimate the longitudinal effects of racial separation on leaving disadvantaged childhood neighborhoods into adulthood, or moving to neighborhoods of affluence into adulthood.

3 Measuring Racial Separation

U.S. Census Bureau (2010) provides several indices of racial separation that capture to varying degrees evenness, exposure, concentration, and clustering; however, the most widely used measure in the literature is referred to as the Index of Dissimilarity.[13] In this section, I formally define the Index of Dissimilarity, discuss its properties and advantages, as well as empirically demonstrate how census tract delineation is related to urban racial separation. Mathematically, the Index of Dissimilarity of a particular MSA is defined as:

$$Index\,of\,Dissimilarity_{MSA} = \frac{1}{2}\sum_{i=1}^{N}\left|\frac{Black_i}{Black_{MSA}} - \frac{Non-black_i}{Non-black_{MSA}}\right|, \tag{1}$$

where $Black_i$ and $Non\text{-}black_i$ are the number of residents in census tract i that are Black and non-Black, respectively. $Black_{MSA}$ and $Non\text{-}black_{MSA}$ are the respective Black and non-Black populations of the Metropolitan Statistical Area, MSA. The index ranges from zero to one, with values closer to one indicating higher levels of racial separation. A key feature of the Index of Dissimilarity is the interpretability of the decimal: this number reflects the proportion of the MSA that would need to relocate to create an equal distribution of racial composition among neighborhoods within the city of interest.[14]

Often measures of racial separation are based upon much smaller levels of analysis, such as the neighborhood, and aggregated to some larger measure, such as the city. The key advantage of such approach is the removal of endogenous sorting of households *within* the city. For example, measures of racial separation at more refined levels of aggregation suffer from Tiebout-like sorting of households. That is, households

[12] Each variable can be selected according to specific race, gender, and percentile rank in the parental national income distribution.

[13] Duncan and Duncan (1955) argued that the Index of Dissimilarity be the standard in measuring racial separation in a city as it largely encapsulates information presented in differing measures of separation. This measure has stood the test of time, and appears throughout recent work (e.g., Chetty and Hendren, 2018; Owens, 2016; Bayer et al., 2014; Ananat, 2011).

[14] Stated alternatively, this measure captures the cumulative racial unevenness within each neighborhood of the city.

"vote with their feet" into neighborhoods that align with their preference distribution (Tiebout, 1956), and this influences neighborhood racial composition. Thus, creating one measure that reflects the cumulative unevenness of neighborhoods within a city overcomes the issue of intracity sorting.

I conclude this section by demonstrating that additional census tract delineation, or nested census tracts, are correlated with levels of racial separation across cities. To illustrate this relationship, I estimate the following regression:

$$Racial\,Separation_{ct} = \alpha_0 + \beta\, nested\,census\,tracts_{ct} + f(population_{ct}) + \epsilon_{ct} \tag{2}$$

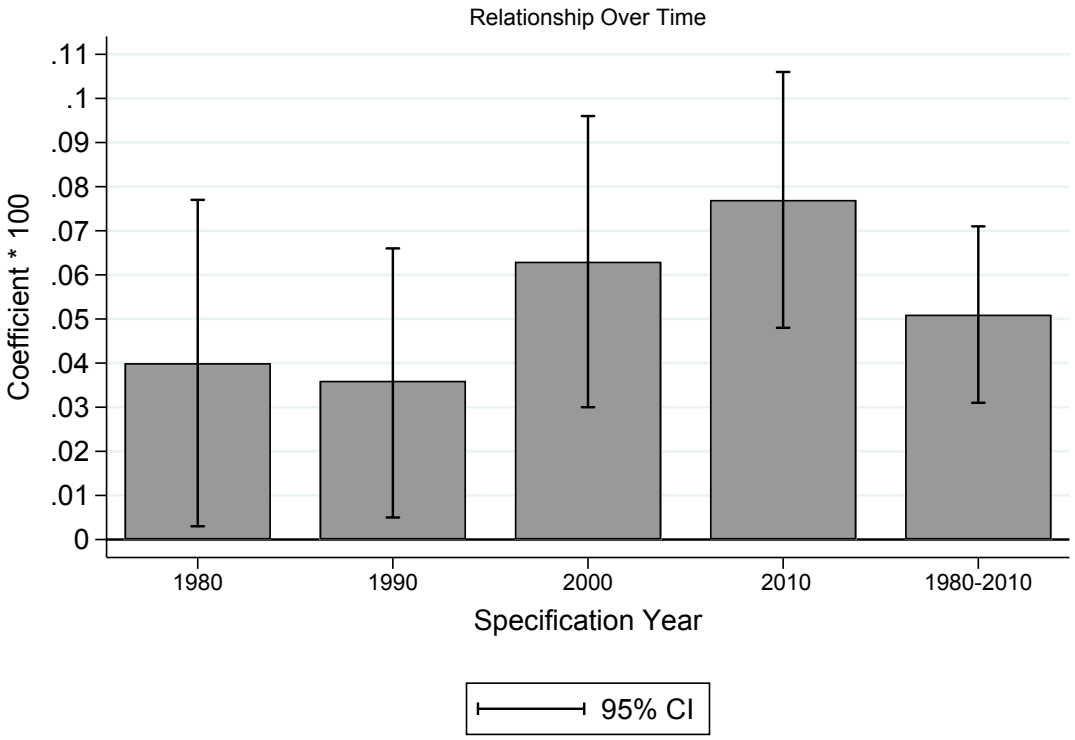
where $Racial\,Separation_{ct}$ is the Index of Dissimilarity for city c at time t, $nested\,census\,tracts_{ct}$ refers to the number of census tracts within city c at time t, $f(\cdot)$ is a quartic function of the population, and ϵ_{ct} is the error term. Standard errors are robust and clustered to the city level. β is the coefficient of interest and is interpreted as the percentage point change in racial separation as a result of an additional census tract, conditional on population counts.

Figure 1 illustrates the coefficient β from Equation 2. Further regression characteristics are presented in Table A.3. Each column is a separate regression of Equation 2 cross sectionally and over time from 1980 to 2010. Over time, the effect size on the correlation between the number of census tracts and levels of racial separation has increased dramatically. The final column of Equation 2 indicates that for each additional census tract over this period there is an average increase in racial separation of 0.051 percentage points.

4 Empirical Analysis: the Effect of Racial Separation

The goal of this section lies in estimating the impacts of census tract-induced racial separation on the economic opportunities one enjoys in life. I begin with a discussion of why the use of ordinary least squares (OLS) estimation is inappropriate for obtaining causal estimates of racial separation. Next, I present an alternative identification method using instrumental variables (IV). I provide a falsification exercise that further tests the accuracy of the instrument. I conclude by replicating, updating, and extending the results found in Cutler and Glaeser (1997).

