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SEPARATE WHEN EQUAL? RACIAL INEQUALITY
AND RESIDENTIAL SEGREGATION

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ABSTRACT

In contrast to conventional wisdom, this paper identifies a powerful mechanism which can lead to persistent and even *increasing* residential segregation when racial differences in education and other sociodemographics narrow. We document that middle-class black neighborhoods are in short supply in many U.S. metropolitan areas, forcing highly educated blacks either to live in white neighborhoods with high amenity levels or in more black neighborhoods with lower amenity levels. A simple model then shows that increases in the proportion of highly educated blacks in a metropolitan area may lead to the *emergence* of new middle-class black neighborhoods, relieving the prior neighborhood supply constraint and causing increases in residential segregation. Cross-MSA evidence from the 2000 Census indicates that this mechanism does in fact operate: as the proportion of highly educated blacks in an MSA increases, so the segregation of educated blacks and blacks more generally goes up. Our empirical findings are robust and have important implications for the evolution of residential segregation.

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1 Introduction

In his seminal work on segregation, Schelling ([28], [29]) observed that racial segregation would arise in the housing market even in the absence of explicit sorting on the basis of race, given that race is correlated with income and income affects residential choices. Some degree of racial segregation would emerge, for example, as the by-product of the selection of higher-income individuals into bigger houses and nicer neighborhoods. A seemingly natural corollary of Schelling’s observation is that a reduction in socioeconomic inequality across race would lead to a reduction in racial segregation.¹

In this paper, we conjecture that the opposite would occur in U.S. metropolitan areas: a reduction in racial socioeconomic inequality would actually lead to an *increase* in segregation. Our hypothesis is motivated by three key observations about the set of neighborhoods currently available in U.S. metropolitan areas (see Section 2). First, middle-class black neighborhoods are in extremely short supply in almost all metropolitan areas. Second, given the short supply of middle-class black neighborhoods, a substantial fraction of highly educated blacks (education proxying for socioeconomic status (‘SES’) more generally) reside in predominantly black, low-SES neighborhoods, while others reside in predominantly white, high-SES neighborhoods. This suggests that the short supply of middle-class black neighborhoods may be binding – that many highly educated blacks might prefer middle-class black neighborhoods *were they available*.² Third, metropolitan areas with a greater proportion of highly educated blacks tend to have a greater supply of middle-class black neighborhoods. Were the proportion of highly educated blacks to increase, raising the supply of middle-class black neighborhoods, so these new neighborhoods might provide an attractive alternative for high-SES (and possibly other) blacks as the range of neighborhood options expanded, leading to the hypothesized increase in segregation.

We formalize the mechanism underlying our hypothesis in Section 3, setting out a simple equilibrium model of decentralized residential choice. The model shows how the set of available neighborhoods and the racial segregation of both highly and less-educated blacks is likely to vary with

¹A number of studies have attempted to estimate the contributions of socioeconomic characteristics in explaining racial segregation. See Miller and Quigley [25], Harsman and Quigley [16], Bayer, McMillan and Rueben [2], and Sethi and Somanathan [30], among others.

²This is consistent with Vigdor’s [32] finding that “the nationwide proportion of Black households with *few or no* Black neighbors exceeds the proportion stating a preference for such neighborhoods” (p. 589).

the proportion of highly educated blacks in the metropolitan population.³ When this proportion is sufficiently low, only low-SES black neighborhoods arise in equilibrium, and many highly educated blacks reside in predominantly white, high-SES neighborhoods. As the proportion of highly educated blacks in the population increases, the model distinguishes two separate cases.

In the first and most empirically relevant case, when the proportion of highly educated blacks rises from a low to a moderate level, the average SES in all-black neighborhoods increases, thereby making black neighborhoods more attractive to highly educated blacks. The comparative statics of the model then predict the formation of mixed-SES black neighborhoods, potentially increasing the segregation of *both* highly and less-educated blacks. In the second case, when the proportion of highly educated blacks grows sufficiently large, so exclusively high-SES black neighborhoods emerge.⁴ In this case, the segregation of highly educated blacks continues to increase but is driven solely by increased neighborhood-level exposure to other highly educated blacks.⁵ These two predictions will be relevant in the empirical work that follows.

In Section 4, we present a direct empirical test of our primary hypothesis. In particular, we use Census Tract Summary Files from the 2000 Census to examine the cross-sectional relationship between metropolitan sociodemographic composition and segregation patterns. The results show that the segregation of both highly- and less-educated blacks is sharply increasing in the proportion of highly educated blacks in the MSA. This increased segregation is driven by a significant increase in neighborhood-level exposure to both highly- and less-educated blacks, implying a greater presence of mixed-SES black neighborhoods in metropolitan areas with a greater proportion of highly educated blacks. The results are robust to controls for metropolitan area size and region; and they are consistent with the prediction of our model when the proportion of highly educated blacks in an MSA increases from a low to a moderate level.

In light of the strong positive correlation between black segregation and the proportion of

³In our empirical analysis, the Census Summary Files necessitate the use of a single dimension of socioeconomic status as they only provide the joint distribution of race-by-income or race-by-education for a given neighborhood. In light of this, we use educational attainment as a proxy for socioeconomic status in the remainder of the paper, noting that it is a better predictor of permanent income than current income in the Census year.

⁴Note that we use the terminology ‘the *emergence* or *formation* of middle-class black neighborhoods’ to describe an increased concentration of middle-class blacks within existing neighborhoods, and not the literal development of a neighborhood associated with new housing construction.

⁵A recent paper by Sethi and Somanathan [31] sets out a different model showing that racial segregation and income inequality do not exhibit a monotonic relationship. See Section 3 for more discussion.

highly educated blacks in a metropolitan area, we then explore the possibility that the correlation may not be related to within-metro sorting (as we propose), but may instead arise due to some other mechanism. Before turning to any specific analysis, we emphasize that most of the leading alternative explanations for a correlation between these measures would imply a *negative* rather than positive relationship. Explanations that can be ruled out on this ground include statistical discrimination in either the housing or mortgage market, and standard intuition related to within-metro sorting on the basis of socioeconomic characteristics described above.

In Section 5, we examine the following potential explanations in greater detail : (i) the impact of segregation on socioeconomic outcomes (reverse causation); (ii) across-metro sorting on the basis of observables; and (iii) across-metro sorting on unobservables. One of the main contributions of our empirics is to shed light on (i), the reverse causation channel. In particular, we provide a clear reconciliation of our finding of a robust positive correlation between segregation and the proportion of highly educated blacks in a metropolitan area with an apparently conflicting correlation highlighted in an important and well-known paper by Cutler and Glaeser [10, CG hereafter]. Focusing on young adults aged 20-30, CG demonstrate that the educational attainment of blacks is lower (relative to whites) in more segregated metropolitan areas. As one considers successively older individuals, however, this negative relation turns positive, and becomes strongly so for blacks aged 40 and above. Consideration of this age profile thus reconciles the respective correlations and along with additional analyses, suggests that both mechanisms may play important roles in generating a relationship between racial inequality and segregation.⁶

The evidence we present on alternative explanations (ii) and (iii) also provides strong support for the notion that the positive correlation between metropolitan segregation and fraction of highly educated blacks in the population is in fact related to *within-metropolitan area* sorting, as we hypothesize. We also present additional time-series evidence on the relationship, showing that an increase in black educational attainment in a metropolitan area between 1990-2000 significantly increases segregation.

In terms of their significance, our results relate directly to two of the most important issues in the segregation literature. First, when combined with the central conclusion of CG, our results draw attention to the operation of an important negative feedback loop in the evolution of resi-

⁶The discussion of CG's analysis is relevant to the interpretation of the magnitudes of our findings. Because the two forces work against each other, the strength of the mechanism we draw attention to will tend to be understated; more generally, the simultaneous presence of both forces will tend to mask the role of other in the data. What is striking, given the results in CG, is that the overall correlation is not negative, but rather significantly positive.

dential segregation and racial socioeconomic inequality. Working in one direction, CG’s analysis demonstrates that metropolitan segregation significantly worsens educational and labor market outcomes for young blacks relative to whites, increasing inequality across race. Working in the opposite direction, our results indicate that reductions in across-race inequality lead to increases in segregation. In the face of some shock that reduced racial inequality, our mechanism should lead to an increase in segregation among blacks of all education levels. And via the mechanism highlighted in CG, the increased segregation should in turn lead to lower educational attainment among young blacks, undoing some of the initial reduction in racial inequality over time. Because of this negative feedback, the movement towards convergence will be inhibited.⁷

The results also have important implications for our understanding of the residential isolation of poorer blacks in the United States. Both our theory and empirical results imply that as the proportion of highly educated blacks increases, so mixed-SES black neighborhoods should emerge in U.S. metropolitan areas. Further, in cases where the proportion of highly educated blacks is sufficiently high, the formation of exclusively high-SES black neighborhoods is predicted; this is consistent with the observed patterns of black gentrification in some U.S. cities such as Atlanta and Washington DC in the latter part of the 20th Century (see, e.g., Patillo [26]).

2 The Supply of Neighborhoods in U.S. Metropolitan Areas

In this section, we describe several empirical facts relevant to the supply of neighborhoods in U.S. metropolitan areas. These facts motivate our central hypothesis.

Throughout our analysis, we define metropolitan areas as either (i) free-standing Metropolitan Statistical Areas (MSAs) or (ii) Consolidated Metropolitan Statistical Areas (CMSAs) consisting of two or more economically and socially linked metropolitan areas – Primary Metropolitan Statistical Areas (PMSAs). (Henceforth, for expositional convenience, we will just use the term ‘MSA.’) Within these MSAs, we characterize each neighborhood on the basis of two dimensions: *the fraction of residents who are black*⁸ and *the fraction of residents who are college-educated*.⁹ A ‘neighborhood’

⁷The persistence of racial inequality is an important theme in the work of Loury [20], drawing attention to a negative externality in the accumulation of human capital, which gives rise to persistent differences in income across race.

⁸Our focus is on non-Hispanic black and non-Hispanic white individuals 25 years and older residing in U.S. metropolitan areas.

⁹As we mentioned earlier, educational attainment is used to proxy socioeconomic status more generally: it is a

in our primary analysis corresponds to a Census tract, which typically contains 3,000 to 5,000 individuals; and we use publicly available Census Tract Summary Files (SF3) from the 2000 Census, which provide information on the distribution of education by race for each Census tract.

We establish three main stylized empirical facts:

FACT 1. Neighborhoods that combine high fractions of both college-educated and black individuals are in short supply in almost every MSA.

FACT 2. College-educated blacks live in a very diverse set of neighborhoods in each MSA; substantial fractions live in predominantly white high-SES neighborhoods as well as predominantly black low-SES neighborhoods.

FACT 3. Predominantly black high-SES neighborhoods are concentrated in only a handful of MSAs; the availability of these neighborhoods is increasing in the proportion of college-educated blacks in the MSA population.

Before detailing these facts, we first characterize the composition of U.S. MSAs by race and education. In particular, blacks and whites respectively constitute 11.1 and 69.5 percent of the U.S. population 25 years and older residing in MSAs. Among blacks, 15.4 percent have at least a four-year college degree, while the comparable number for whites is 32.5 percent. Thus college-educated blacks make up only 1.7 percent of the U.S. population residing in MSAs.

[Table 1 About Here]

Table 1 provides very clear evidence on Fact 1 – the short supply of high-SES black neighborhoods. It documents the number of tracts in the U.S. by the percentage of individuals with a college degree and the percentage of individuals who are black versus white. Panel A describes the number of tracts in which more than 0, 20, 40 and 60 percent of individuals 25 years and older are at least college-educated, respectively. Panel B reports the number of tracts in each of the categories listed in the column headings that contain a minimum fraction of blacks equal to 20, 40, 60, and 80 percent, respectively.

As the corresponding numbers show, a much smaller fraction of the tracts with a high proportion of blacks also have a high proportion of college-educated individuals. For example, while 22.6 percent (row 1, column 3) of all tracts are at least 40 percent college-educated, only 2.5 percent

better predictor for one's permanent income than current income in the Census year.

(row 3, column 3) of tracts that are at least 40 percent black are at least 40 percent college-educated, and only 1.1 percent (row 4, column 3) of tracts that are at least 60 percent black are at least 40 percent college-educated. In marked contrast, Panel C of Table 1 presents analogous numbers for whites. They show a far greater fraction of neighborhoods with at least 40, 60, and 80 percent white meeting the education criteria listed in the column headings.

[Table 2 About Here]

While Table 1 reveals a scarcity of high-SES black neighborhoods in the U.S. as a whole, Table 2 shows that these tracts are concentrated in only a handful of MSAs, most notably Baltimore-Washington, DC. This implies that the supply of such neighborhoods in most MSAs is even more limited. Of the 44 tracts (see row 4, column 3 of Table 1) that are at least 60 percent black and 40 percent college-educated, Table 2 shows that 14 are in Baltimore-Washington DC, 8 in Detroit, 6 in Los Angeles, and 5 in Atlanta. Of the 142 tracts (see row 3, column 3 of Table 1) that are at least 40 percent black and 40 percent college-educated, almost two-thirds are in the MSAs listed above along with Chicago and New York.

Given the short-supply of high-SES black neighborhoods in most MSAs, Figure 1 illustrates the composition of the neighborhoods in which college-educated blacks live within four metropolitan areas: Boston, Dallas, Philadelphia, and St. Louis. In each scatterplot, a circle represents a Census tract and its coordinates represent the fraction of college-educated individuals (vertical axis) and the fraction of blacks (horizontal axis) in the tract. The diameter of the circle is proportional to the number of college-educated blacks in the tract; thus the largest circles correspond to the tracts where highly educated blacks are most likely to live.¹⁰ As suggested by Table 1, the scatterplots demonstrate the short supply of high-SES black neighborhoods in these four metropolitan areas, neighborhoods that would have appeared in the north-east portion of each plot.

