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ABSTRACT

This paper hypothesizes that segregation in US cities increases as racial inequality narrows due to the emergence of middle-class black neighborhoods. Employing a novel research design based on life-cycle variations in the relationship between segregation and inequality, we test this hypothesis using the 1990 and 2000 Censuses. Indeed, increased black educational attainment in a city leads to a significant rise in the number of middle-class black communities and segregation for older adults both in the cross-section and over time, consistent with our hypothesis. These findings imply a negative feedback loop that inhibits reductions in racial inequality and segregation over time.

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1 Introduction

Residential segregation has long been established as an important barrier to the narrowing of historical racial differences in education, income, and wealth in the United States. Cutler and Glaeser (1997) have shown convincingly, for example, that young blacks have significantly worse educational and labor market outcomes than whites in more segregated cities. The extent of racial inequality in a city also affects the way that households sort across neighborhoods, thereby influencing the level of segregation that arises in equilibrium. In this way, residential segregation and racial inequality are linked in an intergenerational feedback loop, with today's level of segregation affecting future inequality, which in turn alters the extent of segregation to emerge in the city.

This feedback loop has potentially important consequences for the long-run persistence of racial differences in education and income. As such, the task of understanding both the character of the feedback (whether positive or negative in nature) and the strength of the contributing forces is of general policy interest. Yet while the first part of this loop – the effect of segregation on racial inequality – has been well-studied, the second part – how racial inequality affects the extent of segregation in a city – has received less attention, possibly because the nature of this relationship seems obvious. For example, given that higher-income households are likely to sort into neighborhoods with bigger houses and better amenities, we might naturally expect greater racial inequality to lead to more racial segregation, implying a *positive* segregation-inequality relationship, simply because of sorting in dimensions correlated with race.[1]

In this paper, we explore a neighborhood formation mechanism that may generate a *negative* relationship between residential segregation and racial inequality, in contrast to the standard intuition. Decentralized residential choice implies that the neighborhood choice set is endogenous, with the characteristics of the available neighborhoods in a city being determined in equilibrium through household sorting. With this in mind, suppose that the proportion of highly educated blacks were to increase from a previously low level, holding fixed the educational attainment of whites in the city. This reduction in racial inequality would allow new middle-class black neighborhoods to emerge, and these would likely be attractive to black households, especially among the highly educated, potentially leading to *increases* in residential segregation as households re-sorted.

To formalize our neighborhood formation mechanism, we present a simple equilibrium model of residential choice that serves to link a metropolitan area's sociodemographic composition to its level of neighborhood segregation on the basis of race. If households do not care about the race of their neighbors when deciding where to live, we show that socioeconomic inequality and racial segregation exhibit a monotonic positive relationship; that is, the standard intuition holds, with declines in the level of racial inequality being associated with reductions in segregation. Yet such

[1] Given the correlation between race and socioeconomic status, Schelling (1969, 1971) noted that racial segregation would arise in the housing market even in the absence of explicit sorting on the basis of race.

monotonicity breaks down in the more general case when racial considerations also affect household location choices. Here, if the proportion of highly educated blacks is sufficiently low, the choice set is restricted in the sense that middle-class black neighborhoods are scarce; and facing this choice constraint, highly educated blacks reside in either largely white, highly educated communities or less-educated, predominantly black communities. As the proportion of highly educated blacks in a city increases, this expands the set of available neighborhood options through the emergence of new middle-class black neighborhoods.[2] While segregation may fall initially, at some point the new neighborhood options provide an opportunity for segregation to rise as blacks and especially highly educated blacks move from predominantly white neighborhoods into these new middle-class black neighborhoods. Our model makes explicit how such increases in residential segregation can occur as inequality narrows.

Our focus on neighborhood formation is motivated by three stylized observations about the set of neighborhoods currently available in U.S. metropolitan areas. First, the vast majority of metropolitan areas contain very few middle-class black neighborhoods. Second, given the limited availability of these neighborhoods, a substantial fraction of highly educated blacks (education proxying for socioeconomic status ('SES') more generally) do in fact reside in predominantly white, high-SES neighborhoods, while a substantial fraction of others reside in predominantly black, low-SES neighborhoods. This suggests that many highly educated blacks might well prefer to locate in middle-class black neighborhoods *were they available*.[3] Third, metropolitan areas with a higher proportion of highly educated blacks tend to contain a greater number of middle-class black neighborhoods. Together, these facts make clear that the conditions needed for middle-class black neighborhood formation to influence segregation might obtain in practice. And this raises the *possibility* that, were the proportion of highly educated blacks to increase and thus expand the number of middle-class black neighborhoods (as the descriptive evidence suggests), so an empirically significant increase in segregation could result after household re-sorting.

We are interested in exploring the empirical relevance of this possible channel. As a precursor to our empirical analysis, it is worth emphasizing that the negative correlation between racial inequality and residential segregation predicted by the neighborhood formation mechanism is in *stark contrast* to the positive correlation arising from a variety of well-known alternative mechanisms. For example, direct sorting on the basis of education and income (*a la* Schelling) would tend to lead to an increase in racial segregation as a side product when racial inequality increased, for

[2]We use the terminology 'emergence' or 'formation' of middle-class black neighborhoods to refer to not only the literal development of such neighborhoods from new housing construction, but also an increased concentration of middle-class blacks *within* existing neighborhoods.

[3]This is consistent with Vigdor's (2003) 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 reason highlighted above.[4] Similarly, if discrimination played an important role in the housing and mortgage markets and contributed to residential segregation in a non-trivial way, then to the extent that better-educated blacks were significantly less discriminated against, we would expect narrowing racial inequality to lead to reductions in segregation. And also working in the same direction, the well-established 'neighborhood effects' channel studied in Cutler and Glaeser (1997, henceforth 'CG') implies, for younger blacks at least, a strong positive correlation between racial inequality and segregation. Taken together, these contrasting inequality-segregation effects provide the basis for potentially fruitful empirical strategies, which we seek to develop and use.

The central empirical goal of this paper is to shed light on the importance of the neighborhood formation channel *in the presence* of the mechanisms outlined above – particularly CG's neighborhood effects channel – that yield competing predictions. To that end, we propose a new two-part research design, taking advantage of differential relations between black-white education inequality and neighborhood segregation across individuals' *life cycles*. The key idea is that CG's neighborhood effects channel, which predicts a positive correlation between racial inequality and segregation, is strongest for *young* blacks – those either of school age or recently educated; in contrast, our neighborhood formation mechanism generates a negative relationship between racial inequality and segregation for blacks of *all ages*, and should be especially strong for *older* blacks, whose education has been long since pre-determined.

Building on this idea, in the first part of our research design, we argue that if our neighborhood formation mechanism operates strongly in the data, one would expect to see a negative cross-sectional correlation between inequality and segregation for *older* blacks. This is indeed what we find using Census data: controlling for white educational attainment, the proportion of highly educated blacks aged 40 and above in a metropolitan area increases in the level of neighborhood segregation, implying a strong negative cross-sectional relationship between racial inequality and segregation for this older age group. This finding is surprising because it implies that the force of our neighborhood formation mechanism not only overcomes the opposing force of CG's neighborhood effects channel, but also the other forces tending in the opposite direction, such as statistical discrimination in the housing and mortgage markets, as well Schelling-type within-metropolitan area sorting on the basis of correlated socioeconomic characteristics!

In the second part of our research design, we examine time-series evidence using first differences. Given that CG's neighborhood effects mechanism operates only for younger blacks and our neighborhood formation mechanism operates throughout the life cycle, the underlying idea is that the latter should dominate upon differencing over time. Further, the strength of our mechanism should be identified by the first-difference effect of changes in segregation regressed on changes in

[4] A number of studies have estimated the contributions of socioeconomic characteristics in explaining cross-sectional variation in racial segregation. See Miller and Quigley (1990), Harsman and Quigley (1995) and Bayer, McMillan and Rueben (2004), among others.

neighborhood educational attainment for *older* blacks, controlling for changes in the education of whites. Implementing this first-differencing approach using Census data, we show that increases in the proportion of highly educated blacks relative to whites in a metropolitan area between 1990 and 2000 are associated with significant increases in overall racial segregation, given the educational attainment of whites. And unlike the cross-sectional evidence, first-differencing allows us to remove the effects of fixed city-level factors that may correlate segregation and the educational attainment of blacks relative to whites for other reasons. When we look specifically at older blacks, we find that increases in the proportion of highly educated blacks (again controlling for white education) are associated with strongly positive increases in city-wide segregation; as argued, such increases should reflect the strength of the neighborhood formation mechanism alone.[5] We also find that such changes are associated with significant increases in the number of middle-class black neighborhoods, as hypothesized under our neighborhood formation mechanism.

Our findings have significant implications for the inter-related dynamics of segregation *and* racial inequality, shedding light on both the nature and strength of the intergenerational feedback loop referred to above. When combined with the central finding of CG, our results imply that residential segregation and racial socioeconomic inequality evolve jointly according to a *negative* feedback. Specifically, following a reduction in across-race inequality, our results indicate that this will lead to an increase in segregation, which would then – following CG's mechanism – lead to a worsening of the educational and labor market outcomes for young blacks relative to whites, in turn increasing inequality across race. Because of this negative feedback loop, the intergenerational movement towards socioeconomic convergence across races will tend to be inhibited.[6] As a refinement, we also identify conditions under which the effects of this negative feedback will be mitigated, specifically when (other things equal) the proportion of highly educated blacks in a city is sufficiently high.

The remainder of the paper is organized as follows: In Section 2, we set out a simple equilibrium sorting model and show how increasing the proportion of highly educated blacks in a city while holding white education fixed may lead to increases in segregation due the formation of new neighborhoods. Section 3 presents the empirical motivation for our hypothesis linking neighborhood formation to changes in residential segregation, making clear that the conditions for increases in segregation to occur do appear to hold in the data. In Section 4, we explain our two-part research design in detail and present our main empirical evidence, shedding light on the relationship between neighborhood segregation and racial inequality, both in cross section and using first-differences over time. Complementary evidence is provided in Section 5, along with evidence that our results are

[5]In Section 5, we also present evidence indicating that the positive relation we find is due primarily to within- rather than across-metropolitan area sorting.

[6]The persistence of racial inequality is an important theme in the work of Loury (1977). His research draws attention to a negative externality in the accumulation of human capital, which gives rise to persistent differences in income across race.

robust to alternative explanations. We set out the implications of our findings in Section 6; and Section 7 concludes.

2 The Neighborhood Formation Mechanism in Theory

In this section, we formalize the neighborhood formation mechanism we have in mind, presenting a simple equilibrium sorting model to clarify the relationship between the sociodemographic composition of a metropolitan area and neighborhood segregation.[7] In particular, we consider increasing the proportion of highly educated blacks in the metropolitan area while holding the education of whites fixed; and we show how this change may lead to greater residential segregation by race due to the emergence of new middle-class black neighborhoods.[8]

Neighborhoods. Consider a metropolitan area with a total mass of households equal to 1. Suppose that a fraction $\lambda \in (0,1)$ of these households is black, with the remainder $1-\lambda$ being white. The total number of neighborhoods is fixed at J. Let the number of available houses (or slots) in neighborhood $j \in \{1,...,J\}$ be n_j, and assume that all houses are identical, with the total number of available slots across all neighborhoods being equal to the total number of households, i.e., $\sum_{j=1}^{J} n_j = 1$.

Neighborhood $j \in \{1,...,J\}$ is characterized by *two* attributes. The first, the exogenous amenity level of neighborhood j, is denoted by q_j; without loss of generality, assume that $q_1 \geq q_2 \geq \cdots \geq q_J$.[9] The second attribute, the fraction of neighbors of the same race as household i in neighborhood j, denoted r_{ij}, is endogenous and will be determined in equilibrium.