Figure 1: Nested Census Tracts and Racial Separation



N=1,019 (1980-2010). Each column represents a separate regression estimated from Equation 2. The dependent variable in each specification is the level of racial separation within a city and is defined as the Index of Dissimilarity. The independent variable of interest is the number of census tracts that exist in each specification year. Each specification includes a quartic function in population, and standard errors are corrected for heteroskedasticity. Racial separation mean (1980-2010) = 50.59%

4.1 Discussion

In order to evaluate the impacts of racial separation on Black and non-Black individuals' economic opportunities, I adopt the following general econometric framework:

$$y_{ic} = \alpha + \beta_1 separation_c + \beta_2 black_i \times separation_c + X'_{ic}\beta + \epsilon_{ic} \tag{3}$$

where the dependent variable is the outcome of interest for individual i in city c, *separation* is the measure of racial separation formally defined as the Index of Dissimilarity, and *black* is an indicator that equals one if the individual is Black. The coefficient of interest, β_2, is interpreted as the differential effect of racial separation for Black individuals, relative to non-Black individuals. Some readers may also be interested in the effects of β_1 or $\beta_1 + \beta_2$ which reflect the differential effects of racial separation for non-Blacks, and the total effect of racial separation for Blacks, respectively. In general, two types of issues arise when estimation occurs within this framework. The first is that the level of racial separation in a city may be a function of poor outcomes, or more formally, reverse causality. The second stems from issues of selection bias whereby more and less successful individuals may sort *across* metropolitan areas. Both violate the restrictions necessary for causal inference.

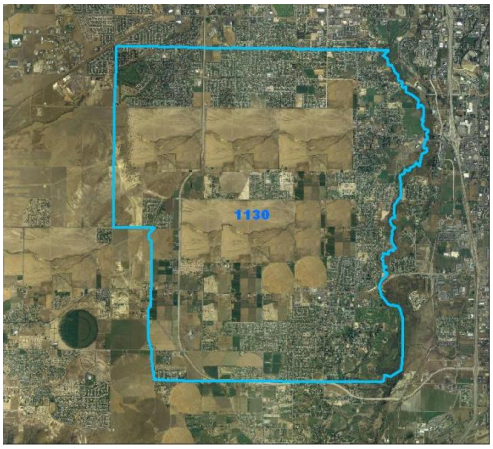
4.2 Identification using Census Tracts

To estimate the causal impacts of racial separation, I require a treatment that randomizes the racial composition of neighborhoods, but is not related to the outcomes one enjoys in life except through its effect on separation. The ideal experiment would randomize individuals' residences at two levels across isolated cities: The first would randomize individuals across cities, and the second would randomize individuals into neighborhoods. Randomization across cities would provide analysis as to how cumulative racial separation impacts economic opportunities, while the second would allow estimation of local racial composition impacts relative to neighborhoods close by.

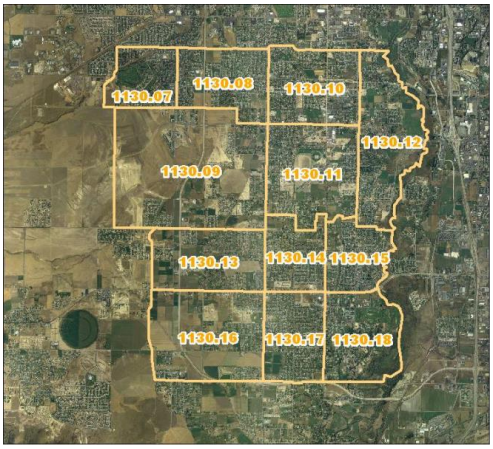
In the absence of such randomization, I rely on a strategy that makes use of plausibly exogenous variation in census tract boundaries for identification. Specifically, I use variation in the number of census tracts, conditional on population characteristics, as an instrument to estimate the impacts of racial separation. The assumption for causal inference using this identification strategy asserts that, conditional on population characteristics, the number of (or change in) census tracts (boundaries) is exogenous. That is, after accounting for population characteristics, there is not some potentially unidentifiable feature correlated with boundary arrangement that would also impact one's economic outcomes.

Figure 2: Census Tract Implementation and Delineation

(a) Original Census Tract "Envelope"



(b) Updated Census Tract Delineation



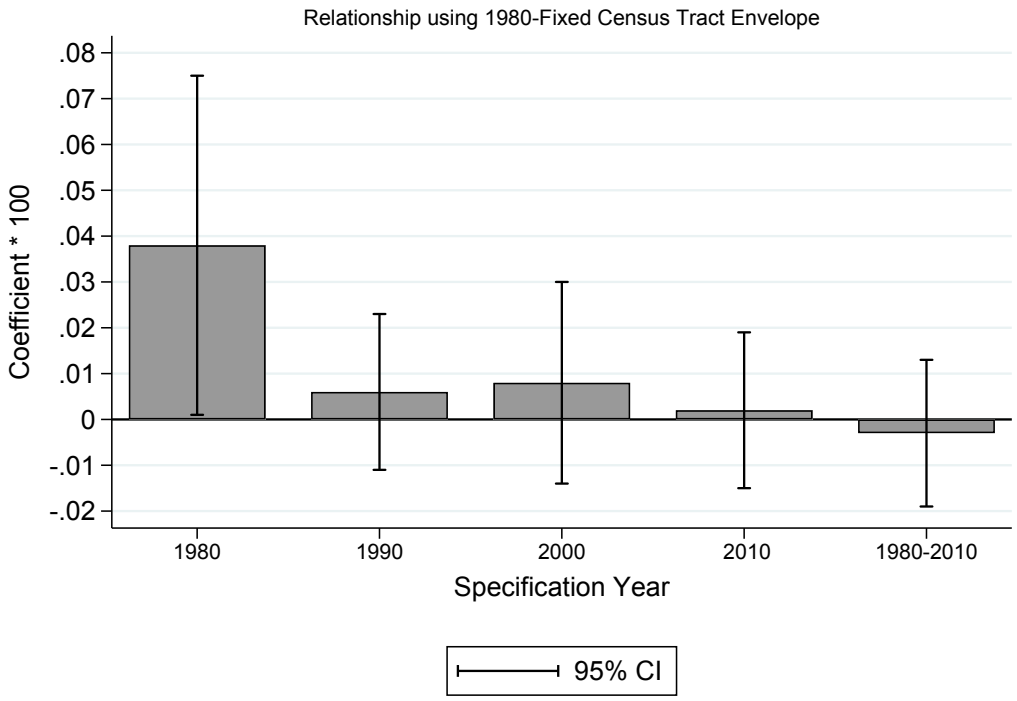
Source: U.S. Census Bureau (2013) This figure shows the evolution of census tract envelope 1130 of Salt Lake County, Utah at two points in time. Panel (a) is the original census tract "envelope" and was established in 1970. Panel (b) shows the updated census tract boundaries resulting from the 2000 Decennial Census.