[Figure 1 About Here]

Relevant to Fact 2, Figure 1 also suggests that, given the absence of mixed- or high-SES black neighborhoods, highly educated blacks live in a diverse set of neighborhoods. While a sizeable fraction of college-educated blacks in each of the four MSAs live in high-SES white neighborhoods (neighborhoods in the north-western corner of the plots), another sizeable fraction choose low-SES black neighborhoods (neighborhoods in the south-eastern corner of the plots).

¹⁰Note that tracts that do not contain any highly educated blacks do not appear in these scatterplots.

Two aspects of this pattern are pertinent to our main hypothesis. First, the fact that such a high fraction of college-educated blacks live in segregated neighborhoods with relatively low average education attainment suggests that – whether due to preferences or discrimination – race remains an important factor in the location decisions of a large number of college-educated blacks. This helps to rule out an obvious potential explanation for the absence of mixed- or high-SES black neighborhoods – namely, that college-educated blacks simply demand college-educated neighborhoods without regard for racial composition. Second, the fact that a significant number of college-educated blacks reside in predominantly-white neighborhoods implies that an increase in the supply of mixed- or high-SES black neighborhoods might lead to an increase in segregation. If college-educated blacks were completely segregated in the absence of mixed- or high-SES black neighborhoods, there would be little potential for segregation to increase.

[Table 3 About Here]

To demonstrate that the patterns shown in Figure 1 for four metropolitan areas are representative of U.S. metro areas as a whole, Panel A of Table 3 summarizes the characteristics of neighborhoods in which college-educated blacks reside in MSAs throughout the United States. In each MSA, we first rank college-educated blacks by the fraction of blacks in their Census tract and assign individuals to their corresponding quintile of this distribution. This amounts to drawing four vertical lines in the scatterplot for each metropolitan area such that an equal number of college-educated blacks fall into each of the resulting five regions. Panel A of Table 3 then summarizes the average fractions of black and college-educated individuals in the tract corresponding to the quintiles of this distribution, averaged over all U.S. metropolitan areas.

The numbers corresponding to different quintiles show a clear trade-off for college-educated blacks between the fraction of their neighbors who are black and the fraction who are highly educated: the average fraction of highly educated neighbors falls from 38.0 percent for those college-educated blacks living with the smallest fraction of black neighbors to 13.8 percent for those living with the largest fraction.¹¹ Thus, the patterns revealed in the scatterplots shown in Figure 1 are

¹¹Panel B of Table 3 reports analogous numbers for college-educated whites. Comparison of Panels A and B reveals that college-educated blacks in each metropolitan area who reside with the smallest fraction of other blacks have roughly the same fraction of college-educated neighbors as college-educated whites do on average; however, college-educated blacks living in the top quintile of tracts (those with the greatest fraction of other blacks) have only about *one-third* of the fraction of highly educated neighbors.

indeed representative of the patterns for U.S. MSAs as a whole: within the typical MSA, college-educated blacks live in a very diverse set of neighborhoods.

[Figure 2 About Here]

Predominantly black highly educated neighborhoods *are* available in some U.S. metro areas, as Table 2 reveals. Figure 2 depicts scatterplots of neighborhoods, analogous to Figure 1, in four of these MSAs - Atlanta, Chicago, Detroit and Washington DC. Figure 2 shows that the supply of mixed- and even high-SES black neighborhoods is substantially greater in these MSAs, thus relaxing (to some extent) the implicit neighborhood supply constraint revealed in Figure 1.

According to our third stylized fact, the supply of mixed- and high-SES black neighborhoods is increasing in the proportion of highly educated blacks. This fact is motivated by the population characteristics of those metropolitan areas where some predominantly black highly educated neighborhoods are available, shown in Table 2. In particular, the fraction of highly educated blacks in the population tends to be relatively high in most of these MSAs.¹² To formalize this relationship, Table 4 reports four regressions that relate the log of the number of tracts in an MSA that meet race and education criteria specified in the column heading on metropolitan socioeconomic characteristics and the log of metropolitan population. These regressions reveal that the availability of middle-class black neighborhoods is significantly increasing with the fraction of college-educated blacks in the MSA. Holding the size of the MSA constant, a one percentage point increase in the proportion of college-educated blacks in an MSA (at the expense of the omitted category, Asians and Hispanics), for example, increases the number of tracts that are least 60 percent black and 40 percent college-educated by 42 percent and that are at least 60 percent black and 20 percent college-educated by 56 percent. The number of such tracts is also, not surprisingly, increasing in the population of the MSA.¹³

[Table 4 About Here]

¹²In the few cases where this fraction is low, the total population of the MSA is high.

¹³We also examined a series of quantile regressions designed to fit the 90th percentile of the relationship between neighborhood education and race shown in the scatterplots for college-educated blacks – that is, to approximate the implicit neighborhood availability constraint defined by the absence of neighborhoods in the upper-right portion of these scatterplots. These regressions demonstrate that the neighborhood availability constraint shifts significantly outward as the fraction of college-educated blacks in the MSA population is increased. This result holds no matter whether the fraction black or fraction of college-educated households in the MSA is held constant.

It is this third stylized fact along with the documented short supply of middle-class black neighborhoods in the vast majority of U.S. metropolitan areas that motivates our central hypothesis that an increase in the proportion of highly educated blacks within a metropolitan area allows middle-class black neighborhoods to form more readily and consequently leads to an increase in the residential segregation of highly educated blacks and potentially less-educated blacks as well.¹⁴

3 A Model

Having motivated our central hypothesis by examining the supply of neighborhoods in U.S. metropolitan areas, we now present a simple model of residential choice that allows for endogenous neighborhood emergence. This model formalizes our idea that the supply of middle-class black neighborhoods is an increasing function of the proportion of highly educated blacks in the population in the metropolitan area. With this increased supply of middle-class black neighborhoods, the model predicts a clear increase in the segregation of highly educated blacks and, more subtly, a possible increase in the segregation of less-educated blacks, provided that the number of highly educated blacks does not get too high. Within the context of the broader paper, this stylized model serves to clarify the potential role of endogenous neighborhood formation in affecting segregation levels; the empirical analysis that follows does not rely on the specific assumptions of the model.

Sethi and Somanathan [31] present an alternative model in which they show that low levels of racial inequality are consistent with extreme and even rising levels of segregation in cities where the minority population is large. Their model does not explicitly emphasize the idea of neighborhood emergence since they treat the total number of neighborhoods as being exogenously fixed. In contrast, our model emphasizes the emergence of new middle-class neighborhoods, consistent with the evidence on increased supply documented in Section 2.

Basic Ingredients. Before describing the detailed features of the model, we highlight three important ingredients that drive our results.

¹⁴The same set of facts presented in this section prompt a separate piece of research in Bayer and McMillan (2005) that uses an equilibrium model of residential sorting to examine the effects of the neighborhood supply constraint on the consumption of neighborhood amenities by blacks versus whites. The key idea in that research is that the implicit bundling of neighborhood race with neighborhood amenities, as seen in Figure 1, increases the implicit price of neighborhood amenities for blacks relative to whites, thereby exacerbating racial differences in the consumption of neighborhood amenities.

The first ingredient is an assumption about population preferences – that, *taking housing prices into account*, individuals prefer to live near others of the same race and education level. This assumption is a statement about the indirect rather than the direct utility function. In terms of education-related sorting, it allows for the possibility that all individuals prefer to live with highly educated neighbors due to, say, positive externalities in human capital production (see Benabou [5] and Cutler and Glaeser [10], for example); but given the capitalization of these externalities into housing prices, highly educated individuals are able to outbid less-educated individuals to live in more educated neighborhoods. This convenient reduced-form simplification allows us to place the role of house prices in the background of the analysis. In terms of racial sorting, there is ample direct evidence supporting the assumption that individuals prefer to live in neighborhoods with others of the same race, taking housing prices into account.^{15, 16} Moreover, the preferences for neighborhoods with higher fractions of individuals of the same race need not arise through direct preferences for the race of one’s neighbors, but might also come about through indirect channels.¹⁷ What is important from the point of view of our model is that race proxies for an important dimension of the residential choice process that has a considerable impact on location decisions.

The second basic ingredient in our model is the notion of a critical neighborhood size. To capture this notion, we define a neighborhood as a collection of individuals residing at a particular point in space and assume that each resident incurs a cost that is decreasing in the total number of

¹⁵Cornell and Hartmann [9], Farley *et al.* [13], O’Flaherty [22] and Lundberg and Startz [21] provide various theoretical arguments as to why individuals might care about the racial composition of their neighborhoods.

¹⁶For example, in the Multi-City Survey of Urban Inequality (MCSUI), respondents were shown a card representing a neighborhood with fifteen houses (in three parallel rows of five houses each), and then asked to illustrate the racial composition of their ‘ideal’ neighborhoods, where they were presumed to live in the house located at the center of the middle row. Using data from the MCSUI conducted between 1993-1994 in the Atlanta, Detroit, and Los Angeles metropolitan areas, Ihlanfeldt and Scafidi [17] found that, 35-43 percent of blacks designated an all-black neighborhood or mostly black neighborhood (eleven blacks and four whites) as their top choice; and 81-92 percent of the blacks chose all black or mostly black neighborhoods as one of their top two choices. See also Vigdor [32] and Charles [6],[7] for related evidence.

It is important to emphasize that such evidence has to be at best considered as suggestive, as the MCSUI survey questions make no mention of neighborhood amenities, housing prices, or other factors that might influence residential choices. Thus such evidence does not necessarily reveal fundamental racial preferences. King and Mieszkowski [19], Yinger [35], and Galster [14] report evidence of segregating preferences based on housing prices and rents.

¹⁷In particular, individuals of the same race may cluster together in residential neighborhoods because they have correlated preferences for local public and private goods including retail, restaurants, newspapers, and churches (see Berry and Waldfogel [4]) or because they have preferences to live near family members.

residents in the neighborhood. Rather than simply postulating some critical neighborhood size, we assume a decreasing average cost function because it more readily captures the idea that a larger population of individuals can sustain a larger number (and higher quality) of local goods in line with the preferences of those in the neighborhood (see, e.g., Berry and Waldfogel [4], and references cited therein).

The final important component of the model is the specification of idiosyncratic location preferences that are unrelated to sorting on the basis of education or race. We capture heterogeneity in preferences for locations throughout the metropolitan area by assuming that individuals have employment locations distributed in space and would prefer to commute shorter distances. Such an assumption is standard in the “spatial mismatch” literature (see Kain [18], Ross [27] and Weinberg [33]). The introduction of preferences for location unrelated to neighborhood race and education brings the physical geography of a metropolitan area into the model in a natural way and renders the density as well as the size of a given race-education category important to the neighborhood formation process.

Model Consider a metropolitan area located on a straight line with length 2, represented by the interval $[-1, 1]$. The population density in the metropolitan area is given by $N > 0$, so its total population is $2N$. There are two racial groups $r \in \{b, w\}$, a proportion $\lambda_w \in (0, 1)$ who were white, the remaining proportion $\lambda_b = 1 - \lambda_w$ being black. Individuals within each racial group differ in their educational attainment: a fraction $\rho_r \in (0, 1)$ of race- r individuals are highly educated and the remaining fraction $1 - \rho_r$ are less-educated. Cross-race inequality in socioeconomic characteristics is reflected by the difference $\rho_w - \rho_b$. For all metropolitan areas in the U.S., the relevant case is $\rho_w > \rho_b$. Thus a narrowing in the racial gap in educational attainment can be represented by an increase in ρ_b while keeping ρ_w fixed.

For simplicity, we assume that whites’ residential locations are fixed: at each endpoint of the line, there are two communities, one for highly educated whites (called communities WH and WH’) and one for less-educated whites (called communities WL and WL’).

We focus our analysis on the residential location choices of blacks and the *emergence* of black neighborhoods. Accordingly, we model idiosyncratic locational preferences of blacks by assuming that their job locations are uniformly distributed along the straight line. Commuters experience a cost of $\theta > 0$ per unit distance between their work and place of residence. There is also a cost of maintaining a community, the average per-resident cost being given by $c(n)$, where n is the number

of residents in the community.¹⁸ We assume that $c(\cdot)$ decreases in n .

We now describe blacks' preferences. Consider a black individual with education $e \in \{l, h\}$ (where l is the education level of the less-educated type and h , the education level of the highly educated type), whose job location is at point $z \in [-1, 1]$ on the straight-line. Her utility from living in a community $j \in J$, where J is the set of available communities to be determined in equilibrium, is given by:

$$u(j; z, e) = \alpha [p_b(j) + \gamma_1 p_w(j)] + \beta [p_e(j) + \gamma_2 p_{e'}(j)] - \theta D(j, z) - c(n(j)), \quad (1)$$

where $e' \neq e$ is the other education category; $p_r(j)$ is the proportion of residents in community j of race r ; $p_e(j)$ is proportion of residents in j with education attainment e ; $D(j, z)$ is the commuting distance between community j and z 's job location; $n(j)$ is the number of residents in community j ; and $\alpha > 0, \beta > 0, \gamma_1 \in (0, 1)$, and $\gamma_2 \in (0, 1)$ are constants.

In utility function (1), the first term $\alpha [p_b(j) + \gamma_1 p_w(j)]$ captures the utility from interacting with people of different races in the same community, where $1/\gamma_1 > 1$ measures the same-race preference discussed earlier. The interpretation of the second term $\beta [p_e(j) + \gamma_2 p_{e'}(j)]$ is more subtle. As we explained previously, it is meant to capture (in a reduced-form way) the idea that highly educated individuals will *on net* (that is, taking into account both human capital externalities and housing prices) prefer to live in more expensive neighborhoods with many other highly educated residents, while less-educated individuals will prefer on net to live in cheaper neighborhoods with other less-educated residents.