Households. Households are heterogeneous in their tastes for the amenity (denoted by α_i for household i) and also, potentially, their preferences for the race of their neighbors (denoted by

[7] Our stylized residential choice model below abstracts from several considerations likely to be relevant in practice. Commuting plays no role in location decisions, for example; thus we interpret our model as being relevant to neighborhood choices after decisions regarding commutes have already been made. We also abstract from the possible feedback from neighborhood composition to the production of individual attributes, such as educational attainment and, more broadly, aggregate racial inequality. In our empirical analysis in Section 4, we allow for the operation of this 'neighborhood effects' channel.

[8] Sethi and Somanathan (2001) develop a model that helps explain the persistence of high levels of racial segregation in many U.S. cities. Their model allows for horizontally differentiated preferences, as is realistic, and generates several novel results. In particular, in cities where the minority population is large, they show that both high *and* low levels of racial inequality are consistent with extreme levels of segregation; when racial inequality takes on intermediate ranges, segregated equilibria are unstable (see Figure 4 in their paper for a clear illustration), giving rise to potential non-monotonicities, as with our mechanism. Their treatment focuses on the stability of neighborhood equilibria in the context of a transparent two-community model, rather than the role of neighborhood formation as in our analysis.

[9] As in Sethi and Somanathan (2001)'s work, it is possible to endogenize the amenity level – for instance, by making it equal to the fraction highly educated in the neighborhood. For our purposes, this generalization is not essential.

β_i).[10] The utility that household i with preferences (α_i, β_i) receives from living in neighborhood j with attributes (q_j, r_{ij}) is given by

$$U_{ij} = \alpha_i q_j + \beta_i r_{ij} - p_j, \tag{1}$$

where p_j is the price of housing in neighborhood j.

We assume that a household's taste for the amenity, α_i, varies with the household's education level, with education taking on two possible values: high and low. If a household is highly educated, then its amenity taste parameter α is drawn from a continuous CDF $F_h(\cdot)$, while if a household is less-educated, then its α is drawn from a continuous CDF $F_l(\cdot)$, where $F_h(\cdot)$ first-order stochastically dominates $F_l(\cdot)$. This captures the idea that highly educated households are more willing to pay for amenities than less-educated households. We denote the fraction of highly educated among all black households in the city by $\rho_B \in (0,1)$ and the fraction highly educated among whites, $\rho_W \in (0,1)$. For simplicity, assume that the taste parameter for same-race neighbors β_i is identical for all households, i.e. $\beta_i = \beta \geq 0$ for all i. Given their preferences, households simply choose to reside in one of the J neighborhoods in order to maximize utility.[11]

Equilibrium. An equilibrium in this model is characterized by a rule assigning households to neighborhoods and a vector of housing prices $(p_1, ..., p_J)$, where p_J is normalized to zero, such that the housing markets in each neighborhood clear, and all households are in their most preferred location given the amenity levels, racial compositions, and housing prices in all neighborhoods.

Given this simple structure, we now describe how to solve the model, first in the simpler case where tastes over the race of one's neighbors are switched off, i.e., when $\beta = 0$. For a given equilibrium, we calculate a standard segregation measure, the exposure rate; then we examine how the exposure rate changes as we increase the proportion of highly educated blacks in the metropolitan area population, given the education of whites. The results from this exercise provide a benchmark against which we compare the more general case where households are allowed to have tastes over the race of their neighbors as well as preferences over exogenous amenity levels.

[10] The preference for same-race neighbors can either represent a pure taste for living in neighborhoods with others of the same race or arise through indirect channels. For example, individuals of the same race might cluster together in residential neighborhoods because they have correlated preferences for local public and private goods including retail outlets, restaurants, newspapers, and churches (see Berry and Waldfogel, 2003; and Waldfogel, 2007). It is unnecessary for us to take a stand as to the underlying nature of these same-race preferences. For various theoretical arguments why individuals might care about the racial composition of their neighborhoods, see, e.g., Cornell and Hartmann (1997), Farley *et al.* (1994), O'Flaherty (1999) and Lundberg and Startz (1998); for empirical evidence, see, e.g., Ihlanfeldt and Scafidi (2002), Vigdor (2003), and Charles (2000, 2001), King and Mieszkowski (1973), Yinger (1978) and Galster (1982).

[11] The assumption that the blacks are free to choose from the whole set of neighborhoods is made to simplify our argument and focus on our neighborhood formation mechanism alone. To the extent that blacks may be excluded from living in some neighborhoods due to discrimination, we may want to view our use of the phrase that blacks make 'choices' as shorthand to include both their locational preferences and discrimination.

We develop the basic intuition for our mechanism using a six-community example. While the details of the parameterization are not crucial, we provide them here for completeness. In particular, we suppose that the six neighborhoods are equal-sized, i.e. $J = 6$ and $n_j = 1/6$ for all j. The neighborhoods differ in amenity levels, with $q_1 = q_2 = 2$, $q_3 = q_4 = 1$ and $q_5 = q_6 = 0$. Also suppose that $\lambda = 3/8, \rho_B = 1/3$ initially, and $\rho_W = 3/5$, so the total fraction of highly educated is 1/2, i.e. $\sum_{r \in \{b,w\}} \rho_r \lambda_r = 0.5$. Finally, we assume that α among the highly educated is distributed uniformly on $[400, 1000]$, while among the less-educated it is distributed uniformly on $[0, 600]$, thereby allowing highly educated households to have higher willingness to pay for amenities, though with some overlap.[12]

No Same-Race Preferences ($\beta = 0$). In the case where households do not care about the race of their neighbors, neighborhoods differ in one relevant dimension only: their amenity levels. The (essentially) unique equilibrium of the one-dimensional model is a positive assortative matching equilibrium, where households with a high preference for amenities sort into high-amenity neighborhoods, with housing prices in neighborhood j set at a level that makes the marginal household indifferent between living in neighborhood j and neighborhood $j - 1$, the next level down in terms of amenity quality.

The equilibrium in this case is straightforward to characterize, and can be solved for analytically. The first step involves finding the threshold values of α recursively that will equate the demand with the supply of houses in each neighborhood; the second step is then to find the housing prices in each neighborhood to ensure that the marginal households are indifferent between the neighborhoods with adjacent values of amenities.[13] Under the assumption that the race of residents in a particular community is randomly drawn from blacks and whites given their educational attainment – reasonable given that there are no same-race preferences – we can infer the racial compositions of each neighborhood, which we can then compute segregation indices from.[14]

The segregation measure that we use in this illustrative model is (as mentioned) the *exposure rate*. At the individual level, the exposure rate of a household i in group g to another group g' is the percentage of household i's neighbors that belong to group g'. In our context, consider for

[12] We assume uniform distributions for analytic convenience.

[13] Given the illustrative parameterization above when $\rho_B = 1/3$ and $\rho_W = 3/5$, in the essentially unique sorting equilibrium, the high-amenity neighborhoods 1 and 2 will be occupied only by highly educated households with α in the interval $[600, 1000]$; the medium-amenity neighborhoods 3 and 4 will be occupied by a 50/50 mixture of highly educated and less-educated residents with their α lying in the interval $[400, 600]$; and the low-amenity neighborhoods 5 and 6 will be occupied only by the less-educated, with their α's in the interval $[0, 400]$. The equilibrium housing prices are $p_1 = p_2 = 1000, p_3 = p_4 = 400$ and $p_5 = p_6 = 0$.

[14] In the equilibrium described in footnote 13 for the case with $\rho_B = 1/3$ and $\rho_W = 3/5$, the fraction of residents in neighborhoods 1 and 2 who are black is 25%, the fraction in neighborhoods 3 and 4 is 37.5%, and in neighborhoods 5 and 6, it is 50%.

example a black household i's exposure to white neighbors (where g is 'black' and g' is 'white.' At the neighborhood level, the exposure of black households to whites is give by the average, across all black households, of the individual exposure rates.[15]

Our primary interest lies in the consequences for racial segregation – specifically, the exposure rate of black households to white neighbors – of an increase in the fraction of highly educated blacks – that is, as ρ_B approaches ρ_W from below.[16] (In particular, we increase the proportion of highly educated blacks at the expense of less-educated blacks, starting from zero, holding fixed the educational attainment of whites.) When same-race preferences are switched off, i.e. when $\beta = 0$, the average exposure of blacks to white neighbors will be monotonically increasing in ρ_B over the relevant range, $\rho_B < \rho_W$. Intuitively, as blacks shift up the education distribution, so their tastes for higher quality public goods strengthen, and this leads to greater residential integration as blacks and whites become more similar in this dimension. For illustration, we plot this relation in Figure 1(a), using the parameterization given in the example. Also note that, when sorting occurs solely on the basis of education and the associated taste for the amenity, some racial segregation arises initially simply because race is correlated with education.[17] This corresponds to the logic in Schelling's argument (see footnote 1) that some degree of racial segregation would be expected even in the absence of any direct preference over the race of one's neighbors.

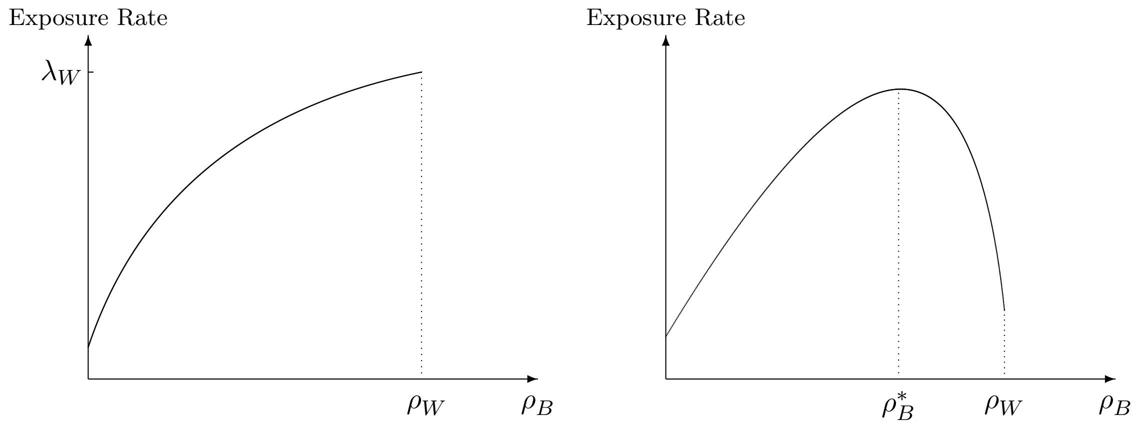
Strictly Positive Same-Race Preferences ($\beta > 0$). We now provide an intuitive characterization of the equilibria for the case where households care about the race of their neighbors in addition to amenity levels. Because analytical solutions are difficult to obtain in this more general case, we confirm the main intuition by solving for the model's equilibria using numerical methods.

When households care about the race of their neighbors, the allocation rule described above for the case without same-race preferences needs to be modified. Since the high-amenity neighborhoods 1 and 2 are predominantly (75%) white, whites with any given taste for amenity will now be willing to pay more than, and thus outbid, blacks with the same taste for the amenity, due to same-race preferences. This will drive the proportion of whites even higher, leading other whites to find these

[15] Thus in our simple example, in neighborhoods 1 and 2, a black household's exposure rate to whites is 3/4, given that 75% of the residents are white; similarly, in neighborhoods 3 and 4, black households' exposure rate to whites is 5/8; and black households' exposure to whites in neighborhoods 5 and 6 is 1/2. Since the fraction of blacks living in neighborhoods 1 and 2, 3 and 4, and 5 and 6, respectively, are 1/9, 1/3 and 4/9, the average exposure rate of blacks to whites in this initial equilibrium is given by $\frac{2}{9} \times \frac{3}{4} + \frac{1}{3} \times \frac{5}{8} + \frac{4}{9} \times \frac{1}{2} = 43/72$.

[16] Our arguments below also go through if we use an alternative segregation measure, the dissimilarity index, adjusting for the fact that it is inversely related to our exposure rate measure. Dissimilarity indices are used in our main empirical analysis in Section 4.

[17] For example, the exposure rate of 43/72 in the sorting equilibrium when $\rho_B = 1/3$ and $\rho_W = 3/5$ is lower than the overall proportion of whites in the population $1 - \lambda = 5/8 = 45/72$, which is the exposure rate that would arise under 'random spreading.'