Before moving to the main estimation of racial separation, I provide a falsification test of the instrument. This exercise is similar to the relationship developed through Equation 2, and illustrated in Figure 1; however, instead of estimating the relationship between the number of census tracts and the level of racial separation constructed using contemporaneous census tract boundaries, I collapse census tracts to their original boundary "envelopes" and calculate the measure of racial separation using these outer shells. Figure 2 enhances the visualization of this exercise. Panel (a) illustrates the original census tract "envelope" and panel (b) shows the resulting census tract boundaries nested within the envelope after the 2000 Decennial Census.

To construct the measure of racial separation holding census tract envelopes fixed to their original boundary delineations, I collapse panel (b) census tract characteristics to their outer envelopes reflected in panel (a). Then, I estimate Equation 2 replacing the dependent variable, $Racial\,Separation_{ct}$, with the measure of racial separation calculated using the collapsed census tract envelopes. The intuition behind this test is as follows: If additional census tract delineation generates racial separation and the measure of racial separation is calculated using a fixed number of census tract envelopes, then there should be no correlation between the number of contemporaneous census tracts and the envelope-fixed racial separation index over time. Alternatively, if a relationship does exist within this framework, it could be argued that the number of census tracts instead reflect some unobservable characteristic that also induces racial separation, rather than the boundaries themselves.

Figure 3 illustrates the results of this falsification test. Further regression characteristics are presented

Figure 3: Falsification Test – Relation between Census Tracts and Racial Separation using Fixed Boundaries



N=895 (1980-2010). Each column represents a separate regression. The dependent variable in each specification is the level of racial separation within a city and is defined as the Index of Dissimilarity. This measure is calculated using fixed census tract envelopes that were established in either 1970 or 1980. The independent variable of interest is the number of census tracts that exist in each specification year. The sample includes MSAs that existed in 1980 and could be followed to 2010. Each specification includes a quartic function in population, and standard errors are corrected for heteroskedasticity. Racial separation mean (1980-2010) = 50.59%

in Table A.4. In 1980 there exists a positive relationship similar to that found in Figure 1, documenting the relationship between census tracts and racial separation. This makes sense because most census tract envelopes were created in 1980, and thus should be correlated with the level of racial separation if census tracts generate separation; however, beyond this point we would expect to see no relationship as boundaries are collapsed to their original shells while true boundaries evolve beyond this point in time.

4.3 IV Estimation

In the current empirical setting, I exploit variation in neighborhood boundaries to estimate the effect of census tract-induced racial separation on educational, labor market, and social outcomes. I adopt an instrumental variables approach using two-stage least squares (2SLS) where the number of census tracts instruments for cumulative levels of racial separation in a city. More formally, the first-stage of my IV estimation is:

$$s_{ct} = \alpha_0 + \alpha_1 n_{ct} + x'_{ct}\theta + \rho_c + \gamma_t + \nu_{ct}, \tag{4}$$

where the dependent variable s_{ct} is the level of racial separation in city c and year t. The instrument n_{ct} is the number of census tracts in city c and year t.[15] The vector x_{ct} contains city-level control variables, including population, percent Black, percent Hispanic, percent with a high school degree or less, percent manufacturing, unemployment rate, median HH income, percent married, and separation by skill level. ρ and γ are city and time fixed effects, respectively, and ν_{ct} is the error term. Using exogenous variation from the fitted values of Equation 4, second-stage estimation is a variation of Equation 3 correcting for issues of endogeneity:

$$y_{icbt} = \beta_0 + \beta_1 \hat{s}_{ct} + \beta_2 black_{icbt} * \hat{s}_{ct} + x'_{ict}\theta + \eta_c + \phi_b + \pi_t + \epsilon_{icbt}, \tag{5}$$

where y_{icbt} is the outcome of interest for individual i, born in state b, lives in city c, in year t. The remaining variables and fixed effects are analogous to those in Equation 4 with the inclusion of individual-level controls: age, sex, educational attainment, and birth-state fixed effects. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Table 1 presents the results of estimating Equation 5 in the spirit of Cutler and Glaeser (1997). Appendix Table A.5 presents OLS estimation results. In terms of educational attainment, a one percentage point increase in racial separation reduces the probabilities of a Black individual completing high school or college by 0.16 and 0.60 percentage points, respectively. Further, after accounting for differences in education,

[15] In the resulting empirical analysis, I also use the number of census tracts interacted with the *black* indicator variable. The work of Cutler and Glaeser (1997) follows the strategy of interacting their instrument,as well.

Table 1: IV Estimates of the Effects of Racial Separation on Economic Opportunities

	(1) HS dropout	(2) College graduate	(3) ln(income)	(4) Idle	(5) Single motherhood
Segregation	-0.0001	0.0011***	-0.0003	0.0001	0.0002
	(0.0001)	(0.0001)	(0.0004)	(0.0001)	(0.0006)
Black*segregation	0.0016***	-0.0060***	-0.0024***	0.0011***	0.0038***
	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0004)
Mean of dep. var.	11.64%	22.24%	$24,997.51	6.24%	31.61%
R^2	0.034	0.127	0.223	0.047	0.1859
N	1592503	1592503	1378543	1305801	123236

The first-stage coefficient from Equation 4 is 0.001 (std. error <0.000) and is significant at the 1% level. HS dropout is an indicator variable that equals 1 if the individual completed less than grade 12 in 1980, and in later years equals 1 if the individual completed grade 12, or less, and did not receive a diploma. College graduate is an indicator variable that equals 1 if the individual completed at least 4 years of college in 1980, and in later years equals 1 if the individual has a bachelor's degree or higher. Income is defined as earned income, and is conditional on being in the labor force with nonnegative earnings. Idleness is an indicator variable that equals 1 if the individual is in the labor force, but neither going to school nor employed. Single motherhood is an indicator that equals 1 if the female is not currently married, and has ever had a child in 1980 or 1990. In 2010 single motherhood refers to females who are not currently married and have had a child in the last year. Single motherhood data are not available for 2000. Separation is defined as the Index of Dissimilarity, and the interaction term includes an indicator if the individual is Black. Individual controls include sex, age, and educational attainment. City-level controls include population, percent Black and its interaction, percent Hispanic, percent with a high school degree or less, percent manufacturing and its interaction, unemployment rate, median HH income, percent married, segregation by skill level, birth place state FE, and year and region FE. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