We define an equilibrium of this simple model to be a set of neighborhoods J^* (including the existing neighborhoods WH, WH', WL, WL') and the residential choices of all blacks such that: (1) given J^* , all black individuals' residential choices are utility-maximizing; (2) no coalitions of blacks in $j \in J^*$ can be better off by forming their own neighborhood; and (3) there is a positive measure of residents in all neighborhoods $j \in J^*$.¹⁹ It is important to remark that our equilibrium condition (2) assumes away the coordination problem among highly educated blacks in their decision to form their own neighborhood. Indeed, a *coordination problem*, if it exists, is likely to be a short-term phenomenon, as developers and other entrepreneurs have an incentive to solve it. In our model, the lack of middle-class black neighborhoods in a metropolitan area is a result of a *small*

¹⁸Technically, this rules out tiny enclaves of individuals claiming to form a neighborhood of their own.

¹⁹Note that we do not need to directly impose a threshold neighborhood size in our model. The existence of the four white neighborhoods, together with the assumption that $c(n)$ is decreasing in n endogenously ensures that small enclaves of blacks will not form their own neighborhoods.

numbers problem - that is, an insufficient density of highly educated blacks given the distribution of idiosyncratic preferences - rather than a coordination problem.

As in many models of residential sorting, there are multiple equilibria. Thus, we focus on a particular equilibrium in which the sizes of black neighborhoods, if formed, are maximized. Given the uniform distribution of the population on the city ‘line,’ this implies that black neighborhoods are formed at the center of the city.

In the equilibrium selected above, the set of neighborhoods J^* depends on the parameters of the model. We are particularly interested in the way the set J^* is affected by an increase in ρ_b - the fraction of highly educated blacks in the metropolitan area. Consider an equilibrium in which a single black community, community B, emerges at point 0 (see Figure 3). Clearly community B, were it to emerge, would consist of blacks whose job locations were close to point 0. Thus given $J^* = \{\text{WH}, \text{WH}', \text{WL}, \text{WL}', \text{B}\}$, blacks’ optimal residential choices can be characterized by a pair $\{x_h^*, x_l^*\}$ such that all highly educated (less-educated, respectively) blacks will choose to live in community B if and only if their job location z satisfies $|z| \leq x_h^*$ ($|z| \leq x_l^*$, respectively). The marginal types $\{x_h^*, x_l^*\}$ can be determined from the indifference conditions (see Appendix A for details). Figure 3 depicts this type of equilibrium when ρ_b , the fraction of highly educated blacks, is small.²⁰

[Figure 3 About Here]

Now imagine that we *add* a positive measure of highly educated blacks to the metropolitan area. This leads to two changes: first, the fraction of blacks in the metropolitan total population, λ_b , increases; second, the fraction of highly educated among the black population, ρ_b , increases.²¹ These changes have the following effects: note that as ρ_b increases, the proportion of highly educated blacks in community B, $p_h(\text{B})$, will increase even if the thresholds $\{x_h^*, x_l^*\}$ were hypothetically unchanged. As $p_h(\text{B})$ increases, community B becomes more attractive vis-à-vis community WH and WH’ for highly educated blacks. As a result, the marginal highly educated black who commutes

²⁰If such an equilibrium exists with a sufficiently small ρ_b , one can show that $x_l^* > x_h^*$. The reason is simple: when ρ_b is small, community B is necessarily a predominantly less educated all-black community. Because $\gamma_2 < 1$, the utility for a less-educated black from community B is always higher than that for a highly educated black at any job location. Thus less-educated blacks are more willing to commute to community B. This is not important for the analysis but explains the ranking of x_l^* and x_h^* in Figure 3.

²¹The total metropolitan area population also increases, but we can normalize it back to 2 without making an difference.

to community B, x_h^* , will increase, raising the probability that a highly educated black chooses community B. This shift has the effect of increasing the exposure of highly educated blacks to both highly and less-educated blacks at the expense of their exposure to highly educated whites.

The results for less-educated blacks are more ambiguous. On the one hand, community B becomes more educated, which makes it less desirable for less educated blacks according to their preference specified in (1); on the other hand, the increase of black population fraction λ_b leads to an increase in the total population in community B, which in turn drives down the per-resident community cost c . Whether or not community B becomes more desirable for less-educated blacks is indeterminate. It is thus possible that exposure of highly and less-educated blacks to one another may increase. (See Figure 4b for a graphical illustration.)

[Figure 4 About Here]

When λ_b and ρ_b become sufficiently high as we continue the addition of highly educated blacks to the metropolitan area, a point may be reached where it becomes profitable for highly educated blacks in community B to form their own community at point 0, called BH, leaving behind a less-educated black community BL (see Figure 4c). The exact point at which the highly educated black neighborhood BH emerges is determined by the balancing of the following two forces: First, by separating from the less-educated blacks living in community BL, highly educated blacks have to incur a higher per-resident community cost c as a result of the smaller population size; second, because community BH consists only of highly educated blacks, the utility component $p_h(\text{BH}) = 1 > p_h(\text{B}) + \gamma_2 p_l(\text{B})$, because $\gamma_2 < 1$.

Relation to Empirical Analysis. This simple model will provide a useful lens when carrying out the empirical analysis in the remainder of the paper. The key insight from the model is that the nature of available neighborhoods for highly educated blacks is likely to change as the fraction of blacks in the total population and the average education level of blacks increases. The change in the available neighborhoods for highly educated blacks occurs both when ρ_b is moderate and when it is high: when ρ_b is moderate, community B will contain more highly educated blacks even though it is not yet stratified on the basis of education; when the proportion of highly educated blacks ρ_b is sufficiently high, a highly educated black community BH emerges and results in a more dramatic change in neighborhood structure. It is worth pointing out that the emergence of community BH is likely to induce an accelerated migration of highly educated blacks from community WH and WH' to community BH, resulting in greater racial segregation in residential locations.

Given the empirical facts presented in Section 2, which demonstrate the relatively small number of highly educated blacks and the short supply of middle-class black neighborhoods in almost all metropolitan areas, we would generally expect the first comparative static described above (an increase in ρ_b from small to moderate level) to apply to the vast majority of MSAs. This comparative static thus forms the basis of our main hypothesis: that the segregation of highly educated blacks (and blacks more generally) is an increasing function of the average educational attainment of blacks in a metropolitan area. We also note that the emergence of middle-class black neighborhoods also depends positively on the population density N and the overall proportion of blacks in the metropolitan area λ_b .²² As we show below, an increase in average black educational attainment in large metropolitan areas leads to especially strong increases in the exposure of highly educated blacks to one another, a result in line with our comparative static predictions above.

4 Empirical Analysis

4.1 An Overview

We now present a series of empirical analyses designed to test our main hypothesis – that the segregation of highly educated blacks (and blacks more generally) is an increasing function of the fraction of highly educated blacks in a metropolitan area. We present results using a variety of organizations of the 1990 and 2000 U.S. Census of Population and a number of distinct empirical specifications. In order to provide a cohesive presentation of these results, we begin with an overview.

Our primary analysis uses Census Tract Summary Files of 2000 Census to examine the cross-sectional relationship between metropolitan sociodemographic composition and segregation patterns. The results confirm our main hypothesis: the segregation of blacks of all education levels is increasing in the fraction of highly educated blacks in the MSA. Moreover, as suggested by our theoretical analysis when the proportion of highly educated blacks is relatively small, an increase in this proportion increases the neighborhood-level exposure of highly educated blacks to less educated blacks and vice versa; i.e., with the formation of mixed-SES black neighborhoods. When broken out by the size of the MSA, the increased segregation of highly educated blacks in large MSAs is driven almost entirely by an increased exposure to other highly educated blacks with a much smaller

²²It also depends indirectly on the commuting cost θ and the community cost function $c(n)$ via their effects on x_h^* .

increase in exposure to less-educated blacks, as seen in smaller MSAs. This pattern of results is also consistent with the theoretical analysis, implying the formation of exclusively high-SES black neighborhoods when the number of highly educated blacks in the population is great enough.

Using this cross-sectional analysis as a baseline, we then explore in Section 5 the possibility that this cross-sectional positive correlation between segregation and average black educational attainment may not be related to within-metro sorting as we propose, but may instead arise due to another mechanism. Before turning to any specific analysis, we emphasize that most of the leading alternative explanations for a correlation between these measures would imply a negative rather than positive correlation. Explanations that can be ruled out on this ground include statistical discrimination in either the housing or mortgage market,²³ or the standard explanation related to within-metro sorting on the basis of socioeconomic characteristics described in the Introduction. We explore the following potential explanations in greater detail: (i) the impact of segregation on socioeconomic outcomes (reverse causation); (ii) across-metro sorting on observables; and (iii) across-metro sorting on unobservables.

Previous research, most notably Cutler and Glaeser [10, CG thereafter], suggests that the channel of reverse causation would result in a negative correlation. Specifically, using the 1990 Census, CG found that segregation at the metropolitan level substantially reduces relative educational and labor market outcomes for blacks *aged 20-30*. In light of this finding, it is actually quite surprising that we find a clear positive correlation between black educational attainment (relative to whites) and segregation at the metropolitan level. We present a detailed analysis in Section 5.1 that reconciles our findings with CG’s results: applying CG’s analysis to older populations in the same dataset yields a large statistically significant positive effect. Given this age profile and additional analyses, we conclude that both mechanisms operate in the data, with each working to obscure the other.

The second alternative explanation relates to across-metro sorting on the basis of observables (Section 5.2). In particular, using Census PUMS microdata, which characterize where an individual resided five years prior to the survey, we examine whether highly educated blacks are drawn disproportionately to metropolitan areas that have a larger number of middle-class black neighborhoods. We find that this is indeed the case. This type of migration is clearly consistent with the broad narrative developed in the paper – that in many metropolitan areas, highly educated blacks are

²³Taste-based discrimination is captured by our model, providing one reason for why agents would prefer to live with neighbors of their own race, as specified by the utility function (1).

constrained by the short supply of middle-class black neighborhoods, and as a result, are more likely to migrate to metropolitan areas with middle-class black neighborhoods. Equally importantly, however, the proportion of highly educated blacks among those migrating into metropolitan areas with a large number of middle-class black neighborhoods is comparable to the proportion in the population already residing there. Thus, this pattern of migration does not systematically contribute to cross-sectional differences in metropolitan composition, allowing us to rule out this type of sorting as an explanation for our baseline positive cross-sectional relationship between segregation and black educational attainment.

We then examine the possibility of across-metropolitan sorting on the basis of unobservable taste for segregation (Section 5.3). Such sorting would give rise to a classic form of selection bias if those highly educated blacks who live in metropolitan areas with a more educated black population have stronger unobserved tastes for segregation. To study this issue, we run a regression that essentially compares the neighborhood composition of individuals migrating into metropolitan areas with a higher fraction of highly educated blacks against the neighborhood composition of those who already reside there. This analysis reveals that highly educated blacks migrating into these metro areas choose less segregated neighborhoods, suggesting that, if anything, selection bias of this kind works to slightly attenuate our main finding.

Taken together, these analyses support the notion that the positive correlation between metropolitan segregation and black educational attainment is in fact related to *within-metro* sorting, in line with our main hypothesis. We conclude in Section 5.4 by presenting time-series evidence on the relationship between metropolitan population structure and segregation. Specifically, we regress the change in a measure of segregation (a dissimilarity index) in a metropolitan area between 1990 and 2000 on the changes in the sociodemographic composition of its population. We find that an increase in black educational attainment in a metropolitan area over time significantly increases its segregation, thus providing additional time-series support for our main hypothesis.

4.2 Cross-Sectional Analysis: Segregation Patterns in U.S. Metropolitan Areas

We begin our cross-sectional analysis by considering the general pattern of segregation in the U.S. as a whole. Panel A of Table 5 reports the average neighborhood composition *relative to the fraction in an individual's MSA* for individuals in each of our four primary race-education categories. The first row of Panel A states that blacks without a college degree are exposed to 19.6 percentage points more blacks without a college degree at the neighborhood level and 2.1

percentage points more college-educated blacks etc., relative to an average individual in the same metropolitan area,

[Table 5 About Here]

Panels B and C of Table 5 report segregation patterns in a manner analogous to Panel A, but separately for metropolitan areas with above and below the median fraction (1.23 percent) of college-educated blacks. Comparison of Panels B and C provides some initial evidence as to how segregation patterns vary with the sociodemographic composition of the metropolitan area. In particular, it shows that the relative exposure of blacks in each education category to both highly and less-educated blacks is *significantly greater* in metropolitan areas with above-median fractions of college-educated blacks. For both highly and less-educated blacks, the average tract-level exposure to blacks *relative* to the fraction of blacks in MSAs above the median is more than double that for MSAs below the median.