(a) No Same-Race Preference: $\beta = 0$.

(b) With Same-Race Preference: $\beta > 0$.

Figure 1: Black Households' Average Exposure Rate to White Neighbors as a Function of ρ_B.
Notes: ρ_B and ρ_W denote the fraction of highly-educated blacks and whites respectively; λ_W denotes the fraction of whites in the MSA population. The figures are drawn from the calculated equilibrium of the model described in the text as ρ_B varies from 0 to $\rho_W = 3/5$. At at $\rho_B = \rho_B^*$, a black majority high-amenity neighborhood becomes sustainable.

neighborhoods even more attractive.

To fix the ideas related to our neighborhood formation mechanism, suppose that the proportion of whites who are highly educated, ρ_W, is fairly close to one, and contrast two extremes. First, consider a situation where the proportion of highly educated blacks among all blacks, ρ_B, is very low. In such a case, it is impossible to have a large fraction of blacks in either one of the high-amenity neighborhoods 1 and 2. Given that, the threshold taste level above which highly-educated blacks will be willing to pay to live in high-amenity neighborhoods, denoted by α_B^*, must be higher than the threshold for highly-educated whites α_W^*, i.e., $\alpha_B^* > \alpha_W^*$. Nonetheless, highly-educated blacks with very high amenity taste draws will find it optimal to live in predominantly white neighborhoods with high amenity levels. As ρ_B increases in a range of small values starting from 0, we would thus expect there to be more highly-educated blacks with exceptionally high values of α who choose to live in predominantly white high-amenity neighborhoods rather than lower-amenity neighborhoods that have greater proportions of blacks. Thus initially, we expect black households' exposure to white neighbors to be increasing in ρ_B.

Now consider the other extreme case, where ρ_B is high and close to ρ_W. Here, it becomes possible for the highly-educated blacks with a high taste for the neighborhood amenity to bid for houses in at least one of the high-amenity neighborhoods and achieve a racial majority there. Once blacks become a majority in a high-amenity neighborhood, the same-race preference will lead more blacks (with somewhat lower α's) to move into that neighborhood, and this process could lead to the emergence of a predominantly black high-amenity neighborhood. In this case, in contrast, the exposure rate of black households to white neighbors tends to be low.[18]

Combining these pieces of reasoning, we would expect the relation between black exposure to whites – our measure of racial *integration* – and the fraction of highly-educated blacks ρ_B to exhibit an inverted-U relationship, with a range of values for ρ_B over which the exposure rate of black households to white neighbors declines in ρ_B. In this range, segregation and racial inequality are negatively related. We verify that this is indeed the case in the context of our stylized residential choice model.

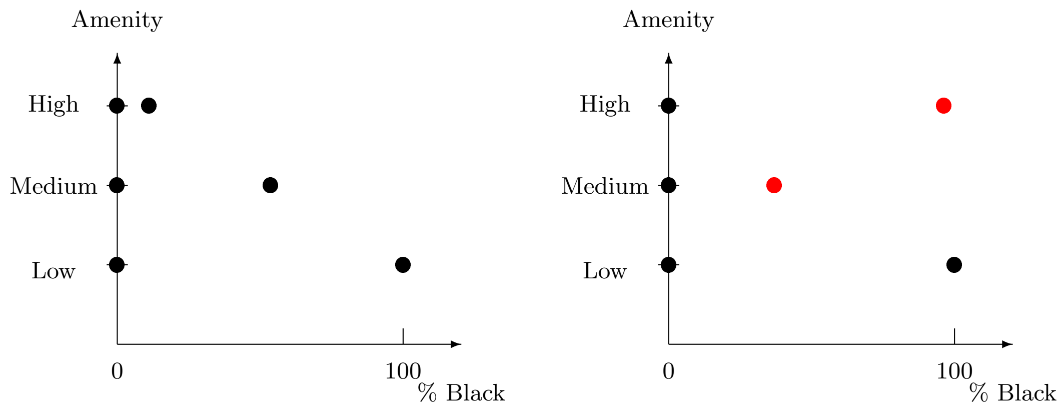
Figure 1(b), drawn from the computational sorting equilibrium of the simple model, illustrates the above argument.[19] As shown, when $\rho_B < \rho_B^*$, there is no possibility of a black majority high-amenity neighborhood; thus, as ρ_B increases, more and more highly-educated black households with high-α preferences live in white-majority high-amenity neighborhoods, and so blacks' average exposure to whites increases in ρ_B. But at $\rho_B = \rho_B^*$, a black majority high-amenity neighborhood becomes sustainable; and as a result, when ρ_B is larger than ρ_B^*, blacks' exposure to white neighbors starts to decline with ρ_B as more and more highly-educated blacks move into high-amenity black majority neighborhoods.[20]

A complementary way to depict the effects of an exogenous increase in the proportion of highly educated blacks ρ_B, while holding ρ_W fixed, is to directly examine the evolution of available neighborhoods that arise in equilibrium. Using the simulated equilibrium outcomes for the model outlined above by varying ρ_B, for a given $\beta > 0$, Figure 2 plots the available equilibrium neighborhood configurations in the "% Black" (horizontal axis) and "Amenity" (vertical axis) space for two different values of ρ_B. The left panel 2(a) shows that, when ρ_B is small, the sorting equilibrium is

[18] Potential multiple equilibria complicate our discussion. Here we are just referring to the possibility of such a predominantly black high-amenity equilibrium. It should be intuitively clear that with same-race preferences, the equilibrium with the highest degree of racial segregation actually maximizes landowner profits from house sales, i.e. it is the equilibrium that maximizes the total housing prices of the neighborhoods. We assume that such an equilibrium is likely to be selected. This allows us to assume away the *coordination problem*, and instead focus on the *small numbers problem*, according to which middle-class black neighborhoods may not arise because of an insufficient mass of highly educated blacks. Coordination problems are likely to be a short-term phenomenon, as developers and other entrepreneurs have an incentive to solve them.

[19] We apply a variant of the algorithm that solves numerically for sorting equilibria presented in Bayer, McMillan and Rueben (2011). Given some starting allocation of households to communities and a vector of initial house prices, the first step of the algorithm involves calculating household demands over the available communities, allowing for same-race preferences over neighborhood racial composition. From these demands, we compute a set of prices to clear the housing market. Next, households are re-allocated to their preferred communities at these market-clearing prices. Then we re-calculate household demands over communities, given the new neighborhood compositions, compute a new set of market-clearing prices, and continue iteratively until the process converges.

[20] The empirics we present in Section 4 support the view that in the current configuration of U.S. cities, the relationship between blacks' educational attainment (relative to whites) and residential segregation is likely to be on the decreasing portion of the curve, as shown in Figure 1(b).



(a) When ρ_B is Low.

(b) When ρ_B is Sufficiently High.

Figure 2: Neighborhoods in the '% Black'-'Amenity' Space as ρ_B Increases, when Residents have Same-Race Preferences.

unable to support high-amenity, black majority neighborhoods (i.e., neighborhoods in the north-east quadrant) due to an insufficient number of highly educated blacks with strong tastes for amenities; instead, the small measure of highly-educated blacks with strong tastes for amenities live in white-majority high-amenity neighborhood. However, the right panel 2(b) shows that, as ρ_B becomes sufficiently high, high-amenity, black-majority neighborhoods start to emerge in the north-east portion of the figure. The presence of such neighborhoods provides an opportunity for racial segregation to increase, as we hypothesize.

The stylized depiction in Figure 2 has a useful analog in terms of scatterplots describing actual cities. As we will see, Figure 3 in Section 3 presents scatterplots analogous to those shown in Figure 2, showing how the range of available communities can expand when the underlying demographic structure of the MSA changes. Specifically, Figure 3 is constructed using actual cross-sectional Census data from U.S. cities, where Boston and St. Louis represent MSAs with low proportions of highly educated blacks (ρ_B) and Atlanta and Baltimore-Washington DC represent MSAs with high proportions. We discuss the relevant patterns in some detail next.

3 Neighborhood Availability in U.S. Metropolitan Areas

In this section, we describe three stylized empirical facts about the availability of neighborhoods in U.S. metropolitan areas that help motivate our focus on the neighborhood formation mechanism.

Our primary data set is the 2000 U.S. Census, and our sample consists of 276 such Metropolitan Statistical Areas (MSAs).[21] Within each MSA, we examine the characteristics of its *neighbor-*

[21] We define a Metropolitan Statistical Areas broadly 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). For convenience, we use the

hoods. In our primary analysis, a neighborhood corresponds to a Census tract, which typically contains between 3,000 and 5,000 individuals. Using publicly-available Census Tract Summary Files (SF3) from the 2000 Census, we characterize each neighborhood, so defined, on the basis of two dimensions: *the fraction of residents who are black* and *the fraction of residents who are college-educated*.[22, 23]

We list the empirical facts as follows, before discussing the Census-based evidence that underpins them:

FACT 1. In almost every MSA, there are very few neighborhoods combining high fractions of both college-educated and black individuals.

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 and substantial fractions also live in predominantly black low-SES neighborhoods.

FACT 3. While 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.

For reference, we note that blacks and whites constitute 11.1 and 69.5 percent, respectively, 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 over twice as high, at 32.5 percent. College-educated blacks constitute a mere 1.7 percent of the U.S. population residing in MSAs.

[Table 1 About Here]

Table 1 provides very clear evidence relating to Fact 1 – the limited availability of high-SES black neighborhoods. To give the overall distribution of neighborhoods purely on the basis of education for comparison, Panel A lists the overall 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 then shows the number of tracts in the U.S. by both education and race (specifically, the percentage of individuals with a college degree and the percentage of individuals who are black), reporting the

term "MSA" to refer to all three cases.

[22]Our focus in this section is on non-Hispanic black and non-Hispanic white individuals 25 years and older residing in U.S. metropolitan areas.

[23]The Census Summary Files necessitate the use of a single dimension to characterize 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 constraint, we use educational attainment to proxy socioeconomic status more generally on the basis that it is a better predictor of one's permanent income than current income in the Census year.

number of tracts in each of the education 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 percentage black 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 (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 presents analogous numbers for whites, showing a far greater fraction of neighborhoods with at least 40, 60, and 80 percent white meeting the education criteria listed in the column headings.

While Table 1 reveals a scarcity of high-SES black neighborhoods in the U.S. as a whole, these tracts are concentrated in only a handful of MSAs, and most notably Baltimore-Washington, DC. (see Appendix Table 1). For example, of the 44 tracts (see row 4, column 3 of Table 1) that are at least 60 percent black and 40 percent college-educated, 14 are in Baltimore-Washington DC, 8 in Detroit, 6 in Los Angeles, and 5 in Atlanta. This implies that in most MSAs, the availability of high-SES black neighborhoods is even more limited.

Table 2 provides evidence relevant to Fact 2. It summarizes the characteristics of neighborhoods in MSAs throughout the United States in which college-educated blacks reside. Given the absence of mixed- or high-SES black neighborhoods, the table shows that highly educated blacks live in a diverse set of neighborhoods, ranging from those that are predominantly white and highly educated to neighborhoods that are predominantly black with much lower levels of education on average.

[Table 2 About Here]

In each MSA, we first rank college-educated blacks by the fraction black in their Census tract and assign individuals to their corresponding quintile of the associated distribution. Panel A 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 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.[24]

Two aspects of this pattern are pertinent to our neighborhood formation mechanism. First,

[24] Comparison of Panels A and B in Table 2 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 highest fraction of other blacks) have only about *one-third* of the fraction of highly educated neighbors as whites do on average.

the fact that such a high fraction of college-educated blacks live in segregated neighborhoods with relatively low average educational 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 households simply demand college-educated neighborhoods without regard to racial composition. Second, the fact that a significant number of college-educated blacks reside in predominantly white neighborhoods makes it possible for an increase in the availability of mixed- or high-SES black neighborhoods to lead to greater 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.