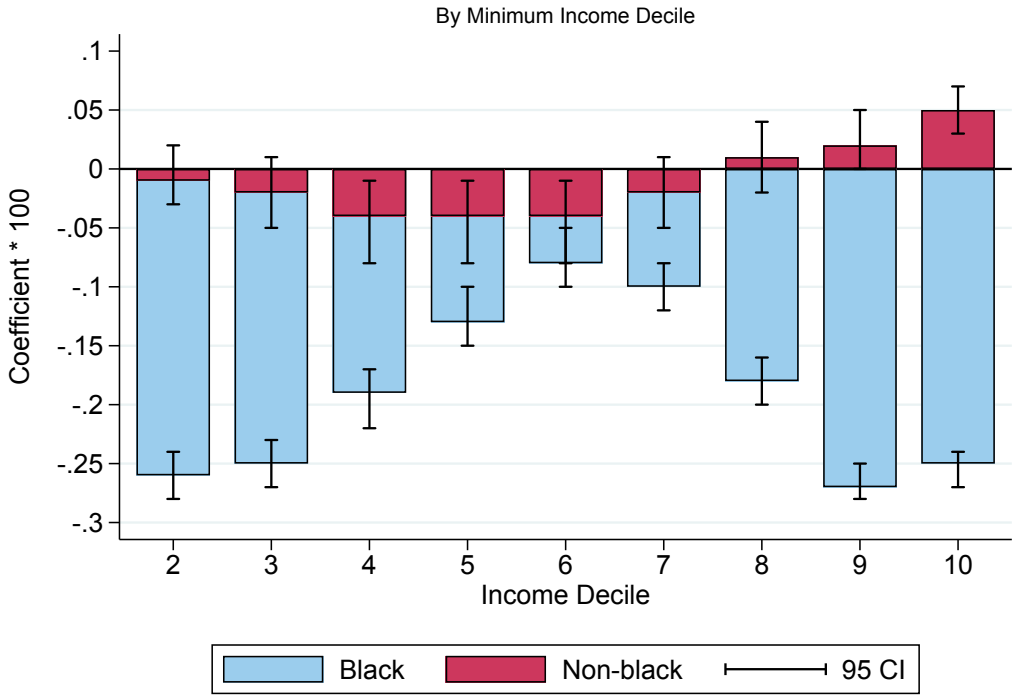
Coefficients statistically significant at ***1%, **5%, and *10% levels.

and conditional on being employed, a one percentage point increase in racial separation reduces a Black individual's annual earnings by 0.24 percent, and increases the probability of idleness in the labor market by 0.11 percentage points compared to non-Black individuals. Lastly, Column (5) suggests racial separation increases the probability of single motherhood for Black females relative to non-Black females. In the context of Cutler and Glaeser (1997), I find that the effects of racial separation for non-Black individuals become largely insignificant after accounting for issues of endogeneity. Given the average difference between high and low racially separated cities in 2010 was 20.3 percentage points, these estimates indicate large reductions in economic opportunities for Black residents, and little to no benefit of racial separation for non-Black residents.

4.4 Heterogeneous Effects

Previous work has been limited in answering questions of heterogeneous impacts – Are negative impacts of racial separation driven by concentrated declines in outcomes for the worst-off individuals, or do these effects remain as we move across outcome distributions? In order to answer questions of this type, I estimate regressions separating income and education according to various thresholds. I begin by estimating Equation

Figure 4: Effect of Racial Separation on the Probability of Moving Up the Income Distribution



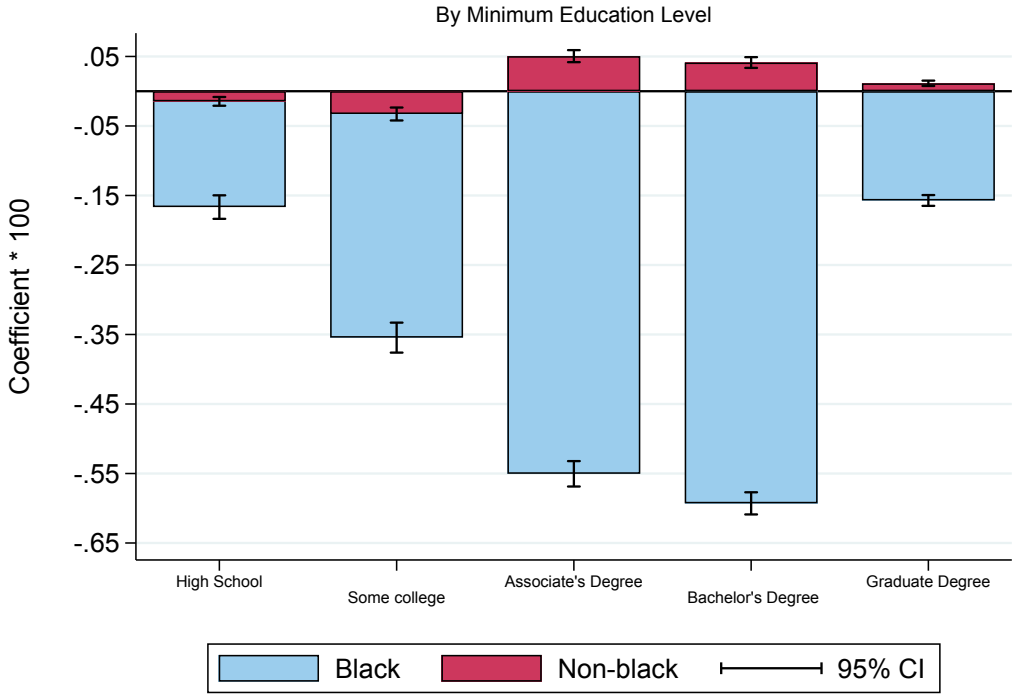
N=1,591,735. Each column is a separate regression where the dependent variable is an indicator for at being in at least the specified income decile along the x-axis. Estimates indicate the percentage point change in the probability of reaching at least the specified decile in the income distribution among those ages 20-30. Regressions include all controls specified in Equation 5. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

5 where the dependent variable is replaced as a series of increasing income decile thresholds within the national income distribution for individuals ages 20 to 30.

Figure 4 illustrates the results of this first heterogeneity exercise. Each column is a separate regression where the dependent variable is an indicator for being in at least the specified income decile along the x-axis. Coefficients are multiplied by 100 so that effect sizes have an interpretation of hundredths of a percentage point. The figure suggests that not only does racial separation reduce the likelihoods a Black young person reaches the highest income decile, but the estimate in column 1 suggests a one percentage point increase in racial separation reduces the probability a Black individual moves beyond the first income decile by 0.26 percentage points relative to a non-Black individual. Further, a one percentage point increase in racial separation reduces the probability a Black young person (ages 20-30) earns more than the median income earner in the national income distribution by 0.12 percentage points. These negative impacts illustrate the significant inequalities Black residents face in the labor market at a result of increased separation by race, relative to non-Black individuals.