4.3 Cross-Sectional Analysis: Regression Results

To control more formally for the sociodemographic structure of the metropolitan area, Table 6 reports the results of a series of regressions of various tract composition measures on individual and MSA characteristics. Econometrically, the regressions reported in Table 6 are of the following form:

$$Y_{i,m} = \alpha_m + \beta \mathbf{X}_i + \gamma \mathbf{X}_i \cdot \mathbf{X}_m + \varepsilon_{i,m}, \quad (2)$$

where $Y_{i,m}$ denotes the Census-tract level exposure rate for an individual i living in MSA m ; \mathbf{X}_i measures i 's individual characteristics and \mathbf{X}_m , the characteristics of MSA m ; and the term α_m represents the MSA fixed effect.²⁴ The dependent variable $Y_{i,m}$ varies by the heading listed in each column. For example, the dependent variable for the regression in Column 1 is the fraction of college-educated blacks in i 's Census tract, and the dependent variable for Column 2 is the fraction of less-educated blacks in i 's Census tract, etc. The inclusion of the MSA fixed effects ensures that

²⁴Because we use the Census Tract Summary Files in our empirical analysis, in practice, \mathbf{X}_i just contains i 's race-education categories. In the basic regressions reported in Table 6, \mathbf{X}_m includes the MSA's population compositions, namely, the proportion of the MSA population that is white/highly educated, black/highly educated, white/less educated and black/less-educated. It is also worth mentioning that the Census Summary Tract Files provide the *number* of individuals in each race/education category by Census tract; thus our regression in practice is equivalent to running weighted OLS where the weight is given by the number of individuals in each race/education cell.

all of the other parameters characterize the effect on average tract composition *relative to the MSA average* for each set of individuals, so that the regressions account for the mechanical increase in neighborhood-level exposure that would follow from a change in the MSA’s composition.

[Table 6 About Here]

These regressions are summarized in Table 6. The key coefficients are the coefficients γ on the interactions between individual and MSA characteristics. For individuals in a given race-education category, these coefficients reveal how their average neighborhood composition varies with MSA characteristics. For example, Column 1 shows that a one percentage-point increase (at the expense of the omitted race category – primarily Hispanics and Asians) in the proportion of college-educated blacks in an MSA is associated with an increase in the exposure of college-educated blacks to other college-educated blacks of 0.97 percentage points *relative to the MSA average*, which mechanically increases by about 1 percent as well. In this way, the neighborhood-level exposure of highly educated blacks to other highly educated blacks increases at a 2-to-1 rate with the fraction college-educated blacks in the metropolitan population.

It is also useful to look across a particular row. For example, the first row tells us that a one percentage-point increase in the proportion of college-educated blacks in an MSA will increase the relative exposure of college-educated blacks to other college-educated blacks by 0.97 percentage points (Column 1), to less-educated blacks by 3.04 percentage points (Column 2), and to blacks overall by 4.008 percentage points (Column 3); but it decreases the relative exposure of college-educated blacks to college-educated individuals overall by 1.261 percentage points (Column 4).

Table 7 summarizes the coefficient estimates in Table 6 and other similar regressions. Results are reported for a one percentage-point increase in the proportion of highly educated blacks in the MSA under alternative assumptions as to which alternative race-education category experiences a one percentage-point decline in representation. Results are also reported for alternative definitions of “highly educated,” controlling for region and population of the MSA, and broken out by metropolitan area size.

[Table 7 About Here]

Panel 1 of Table 7 shows that when the fraction of college-educated blacks in a metropolitan area increases by 1 percent at the expense of the omitted race-education category (primarily Hispanics and Asians), the relative exposure of college-educated blacks to other college-educated blacks

increases by 1 percentage point and is statistically significant; the relative exposure of less-educated blacks to college-educated blacks also increases by 1.1 percentage points. Overall, the relative exposures of blacks with and without a college degree to other blacks increase by 4 and 6.1 percentage points respectively, highlighting the increased segregation of blacks of all education levels following an increase in the average education of the black population. In this way, the neighborhood-level exposure of both highly- and less-educated blacks to other blacks increases by 5 and 7.1 percentage points, respectively with only a one percentage point increase in the proportion of highly educated blacks in the MSA. The magnitude of this increase suggests that the formation of mixed-SES black neighborhoods is sharply increasing in the proportion of highly-educated blacks in the metropolitan population. This empirical finding is consistent with our model’s prediction when ρ_b lies in an intermediate range (Figure 4b), which we think is the plausible scenario for most U.S. metropolitan areas.²⁵

Panels 2 and 3 of Table 7 report results analogous to Panel 1 under alternative assumptions as to which alternative race-education category experiences a one percentage-point decline in representation. Panel 2 reduces the fraction of highly educated whites by one percent (i.e., holds constant the fraction of highly educated individuals in the population) while Panel 3 decreases the fraction of less-educated blacks (i.e., holds constant the fraction of blacks in the population). As these panels reveal, the qualitative nature of the results is not affected by the choice of which alternative race-education category whose representation is reduced.

Panel 4 of Table 7 reports results analogous to those reported in Panel 3 with the exception that the underlying measure of “highly educated” is changed to include those individuals having at least attended college. With this broader definition, the fraction of individuals 25 years and older in U.S. metropolitan areas who are highly educated is 54 percent, the fraction who are both highly educated and black is 5 percent, and the fraction of blacks who are highly educated is 45 percent.

²⁵The results of Table 6 are not driven by the specific form of the dependent variable that we employ. We conducted a series of regressions analogous to those reported in Table 6 except that the dependent variable is defined as the fraction of individuals in a given category in an individual’s tract divided by the fraction in the metropolitan area as a whole. In this way, an increase in tract-level exposure to individuals in a given category from 6 to 12 percent following an increase in the proportion of these individuals in the metropolitan area from 3 to 6 percent would not result in an increase in the dependent variable in this case, while it would have resulted in a 3 percentage point increase in the dependent variable used in the regressions reported in Table 6. The resulting parameter estimates led to a very similar set of conclusions, ensuring that our initial results are not driven by the functional form of the dependent variable. Throughout the remainder of the paper, we present the results of regressions analogous to those reported in Table 6.

Our primary objective in examining an alternative is to consider a definition of “highly educated” that includes a larger fraction of individuals and especially black individuals. A comparison of Panel 4 and Panel 3 reveals a qualitatively similar pattern. With the expanded definition of highly educated, the relative increase in exposure of both highly and less-educated blacks to other blacks is more evenly split between highly and less-educated blacks.

In sum, both definitions of “highly educated” (at least college degree and at least some college) reveal a pattern of increased relative exposure of both highly and less-educated blacks to blacks in each education category when the fraction of highly educated blacks in the metropolitan area increases. This pattern is consistent with the predictions of our model corresponding to an increase in ρ_b (the fraction of blacks who are highly educated) from low to moderate levels. With an increase in the average education level of the black population, highly educated blacks move on net into more segregated neighborhoods, increasing the average education level in some of the most segregated neighborhoods. In terms of the scatterplots, this pattern is consistent with the formation of segregated black neighborhoods with mixed education levels along with a corresponding shift of highly educated blacks away from highly educated, predominantly white neighborhoods to these newly-formed neighborhoods.

4.4 Cross-Sectional Analysis: Robustness and Heterogeneity

One potential concern with the results presented in Panels 4 and 3 of Table 7 is that they may be driven by unobserved factors related to historic patterns of black settlement, migration, and segregation in the United States. To address such concerns, Panel 3 of Table 7 reports the results of a set of regressions analogous to those reported in Panels 1 and 2, with the addition of a complete set of interactions between each individual’s race-education category and a measure of metropolitan size and four dummies for Census region (Northeast, Midwest, South, West).²⁶

A comparison of the results in Panel 5 and Panel 4 reveals a qualitatively similar pattern both in magnitude and in statistical significance. In particular, with the additional controls, the increase in the relative exposure of both highly and less-educated blacks to other blacks declines by 15-20 percent in magnitude, but remains highly significant. Changes in relative exposure to highly educated neighbors also decline and remain insignificant in each case. Taken together, these results give us confidence that the main conclusions of the paper are not driven by obvious omitted variable biases.

²⁶A total of 16 interaction terms are added to the regression.

While we added metropolitan size and interactions in the results reported in Panel 5 of Table 7, we still assumed that the effects of the fraction of highly educated blacks on segregation do not depend on metropolitan area size. The critical mass story implicit in our model implies that not only the fraction but also the number of highly educated blacks in the metropolitan area may be important for the formation of more-educated and segregated black neighborhoods. Given the same fraction of highly educated blacks, highly educated black neighborhoods might more easily form in large (population-wise) rather than small metropolitan areas.

Panels 6-8 present separate regressions, including the additional 16 control variables added in Panel 5, for small (0-200k), medium (200-600k), and large (600k+) metropolitan areas. A clear pattern emerges in the table: following an increase in the average education level of the black population, the increased relative exposure of both highly and less-educated blacks to other blacks is much greater in large versus small metropolitan areas. For highly educated blacks, the magnitude of the effect rises from 0.002 in small, to 0.025 in medium-sized, and 0.040 in large metro areas. The results tend to have higher statistical significance in larger metropolitan areas. These results are consistent with the notion of critical neighborhood size, as a percentage point increase in the fraction of highly educated blacks in a large versus small metropolitan area obviously represents a larger increase in the number of highly educated blacks in the MSA.

In line with the predictions of our theoretical model, a qualitatively different pattern begins to emerge in large metropolitan areas. In particular, the increased exposure of highly educated blacks to other blacks is dominated by an increased exposure to other highly educated blacks. Thus, for this subsample, an increase in the average education of the black population might be associated with the formation of predominantly highly educated, segregated black neighborhoods. Not surprisingly, the relative exposure of less-educated blacks to educated neighbors declines most markedly in this sub-sample, marking the only specification where this effect even borders on statistical significance. Thus, the results for large metropolitan areas correspond well to the predictions of the model related to an increase in the fraction of highly educated blacks from a moderate to a large number.

5 Robustness to Alternative Explanations

The cross-sectional finding of a positive relationship between residential segregation and black educational attainment at the metropolitan level is in many ways a surprising result. As noted in the Introduction, most first-order explanations for such a relationship in the literature would imply

a negative relationship. Motivated by the short supply of middle class black neighborhoods in most MSAs, we argue that the impact of increased black educational attainment on the formation of such neighborhoods provides a potential explanation for this positive relation. In this section, we consider other potential explanations for a positive correlation between black segregation and educational attainment.

For the empirical analysis reported in Section 4, we used Census Tract summary file (SF3) data. The advantage of the tract level data is that we are able to observe an individual’s neighborhood at the geographically disaggregated level of a Census tract. The disadvantage, however, is that the data are summarized at the tract level and we are unable to observe the whole vector of individual characteristics that the Census actually collects. In this section, we will instead rely on another organization of the Census, the Public Use Microsample (PUMS data). Relative to the data from the Census summary files, the PUMS data specify the geographic location of an individual’s residence in terms of a much larger region, about 20-30 times larger than a tract – a Census PUMA; but PUMS data have the advantage that they are at the individual level.²⁷

5.1 Reverse Causality: Reconciliation with Cutler and Glaeser (1997)

As discussed above, the primary reason that finding a positive correlation between black segregation and educational attainment (measured at the metropolitan level) is surprising is that Cutler and Glaeser [10] report a negative correlation when running essentially the reverse regression for individuals *aged 20-30*. In this subsection, we present a detailed analysis that reconciles the findings of these two studies.

CG run a series of regressions that relate individual education, fertility, and labor market outcomes to individual and metropolitan characteristics. Their primary focus is on isolating the effect of living in a more segregated metropolitan area on these outcomes for blacks relative to whites. The effect is summarized as the coefficient on the interaction of a measure of metropolitan segregation and a dummy variable that indicates whether the individual is black. The regressions that relate most directly to our primary findings involve college education as the dependent variable. Here, the coefficient estimates on the interaction term describe the correlation between metropoli-

²⁷Using PUMAs rather than tracts as the geographic unit to define the left-hand side variables in the regressions specified in regression equation (2) results in coefficient estimates that are qualitatively similar to those reported in Table 7. As would be expected, the magnitudes are slightly smaller in this case due to the use of a larger geographic unit. Details are available from the authors upon request.

tan segregation and the relative educational attainment of blacks, holding the attainment of whites constant. They report results both from OLS regressions and IV regressions, where they instrument for segregation with a number of alternative variables designed to isolate the causal effect of residential segregation on outcomes.

[Table 8 About Here]

To reconcile our results with CG's, we begin with their OLS results. Table 8 reports the coefficient on the interaction between their metropolitan dissimilarity measure and whether an individual is black, first replicating their results for age groups 20-24 and 25-30 and then reporting analogous coefficients for individuals between the ages of 31-40, 41-50, 51-60, and 61-70, respectively. The coefficients for older individuals reveal a markedly *different* pattern from those for younger individuals. Focusing specifically on college education and earnings, which most closely correspond to our definition of highly educated (or high SES), the coefficients reverse sign from negative to positive starting for individuals slightly older than those studied by CG. From a purely mechanical perspective, this age profile reconciles the results presented in our paper with those in CG, thereby implying that the overall positive correlation that we report in Section 4 is driven primarily by older individuals.

The primary results presented in CG are not the OLS results replicated here, but a series of IV estimates that instrument for metropolitan segregation with three alternative instruments designed to isolate the causal impact of segregation on outcomes. CG motivate this IV approach by suggesting that their negative coefficient estimates from OLS regressions might be attributable to within-metropolitan sorting, namely that segregation might be higher in metropolitan areas where blacks had poor socioeconomic characteristics relative to whites as a result of sorting on the basis of socioeconomic characteristics. Importantly, however, when they instrument for segregation, the point estimate on the interaction between black and segregation in the college degree and log earnings regressions becomes *more negative* in every case (for both age groups and with each alternative instrument - a total of 12 regressions). This suggests that the reverse channel of causality (within metropolitan-area sorting) is actually working against their result, causing the correlation between black socioeconomic status and metropolitan segregation to move in a positive rather than a negative direction.²⁸

²⁸ Another superficial difference between Cutler and Glaeser [10] and our work, which is not important in explaining the differences in the cross-sectional correlations reported in each paper, relates to the measure of segregation. In

In this way, the full set of results reported in CG (OLS and IV) along with our results in this paper can be fully reconciled as the operation of the mechanisms that form the focus of the two papers, with each mechanism working to obscure the other in the data. Because many individuals migrate across metropolitan areas in early adulthood and metropolitan level segregation evolves (slowly) over time, one would generally expect the negative relationship between segregation in an individual’s current MSA and educational outcomes related to the CG mechanism to be strongest for the youngest cohort of adults. (This is why they study young adults in the first place.) Conversely, the positive correlation between average black educational attainment and metropolitan segregation related to the within-metro sorting mechanism that we identify should be strongest among older cohorts. These individuals collectively have had the greatest amount of time to influence the metropolitan neighborhood structure and consequently also the segregation levels in the MSA in which they reside.