In support of our third stylized fact, Table 3 reports four regressions that relate the log of the number of tracts in an MSA that meet the race and education criteria specified in the column heading to metropolitan socioeconomic characteristics (proportion highly educated black, highly educated white, less-educated black and less-educated white) and the log of metropolitan area population. These regressions reveal that the availability of middle-class black neighborhoods increases sharply in the fraction of college-educated blacks in the MSA. Holding the size of the MSA constant, a one percentage-point increase – just under a standard deviation – in the proportion of college-educated blacks in an MSA (at the expense of the omitted category, Asians and Hispanics) increases the number of tracts that are least 60 percent black and 40 percent college-educated by 42 percent, and the number that are at least 60 percent black and 20 percent college-educated by 56 percent. These effect sizes are substantially in excess of the mechanical increase that would arise were the additional blacks distributed evenly across all the typical MSA's tracts – unsurprising given the small fraction of the typical MSA population accounted for by college-educated blacks. The number of middle-class black tracts is also increasing in the population of the MSA, as one would expect (coefficients not shown in the table).

[Table 3 About Here]

Neighborhood Scatterplots using Census Data. Related to this regression evidence in Table 3, Figure 3 shows scatterplots of available neighborhoods in four metropolitan areas: Boston and St. Louis in Panel A, and Atlanta and Baltimore-Washington DC in Panel B. Note that in Boston and St. Louis, the blacks with college degrees account for around 11 percent of the population, while the fractions in Atlanta and Baltimore-Washington DC are approximately twice as high.

In each scatterplot, a circle represents a Census tract and its coordinates describe the fraction of blacks (horizontal axis) and the fraction of college-educated individuals (vertical axis) in the tract. The diameter of each 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. Panel A reveals a short supply of neighborhoods in Boston and St. Louis that combine high fractions of both highly educated and black individuals – few neighborhoods appear in the north-east corner of the plot. Panel B shows that a substantially greater number of neighborhoods combining relatively high fractions of both black and highly educated individuals – those populating the north-east corner of each figure – are found in the Atlanta and Baltimore-Washington DC metropolitan areas. These scatterplots very much resemble stylized Figure 2, which illustrates neighborhood formation derived from our model when residents have same-race preferences.

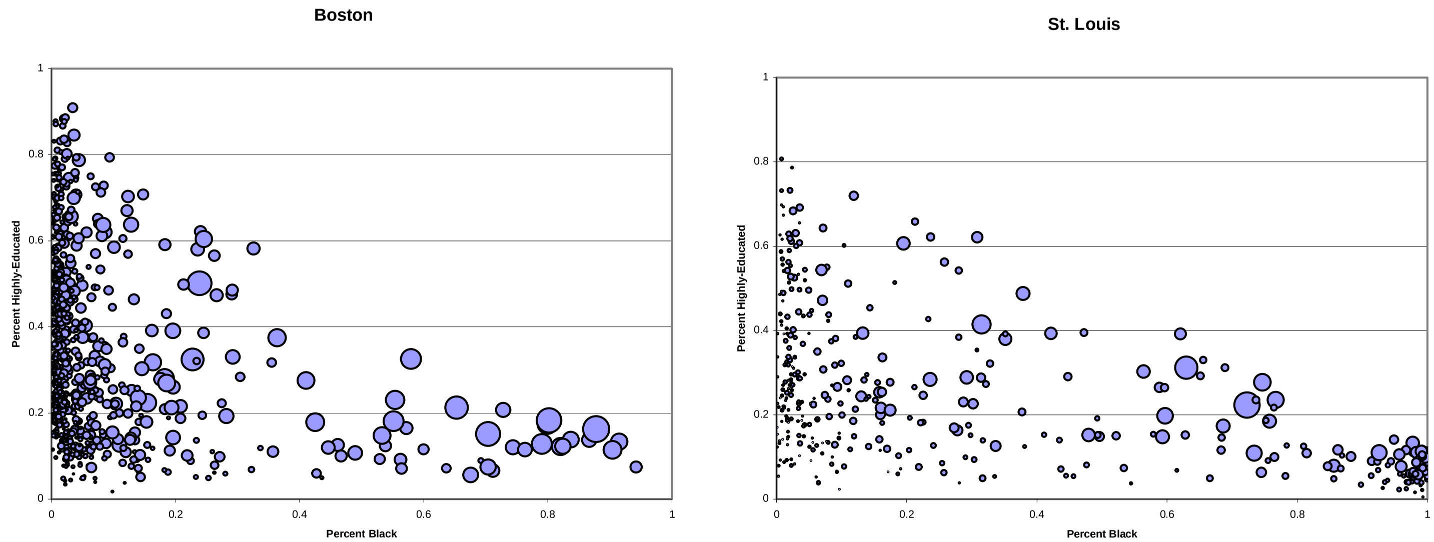
It is this third stylized fact along with the documented small number of middle-class black neighborhoods in the vast majority of U.S. metropolitan areas (Fact 1) that motivates the idea that an increase in the proportion of highly educated blacks within a metropolitan area should allow middle-class black neighborhoods to form more readily. As these neighborhoods are likely to be attractive to highly educated blacks, and possibly less-educated blacks as well, so their emergence may lead to an increase in residential segregation on the basis of race once households re-sort, along the lines of the model in Section 2. The potential for such re-sorting is apparent from Fact 2, given that a non-trivial fraction of highly educated blacks currently reside in predominantly white neighborhoods.

4 Research Design and Main Results

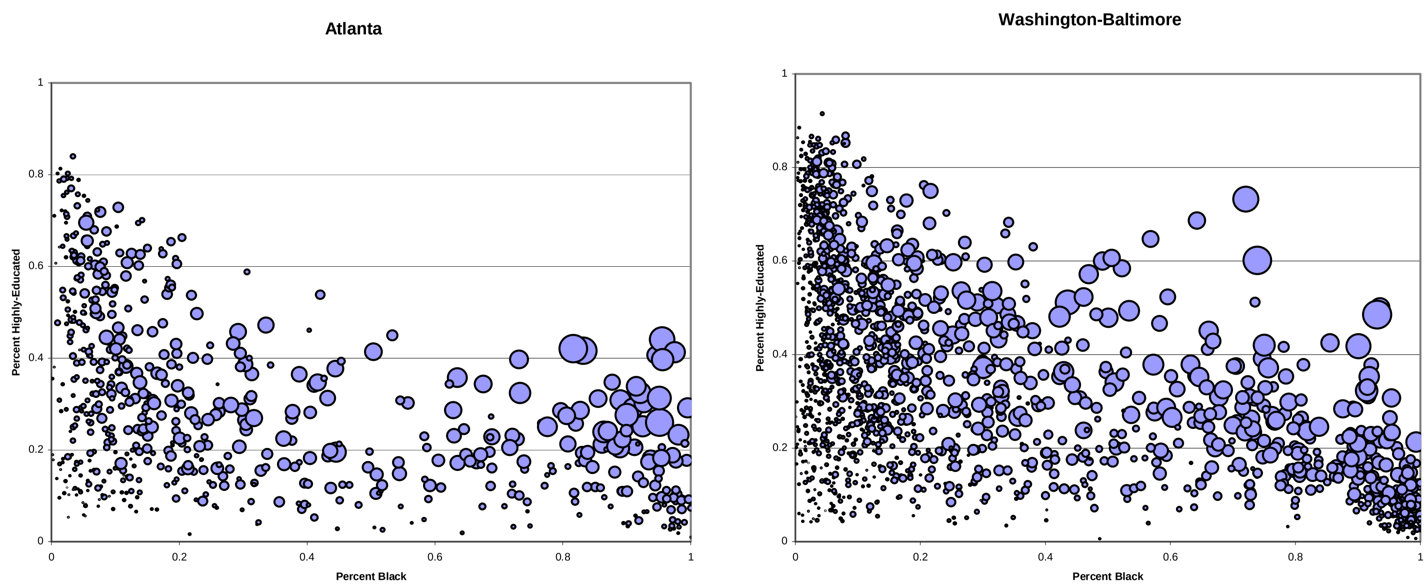
The theoretical and descriptive analysis of the previous two sections motivate our main empirical hypothesis – that given the racial and socioeconomic compositions of most U.S. metropolitan areas, residential segregation and racial inequality will be *negatively* related. Further, this negative relationship arises – so we argue – through a process of neighborhood formation.

One possible approach to shedding light on this hypothesis is to mimic the stylized exercise in Section 2, specifying household tastes over locational attributes, then estimating a structural residential choice model using data drawn from a single metropolitan area (see, e.g., Bayer *et al.* (2011)). In this paper, we take a different tack, making use of across-MSA data in order to assess whether the neighborhood formation mechanism is important in practice. As we discussed in the Introduction, this task is complicated by a host of factors other than neighborhood formation that are also likely to influence the relationship between segregation and inequality. Of course, the observational data we use for our analysis make it extremely difficult to isolate exogenous variation in the sociodemographic variables of interest; yet even in the absence of compelling instruments, we argue that the pattern of observed correlations between MSA-wide segregation and inequality, both cross-sectionally and over time, can be informative as to which of the potential mechanisms are operating strongly in the data.

To explain the logic of our approach, consider as a starting point estimates of the cross-sectional relationship between an MSA's level of residential segregation and its fraction of highly educated



(a). Metro Areas with Small Fractions of Highly Educated Blacks.



(b). Metro Areas with Larger Fractions of Highly Educated Blacks.

Figure 3: Neighborhood Characteristics in Illustrative Metropolitan Areas: Boston and St. Louis (Panel A); Atlanta and Baltimore-Washington DC (Panel B).

blacks, controlling for the educational attainment of whites.[25] Such estimates will clearly reflect the overall impact of several alternative mechanisms, as discussed in the Introduction.[26] In order to distinguish the impact of our hypothesized neighborhood formation mechanism from the alternative mechanisms, including CG's neighborhood effects mechanism, we take advantage of the *differential timing of these mechanisms over the life cycle*. In particular, the neighborhood effects mechanism implies a negative relationship between concurrent measures of segregation and the educational attainment of *young* blacks; as the metropolitan area evolves and individuals move within and across metropolitan areas, this negative relationship should generally weaken with age. In contrast, our neighborhood formation mechanism gives rise to a cross-sectional relationship between concurrent measures of segregation and the educational attainment of blacks that should be positive for households of *all ages*, and potentially be *even stronger for older households*, who are more likely to have made multiple residential location decisions during their lives. Consideration of this life-cycle pattern suggests two complementary ways to distinguish the neighborhood formation mechanism from the neighborhood effects mechanism empirically, which we describe below.

4.1 Research Design in Cross Section

The first approach is cross-sectional. If we extend the analysis of Cutler and Glaeser (1997) to older individuals (their paper focuses on ages 20-30), we should see a significant weakening of the effects that they find. To that end, we follow CG and estimate regressions of the form:

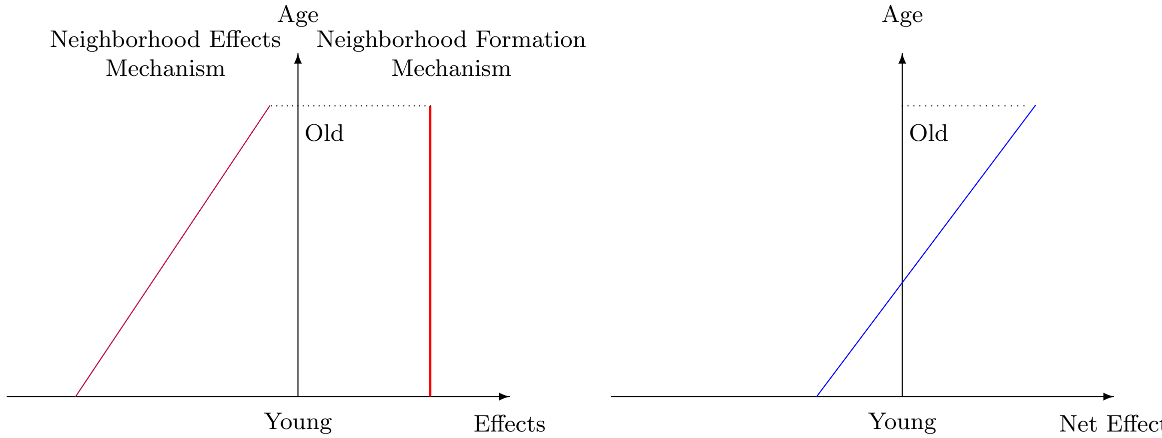
$$y_i = \boldsymbol{X_i}'\boldsymbol{\beta} + \beta_1 \text{SEG}_i + \beta_2 \text{SEG}_i \times \text{BLACK}_i + \epsilon_i, \tag{2}$$

where y_i represents an individual outcome variable, SEG_i is an MSA-level measure of segregation of blacks and whites, BLACK_i is a dummy variable taking value 1 if individual i is black, and $\boldsymbol{X_i}$ includes individual demographic and MSA-level characteristics.[27] We do so separately for individuals aged 20-24 and 25-30, as in CG, but also for older age groups, between the ages of 30 and 70, with a focus on the effect of living in a more segregated metropolitan area for blacks relative to whites, summarized by the coefficient (β_2) on the segregation-black dummy interaction term.