To disaggregate the effects of racial separation by skill level, I examine impacts on differing levels of educational attainment. Specifically, I estimate versions of Equation 5 where the dependent variable is an indicator if the individual has reached at least the specified level of education: high school graduate, some college, associate's degree, bachelor's degree, and graduate degree.

Figure 5: Effect of Racial Separation on the Probability of Completing School



N=1,592,503. Each column is a separate regression and estimates the percentage point change in the probability of completing at least that level of education. Regressions include all controls specified in Equation 5. Standard errors are corrected for heteroskedasticity and intra-MSA clustering. In 1980: high school is defined as having completed grade 12; some college is defined as having completed one year of post-secondary education; associate's degree is defined as having completed two years of college; bachelor's degree is defined as completing four years of college; graduate degree is defined as 6 years of college.

Figure 5 presents the impacts of racial separation on increasing levels of educational attainment. While the effects of racial separation not only impact the probability that Black individuals complete some college, these negative impacts remain even for those who go on to receive graduate education – likely two distinct groups in terms of underlying abilities. To summarize the total effect across the skills distribution, at the lowest levels of educational attainment, separation by race is harmful regardless of race. At higher levels of attainment, results suggest racial separation reduces the likelihood of Black individuals becoming more skilled – negative estimates are an order of magnitude larger in absolute value for Black students compared to non-Black students.

5 Mechanism Analysis of Tract-Induced Racial Separation

The goal of this section is to consider potential causes and consequences of census tract-induced racial separation. To explore mechanisms behind the negative impacts Black residents face, I focus on two hypotheses: The first tests for weakened labor market attachment among Black residents. The second hypothesis tests that Blacks have worse outcomes in more racially separated neighborhoods because they have less contact with positive peer influences. I conclude by examining the impact census tract-induced racial separation has on the ability to leave predominantly Black neighborhoods into adulthood.

I begin by estimating a variant of Equation 5 where the unit of analysis is the neighborhood rather than the individual. More formally, I adopt the following econometric framework:

$$y_{nc} = \gamma_0 + \gamma_1 \hat{s}_c + \gamma_2 black_{nc} * \hat{s}_c + x_c^{'}\theta + \epsilon_{nc} \tag{6}$$

where the dependent variable y_{nc} is the outcome of interest for neighborhood n in city c, $\hat{s}_c$ is the fitted value of racial separation estimated from Equation 4 in city c, $black_{nc}$ is an indicator variable that is used within two specifications: the first equals 1 if neighborhood n is "predominantly" Black reflecting a Black resident proportion of 75 percent or greater. The second specification defines $black_{nc}$ equal to 1 if the neighborhood is "heavily" Black, or at least 90 percent Black. My IV estimation strategy is now estimating the impact of cumulative racial separation in predominantly Black neighborhoods, relative to less-Black neighborhoods. Standard errors are corrected for heteroskedasticity and intra-MSA clustering. A majority of the dependent variables in this analysis come from newly available Opportunity Insights data and are available on a cross-sectional basis, and thus, my analysis is limited to cross-sectional evidence.

To evaluate labor market attachment for Black individuals, I examine whether there are fewer local job opportunities for Black residents relative to those who live in less-Black neighborhoods. Local job opportunities consist of those falling within 5 miles of the neighborhood of interest. I restrict this measure further to consider only high paying local job opportunities, defined as local jobs with monthly earnings of at least $3,333 (2010 dollars). Lastly, I consider whether Black individuals face increased costs of getting to their jobs, conditional on being employed, as a result of increased separation.

Table 2 presents the first set of results in testing for weakened labor market attachment among predominantly Black neighborhoods. Panel (a) refers to neighborhoods with a Black residency of at least 75 %, while panel (b) re-estimates Equation 6 using increased requirements on neighborhood characterization.[16] Taken together, columns (1) and (2) indicate that not only are there fewer *high paying* local job opportunities in predominantly Black neighborhoods, but fewer job opportunities in general. Put into perspective, an indi-

[16] About five percent of the sample falls with the category of a "heavily" Black neighborhood.

Table 2: Separation and Job Availability in Predominantly Black Neighborhoods

Panel (a): Predominantly Black neighborhoods			
	(1) # of jobs	(2) # of high paying jobs	(3) Annual job growth
Separation	104.3951***	138.0593**	-0.0004***
	(39.3711)	(67.7192)	(0.0000>)
≥75% Black*separation	-1728.3485***	-1493.4829***	0.0005***
	(553.4968)	(341.7891)	(0.0002)
Mean of dep. var.	138,514.6	71,646.09	1.65%
R^2	0.255	0.216	0.020
N	50211	50211	49789

Panel (b): Heavily Black neighborhoods			
	(4) # of jobs	(5) # of high paying jobs	(6) Annual job growth
Separation	171.8717***	102.4362***	-0.0004***
	(63.7431)	(36.8704)	(0.0000>)
≥90% Black*separation	-3964.8218***	-2592.5179***	0.0005
	(700.1144)	(439.3370)	(0.0003)
R^2	0.255	0.216	0.019
N	50211	50211	49789

Estimates use only the most recent data in the analysis, 2010. Neighborhood-level jobs data come from Opportunity Insights. The variable # of jobs refers to the total number of jobs in own and neighboring tracts whose centroids fall within a 5 mile radius from own tract centroid in 2015. The variable # of high paying jobs restricts # of jobs to those with earnings greater than $3,333 per month in 2015. Annual job growth refers to the average annualized job growth rate over the time period 2004 to 2013. Separation is defined as the Index of Dissimilarity in 2010, and the interaction term includes an indicator if the neighborhood is greater than or equal to 75% and 90% in the respective panels. 2010 city-level controls include population, percent Black and its interaction term, percent Hispanic, percent with high school degree or less, percent in manufacturing and its interaction, unemployment rate, median HH income, percent married, and separation by skill level. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

vidual moving from a city of low separation into a predominantly Black neighborhood in a city of high racial separation can expect about a 25 percent reduction in local job opportunities, on average.[17] While Panel (a) suggests some evidence of increased job growth in predominantly Black neighborhoods, these estimates become insignificant when focusing on heavily Black neighborhoods.