It is important to point out that potential alternative explanations for the age profile revealed in Table 8 do not appear plausible. First, a similar age profile to that reported in Table 8 for the 1990 Census (not shown in the tables) emerges in the 1980 and 2000 Censuses for both college degree and earnings regression. This suggests that alternative interpretations of the profile as a cohort rather than age profile are unlikely to hold.²⁹ For 1980, 1990, and 2000, we have also conducted analyses of across-metro sorting analogous to the next subsection of our paper and the across-metro sorting analysis in CG. These analyses suggest little change in the nature of across-metro sorting as it relates to the correlation of metropolitan segregation and black educational attainment over the past three decades, making alternative explanations for the age profile related to across-metro sorting unlikely as well.

particular, we use race/education specific exposure rates as our measure of segregation while they use MSA-level dissimilarity indices. The dissimilarity index, proposed by Duncan and Duncan [12], is an aggregate-level measure capturing the fraction of blacks that would have to switch areas to achieve an even racial distribution citywide (see Cutler, Glaeser and Vigdor [11] for more discussion). See footnote ?? for the construction of exposure rates.

²⁹Also of note, Collins and Margo (2000) report the key coefficient from a series of CG-style regressions for $\ln(\text{earnings})$ of individuals aged 20 to 30 as far back as the 1940 and 1950 Censuses. They report a statistically insignificant effect of roughly the same magnitude as that reported by CG for 1990.

5.2 Across-Metropolitan Area Sorting: Do Middle-Class Black Neighborhoods Attract Highly Educated Blacks?

Another potential explanation for the existence of a correlation between metropolitan population characteristics and segregation relates to across-metropolitan area sorting, instead of the within-metro sorting that we highlighted in our endogenous neighborhood formation story. Fortunately, the Census PUMS microdata contain information on the metropolitan area in which each individual lived *five years prior to the Census*. Using these data, we consider two aspects of across-metropolitan area sorting. We begin by examining whether highly educated blacks are drawn disproportionately to metropolitan areas that have a larger number of middle-class black neighborhoods. Such a migration pattern would arise as a prediction from an extended version of our model that allowed for migration across MSAs. Such migration patterns might generate another form of a reverse causation problem for our primary cross-sectional results. That is, while our main hypothesis relates to the impact of population characteristics on the equilibrium structure of neighborhoods in a city (e.g., segregation levels), sorting of this kind implies that neighborhood structure affects population characteristics through its impact on migration.

[Table 9 About Here]

To explore this issue further, Table 9 reports the results of a series of regressions that relate the neighborhood structure in an individual's current metropolitan area to a set of individual education-race categories for a sample of individuals aged 20-30, these younger adults being much more likely than others to move to a new metropolitan area during a given five-year period.

The dependent variable in the set of regressions shown in columns 1-3 is the number of tracts in the individual's current MSA that are at least 60% black and 40% college-educated. The regression shown in column 1 is estimated on a sample of individuals that moved to a new MSA between 1995 and 2000 and includes fixed effects for the MSA in which the individual resided in 5 years ago. In essence, this specification compares the characteristics of newly-chosen metropolitan areas for two individuals who resided in the same metropolitan area five years ago. The results clearly demonstrate that college-educated blacks are more likely to choose metropolitan areas with a greater number of neighborhoods that are at least 60% black and 40% college-educated than all other types of individuals. For example, relative to college-educated whites leaving the same MSA, college-educated blacks choose MSAs that have an average of 0.9 more tracts meeting these criteria (the average number of such tracts for all U.S. metropolitan areas is only 0.3). Such sorting is clearly

consistent with the notion that metropolitan areas with a higher fraction of middle-class black neighborhoods are particularly attractive to college-educated blacks, a finding consistent with our specification of blacks’ preferences in our model and the fact that most U.S. metropolitan areas contain a very limited number of middle-class black neighborhoods.

To explore whether this kind of across-metropolitan sorting is likely to lead to the aforementioned reverse causation problem, columns 2-3 in Table 9 report the results of corresponding specifications for individuals who do and do not migrate across MSAs during this five-year period respectively, dropping the fixed effects for the lagged MSA.³⁰ The resulting coefficients reveal a remarkably similar pattern to those reported in column 1. That an almost identical pattern obtains for stayers implies that the proportion of college-educated blacks in the sample of migrants into MSAs with a greater number of middle-class black neighborhoods is roughly the same as the proportion of college-educated blacks already residing in these MSAs. Thus, while college-educated blacks do, in fact, systematically migrate to MSAs with a high number of middle-class black neighborhoods, this migration does not systematically change the socioeconomic structure of these MSAs. In turn, this pattern of migration does not systematically contribute to cross-sectional differences in metropolitan area composition, allowing us to rule out this type of sorting as an explanation for our baseline positive cross-sectional relationship between segregation and black educational attainment.

Columns 4-6 repeat the analysis using the number of tracts in the individual’s current MSA that are at least 40% black and 40% college-educated. These results again reveal the same patterns.

5.3 Across-Metropolitan Area Sorting: Selection Based on Unobservable Taste for Segregation

A second aspect of across-metro sorting that might pose problems for our analysis is related to unobservable characteristics. In particular, if those highly educated blacks who live in metropolitan areas with a more educated black population have stronger unobserved tastes for segregation, this would lead to a positive cross-sectional correlation between segregation and educational attainment unrelated to within-metropolitan area sorting.

To explore the possibility of selection bias, we again make use of the information on the metropolitan area in which each individual resided in 1995. In particular, we decompose the sociodemographic composition of each individual’s current metropolitan area $\mathbf{X}_{m(2000)}$ into two components: the first component, the “lagged measure” $\mathbf{X}_{m(1995)}$, gives the composition of the metropolitan area

³⁰We could not include additional fixed effects for the lagged MSA for stayers since they did not move.

in which that person lived five years ago; the second component, called the “differenced measure” $\Delta \mathbf{X}_m \equiv \mathbf{X}_{m(2000)} - \mathbf{X}_{m(1995)}$, is the difference between the composition of the current metropolitan area and the lagged measure.³¹ Note that $\mathbf{X}_{m(2000)} \equiv \mathbf{X}_{m(1995)} + \Delta \mathbf{X}_m$. For the 90 percent of the population who did not move, the differenced measure is zero, while for movers, this difference reflects the change in metropolitan area sociodemographics associated with their move. We then include distinct interaction terms with both measures in a specification analogous to regression (2) used to generate our baseline cross-sectional results in Tables 7:

$$Y_{i,m(2000)} = \alpha_m + \beta \mathbf{X}_i + \gamma_1 \mathbf{X}_i \cdot \mathbf{X}_{m(1995)} + \gamma_2 \mathbf{X}_i \cdot \Delta \mathbf{X}_m + u_{im}. \quad (3)$$

The estimated coefficients on the lagged measure $\mathbf{X}_{m(1995)}$ versus differenced measures $\Delta \mathbf{X}_m$ indicate the direction of the selection bias: $\gamma_1 > \gamma_2$ would indicate a negative selection bias, while $\gamma_1 < \gamma_2$ indicates a positive selection bias. To see this concretely, suppose for illustration that we run a regression in which $Y_{i,m(2000)}$ measures exposure to blacks and we are interested in the coefficient on interactions with the fraction of highly educated blacks in the metropolitan area. If sorting is purely random with respect to the metropolitan population characteristics, we would expect that the coefficient estimates of γ_1 and γ_2 to be the same (and be equal to the estimate of γ in specification (2)) because current metropolitan characteristics affect all individuals equally. If γ_1 exceeds γ_2 , this implies that, relative to the existing residents of an MSA, individuals migrating from a metropolitan area with a smaller fraction of highly educated black households choose neighborhoods with a smaller fraction of blacks. This implies that, on average, the unobserved taste for segregation (u_{im}) among in-migrants from metropolitan areas with a lower fraction of highly educated blacks must be lower than that of existing residents, thus implying a negative selection bias.³²

[Table 10 About Here]

³¹The subscripts $m(2000)$ and $m(1995)$ denote an individual’s metropolitan area in 2000 and five years prior, respectively.

³²More formally, one needs to make an assumption about the initial distribution of the unobserved taste for segregation u_{im} across metropolitan areas. The comparison of γ_1 and γ_2 serves as a test for selection bias if one assumes that u_{im} is fixed and distributed independently across metropolitan areas at birth. Given some form of migration costs, a positive selection bias would imply that the average u_{im} among in-migrants from metropolitan areas with a smaller fraction of educated blacks would be higher than that of existing residents even allowing for the possibility of migration in previous periods.

Table 10 shows results for analysis comparable to that of Table 7. Because the analysis presented here is based on the 2000 Census PUMS, the definition of neighborhood is the Census PUMA. In each of panels, therefore, the first specification repeats our baseline analysis making this change. As in Table 7, Table 10 summarizes the effect of a one percent increase in the fraction of college-educated blacks in the MSA, holding the fraction of blacks constant. The two panels summarize results for blacks with some college or more and a high school degree or less, respectively, and should be compared with the results presented in column 2 of Table 7. As the initial specification reported in each panel reveals, the results remain statistically significant and only slightly smaller in magnitude than those presented in column 2 of Table 7.

Examining the results when metropolitan measures are decomposed into lagged and differenced measures reveals that $\gamma_1 > \gamma_2$ in all cases. This implies that new migrants to MSAs with high average black educational attainment coming from MSA with lower levels of black educational attainment tend to locate in less segregated neighborhoods upon arriving than otherwise identical longer-term residents of these MSAs. Taken together, these results suggest that across-metro sorting on the basis of unobservables introduces a slight negative selection bias in our main results.

5.4 Time-Series Evidence

Having explored the robustness of our cross-sectional results in detail, we now conclude our empirical analysis by presenting time-series evidence on the relationship between metropolitan structure and segregation. In particular, we regress a measure of the change in the metropolitan level dissimilarity index between 1990 and 2000 on measures of the changes in the sociodemographic composition of the metropolitan area. The results of this regression are summarized in Table 11, which shows a strong positive relationship between the change in the fraction of blacks with a college degree in the population and segregation.

[Table 11 About Here]

Again, it is straightforward to use the coefficients of Table 11 to compute the effect of a one percent increase in the fraction of highly educated blacks holding the fraction of blacks constant, by subtracting the second coefficient from the first. Regression results are presented with and without weighting by the population of the metropolitan area. The results clearly show that metropolitan areas that experienced an increase in average black educational attainment between 1990 and 2000 saw an marked increase in segregation over this period.

6 Implications and Conclusion

In this paper, we presented a new hypothesis to the effect that residential segregation will rise - somewhat counter-intuitively - when racial differences in education and other sociodemographics decline. We motivated our hypothesis by documenting that middle-class black neighborhoods are in short supply given the current black sociodemographic structure in many U.S. metropolitan areas, forcing high-SES blacks either to live in predominantly white neighborhoods with high levels of neighborhood amenities or in more black neighborhoods with lower amenity levels. Using a simple model of residential choice, we showed that, under certain conditions, increases in black educational attainment (proxying for SES more generally) would lead to the emergence of new middle-class black neighborhoods, relieving the prior neighborhood supply constraint and leading to increases in residential segregation.

We then presented across-MSA evidence from the 2000 Census indicating that this mechanism does in fact operate: as the proportion of highly educated blacks in an MSA increases, so the segregation of educated blacks and blacks more generally goes up. This change is driven primarily by a large relative increase in exposure to other highly educated blacks and is more than completely offset by a decrease in exposure to highly educated whites. At the same time, highly educated blacks are also increasingly exposed to less-educated blacks and vice-versa. This effect is consistent with the predictions of our theoretical model when moving from a low to a moderate proportion of highly educated blacks in an MSA. We also showed, as far as possible, that our results are robust to concerns related to reverse causation, omitted variable, and selection biases.

As described in the Introduction, our findings relate directly to two of the most important issues in the segregation literature, informing our understanding of the evolution of residential segregation and racial inequality in addition to the residential isolation of poor blacks. In terms of the former, the analysis draws attention to an important negative feedback mechanism which, in conjunction with the mechanism in Cutler and Glaeser [10], serves to inhibit decreases in residential segregation and racial inequality over time.

In terms of the latter, the results have important implications for our understanding of the residential isolation of poorer blacks in the United States, both historically and in the present. Wilson [34] and Cutler, Glaeser and Vigdor [11] argue convincingly that institutional discrimination in the housing market in the middle of the 20th Century forced most blacks to reside in poor inner city neighborhoods, regardless of their ability to afford housing in other parts of the metropolitan area. With reductions in the strength of centralized discrimination that followed later in the century,

the exodus of highly educated blacks from these neighborhoods resulted in substantial reductions in the exposure of less-educated to highly educated blacks (see Wilson [34]).

Our finding that the exposure of highly educated to less-educated blacks (and vice versa) is increasing in the proportion of highly educated blacks in the population indicates that the sustainability of mixed-SES black neighborhoods is rapidly increasing in the proportion of highly educated blacks in the population. Thus, the exodus of highly educated blacks from poor inner city neighborhoods may have been attributable in large part to the lack of a sufficient density of highly educated blacks in the population of most U.S. metropolitan areas at that time. Both our theory and empirical results imply that as this proportion increases, so mixed-SES black neighborhoods should re-emerge in U.S. metropolitan areas. Further, in cases where the proportion of highly educated blacks is sufficiently high, the formation of exclusively high-SES black neighborhoods is predicted, consistent with the observed patterns of black gentrification in some U.S. cities in the latter part of the 20th Century.