[25] We measure racial inequality using the educational attainment of blacks relative to whites (see the next subsection). On this basis, racial inequality in a city will thus be taken to have narrowed when the proportion of highly educated blacks increases given white educational attainment. In turn, our main empirical hypothesis implies that residential segregation will be *positively* related to the educational attainment of blacks, given the education of whites.

[26] To recap, these include – besides neighborhood formation – statistical discrimination in the housing market, racial sorting on the basis of correlated socioeconomic characteristics, as well as CG's neighborhood effects mechanism.

[27] While CG's framework was developed to explore the importance of neighborhood effects, i.e., the impact of MSA-wide segregation on the educational and labor-market outcomes of blacks relative to whites, controlling for other factors, it also provides us with a useful means of estimating conditional correlations between residential segregation and inequality.



(a) The Two Effects (b) The Net Effect

Figure 4: The Age Profile of the Relationship Between Concurrent Segregation and Black Educational Attainment

Figure 4 illustrates, in a stylized way, the age patterns associated with the neighborhood formation and neighborhood effects mechanisms, operating individually and in combination; it portrays the underlying coefficients measuring the segregation-education correlations for different age groups. Specifically, Panel 4(a) shows the positive relationship between concurrent measures of segregation and the educational attainment of blacks relative to whites associated with the neighborhood formation mechanism, which is hypothesized to be positive and more or less stable across the age range. It also shows the negative impact from the neighborhood effects mechanism, hypothesized to be strongest among young blacks, though this declines with age. If both mechanisms are operating strongly in the data, we might expect the neighborhood effects mechanism to dominate at younger ages and the neighborhood formation mechanism, at older ages. Thus, as shown in Panel 4(b), the *net* relationship between concurrent segregation in a metropolitan area and the educational attainment of blacks relative to whites (captured by the relevant age group-specific coefficient, β_2) should be negative for younger blacks relative to whites, but become positive for older blacks. Further, if we did not distinguish blacks by age, we might observe that the average effects across all ages canceled out; conducting the analysis disaggregated by age allows us to separately identify these two effects.

4.2 Empirical Results in Cross Section

We implement the above cross-sectional research design using data that combine variables from the 5-percent sample of the 1990 Census with the same set of MSA characteristics used in CG.[28] Descriptive statistics for the MSA variables are shown in Appendix Table 2, the sample being drawn

[28]These latter data were generously made available by Jacob Vigdor.

from the 209 metropolitan areas that have populations of at least a hundred thousand and at least ten thousand blacks in 1990. Following CG, we measure residential segregation using dissimilarity indices constructed for each MSA from racial compositions at the tract level – here, the proportions of blacks and non-blacks.[29] The mean value for the dissimilarity index is 56 percent, with a standard deviation of 12.9 percent. The most segregated MSA in 1990 in the sample is Detroit (87.3 percent), and the least is Jacksonville NC (20.6 percent).

We capture racial inequality in an MSA using the educational attainment of blacks relative to whites. Accordingly, racial inequality will be taken to have narrowed in a cross-sectional context when the proportion of highly educated blacks (the proportion with at least a college degree) increases across MSAs given white educational attainment. In our 1990 Census sample, 22.7 percent of the adult population have a college degree or more. For whites, the mean proportion is 24.6 percent, while for blacks, it is under half that, at 11.4 percent. Around these average differences, there is considerable variation in educational attainment by race across MSAs. At one extreme, Stamford CT has the highest gap between the proportion of white with a college degree and the proportion of black, at 38.6 percent, just slightly ahead of the San Francisco-Oakland MSA. At the other extreme, Houma-Thibodoux LA, Danville VA and Fayetteville NC all have gaps between 7 and 8 percent.

Given our interest in the age profile of educational attainment by race, we further disaggregate by age in Appendix Table 3. The pattern is similar for blacks and whites, with educational attainment rising then falling across the age distribution. Considering blacks, for example, the proportion graduating from college rises from around 12 percent for those in the 25-30 age range to over 15 percent for the 31-50 age group, falling to under 10 percent for blacks in the 51-70 age group.

Educational inequality is apparent throughout the age distribution, with black educational attainment being markedly lower than for whites. The proportion of blacks graduating from high school is between 10 and 12 percentage points lower than whites for all age groups except the oldest, where the gap rises to more than 27 percentage points. And the proportion graduating from college is substantially lower: around 10 percentage points lower for the 20-24 and 51-70 age groups, rising to more than 15 percentage points for the middle age groups. This across-age variation in the educational attainment of blacks versus whites is relevant for the first part of our research design.

Appendix Table 3 also shows descriptive statistics for labor market outcome variables – log wages and whether idle (both not working and not in school) – for the same age categories, and further subdivided by race. In terms of earnings, black wages are almost uniformly 30 percent less than those of whites. And blacks aged 30 or less are almost twice as likely as whites to be 'idle,' though

[29] The dissimilarity index, proposed by Duncan and Duncan (1995), is an aggregate-level segregation measure (see Cutler, Glaeser and Vigdor (1999) for more discussion). Dissimilarity indices range from zero to one, and can be interpreted as measuring the proportion of blacks who would need to change tracts in order for races to be evenly distributed throughout the metropolitan area.

this differential erodes markedly as age increases. In the table, we also report descriptive statistics for a set of individual demographic control variables included in the main regressions capturing an individual's race and gender.

OLS Regression Results. Table 4 reports the coefficient estimates for β_2 on the interaction term $\text{SEG}_i \times \text{BLACK}_i$ in the specification described by (2). The individual outcomes we examine include college graduation (column 1) and log earnings (column 2), pertaining to our notion of high-SES individuals, along with high school graduation (column 3) and whether idle (i.e., neither unemployed nor in school, column 4). As in CG, all the specifications include a rich set of controls: individual characteristics (Black, Asian, Other nonwhite, Hispanic, Female), metropolitan characteristics (Segregation, ln(population), Percent black, ln(median household income), and Manufacturing share), and interactions of these metropolitan characteristics with a dummy variable indicating whether the individual is black.

The specifications in CG that relate most directly to our analysis are those using educational attainment as the dependent variable. Table 4 replicates CG's results for age groups 20-24 and 25-30, but extends the analysis for individuals between the ages of 31-50, 51-70, respectively, the latter two groups further broken down into 10-year age spans.

[Table 4 About Here]

The estimated β_2 coefficients in Table 4 for age groups 20-24 and 25-30 are very similar to those reported in Cutler and Glaeser (1997, Table IV), with any minor discrepancies being attributable to differences in Census sample (we use the 5-percent while CG used the 1-percent Census sample). For each outcome, the estimate for the β_2 coefficient on the "SEG×BLACK" interaction implies a significantly worse outcome for younger blacks relative to whites, with the sole exception of college graduation for the age group 25-30; and in this case also, the point estimate indicates that blacks perform worse than whites.

In addition to being highly statistically significant (excepting college graduation for the 25-30 age group), the implied effect sizes are also economically significant, as noted in CG. Taking the age group 20-24 for illustration, a one standard deviation increase in segregation (12.5 percent) would lower the probability of graduating from high school for blacks by around 3.3 percentage points relative to whites; it would lower the earnings of blacks relative to whites by around 6.8 percent; the likelihood of being idle would rise (again relative to whites) by just over 4 percentage points; and the probability of completing college would fall relative to whites by around 1.3 percentage points (acknowledging that for this younger group especially, a fraction will have yet to complete college).

The point estimates for the 25-30 age group are all of the same sign, and in some instances, of roughly similar magnitude. It is worth noting, however, that all the point estimates, for each outcome, are *lower in absolute value* for the 25-30 age group than those for the 20-24 age group. The effect of segregation on the likelihood of being idle is just over 10 percent lower for the 25-30 age group relative to the 20-24 age group, the effect on the probability of graduating from high school is 20 percent lower; and the effect on the probability of college graduation is 28 percent lower. The effect of increased segregation on differences in log earnings of blacks versus whites is substantially (around 65 percent) lower for the 25-30 age group than that for the 20-24 age group.

More strikingly, as we examine even older age groups (see row three and below in the table), the effects of MSA segregation continue to dampen and, for key outcomes, change sign relative to the young age groups, consistent with the predicted age profile of net effects depicted in Figure 4(b). Consider first the relationship between segregation and educational attainment of blacks relative to whites. For college graduation, the negative effect of increased segregation on blacks relative to whites becomes indistinguishable from zero for ages 31-50 – the point estimate is negative for ages 31-40, and positive for the 41-50 age group. It then becomes positive and significant for ages 51-70. In this case, a one standard deviation increase in segregation is associated with a 9 percentage point increase in the probability that blacks graduate relative to whites – a large effect. The effect for the 61-70 subcategory is even larger.

Similar pattern also holds for the other outcomes. For the relationship between segregation and racial inequality in earnings, Column 2 of Table 4 shows that coefficients on "SEG×BLACK" also switch from being negative to being positive and statistically significant, now even for the 31-50 age group, and the sizes of the effect are monotonically increasing with age. Thus, in marked contrast to the 6 percent *reduction* found in the youngest age category, a one standard deviation increase in segregation for ages 51-70 is associated with a 5 percent *increase* in the wages of blacks relative to whites. The pattern of changes for the coefficient estimates on "SEG×BLACK" for different age groups are less dramatic for high school graduation (Column 3) and idleness (Column 4), but they both show that the effects of MSA segregation continue to dampen for older age groups. For example, 20-24 year old blacks are 33.9 percent more likely to be idle than same aged whites in more segregated MSAs, but the 31-40 year old blacks are only 20.8 percent more likely to be idle than same aged whites, and that the difference further declines to 17.6 percent for 41-50 year olds and 10.9 percent for 51-60 olds.

We take these results as strong baseline evidence in support of both the existence of the neighborhood formation mechanism that is the focus of this paper and the neighborhood effects channel identified by CG. At face value, the results suggest that in the very same highly segregated metropolitan areas, older blacks have significantly higher levels of educational attainment and earnings relative to whites (compared to their counterparts in less segregated cities), while younger blacks have significantly worse outcomes relative to whites. This pattern is exactly what one would expect given the combined operation of the neighborhood formation and neighborhood effects mechanisms, working differentially across black households of different ages, as depicted in Figure 4.