Table 3: Separation and Individual Transportation Factors

	(1) Hours worked/week	(2) Travel time	(3) Motor vehicle	(4) Public transit
Separation	-0.0078***	-0.0219***	0.0015***	-0.0013***
	(0.0015)	(0.0026)	(0.0000>)	(0.0000>)
Black*separation	-0.0471***	0.2293***	-0.0041***	0.0049***
	(0.0039)	(0.0081)	(0.0001)	(0.0001)
Mean of dep. var.	39.93 hours	21.91 minutes	88.18%	6.04%
R^2	0.075	0.081	0.094	0.127
N	968424	968424	952705	952705

Estimates use the full panel of data from 1980 to 2010 and are estimated from Equation 5. Hours worked/week is defined as the usual hours worked per week in the previous year. Travel time is defined as the usual number of minutes it took to get from home to work last week, and is topcoded at 120 minutes. Individuals that recorded times greater than the top code were given the state average travel time for those greater than 120 minutes. Motor vehicle is an indicator that equals 1 if the means of transportation to work is a non-public auto vehicle, truck, van, or motorcycle. Public transit is an indicator that equals 1 if the means of transportation to work is public transportation including bus, streetcar, trolley bus/car, subway/elevated, railroad, taxicab, or ferryboat. All estimates are conditional on being in the labor force, not in school, and columns (3) and (4) are also conditional on not working at home. Separation is defined as the Index of Dissimilarity, and the interaction term includes an indicator if the individual is Black. Individual controls include sex, age, educational attainment., and birth state fixed effects. City-level controls include population, percent Black and its interaction, percent Hispanic, percent with a high school degree or less, percent manufacturing and its interaction, unemployment rate, median HH income, percent married, separation by skill level, and year and region FE. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

Table 3 is estimated from Equation 5 and includes the sample of individuals who are employed and not working from home. Results reinforce the evidence found in Table 2 that fewer local job opportunities result in increased commuting costs. Black residents face significantly longer travel times to work, and are more likely to rely on public transportation as a result of increased racial separation, relative to non-Black individuals. These negative impacts are further reflected in the reduction in the usual hours worked per week for Black individuals, even after accounting for experience and education factors. To summarize Tables 2 and 3, my evidence suggests that racial separation reduces labor market attachment by placing fewer jobs in predominantly Black communities and forcing Black residents to more heavily rely on public transportation to commute to further away jobs.

To evaluate peer influences for Black individuals, I examine whether predominantly Black neighborhoods

[17] High racial separation refers to a city with an Index of Dissimilarity above the mean. The average difference between cities of high racial separation and low separation in 2010 was 20.3 percentage points. This reduction is based on an average number of local job opportunities found in Table 2.

have differential likelihoods of interacting with educated individuals, relative to less Black-neighborhoods. I restrict this measure further to consider the likelihood of interacting with *Black* educated individuals in predominantly Black neighborhoods. Lastly, I examine whether predominantly Black neighborhoods are less likely to have complete families and more individuals incarcerated as a result of increased separation.

Before discussing the results of the peer influences hypothesis, I formally construct the measure of interaction among neighborhood groups.[18] This measure is fully developed in U.S. Census Bureau (2010) and is defined as:

$$Education\,Exposure\,Index_n = \sum_{n=1}^{N} \left(\frac{Black_n}{Black_{MSA}}\right) * \left(\frac{Educ_n}{Pop_n}\right) - \left(\frac{Educ_{MSA}}{Pop_{MSA}}\right) \tag{7}$$

where the first term is the proportion of Black residents in neighborhood n relative to the total MSA, the second is the proportion of college educated individuals in neighborhood n, and the final term is the proportion of college educated individuals in the MSA as a whole. The product of the first two captures the probability that Black and college educated individuals interact within neighborhood n, while the subtraction of the MSA proportion of college educated individuals removes differences in general education levels across MSAs. An index greater than zero indicates that Blacks differentially live in neighborhoods with high levels of college educated individuals, while a negative index indicates that Blacks differentially live in neighborhoods with less educated people. The average Education Exposure Index constructed from Equation 7 is -19.75 indicating that Black individuals differentially live in neighborhoods with fewer educated individuals.

The results in Table 4 are used to evaluate the peer influences hypothesis. Column (1) reflects a more general version of the Education Exposure Index found in Equation 7. This measure removes the first term in Equation 7, and reflects the differential proportion of college educated living in neighborhood n. Column (2) reflects the index found in Equation 7. Together, columns (1) and (2) indicate that not only are predominantly Black neighborhoods less likely to have educated individuals, but increased racial separation reduces the likelihood of interaction between Black and college educated individuals. Further, increased racial separation in predominantly Black neighborhoods largely impacts the proportion of households with a father present – a one percentage point increase in racial separation reduces the proportion of complete families in predominantly Black neighborhoods by 0.32 percentage points, relative to less-Black neighborhoods.

To conclude this section, I estimate the impacts that census tract-induced racial separation has on both economic and geographic mobilities. Opportunity Insights provides data on the proportions of children born between 1978 and 1983 who remain in one of their childhood neighborhoods into adulthood. Additionally, they provide proportions who leave one of their childhood neighborhoods in exchange for a neighborhood

[18] A similar measure is found in Cutler and Glaeser (1997).

Table 4: Separation and Peer Influences in Predominantly Black Neighborhoods

Panel (a): Predominantly Black neighborhoods				
	(1) Ed. exposure	(2) Weighted ed. exposure	(3) Father present	(4) Incarcerated
Separation	0.0257***	-0.0708***	0.0382***	-0.0076***
	(0.0061)	(0.0010)	(0.0053)	(0.0008)
≥75% Black*separation	-0.1661***	-0.0258***	-0.3166***	-0.0010
	(0.0131)	(0.0017)	(0.0169)	(0.0031)
Mean of dep. var.	0.02	-19.75	77.86 %	1.57 %
R^2	0.053	0.863	0.377	0.261
N	49840	49840	49577	49511

Panel (b): Heavily Black neighborhoods				
	(5) Ed. exposure	(6) Weighted ed. exposure	(7) Father present	(8) Incarcerated
Separation	0.0206***	-0.0717***	0.0175***	-0.0061***
	(0.0061)	(0.0010)	(0.0059)	(0.0008)
≥90% Black*separation	-0.2256***	-0.0266***	-0.3508***	0.0082
	(0.0192)	(0.0024)	(0.0254)	(0.0051)
R^2	0.034	0.863	0.271	0.181
N	49840	49840	49577	49511

Estimates use only the most recent data in the analysis, 2010. Neighborhood-level peer effects data come from Opportunity Insights. Ed. exposure is a demeaned index measure of interaction. A positive Ed. exposure refers to a neighborhood that has a higher than average percent of college educated. Weighted ed. exposure is demeaned and weighted by the Black population in a given neighborhood relative to the entire city. A positive weighted ed. exposure indicates a neighborhood where Blacks differentially live in a more educated neighborhood. Father present refers to the percent of children who have a male claimer. Incarcerated refers to the percent in a federal detention center, federal prison, state prison, local jail, residential correctional facility, military jail, or juvenile correctional facility. Separation is defined as the Index of Dissimilarity in 2010, and the interaction term includes an indicator if the neighborhood is greater than or equal to 75% and 90% in the respective panels. 2010 city-level controls include population, percent Black and its interaction term, percent Hispanic, percent with high school degree or less, percent in manufacturing and its interaction, unemployment rate, median HH income, percent married, and separation by skill level. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

with a poverty rate of less than 10 percent into adulthood. I apply my IV strategy using 1980 census tract-induced variation to measure the effects of 1980 racial separation levels on these longitudinal geographic mobility variables, after accounting for present day levels of separation. Lastly, I estimate the impacts that census tract-induced racial separation has on the probability of a predominantly Black neighborhood generating economic mobility to the top of the national income distribution.