As an additional implication, the mechanism uncovered in our analysis also suggests that an increase in the educational attainment of blacks in the U.S. as a whole may lead to a decrease in residential segregation *only if* highly educated blacks are dispersed in many, instead of concentrated in few, MSAs. This echoes Glaeser and Vigdor's [15] finding that segregation is lowest among the rapidly growing cities in the West, where as yet there is an insufficient concentration of highly educated blacks.

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A Model Appendix

In this appendix, we explain precisely how the black marginal types $\{x_h^*, x_l^*\}$ are determined. We first restrict attention to equilibria in which, if a highly educated (less-educated, respectively) black is to choose not to live in community B, she will choose community WH or WH' (community WL or WL' respectively) depending on proximity. Given a pair of thresholds $\{x_l, x_h\}$, the total measure of less- and highly educated blacks in community B are, respectively, $2N\lambda_b(1 - \rho_b)x_l$ and $2N\lambda_b\rho_b x_h$. Thus the total population in community B is $2N\lambda_b[\rho_b x_h + (1 - \rho_b)x_l]$. Moreover, the relevant proportions for community B are

$$p_b(\text{B}) = 1, p_w(\text{B}) = 0, p_h(\text{B}) = \frac{\rho_b x_h}{\rho_b x_h + (1 - \rho_b)x_l}, p_l(\text{B}) = \frac{(1 - \rho_b)x_l}{\rho_b x_h + (1 - \rho_b)x_l}.$$

The utilities for a highly and less-educated black individuals with job location $z \in [0, 1]$ from living in community B are then, respectively:

$$\begin{aligned} V_{\text{B}}^h(z; x_h, x_l) &= \alpha + \beta \left[\frac{\rho_b x_h}{\rho_b x_h + (1 - \rho_b)x_l} + \gamma_2 \frac{(1 - \rho_b)x_l}{\rho_b x_h + (1 - \rho_b)x_l} \right] \\ &\quad - \theta z - c(2N\lambda_b[\rho_b x_h + (1 - \rho_b)x_l]); \\ V_{\text{B}}^l(z; x_h, x_l) &= \alpha + \beta \left(\frac{(1 - \rho_b)x_l}{\rho_b x_h + (1 - \rho_b)x_l} + \gamma_2 \frac{\rho_b x_h}{\rho_b x_h + (1 - \rho_b)x_l} \right) \\ &\quad - \theta z - c(2N\lambda_b[\rho_b x_h + (1 - \rho_b)x_l]). \end{aligned}$$

We can also calculate the utilities from living in communities WH for a highly educated black with job location $z \in [0, 1]$. Given the postulated threshold x_h , the measure of highly educated blacks in community WH is $N\lambda_b\rho_b(1 - x_h)$. Taking account of the measure of highly educated whites in community WH, we have the following proportions:

$$p_b(\text{WH}) = \frac{\lambda_b\rho_b(1 - x_h)}{\lambda_b\rho_b(1 - x_h) + \lambda_w\rho_w}, p_w(\text{WH}) = \frac{\lambda_w\rho_w}{\lambda_b\rho_b(1 - x_h) + \lambda_w\rho_w}, p_h(\text{WH}) = 1, p_l(\text{WH}) = 0.$$

Thus the utility for a highly educated black from living in community WH is:

$$\begin{aligned} V_{\text{WH}}^h(z; x_h) &= \alpha \left[\frac{\lambda_b\rho_b(1 - x_h)}{\lambda_b\rho_b(1 - x_h) + \lambda_w\rho_w} + \gamma_1 \frac{\lambda_w\rho_w}{\lambda_b\rho_b(1 - x_h) + \lambda_w\rho_w} \right] + \beta \\ &\quad - \theta(1 - z) - c(N[\lambda_b\rho_b(1 - x_h) + \lambda_w\rho_w]). \end{aligned}$$

Similarly, the utility for a less-educated black with job location $z \in [0, 1]$ from living in community WL is:

$$\begin{aligned} V_{\text{WL}}^l(z; x_l) &= \alpha \left[\frac{\lambda_b(1 - \rho_b)(1 - x_l)}{\lambda_b(1 - \rho_b)(1 - x_l) + \lambda_w(1 - \rho_w)} + \gamma_1 \frac{\lambda_w\rho_w}{\lambda_b(1 - \rho_b)(1 - x_l) + \lambda_w(1 - \rho_w)} \right] \\ &\quad + \beta - \theta(1 - z) - c(N[\lambda_b(1 - \rho_b)(1 - x_l) + \lambda_w(1 - \rho_w)]). \end{aligned}$$

The equilibrium pair of thresholds (x_l^*, x_h^*) must satisfy

$$V_B^h(x_h^*; x_h^*, x_l^*) = V_{WH}^h(x_h^*; x_h^*), \quad (4)$$

$$V_B^l(x_l^*; x_h^*, x_l^*) = V_{WL}^l(x_l^*; x_l^*). \quad (5)$$

Equation (4) requires that the marginal type for highly educated blacks, x_h^* , is indifferent between living in community B (an all-black mixed-education community) and community WH (a highly educated community with a white majority). Equation (5) requires that the marginal type for less-educated blacks x_l^* is indifferent between living in community B and community WL (a less-educated community with white majority). We assume that the parameters of the model are such that equation system (4) and (5) has solutions.

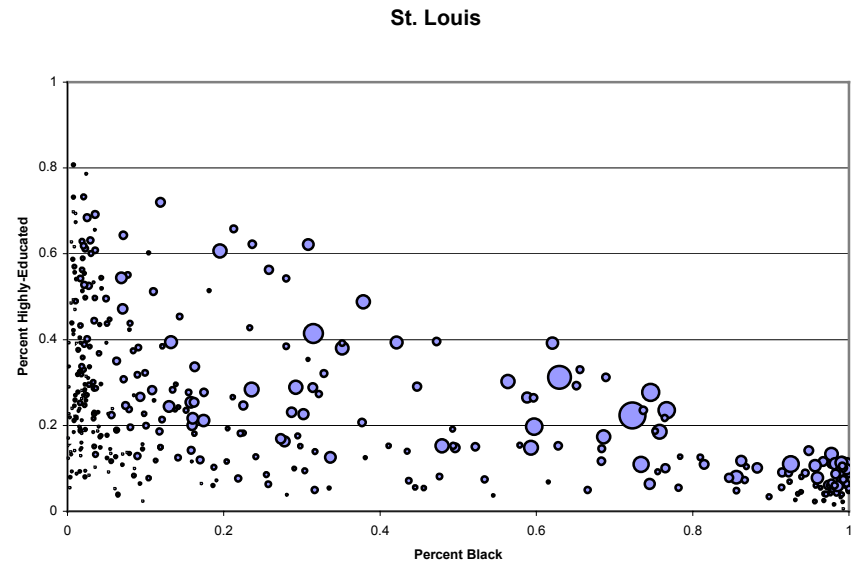
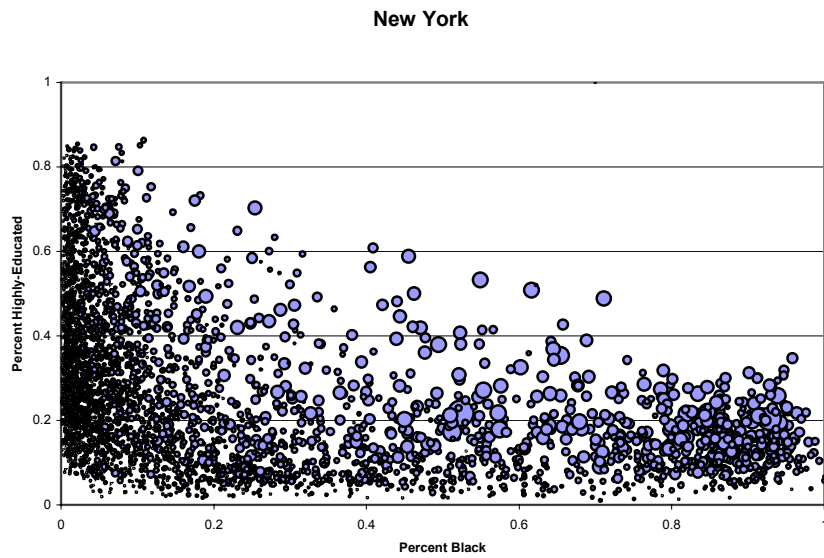
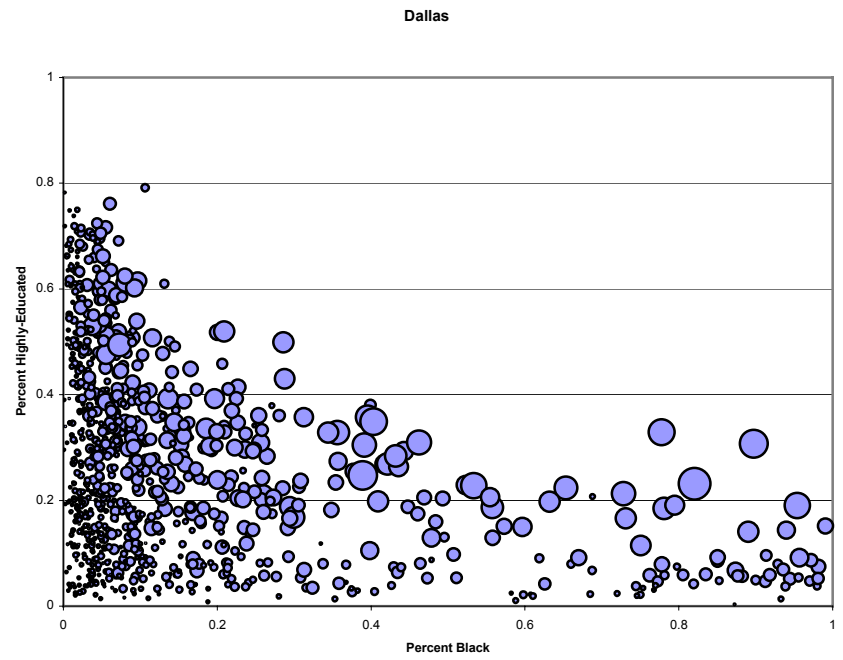
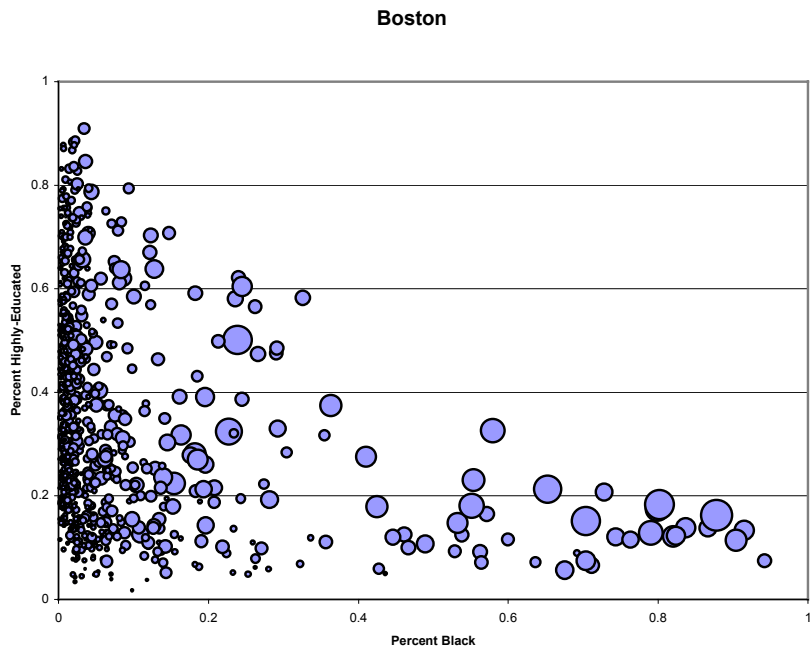


Figure 1: Neighborhood Choice Sets in Boston, Dallas, New York and St. Louis.