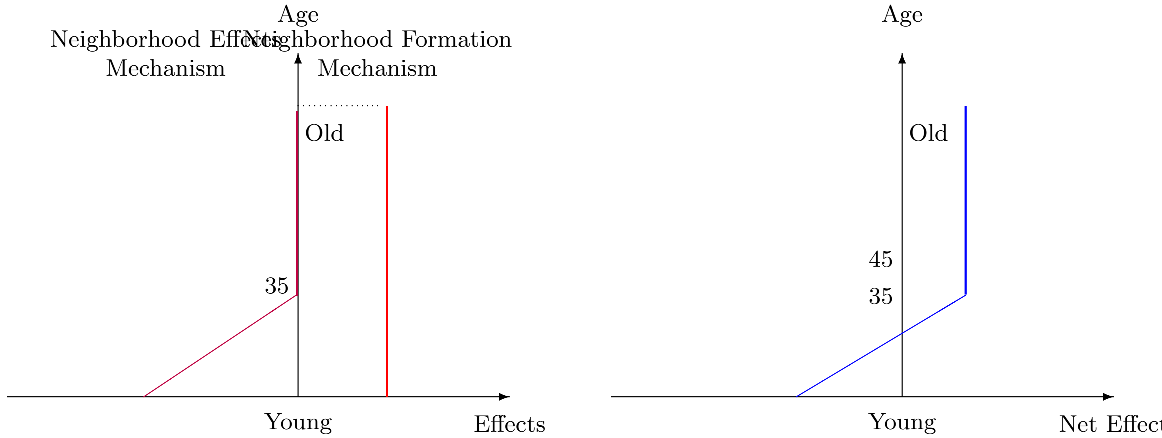
Instrumenting. The OLS results in CG and replicated in the top portion of our Table 4 are supplemented by a series of IV estimates, shown in Table V of their paper where they instrument for MSA segregation with three instruments designed to isolate the causal impact of segregation on individual outcomes. CG motivate the use of instruments by suggesting that their negative coefficient estimates from the OLS regressions might be attributable to within-metropolitan area sorting; specifically, 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. This corresponds to the view that segregation and racial inequality are likely to be positively related – the reverse of our neighborhood formation story.

It is worth noting that when CG instrument for segregation, the point estimates on the interaction between black and segregation in the college degree and log earnings regressions become *more negative* in every case (for both age groups and with each alternative instrument - a total of 12 regressions). This suggests that our neighborhood formation mechanism, representing the reverse channel of causality that their instruments are intended to purge, is actually working against their result, as it leads the correlation between black socioeconomic status and metropolitan segregation to move in a positive rather than a negative direction. This evidence further implies that CG's OLS specifications may understate the strength of the neighborhood effects channel that is the primary focus of their empirical analysis.

Based on this discussion, the OLS and IV results reported in CG can be fully reconciled with the results presented here. The interpretation we offer, in the spirit of the first part of our research design, is that differences in the impact of segregation across the age profile reflect the operation of two separate and competing mechanisms, with each mechanism working to obscure the other in the data. Because many individuals migrate across metropolitan areas during adulthood and metropolitan level segregation evolves (slowly) over time, one would generally expect the negative relationship associated with CG's mechanism between segregation in an individual's current MSA and educational outcomes to be strongest for the youngest adults. (This is why CG study young adults in the first place.) Conversely, the positive correlation between average black educational attainment relative to whites and metropolitan segregation associated with our neighborhood formation mechanism on should be strongest among older age groups. Older individuals collectively have had the greatest amount of time to influence the metropolitan neighborhood structure, including segregation levels, of the MSA they reside in.

4.3 Research Design in First Differences

In the second part of our research design, we use the fact that the life cycle patterns we exploited in the first part of our research design also give rise to a strong prediction concerning the relationship between segregation and the socioeconomic status of blacks relative to whites *in first differences*.



(a) The Two Effects

(b) The Net Effect

Figure 5: The Age Profile of the Relationship Between the Changes in Segregation and Changes in Blacks' Educational Attainment

Consider the relationship between the *change* in segregation in an MSA and the *change* in black socioeconomic status over time – for instance, comparing across decennial censuses, as we will do in subsection 4.4 – while controlling for changes in the socioeconomic status of whites.

In this case, the operation of the neighborhood effects mechanism in CG implies that the change in segregation can only directly affect the educational attainment of younger blacks relative to younger whites and should have no effect on that of older age groups. The neighborhood formation mechanism, in contrast, should continue to generate a positive relationship between the relative educational attainment of blacks (versus whites) and segregation at all ages. Relative to the cross-sectional relationship in levels, therefore, the neighborhood formation mechanism should more fully dominate the neighborhood effects mechanism in first differences. Moreover, the relationship between these variables attributable to the neighborhood formation mechanism should be identified by the correlation between changes in segregation and changes in black educational attainment relative to whites observed for older individuals.

Figure 5 highlights, again in a stylized manner, the age profile associated with the relationship between changes in segregation and changes in black educational attainment relative to whites. For blacks who are middle-aged and older, as Panel 5(a) indicates, we should expect that the changes in the MSA segregation in the previous decade should have no effect on changes in their educational attainment compared to whites due to the neighborhood effects mechanism in CG. This is so because their educational (and human capital investment) decisions were largely complete around age 25. In contrast, the positive relationship due to the neighborhood formation mechanism is more or less constant. Thus on net, we would expect to see a strong positive relationship in the data between changes in metropolitan segregation and changes in black educational attainment for older blacks controlling for changes in the educational attainment of whites, as shown in the Panel

5(b).

To implement our second approach using changes over time, we will estimate equations at the metropolitan area level of the form:

$$\Delta\text{SEG}_j = \gamma_1 \Delta\%\text{-HIGHLY-EDU-BLACK}_j + \boldsymbol{\Delta X_j}'\boldsymbol{\gamma} + \nu_j, \tag{3}$$

where ΔSEG_j represents the change in MSA j's segregation (captured by a relevant segregation index) between the 1990 and 2000 Censuses, $\Delta\%\text{-HIGHLY-EDU-BLACK}_j$ is the change in percent highly educated black in MSA j over the same time period, and $\boldsymbol{\Delta X_j}$ includes MSA-level changes in other sociodemographics across Census years, including changes in the percentage of highly educated whites. Interest focuses on the coefficient γ_1, which we hypothesize to be positive if the neighborhood formation mechanism dominates. Note that the first differences research design also allows us to deal with identification issues associated with time-invariant omitted MSA-level characteristics that may influence neighborhood availability and are also correlated with the MSA's demographic structure.

4.4 Empirical Results for First Differences

To estimate equation (3), we extract the same individual and MSA variables used in the cross-sectional analysis for 1990 (see Table 4), but for the 2000 Census as well. We then average the variables up to the MSA level, and construct first differences for each MSA based on 1990 and 2000 MSA averages. Descriptive statistics are given in Appendix Table 4, for the sample of 214 MSAs appearing in both waves.[30] The first feature to note from Appendix Table 4 is that segregation, measured at the MSA level using dissimilarity indices, fell quite sharply over the decade; on average, dissimilarity indices were 5.4 percent lower, with a standard deviation of 4.1 percent.[31] This accords with a fact that has been well-documented: for example, as Iceland, Weinberg and Steinmetz (2002) show in a thorough analysis of past Census data, residential segregation in U.S. cities has been following a downward trend over the three decades since the 1980 Census, a conclusion that is invariant to the way segregation is measured.

Appendix Table 4 also provides suggestive aggregate evidence that racial inequality has increased over the same decade. While the proportion of blacks with a college degree increased only very slightly between 1990 and 2000, the proportion of whites with a college degree rose by around 2.2 percentage points. In the same broad direction, while the proportion of less educated blacks remained virtually unchanged, the proportion of less educated whites fell sharply. The table also

[30]For this analysis, unlike in Subsection 4.2, we no longer restrict attention to MSAs that have at least 100,000 individuals and 10,000 blacks, which increases the sample of MSAs slightly. Our results are insensitive to this, one way or the other.

[31]The MSA with the largest drop over the decade was Fort Collins-Loveland CO, down 19.7 percent. This is in sharp contrast to Ann Arbor, at the other end of the spectrum, where segregation actually rose by 11.5 percent.

reports first-difference changes in MSA characteristics, using the same variables controlled for in levels in Table 4. The population of the typical MSA rose by almost 18 percent between 1990 and 2000, in line with the overall population increase in the United States over the same decade. Median household incomes rose significantly; the average share of manufacturing fell, by almost five percentage points; and the black population in the typical MSA rose just fractionally.

First-Difference Regression Results. Table 5 reports the estimation results for four specifications given by Equation (3). We regress the change in the MSA-level dissimilarity index between 1990 and 2000 on a variety of measures of the change in the sociodemographic composition of the metropolitan area over the same period, along with other metropolitan controls.

[Table 5 About Here]

Column 1 reveals a strong positive relationship between the change in the fraction of blacks with a college degree in the MSA population and the change in segregation, controlling for other changes in the education composition of the MSA and also changes in log population. Specifically, our estimate indicates that a one-standard deviation increase in the fraction of highly educated blacks, holding fixed the education composition of whites, would lead to about a one-percent increase in the dissimilarity index. This is a large positive effect in the order of a quarter of a standard deviation in the change in the dissimilarity index over the decade. The finding is robust to the inclusion of additional MSA-level covariates, measuring changes in median household income and manufacturing share, as shown in Column 2.

To further investigate the role of age structure along the lines hypothesized in Figure 5, we break the effect of changes in the proportion of highly educated blacks in an MSA relative to whites down by age in Columns 3 and 4. Specifically, we measure the effects of changing the proportion of highly educated blacks in two separate age categories – 25-44 and 45 or older – on the change in the MSA segregation; we also break down the other education controls (for less-educated blacks, and highly and less-educated whites) in the same way. Column 3 just controls for changes in log population, while Column 4 also controls for changes in the MSA median household income and manufacturing share between 1990 and 2000. The results from this age disaggregation reported in Columns 3 and 4 make very clear that it is changes in the proportion of *older* highly educated blacks, aged 45 and above rather than 25-44, that affect residential segregation in first differences. Indeed, the estimates indicate that effectively all the positive impact of changes in the proportion of highly educated blacks comes through the older age category, with estimated effect sizes similar to those for highly educated blacks in Columns 1 and 2: the effects for the younger group are actually slightly negative, if indistinguishable from zero. This striking age pattern is again consistent with Figure 5 where we argued that the neighborhood formation mechanism and the neighborhood effects mechanism of CG seem to cancel out for younger adults, leaving no significant relationship on net.

5 Complementary Analysis and Robustness

5.1 Neighborhood Formation

Complementing the analysis of changes in segregation over time just described, we provide evidence of neighborhood formation using the same organization of the first-differenced MSA data as in Section 4.4. Unlike the cross-sectional estimates in Table 3, first-differencing has the advantage that it removes the influence of fixed factors, whether observed or unobserved, that affect the relationship between racial inequality and MSA-wide neighborhood availability. Specifically, we examine the relationship between the changes in the proportion of highly educated blacks and the changes in the number of middle-class black neighborhoods within an MSA, conditioning on changes in other MSA sociodemographics.

[Table 6 About Here]

Table 6 provides evidence relating to the formation of middle-class black neighborhoods, focusing on the effects of within-MSA variation in the proportion of highly educated blacks, controlling for changes in the education composition of other groups. Columns 1-4 show results based on different definitions of 'middle-class black neighborhood,' the dependent variable being the change in the log number of tracts satisfying the given definition in the column heading. Column 1 shows that a one-standard deviation increase in the proportion of highly educated blacks, controlling for the education of whites, is associated with a 22 percent increase in the number of middle class black communities, defined as tracts that are both at least 60 percent black and 40 percent college educated. The estimated effects are even larger when considering broader definitions of 'middle-class black neighborhood.' [32]

[Table 7 About Here]

While Table 6 shows that increases in the proportion of college-educated blacks are associated with sharp increases in the number of middle-class neighborhoods in the MSA, the life-cycle logic we emphasized in Section 4 suggests that, to the extent that residential choices are mostly made by relatively older individuals, we should expect to see stronger associations between the changes in the number of middle-class neighborhoods and the changes in the proportion of older college-educated blacks. This is indeed confirmed in Table 7, where we report the effects of changing

[32] In each column, we control for changes in log population of the MSA. The results are robust to the inclusion of changes in log(median income) and manufacturing share.

the proportion of younger versus older highly educated blacks in an MSA on middle-class black neighborhood formation, again conditioning on other sociodemographics. It shows the consistently positive impact of increasing the proportion of older college-educated blacks (aged 45 and above), while changes in the proportions of younger college-educated blacks (aged 25-44) tend to be smaller, and are insignificant for the narrowest definition of middle-class black neighborhoods (at least 60 percent black and at least 40 percent college-educated).