Table 5: Separation and Geographic and Economic Mobility in Predominantly Black Neighborhoods

	Geographic Mobility		Economic Mobility	
	(1) % remaining in childhood census tract into adulthood	(2) % that move into affluent neighborhood in adulthood	(3) Probability of reaching top 1% of income earners	(4) Probability of reaching top 20% of income earners
Separation	-0.0199	0.0773	0.0258***	0.3408***
	(0.0183)	(0.0583)	(0.0051)	(0.0264)
≥75% Black*separation	0.0438**	-0.2445***	-0.0367***	-0.2164***
	(0.0204)	(0.0236)	(0.0018)	(0.0119)
Mean of dep. Var.	19.36%	49.16%	1.16%	21.04%
R^2	0.156	0.257	0.064	0.194
N	45368	45368	45379	45379

Census tract-level data come from Opportunity Insights, and consist of data collected for individuals born between 1978-1983. In columns (1) and (2), childhood refers to individuals up to age 23. Since columns (1) and (2) refer to data based upon childhood census tracts, estimates are calculated using 1980 racial separation levels with the number of 1980 census tracts as the instrument, 1980 controls, and present day levels of separation. Columns (3) and (4) refer to the estimated probability of an individual in a given tract reaching the respective percentile of the national income distribution (among children born in the same cohort) in 2014-2015. Columns (3) and (4) are estimated using 2010 racial separation levels, census tract count, and controls. Separation is defined as the Index of Dissimilarity, and the interaction term includes an indicator if the neighborhood is greater than or equal to 75% Black. City-level controls include population, percent Black and its interaction term, percent Hispanic, percent with high school degree or less, percent in manufacturing and its interaction, unemployment rate, median HH income, percent married, and segregation by skill level. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

Table 5 presents the results of childhood census tract-induced racial separation on economic and geographic mobilities in predominantly Black neighborhoods. Appendix Table A.6 presents these results for heavily Black neighborhoods. A one percentage point increase in childhood racial separation increases the proportion remaining in a predominantly Black childhood neighborhood into adulthood by 0.044 percentage points, relative to less-Black childhood neighborhoods. Additionally, childhood racial separation reduces the proportion growing up in predominantly Black childhood neighborhood that move into neighborhoods of affluence in adulthood. Columns (3) and (4) further verify the relationship found in Figure 4, depicting the heterogeneous impacts of advancing up the income distribution. Both columns indicate that census tract-induced racial separation in predominantly Black neighborhoods reduces the probability of the neighborhood serving as an engine to drive economic mobility.

6 Conclusion

While the United States is the most diverse it's ever been, urban America continues to be racially and economically divided. A longstanding literature has attributed economic disparities between races to this urban racial inequality; however, less focus has been placed on the link through which racial separation impacts economic opportunities for minority residents, and whether these effects impact minorities differentially.

This paper makes several contributions to this literature. First, by leveraging variation in census tract boundaries from the 1980 to 2010 Decennial Census boundary updates, I estimate heterogeneous impacts of urban racial separation on several economic outcomes of interest. Second, using this variation in census tract delineation paired with detailed neighborhood data through Opportunity Insights, I push two hypotheses further in explaining the negative impacts that minority residents face through increased racial separation. Lastly, I document the impact that racial separation has on geographic and economic mobilities for individuals growing up in predominantly black neighborhoods.

My first key set of results suggest that the negative impacts of racial separation are not driven by effects concentrated among the worst-off individuals, instead these impacts remain across both the income and skills distributions. Potential channels for the resulting negative relationships include reduced labor market attachment for Black individuals, as well as reduced positive peer influences in predominantly Black neighborhoods. Results suggest that not only are there fewer job opportunities in these neighborhoods, but that Black residents rely more heavily on public transportation to commute to further away jobs, as a result of increased racial separation. Lastly, I empirically demonstrate that increased racial separation in predominantly Black neighborhoods reduces the probability of the neighborhood serving as a driver of economic mobility into adulthood.

To my knowledge, this is the first paper to use census tract boundaries in measuring urban racial separation. Several related papers have used historical and geographic features as instruments to measure how neighborhood racial composition affects outcomes of interest, and this work contributes a new identification approach that can be applied both spatially and temporally. Future work should consider alternative impacts of census tract-induced racial separation, and ultimately how census tract delineation may play a role in shaping neighborhood dynamics.

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Appendix A

Table A.1: Microdata Characteristics

	Total (Age 20 - 30)			
	1980		2010	
Variable	White	Black	White	Black
A.Education				
High school graduate	87.5%	76.3%	93.6%	86.7%
College graduate	19.7%	8.8%	31.8%	14.6%
Avg. years of schooling	14	13	15	14
B. Work and income				
Idle	7.0%	16.4%	11.2%	25.9%
Earnings	$28,835	$22,045	$30,316	$19,349
Usual hours worked/week	40.1	38.6	39.3	36.6
C. Social				
Single mother	19.1%	54.7%	31.8%	70.3%
N	1,592,503			

High school graduate in 1980 is defined as having reached 12th grade. College graduate is defined as having completed at least 4 years of college in 1980, and is defined as having at least completed a bachelor's degree in 2010. Average years of schooling includes kindergarten. K-12th grade indicates 13 years of schooling. Idleness is conditional on being in the labor force, and is defined as unemployed and not in school. Earnings data are for people who are in the labor force, not enrolled in school, and have nonnegative earnings. Usual hours worked per week are for people who are in the labor force and not enrolled in school. Single mother refers to females that are not currently married and have ever had a child in 1980, and in 2010, refers to females that are not currently married and have had a child in the last year.