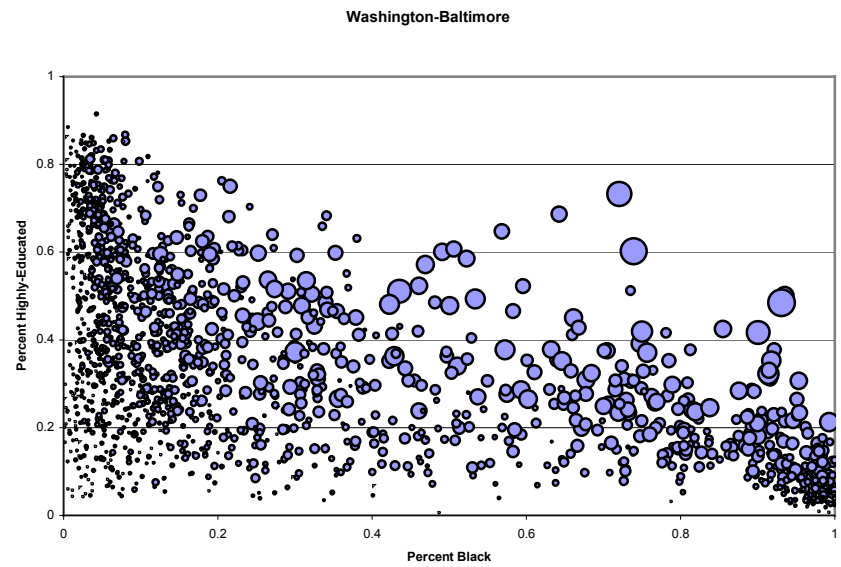
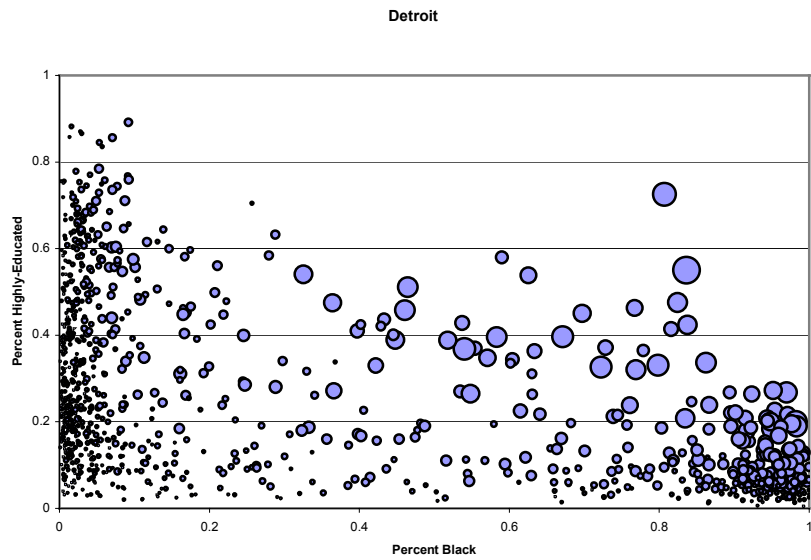
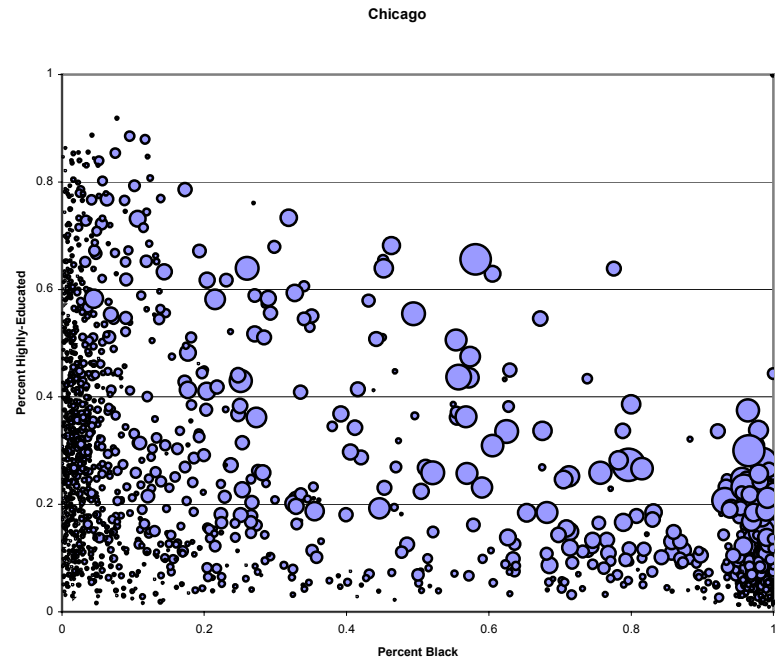
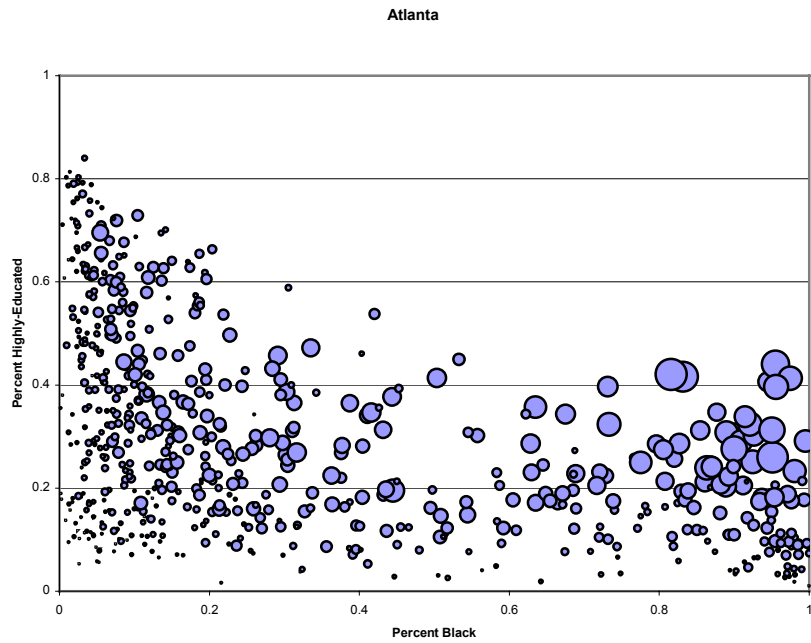


Figure 2: Neighborhood Choice Sets in Atlanta, Chicago, Detroit and Washington DC-Baltimore.

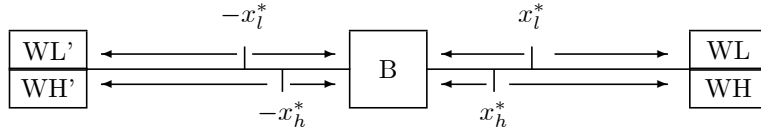


Figure 3: A Graphical Illustration of an Equilibrium.

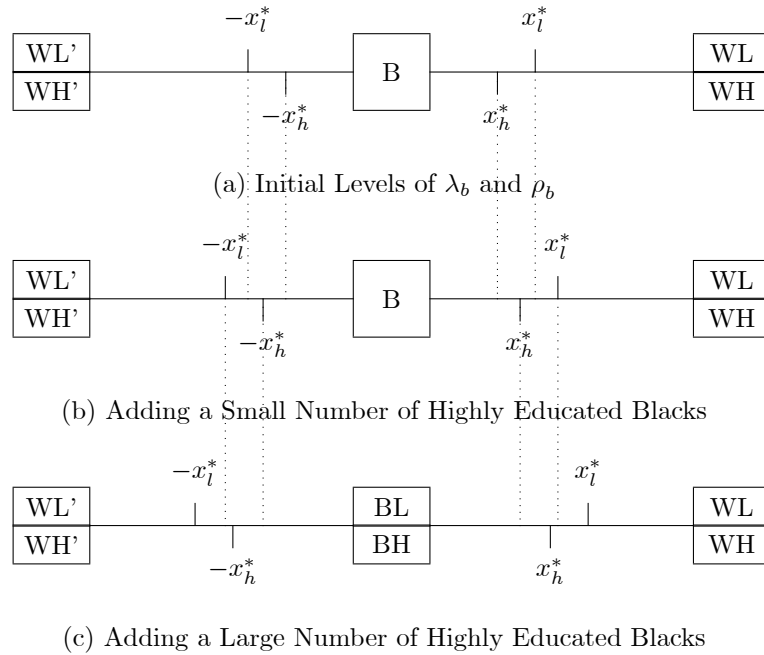


Figure 4: Comparative Statics When We Add Highly Educated Blacks to the Metropolitan Population.

Table 1: Number of Tracts in United States in 2000 by Race and Education

	(1)	(2)	(3)	(4)
	Percent College Degree or More			
	<i>All</i>	<i>>20%</i>	<i>>40%</i>	<i>>60%</i>
Panel A: All Tracts				
(1) All	49,021	26,351	11,094	3,005
	100.0%	53.8%	22.6%	6.1%
Panel B: Tracts by Percent Black				
(2) <i>> 20% Black</i>	9,149	2,567	641	59
	100.0%	28.1%	7.0%	0.6%
(3) <i>> 40% Black</i>	5,657	1,164	142	14
	100.0%	20.6%	2.5%	0.2%
(4) <i>> 60% Black</i>	3,921	623	44	5
	100.0%	15.9%	1.1%	0.1%
(5) <i>> 80% Black</i>	2,559	271	21	1
	100.0%	10.6%	0.8%	0.0%
Panel C: Tracts by Percent White				
(6) <i>> 20% White</i>	43,179	25,178	11,041	2,999
	100.0%	58.3%	25.6%	6.9%
(7) <i>> 40% White</i>	39,602	24,566	10,839	2,967
	100.0%	62.0%	27.4%	7.5%
(8) <i>> 60% White</i>	35,154	22,543	10,214	2,870
	100.0%	64.1%	29.1%	8.2%
(9) <i>> 80% White</i>	26,910	17,539	8,102	2,339
	100.0%	65.2%	30.1%	8.7%

Note: The top number in each cell reports the number of tracts meeting both the education criterion described in the column heading (e.g., greater than 40 percent college-educated) and the race criterion in the row heading (e.g., greater than 40 percent black); the bottom number in each cell reports the number of tracts meeting each race and education criterion as a fraction of the number of tracts meeting each race criterion. Tract compositions are calculated using individuals 25 years and older in U.S. metropolitan areas. Tracts considered in this table have a minimum of 800 such individuals (the average tract in the full sample has slightly over 3,000).

Table 2: Metropolitan Areas with Tracts Combining High Fractions of Black and College-Educated Individuals

	Number of tracts meeting both race and education criteria			Population 25 years and older (in millions)	Fraction black	Fraction of blacks with college degree
	>80%	>60%	>40%			
Percentage black						
Percentage with college degree	>40%	>40%	>40%			
Baltimore-Washington	5	14	33	5.06	0.24	0.21
Detroit	5	8	19	3.51	0.19	0.13
Chicago		3	16	6.11	0.16	0.15
New York		4	15	14.88	0.15	0.17
Los Angeles	4	6	10	11.50	0.06	0.18
Atlanta	5	5	8	2.65	0.26	0.22
Cleveland		1	6	1.96	0.15	0.11
Philadelphia		1	5	4.12	0.17	0.13
San Francisco-Oakland			5	4.95	0.06	0.19
Raleigh-Durham		1	3	0.65	0.12	0.22
Indianapolis			3	1.05	0.12	0.14
Jackson, MS	1	1	2	0.44	0.25	0.17
Houston	1	1	2	3.10	0.15	0.18
Columbia, SC			2	0.59	0.17	0.17
New Orleans			2	0.85	0.33	0.13
All US Metro Areas	21	44	142	154.84	0.11	0.15

Notes: Tract compositions are calculated using individuals 25 years and older in US metropolitan areas. Tracts considered in this table have a minimum of 800 such individuals.

Table 3: Neighborhood Patterns for College-Educated Individuals in the United States

Panel A: College-Educated Blacks

College-educated blacks first ranked within each MSA by percent black in Census tract

Average tract composition reported by corresponding quintile averaging across all MSAs

Quintile	1	2	3	4	5	Total
Percent Black	5.7	14.4	28.3	54.6	78.9	32.0
Percent College-Educated	38.0	31.6	26.2	18.4	13.8	27.2
Percent Black and College-Educated	1.3	3.3	6.2	8.0	10.0	5.2

Panel B: College-Educated Whites

College-educated whites first ranked within each MSA by percent white in Census tract

Average tract composition reported by corresponding quintile averaging across all MSAs

Quintile	1	2	3	4	5	Total
Percent White	55.0	77.9	86.6	90.4	94.5	77.4
Percent College-Educated	27.0	36.2	40.7	39.3	39.2	35.3
Percent White and College-Educated	20.1	30.4	36.2	36.1	37.4	30.4

Note: The panels of the table summarize the average distribution of neighborhoods in which college-educated blacks and whites in U.S. metro areas reside, respectively. To construct the numbers in Panel A, college-educated blacks in each metro area are ranked by the fraction of blacks in their tract and assigned to one of five quintiles. Average neighborhood sociodemographic characteristics are then reported for each quintile, averaging across all metro areas. Panel B reports analogous figures for college-educated whites, first ranking by their tract-level exposure to whites within each MSA. Tract compositions are calculated using individuals 25 years and older in U.S. metropolitan areas.

Table 4: The Availability of Middle-Class Black Neighborhoods in 2000

Dependent Variable:	log(number of tracts in MSA >60% black and >40% college- educated)	log(number of tracts in MSA >60% black and >20% college- educated)	log(number of tracts in MSA >40% black and >40% college- educated)	log(number of tracts in MSA >40% black and >20% college- educated)
	(1)	(2)	(3)	(4)
<u>Metropolitan Composition</u>				
% Black with college degree	42.16 (10.28)	55.70 (11.33)	36.14 (13.35)	38.51 (11.37)
% Black with less than college degree	-4.51 (1.83)	0.49 (2.34)	-1.52 (2.42)	5.22 (2.21)
% White with college degree	-1.64 (1.20)	1.06 (1.49)	0.49 (1.55)	3.52 (1.62)
% White with less than college degree	0.06 (0.57)	1.77 (0.73)	-0.21 (0.65)	1.84 (0.81)
Log (population)	0.257 (0.073)	0.635 (0.095)	0.392 (0.099)	0.661 (0.087)
N	267	267	267	267

Notes: The four regressions reported in this table relate various measures of the availability of middle-class black neighborhoods to the sociodemographic composition of the metropolitan area. Metropolitan-level observations are weighted by population. Standard errors are reported in parentheses.