5.2 Across-MSA Sorting

So far, the results presented in Table 4-7 provided supportive evidence consistent with our neighborhood formation mechanism. However, our evidence is based on least squares estimates, given that it is extremely challenging to find valid instruments for changes in MSA racial and educational composition. To the extent that the changes in MSA black education composition between 1990 and 2000 are not necessarily exogenous, one might be concerned that sources of these changes may give rise to spurious correlations unrelated to our neighborhood formation hypothesis. In this subsection, therefore, we consider an alternative possible explanation for a positive relationship between segregation and racial inequality. This is due solely to *across*-MSA sorting, where highly educated blacks differentially migrate to MSAs with more middle-class black neighborhoods, instead of our neighborhood formation mechanism, which has focused implicitly on within-MSA sorting.

To address the likely strength of this alternative, we make use of rich Census microdata providing information on the metropolitan area in which each individual lived *five years prior to the Census*. These data allow us to examine the extent to which highly educated blacks are drawn disproportionately to metropolitan areas that have a larger number of middle-class black neighborhoods. Such a migration pattern could generate the kinds of cross-sectional results shown for older adults in Table 4 if black in-migrants were significantly more educated than those who already lived in segregated metropolitan areas.

[Table 8 About Here]

Table 8 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.[33] 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 percent black and 40 percent college-educated.

The regression shown in Column 1 is estimated on a sample of individuals who moved to a new MSA between 1995 and 2000 and includes fixed effects for the MSA the individual resided in 5

[33] We focus on these younger adults on the basis that they are more likely than others to move to a new metropolitan area during a given five-year period.

years prior to the Census year. 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 demonstrate clearly that college-educated blacks are indeed more likely to choose MSAs with a greater number of neighborhoods that are at least 60 percent black and 40 percent 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 across-MSA 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. This finding accords both with individuals' same-race preference as specified in our model and the fact that most U.S. MSAs contain a very limited number of middle-class black neighborhoods.

It is important to point out that this kind of across-MSA sorting is *unlikely* to be responsible for the negative relationship between segregation and racial inequality we documented earlier. To see this, Columns 2 and 3 in Table 8 report the results of corresponding specifications for individuals who, respectively, do and do not migrate across MSAs during this five-year period, dropping the fixed effects for the lagged MSA.[34] The resulting coefficients reveal a remarkably similar pattern to those reported in Column 1. That an almost identical pattern obtains for stayers as movers 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 MSA educational composition of the blacks, allowing us to rule out this type of sorting as an explanation for the positive relationship between segregation and black educational attainment relative to whites.

As a further robustness check, Columns 4-6 repeat the analysis using the number of tracts in the individual's current MSA that are at least 40 percent black and 40 percent college-educated. These results are similar to those presented in Columns 1-3 in that there is little discernible difference when comparing movers and stayers.

5.3 Cohort Effects? Cross-Sectional Results for 2000 Census

Another potential concern is that the age pattern we document in Table 4 is not a life-cycle effect as we argue, but it represents cohort effects instead. To distinguish age effect from cohort

[34] Additional fixed effects for the lagged MSA cannot be included for stayers since they did not move.

effect, we report in Appendix Table 5 the same analysis we carried out in Table 4 but using the 2000 Census instead of the 1990 Census.[35] Comparing interaction coefficients in each column of this table against the corresponding entries in Table 4 reveals a similar pattern and similar point estimates. In the case of college education, shown in the first column, there is evidence of a mild steepening of the profile in 2000 relative to 1990 – slightly more negative to slightly more positive – and the estimates are somewhat more precise. For log earnings, the profile is somewhat flatter, becoming positive for the 41-50 age group rather than the 31-40 age group in 1990 (though in this latter case, the point estimate is imprecise). These estimates make clear that a very similar age profile to that reported in Table 4 for the 1990 Census emerges using 2000 Census data.

On a related theme, Collins and Margo (2000) report the interaction coefficient from a series of CG-style regressions for the log(earnings) of individuals aged 20 to 30 as far back as the 1940 Census. They estimate an effect of roughly the same magnitude (though statistically insignificant) as that reported by CG for 1990.[36]

6 Implications

The results reported in Sections 4 and 5, taken together, provide strong evidence underlining the important role neighborhood formation plays in generating the relationship between racial inequality and residential segregation. In this section, we discuss the broader significance of our findings in terms of the inter-related dynamics of segregation and inequality.

The joint presence of the neighborhood formation mechanism (which predicts a negative relationship between residential segregation and racial inequality) and the neighborhood effects mechanism of CG (which predicts a positive relationship) points toward the operation of a *negative feedback loop* affecting the joint evolution of residential segregation and racial socioeconomic inequality. For example, suppose that government policies aimed at improving inner city schools are able to reduce racial educational inequality in an MSA. Our neighborhood formation mechanism predicts that this will lead to an increase in segregation among blacks of all education levels; the increase in segregation will then, via Culter and Glaeser's (1997) neighborhood effect mechanism, in turn lead to lower educational attainment among young blacks relative to whites, undoing some of the initial reduction in racial inequality over time. The operation of this negative feedback loop implies that the movement towards racial convergence will tend to be inhibited and slow.

[Table 9 About Here]

Relevant to the unresolved issue of the strength of the feedback, we also note that the effects

[35] The summary statistics for the 2000 micro Census data are provided in Appendix Table 6.

[36] They interpret this evidence as supporting the notion that "ghettos did not *turn* bad" (drawing on the title of CG's paper) in more recent decades.

of the negative feedback may be mitigated when the proportion of highly educated blacks in an MSA is sufficiently high. To see this, Table 9 reports a series of OLS regression results whose specifications are similar to that of (2) used in Table 4, with the exception that we now add the triple interaction $\text{SEG}_i \times \text{BLACK}_i \times$(% METRO BLACK AND COLLEGE EDUCATED).[37] Columns 1-4 focus on the sample of 20-24 age group and Columns 5-8, the 25-30 age group. As in Table 4, we examine the four outcomes, high school graduation, college graduation, log earnings and whether idle. The coefficient estimates indicate that, even though segregation is negatively correlated with black outcomes relative to whites for these two young age groups, a result confirming Cutler and Glaeser (1997, Table IV) and our own Table 4, a significant exposure to highly educated blacks actually has a positive effect on individual outcomes. For example, for high school graduation, the coefficient estimate of the term $\text{SEG}_i \times \text{BLACK}_i \times$(% METRO BLACK AND COLLEGE EDUCATED) suggests that being exposed to the negative influence of segregation on younger blacks' high school graduation rate will be reduced by about 15 percent due to the exposure of more highly educated blacks. This result thus suggests the possibility that, when there is sufficiently high proportion of highly educated blacks in an MSA, we may break out of the negative feedback loop and achieve a simultaneous reduction in residential segregation *and* racial inequality.

7 Conclusion

In this paper, we have argued that residential segregation may rise, somewhat counter-intuitively, when racial differences in education and other sociodemographics narrow. We proposed a mechanism that could generate such a negative inequality-segregation relationship, involving a process of *neighborhood formation*. As motivation for this, given the scarcity of middle-class black neighborhoods in many U.S. cities, we noted that highly educated, high-income blacks are forced to choose from either predominantly white neighborhoods with high levels of neighborhood amenities or neighborhoods with higher proportions of blacks and fewer amenities. In the face of such a neighborhood availability constraint, increases in black socioeconomic status relative to whites would, we argued, lead to the formation of new middle-class black neighborhoods, and these could in turn be attractive to blacks, especially those who were highly educated, permitting increases in residential segregation as inequalities across race narrowed.

In order to examine the importance of this neighborhood formation mechanism in practice, alongside competing mechanisms also likely to influence the inequality-segregation relationship, we proposed a new two-part research design, yielding distinctive cross-sectional and time-series predictions. Cross-sectionally, we argued that differential relations between black educational attainment relative to whites and segregation over the life cycle allow us to distinguish the neighborhood formation mechanism from the well-established 'neighborhood effects' mechanism of Cutler and Glaeser

[37] Of course, we also add the interaction BLACK × (% METRO BLACK AND COLLEGE EDUCATED) in Table 9.

(1997). While the neighborhood effects mechanism should operate only for younger blacks, whose education is either on-going or only recently completed, our neighborhood formation mechanism should operate, in contrast, for blacks of all ages, thus showing up most clearly for older blacks. This age pattern in the correlation between racial inequality and residential segregation should distinctively reveal the presence of our neighborhood formation mechanism. In first differences over time, the latter mechanism should dominate, and be identified by the first-difference effect found for older blacks.

We implemented this two-part design using Census data, showing that there was indeed a negative cross-sectional relationship between inequality and segregation for older blacks, based on both the 1990 and 2000 Censuses. In terms of the time series evidence, we also showed that increases in the proportion of highly educated blacks in a metropolitan area between 1990 and 2000, controlling for the education of whites, are associated with greater racial segregation; and when we looked specifically at older blacks, we found even stronger increases in city-wide segregation, likely reflecting the strength of neighborhood formation alone. Further, changes between 1990 and 2000 within-MSA clearly indicate that increases in average educational attainment of blacks relative to whites are associated with sharp rises in the number of middle-class black communities, consistent with the operation of the neighborhood formation mechanism.

In terms of the broader implications of our analysis, we noted at the outset that racial inequality and residential segregation are linked in an intergenerational feedback loop, with segregation influencing racial inequality in the present, which then affects household residential sorting and so future segregation, in turn influencing socioeconomic inequality. Our results, in combination with the findings of CG, indicate that the feedback is negative in character, likely to inhibit reductions in segregation and racial inequality over time. This has obvious policy relevance. In terms of shedding light on the strength of the feedback, we also identified conditions under which the effects of this negative feedback loop are likely to be mitigated, namely when the proportion of highly educated blacks in a city is sufficiently high.

It is worth drawing attention to another channel, related to the formation of preferences, that might also serve to weaken the negative feedback loop. The results in our paper are based entirely on the recent range of data across U.S. cities, where we never get very close to racial equality. And it is possible that if racial inequalities in education and income were reduced significantly, so the general strength of racial preferences might also weaken, with racial segregation declining as a result. Endogenizing preferences in this fashion presents an important, as well as challenging, area for future work. Further, to explore the inter-related dynamics of segregation and inequality more explicitly calls, naturally, for a dynamic model that incorporates both neighborhood sorting and education production. The task of developing and estimating such a model also provides a worthwhile avenue for future research.

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

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

Note: The top number in each cell gives 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 gives 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: Neighborhood Patterns for College-Educated Individuals in the United States in 2000

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**	**Overall**
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**	**Overall**
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. metropolitan areas reside, respectively, using data from the 2000 Census. To construct the numbers in Panel A, college-educated blacks in each MSA are ranked by the fraction of blacks in their tract and assigned to one of five quintiles for that MSA. Average neighborhood sociodemographic characteristics are then reported for each quintile, averaging across all MSAs. Overall averages are given in the last column. 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 3: 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)
Metropolitan Composition				
% 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)

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 using 2000 Census data. Metropolitan-level observations (N = 276) are weighted by population, and the log of the population is included as an additional control. Standard errors are reported in parentheses. *** denotes significance at the 1-percent level, and ** denotes significance at the 5-percent level.