Table A.2: City Characteristics

	1980			2010		
Variable	Mean	Min.	Max.	Mean	Min.	Max.
Population (1000s)	685.7	89.0	8275.0	836.0	98.7	9818.6
A. Race/Ethnicity						
Non-Hispanic white	82.6%	31.3%	98.7%	68.4%	3.3%	95.6%
Non-Hispanic Black	10.7%	0.5%	40.9%	12.8%	0.2%	56.4%
Hispanic	4.8%	0.3%	61.9%	13.6%	1.0%	95.8%
Asian	1.2%	0.2%	59.9%	3.9%	0.6%	68.4%
B. Measures of separation						
Separation by race	62.0%	30.4%	87.9%	44.1%	15.7%	76.7%
Separation by education	34.6%	18.2%	54.8%	35.3%	20.5%	53.9%
Number of neighborhoods	164	21	2,476	196	23	2,475
C. Monetary characteristics						
Median home value	$130,506	$74,136	$368,446	$176,053	$75,851	$730,827
Median Household income	$47,735	$32,466	$78,226	$51,967	$31,881	$97,378
Median income per person	$20,063	$13,954	$33,559	$25,924	$13,928	$49,744
D. Labor market characteristics						
High school diploma or less	67.9%	48.3%	84.2%	42.8%	22.3%	65.5%
Unemployment rate	6.7%	2.1%	15.2%	9.4%	3.9%	16.4%
Share in manufacturing	22.7%	3.2%	51.9%	11.0%	2.0%	31.6%
Total number of cities			237			257

Separation measures are in terms of the Index of Dissimilarity. This refers to the percent of the population that would need to move within the city in order to create an equal distribution with respect to the specified characteristic. Neighborhoods are defined as a census tract. All monetary variables are expressed in 2010 dollars. City is defined as the Metropolitan Statistical Area (MSA).

Table A.3: The Relationship Between Census Tracts and Racial Separation Over Time

	(1)	(2)	(3)	(4)	(5)
	Racial Separation	Racial Separation	Racial Separation	Racial Separation	Racial Separation
Year	(1980)	(1990)	(2000)	(2010)	(1980-2010)
Num. of census tracts	0.040**	0.036**	0.063***	0.077***	0.051***
	(0.019)	(0.015)	(0.017)	(0.015)	(0.010)
Mean of dep. var.	62.00%	55.99%	49.11%	44.13%	52.53%
Std. dev. of dep. var.	12.29%	12.81%	13.44%	12.50%	14.42%
R^2	0.188	0.160	0.222	0.195	0.137
N	237	249	276	257	1019

The dependent variable in each specification is the level of racial separation within a city and is defined as the Index of Dissimilarity. Each specification includes a quartic function in population, and standard errors are corrected for heteroskedasticity.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

Table A.4: Falsification Test of the Instrument

Year	(1) Racial Separation (1980)	(2) Racial Separation (1990)	(3) Racial Separation (2000)	(4) Racial Separation (2010)	(5) Racial Separation (1980-2010)
Num. of census tracts	0.038**	0.006	0.008	0.002	-0.003
	(0.019)	(0.009)	(0.011)	(0.009)	(0.008)
Mean of dep. var.	60.93%	53.24%	47.05%	39.61%	50.59%
Std. dev. of dep. var.	12.60%	13.46%	13.69%	12.32%	15.19%
R^2	0.165	0.107	0.103	0.082	0.063
N	237	231	219	208	895

The dependent variable in each specification is the level of racial separation within a city and is defined as the Index of Dissimilarity. This measure is calculated using census tract envelopes that were established in either 1970 or 1980. The sample includes MSAs that existed in 1980 and could be followed to 2010. Each specification includes a quartic function in population, and standard errors are corrected for heteroskedasticity.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

Table A.5: OLS Estimates of the Effects of Racial Separation on Economic Opportunities

	(1) HS dropout	(2) College graduate	(3) ln(income)	(4) Idle	(5) Single motherhood
Separation	0.0002***	0.0004***	0.0008***	0.0001***	0.0004***
	(0.0000>)	(0.0000>)	(0.0001)	(0.0000>)	(0.0002)
Black*separation	0.0014***	-0.0034***	-0.0035***	0.0010***	0.0051***
	(0.0000>)	(0.0000>)	(0.0001)	(0.0000>)	(0.0002)
Mean of dep. var.	11.64%	22.24%	$24,997.51	6.24%	31.61%
R^2	0.031	0.120	0.219	0.046	0.185
N	1592503	1592503	1378543	1305801	123236

HS dropout is an indicator variable that equals 1 if the individual completed less than grade 12 in 1980, and in later years equals 1 if the individual completed grade 12, or less, and did not receive a diploma. College graduate is an indicator variable that equals 1 if the individual completed at least 4 years of college in 1980, and in later years equals 1 if the individual has a bachelor's degree or higher. Income is defined as earned income, and is conditional on being in the labor force with nonnegative earnings. Idleness is an indicator variable that equals 1 if the individual is in the labor force, but neither going to school nor employed. Single motherhood is an indicator that equals 1 if the female is not currently married, and has ever had a child in 1980 or 1990. In 2010 single motherhood refers to females who are not currently married and have had a child in the last year. Single motherhood data are not available for 2000. Separation is defined as the Index of Dissimilarity, and the interaction term includes an indicator if the individual is Black. Individual controls include sex, age, and educational attainment. City-level controls include population, percent Black and its interaction, percent Hispanic, percent with a high school degree or less, percent manufacturing and its interaction, unemployment rate, median HH income, percent married, segregation by skill level, birth place state FE, and year and region FE. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Coefficients statistically significant at ***1%, **5%, and *10% levels.

Table A.6: Separation and Geographic and Economic Mobility in Heavily Black Neighborhoods

	Geographic Mobility		Economic Mobility	
	(1) % remaining in childhood census tract into adulthood	(2) % that move into affluent neighborhood in adulthood	(3) Probability of reaching top 1% of income earners	(4) Probability of reaching top 20% of income earners
Separation	-0.0249	0.1848***	0.0211***	0.3052***
	(0.0183)	(0.0596)	(0.0050)	(0.0267)
≥90% Black*separation	0.0143	-0.2782***	-0.0401***	-0.2738***
	(0.0270)	(0.0284)	(0.0020)	(0.0173)
Mean of dep. Var.	19.36%	49.16%	1.16%	21.04%
R^2	0.151	0.216	0.054	0.171
N	45368	45368	45379	45379

Census tract-level data come from Opportunity Insights, and consist of data collected for individuals born between 1978-1983. In columns (1) and (2), childhood refers to individuals up to age 23. Since columns (1) and (2) refer to data based upon childhood census tracts, estimates are calculated using 1980 racial separation levels with the number of 1980 census tracts as the instrument, and 1980 controls. Columns (3) and (4) refer to the estimated probability of an individual in a given tract reaching the respective percentile of the national income distribution (among children born in the same cohort) in 2014-2015. Columns (3) and (4) are estimated using 2010 racial separation levels, census tract count, and controls. Separation is defined as the Index of Dissimilarity, and the interaction term includes an indicator if the neighborhood is greater than or equal to 90% Black. City-level controls include population, percent Black and its interaction term, percent Hispanic, percent with high school degree or less, percent in manufacturing and its interaction, unemployment rate, median HH income, percent married, and segregation by skill level. Standard errors are corrected for heteroskedasticity and intra-MSA clustering.

Coefficients statistically significant at ***1%, **5%, and *10% levels.