Table 5: Neighborhood-Level Composition by Race and Education**Panel A: All Metropolitan Areas**

<u>Individual</u>	Neighborhood Composition relative to Metro Area ($Z_n - Z_m$)			
	% Black College Degree	% Black < College Deg	% Black	% College Degree
Black with less than college degree	0.021	0.196	0.217	-0.063
Black with college degree	0.026	0.133	0.159	-0.021
White with less than college degree	-0.003	-0.014	-0.017	-0.009
White with college degree	-0.001	-0.010	-0.011	0.044

Panel B: Metropolitan Areas Below Median Fraction of College-Educated Blacks (<1.23 percent)

<u>Individual</u>	Neighborhood Composition relative to Metro Area ($Z_n - Z_m$)			
	% Black College Degree	% Black < College Deg	% Black	% College Degree
Black with less than college degree	0.013	0.111	0.124	-0.038
Black with college degree	0.016	0.078	0.094	0.005
White with less than college degree	-0.001	-0.006	-0.007	-0.004
White with college degree	0.000	-0.007	-0.007	0.045

Panel C: Metropolitan Areas Above Median Fraction of College-Educated Blacks (>1.23 percent)

<u>Individual</u>	Neighborhood Composition relative to Metro Area ($Z_n - Z_m$)			
	% Black College Degree	% Black < College Deg	% Black	% College Degree
Black with less than college degree	0.024	0.220	0.244	-0.070
Black with college degree	0.028	0.147	0.175	-0.027
White with less than college degree	-0.005	-0.024	-0.029	-0.014
White with college degree	-0.002	-0.012	-0.014	0.043

Note: Table reports average neighborhood (tract) characteristics Z_n for individuals in the race-education category shown in row heading relative to average composition of the individual's metropolitan area Z_m . Average compositions are reported for all metropolitan areas (Panel A) and for metro areas in which less than (Panel B) and more than (Panel C) 1.23 percent of the population is college educated and black, respectively. Tract and metropolitan compositions are calculated using individuals 25 years and older in U.S. metropolitan areas.

Table 6: Fixed Effects Regression of Neighborhood Composition on Interactions of Individual and Metro Characteristics

Dependent Variable:	Neighborhood (Tract) Composition			
	% Black Col Deg	% Black < Col Deg	% Black	% College Degree
	(1)	(2)	(3)	(4)
Individual_BlackHighEd*	0.968	3.040	4.008	-1.261
Metro_%BlackHighEd	(0.201)	(1.575)	(1.720)	(0.861)
Individual_BlackHighEd*	-0.065	0.069	0.004	0.128
Metro_%BlackLowEd	(0.062)	(0.360)	(0.413)	(0.124)
Individual_BlackHighEd*	-0.058	-0.257	-0.315	0.070
Metro_%WhiteHighEd	(0.018)	(0.091)	(0.104)	(0.042)
Individual_BlackHighEd*	0.000	0.148	0.149	0.066
Metro_%WhiteLowEd	(0.024)	(0.091)	(0.113)	(0.033)
Individual_BlackLowEd*	1.022	4.911	5.933	-2.340
Metro_%BlackHighEd	(0.119)	(1.983)	(2.030)	(1.295)
Individual_BlackLowEd*	-0.086	-0.062	-0.148	0.319
Metro_%BlackLowEd	(0.040)	(0.399)	(0.427)	(0.185)
Individual_BlackLowEd*	-0.039	-0.325	-0.364	0.191
Metro_%WhiteHighEd	(0.014)	(0.094)	(0.105)	(0.045)
Individual_BlackLowEd*	0.014	0.218	0.232	0.079
Metro_%WhiteLowEd	(0.017)	(0.124)	(0.140)	(0.044)
Individual_BlackHighEd	0.023	0.030	0.053	-0.007
	(0.015)	(0.060)	(0.073)	(0.024)
Individual_BlackLowEd	0.011	0.049	0.059	-0.086
	(0.011)	(0.078)	(0.088)	(0.029)
Individual_WhiteHighEd	-0.004	-0.038	-0.041	0.094
	(0.002)	(0.011)	(0.011)	(0.014)
Individual_WhiteLowEd	-0.005	-0.037	-0.041	0.035
	(0.002)	(0.010)	(0.012)	(0.012)
Includes MSA Fixed Effects	Yes	Yes	Yes	Yes

Note: All regressions include metropolitan area fixed effects. 'High Ed' refers to individuals with a college degree and 'Low Ed' refers to those with less than a college degree. Each regression is estimated on the sample of individuals 25 years and older in US metropolitan area (about 155 million observations when Census weights are applied). Tract and metropolitan compositions are calculated using this same sample. Standard errors adjusted for clustering at the metropolitan area level are reported in parentheses.

Table 7: Predicted Change in Neighborhood Composition relative to Metropolitan Average ($Z_n - Z_m$)

Estimated effect of a one percent increase in fraction of highly-educated blacks in MSA

	Panel 1		Panel 2		Panel 3		Panel 4		Panel 5		Panel 6		Panel 7	
Sample:	Full Sample		Full Sample		Full Sample		Full Sample		Full Sample		MSA Pop < 200K		MSA Pop 200-600K	
Definition of 'High Ed':	Col. Deg. or More		Col. Deg. or More		Col. Deg. or More		Some Col. or More		Some Col. or More		Some Col. or More		Some Col. or More	
Race-Education category decreased by one percent	Omitted Category: Asians; Hispanics		High-Ed Whites		Low-Ed Blacks		Low-Ed Blacks		Low-Ed Blacks		Low-Ed Blacks		Low-Ed Blacks	
Individual:	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>	<i>Black</i>
	<i>High Ed</i>	<i>Low Ed</i>	<i>High Ed</i>	<i>Low Ed</i>	<i>High Ed</i>	<i>Low Ed</i>	<i>High Ed</i>	<i>Low Ed</i>	<i>High Ed</i>	<i>Low Ed</i>	<i>High Ed</i>	<i>Low Ed</i>	<i>High Ed</i>	<i>Low Ed</i>
Change in Rel. Neighborhood Exposure ($Z_n - Z_m$)														
% Black & High Ed	0.010	0.011	0.010	0.011	0.010	0.011	0.027	0.027	0.023	0.021	0.001	0.003	0.012	0.012
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.644</i>	<i>0.311</i>	<i>0.015</i>	<i>0.001</i>
% Black & Low Ed	0.030	0.049	0.033	0.052	0.030	0.050	0.017	0.031	0.014	0.025	0.001	0.011	0.013	0.016
	<i>0.055</i>	<i>0.014</i>	<i>0.034</i>	<i>0.009</i>	<i>0.119</i>	<i>0.038</i>	<i>0.159</i>	<i>0.017</i>	<i>0.176</i>	<i>0.035</i>	<i>0.892</i>	<i>0.104</i>	<i>0.063</i>	<i>0.046</i>
% Black	0.040	0.059	0.043	0.064	0.040	0.061	0.044	0.058	0.038	0.046	0.002	0.014	0.025	0.028
	<i>0.020</i>	<i>0.004</i>	<i>0.012</i>	<i>0.002</i>	<i>0.057</i>	<i>0.012</i>	<i>0.014</i>	<i>0.003</i>	<i>0.006</i>	<i>0.003</i>	<i>0.810</i>	<i>0.119</i>	<i>0.022</i>	<i>0.012</i>
% Highly Educated	-0.013	-0.023	-0.013	-0.025	-0.014	-0.027	-0.003	-0.013	-0.002	-0.011	-0.005	0.002	-0.001	-0.002
	<i>0.144</i>	<i>0.072</i>	<i>0.071</i>	<i>0.052</i>	<i>0.156</i>	<i>0.126</i>	<i>0.680</i>	<i>0.094</i>	<i>0.869</i>	<i>0.351</i>	<i>0.471</i>	<i>0.653</i>	<i>0.849</i>	<i>0.758</i>
Includes interactions with region and population?	No		No		No		No		Yes		Yes		Yes	

Note: This table summarizes the predicted change in the average composition of tracts in which blacks with and without a college degree, respectively, reside given a one percent increase in the fraction of highly-educated blacks in the metropolitan area. Panels 1-3 report results for the full sample under alternative assumptions about which race-education category is decreased by one percent when the proportion of highly-educated blacks increases. Panel 4 considers an alternative definition of 'highly-educated'. Panel 5 adds controls for metropolitan size and region. Panels 6-7 report results for metropolitan size. The coefficients report the change in tract composition relative to the metropolitan average, i.e., over and above the mechanical effect of changing the metropolitan size. The coefficients adjusted for clustering at the metropolitan level are reported in italics.

Table 8. Cutler-Glaeser Education and Earnings Regressions by Age
Coefficient on interaction between black and metropolitan segregation (dissimilarity index)

Dependent Variable	Age of Sample					
	20-24	25-30	31-40	41-50	51-60	61-70
College Graduation	-0.094 (0.032)	-0.064 (0.062)	0.002 (0.069)	0.074 (0.059)	0.070 (0.046)	0.034 (0.054)
Ln(Earnings)	-0.786 (0.140)	-0.433 (0.094)	-0.026 (0.084)	0.239 (0.092)	0.411 (0.131)	0.081 (0.280)

Notes: This table reports the results of a series of regressions based on the specification used in Cutler and Glaeser (1997) to generate Table IV. The specification includes individual characteristics [Black, Asian, Other nonwhite, Hispanic, Female], metropolitan characteristics [Segregation, ln(population), Percent black, ln(median household income), Manufacturing share] and interactions of these metropolitan characteristics with whether the individual is black. The coefficient on Black*Segregation is reported here for four individual outcomes and for six age ranges. Cutler and Glaeser report results for individuals between the ages of 20-24 and 25-30, respectively. The coefficients reported for these ages are not identical to those reported in Cutler and Glaeser but are very close. This is most likely attributable to the fact that we use the 5 percent sample of the 1990 Census while the 1 percent sample is used in Cutler and Glaeser. All other measures should be identical as we used the metropolitan characteristics used by Cutler and Glaeser, which Jacob Vigdor has graciously made available on his website.

Table 9: Assessing Across-Metropolitan Sorting on Observable Characteristics

Dependent Variable:	Number of tracts in MSA >60% Black and >40% College-Educated			Number of tracts in MSA >40% Black and >40% College-Educated		
	Sample:	Movers	Movers	Stayers	Movers	Movers
<u>Individual Characteristic:</u>	(1)	(2)	(3)	(4)	(5)	(6)
Black with college degree	1.075 (0.107)	1.165 (0.147)	0.903 (0.812)	2.702 (0.254)	3.104 (0.326)	2.798 (1.198)
Black with less than college degree	0.197 (0.054)	0.253 (0.087)	0.380 (0.681)	0.079 (0.129)	0.372 (0.186)	1.463 (1.293)
White with college degree	0.157 (0.053)	0.170 (0.094)	-0.248 (0.577)	0.833 (0.110)	1.144 (0.160)	0.126 (0.950)
White with less than college degree	-0.499 (0.052)	-0.561 (0.075)	-0.704 (0.562)	-1.380 (0.139)	-1.446 (0.141)	-1.609 (0.969)
Includes fixed effects for MSA of residence 5 years prior to Census?	Yes	No	No	Yes	No	No

Notes: The six regressions reported in this table relate a measure of the availability of middle-class black neighborhoods to an individual's race-education category. All regressions use a sample of individuals aged 20-30 in 2000. Separate regressions are reported for individuals that moved between metro areas and those that did not in the five years prior to the 2000 Census. For movers, a specification that includes fixed effects for the metro area of residence in 1995 is also reported. Standard errors adjusted for clustering at the metropolitan level are reported in parentheses.

Table 10: Assessing Sorting on Unobservables: Including Lagged and Differenced Metro Area Composition

Estimated effect of a one percent increase in fraction of highly-educated blacks in MSA holding the fraction of blacks constant.

Individual:		Panel 1	Panel 2
		<i>Black - Some college or more</i>	<i>Black - HS degree or less</i>
<i>Neighborhood Measure</i>	<i>Time-Period</i>		
	Current (2000)	0.023 <i>0.000</i>	0.024 <i>0.000</i>
% PUMA	Lagged (1995)		0.024 <i>0.000</i>
Black - Some college or more	Differenced (2000-1995)	0.017 <i>0.000</i>	0.020 <i>0.000</i>
	Current (2000)	0.010 <i>0.092</i>	0.022 <i>0.008</i>
% PUMA	Lagged (1995)		0.011 <i>0.085</i>
Black - HS degree or less	Differenced (2000-1995)	0.004 <i>0.722</i>	0.011 <i>0.226</i>
	Current (2000)	0.033 <i>0.001</i>	0.046 <i>0.000</i>
% PUMA	Lagged (1995)		0.035 <i>0.001</i>
Black	Differenced (2000-1995)	0.020 <i>0.076</i>	0.031 <i>0.010</i>

Note: The first column of each panel corresponds to results presented in column 2 of Table 7 using Census PUMAs rather than tracts as the definition of neighborhood. The results summarize the predicted change in the relative PUMA-level exposure of indivi

Table 11: Relating Changes in Segregation to Changes in Metropolitan Composition

Dependent Variable: Weights:	Change in Dissimilarity Index (1990-2000)	
	MSA Population	None
<u>Change in Metropolitan Characteristics (1990-2000)</u>		
% Black w/ College-Degree	3.013 (0.822)	3.472 (0.632)
% Black w/ Less Than College-Degree	-0.214 (0.293)	-0.040 (0.238)
% White w/ College-Degree	0.051 (0.191)	-0.004 (0.174)
% White w/ Less Than College-Degree	0.052 (0.170)	0.310 (0.148)
Population (in millions)	-0.0017 (0.0009)	-0.0031 (0.0012)
Constant	-0.056 (0.009)	-0.042 (0.007)
N	220	220

Notes: The table reports coefficients and standard errors from two regressions of the change in the metropolitan dissimilarity index between 1990 and 2000 on the change in metropolitan composition over this same period. Rsegressions are based on the sample of metropolitan areas that appear in both 1990 and 2000 and are reported with and without weighting by metropolitan population.