Table 4: Segregation and Metropolitan Composition -- Age Profile in 1990

***Coefficient on interaction between black and metropolitan segregation* (*dissimilarity index*)**

Dependent Variable:	College Graduation	Ln(Earnings)	High School Graduation	Idle
	(1)	(2)	(3)	(4)
Age Category:				
20-24	-0.104***	-0.549***	-0.266***	0.339***
	(0.031)	(0.108)	(0.037)	(0.033)
25-30	-0.075	-0.190***	-0.214***	0.302***
	(0.056)	(0.074)	(0.040)	(0.038)
31-50	0.004	0.196**	-0.117***	0.196***
	(0.058)	(0.083)	(0.041)	(0.033)
31-40	-0.034	0.146*	-0.125***	0.208***
	(0.062)	(0.087)	(0.037)	(0.037)
41-50	0.058	0.268***	-0.100**	0.176***
	(0.055)	(0.090)	(0.050)	(0.032)
51-70	0.073**	0.430***	-0.072	0.101***
	(0.034)	(0.124)	(0.061)	(0.031)
51-60	0.061	0.417***	-0.118*	0.109***
	(0.040)	(0.114)	(0.064)	(0.035)
61-70	0.087***	0.480***	-0.004	0.104***
	(0.031)	(0.185)	(0.065)	(0.036)

Notes: This table reports coefficients from a series of regressions based on the specification used in Cutler and Glaeser (1997) to generate their 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 in the table for these ages are not identical to those reported in Cutler and Glaeser but are very close, most likely attributable to the fact that we use the 5-percent sample of the 1990 Census while the 1-percent sample is used by Cutler and Glaeser. All other measures are identical, as we used the same metropolitan characteristics used by Cutler and Glaeser, generously made available by Jacob Vigdor on his website.

*** denotes significance at the 1-percent level, ** denotes significance at the 5-percent level, and * denotes significance at the 10-percent level.

Table 5: Segregation and Metropolitan Composition -- First Differences (1990 to 2000)

Dependent Variable:		Δ dissimilarity index (1990-2000)	Δ dissimilarity index (1990-2000)	Δ dissimilarity index (1990-2000)	Δ dissimilarity index (1990-2000)
		(1)	(2)	(3)	(4)
Δ Metropolitan Characteristics					
% Black with College Degree	**all adults**	**2.573*** **	**2.924*** **		
		(0.728)	**(0.788)**		
	age 25-44			-1.042	-0.273
				(1.311)	(1.346)
	age 45+			**4.489*** **	**3.504** **
				(1.319)	**(1.461)**
% Black with less than College Degree	all adults	-0.031	-0.159		
		(0.226)	(0.167)		
	age 25-44			-0.153	-0.614
				(0.337)	(0.356)
	age 45+			0.528	0.867
				(0.487)	(0.506)
% White with College Degree	all adults	-0.009	-0.009		
		(0.127)	(0.123)		
	age 25-44			-0.053	0.015
				(0.198)	(0.201)
	age 45+			0.088	0.021
				(0.190)	(0.188)
% White with less than College Degree	all adults	0.396***	0.275***		
		(0.095)	(0.092)		
	age 25-44			0.233	0.157
				(0.148)	(0.145)
	age 45+			0.427***	0.295**
				(0.131)	(0.142)
Controls for Change in log(Population)?		Yes	Yes	Yes	Yes
Controls for Changes in Other Metropolitan Variables?		No	Yes	No	Yes

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 changes in metropolitan sociodemographic composition over this same period. All four columns include the change in log(population) as a control. Columns (2) and (4) also include changes in log(median income) and in manufacturing share. Regressions are based on the sample of metropolitan areas that appear in both 1990 and 2000 (N=214). *** denotes significance at the 1-percent level, ** denotes significance at the 5-percent level, and * denotes significance at the 10-percent level.

Table 6: Middle-Class Black Neighborhoods and Metropolitan Composition - First Differences

Dependent Variable:	Δ log(number of tracts in MSA >60% black and >40% college-educated)	Δ log(number of tracts in MSA >60% black and >20% college-educated)	Δ log(number of tracts in MSA >40% black and >40% college-educated)	Δ log(number of tracts in MSA >40% black and >20% college-educated)
	(1)	(2)	(3)	(4)
<u>Δ Metropolitan Characteristics</u>				
% Black with College Degree	**22.03***** **(4.91)**	**39.54***** **(5.96)**	**35.98***** **(5.17)**	**53.36***** **(5.88)**
% Black with less than College Degree	-6.76*** (1.52)	-9.67*** (1.86)	-6.76** (1.60)	-7.33*** (1.83)
% White with College Degree	-1.85** (0.85)	0.21 (1.03)	-1.73* (0.89)	0.73 (1.02)
% White with less than College Degree	-1.45** (0.63)	-0.29 (0.76)	-0.78 (0.66)	0.15 (0.75)

Notes: The table reports coefficients and standard errors from four regressions that relate changes in the number of middle-class black neighborhoods between 1990 and 2000 to the change in metropolitan educational composition over this same period, along with the change in the log of the metropolitan area population. Regressions are based on the sample of metropolitan areas that appear in both 1990 and 2000. *** denotes significance at the 1-percent level, ** denotes significance at the 5-percent level, and * denotes significance at the 10-percent level.

Table 7: Segregation, Middle-Class Black Neighborhoods and Metropolitan Composition - First Differences

Dependent Variable:	Δ log(number of tracts in MSA >60% black and >40% college-educated)	Δ log(number of tracts in MSA >60% black and >20% college-educated)	Δ log(number of tracts in MSA >40% black and >40% college-educated)	Δ log(number of tracts in MSA >40% black and >20% college-educated)
	(2)	(3)	(4)	(5)
<u>Δ Metropolitan Characteristics</u>				
% Black with College-Degree				
adults - age 25-44	10.44	31.01***	31.97***	38.85***
	(9.12)	(11.13)	(9.61)	(10.85)
adults - age 45+	33.72***	47.49***	47.31***	61.92***
	(9.11)	(11.12)	(9.61)	(10.84)

Notes: The table reports coefficients and standard errors from four regressions that relate changes in the number of middle-class black neighborhoods between 1990 and 2000 to the change in metropolitan educational composition over this same period, focusing on changes in the percentage of younger versus older blacks with a college degree. Regressions are based on the sample of metropolitan areas that appear in both 1990 and 2000. *** denotes significance at the 1-percent level, ** denotes significance at the 5-percent level, and * denotes significance at the 10-percent level.

Table 8: Assessing Across-Metropolitan Area Sorting

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	Stayers
	(1)	(2)	(3)	(4)	(5)	(6)
Individual Characteristic:						
Black with College Degree	1.075***	1.165***	0.903	2.702***	3.104***	2.798***
	(0.107)	(0.147)	(0.812)	(0.254)	(0.326)	(1.198)
Black with less than College Degree	0.197***	0.253***	0.380	0.079	0.372**	1.463
	(0.054)	(0.087)	(0.681)	(0.129)	(0.186)	(1.293)
White with College Degree	0.157***	0.17*	-0.248	0.833***	1.144***	0.126
	(0.053)	(0.094)	(0.577)	(0.110)	(0.160)	(0.950)
White with less than College Degree	-0.499***	-0.561***	-0.704	-1.38***	-1.446***	-1.609
	(0.052)	(0.075)	(0.562)	(0.139)	(0.141)	(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 each 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 who moved between metropolitan areas and those who did not in the five years prior to the 2000 Census. For movers, a specification that includes fixed effects for the MSA of residence in 1995 is also reported. Standard errors adjusted for clustering at the metropolitan level are reported in parentheses. *** denotes significance at the 1-percent level, ** denotes significance at the 5-percent level, and * denotes significance at the 10-percent level.

Table 9: Enhanced Cutler-Glaeser Regressions: The Effect of Metropolitan Segregation on Individual Outcomes

Coefficients on interactions between black and metropolitan segregation (dissimilarity index) and proportion college-educated blacks in metro area reported

	Age 20-24				Age 25-30			
	HS Graduate (1)	*College Graduate* (2)	*Ln(Earnings)* (3)	*Idle* (4)	*HS Graduate* (5)	*College Graduate* (6)	*Ln(Earnings)* (7)	*Idle* (8)
Cutler-Glaeser Regressions								
Black*Metro Dissimilarity Index (Segregation)	-0.269***	-0.094***	-0.788***	0.340***	-0.201***	-0.064	-0.433***	0.310***
	(0.041)	(0.032)	(0.140)	(0.031)	(0.039)	(0.062)	(0.094)	(0.038)
Adding Interactions with (% Metro Black and College-Educated)								
Black*Segregation	-0.412***	-0.101***	-1.123***	0.387***	-0.241***	-0.016	-0.505***	0.394***
	(0.080)	(0.039)	(0.260)	(0.070)	(0.072)	(0.065)	(0.164)	(0.083)
Black* Segregation* (% Metro Black and College Educated)	**13.60*** **	**2.40**	**20.06***	**-5.26***	**6.21***	**-0.88**	**6.07**	**-7.45** **
	(4.32)	**(3.30)**	**(12.25)**	**(3.09)**	**(3.67)**	**(5.94)**	**(7.93)**	**(3.06)**
Black* (% Metro Black and College Educated)	-8.89***	-2.13	-9.36	4.00*	-3.02	0.54	-0.82	4.51**
	(2.95)	(2.36)	(8.81)	(2.49)	(2.59)	(4.22)	(5.32)	(2.03)

Notes: This table reports the results of a series of OLS regressions based on the specifications in Table IV of Cutler and Glaeser (1997). Each specification includes individual characteristics [Black, Asian, Other nonwhite, Hispanic, Female], metropolitan characteristics [segregation, ln(population), % black, ln(median household income), manufacturing share] and interactions of these metropolitan characteristics with whether the individual is black. The upper panel replicates their results, reporting the coefficient on the interaction between whether the individual is black and metropolitan segregation. The lower panel reports the results of regressions that add interactions with the proportion of the metropolitan population that is college-educated and black. This measure is included directly and interacted with the level of segregation in the metropolitan area. Both of these variables are in turn interacted with a dummy indicating whether the individual is black. Coefficients are reported for only interactions with whether the individual is black. All regressions use the metropolitan variables used by Cutler and Glaeser, which Jacob Vigdor has generously made available on his website.

Standard errors are reported in parentheses and ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix Table 1: Metropolitan Areas in 2000 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	Fraction black	Fraction of blacks with college degree
Percentage black	>80%	>60%	>40%	(in millions)		
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 U.S. Metropolitan Areas	21	44	142	154.84	0.11	0.15

Notes: 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.

Appendix Table 2: Metropolitan Area Characteristics for 1990

City-Level Descriptives for 1990

Variable	Residential Segregation (Dissim. Index)	ln(MSA population)	Percent Black	ln(median income)	Manufacturing Share
Number of Cities	209	209	209	209	209
Mean	0.586	13.1	0.138	10.3	0.172
Standard Deviation	0.126	1.0	0.092	0.2	0.069
Minimum	0.206	11.6	0.009	9.9	0.036
Maximum	0.873	16.0	0.457	11.0	0.456

Notes: The sociodemographic variables are obtained using the 5-percent sample of the 1990 Census.

Appendix Table 3

Summary Statistics for 1990 Census Micro Data

	Age 20-24		Age 25-30		Age 31-50		Age 51-70	
Variable	White	Black	White	Black	White	Black	White	Black
<u>Education</u>								
High school graduate	87.7%	75.9%	89.9%	79.2%	90.9%	77.4%	76.4%	48.8%
College graduate	14.8%	5.0%	28.8%	12.3%	31.5%	15.3%	19.7%	9.2%
<u>Work and income</u>								
Idle	12.6%	30.6%	14.7%	27.6%	15.5%	23.7%	48.8%	52.8%
ln(earnings)	9.3	9.0	9.8	9.5	10.1	9.8	10.0	9.7
<u>Demographic variables</u>								
Black	15.1%		13.3%		12.3%		11.2%	
Asian	1.4%		1.1%		0.9%		0.9%	
Other non-white	4.3%		3.4%		2.3%		1.3%	
Hispanic	8.0%		6.2%		4.0%		2.8%	
Female	51.6%		51.6%		51.6%		53.5%	
N	417,838		627,503		1,766,671		1,051,655	

Notes : This table is analogous to Cutler and Glaeser (1997) Table 2, though using the 1990 Census 5-percent rather than the 1-percent sample. It adds columns for ages 31-50 and 51-70. The education categories are not exclusive. 'Idle' corresponds to not working and not being in school.

Appendix Table 4:
Segregation and Metropolitan Characteristics - First-Differenced (1990 to 2000) at the MSA Level

Variable	Mean	Standard Deviation	Minimum	Maximum
Dissimilarity Index	-0.054	0.041	-0.197	0.115
% Black with College Degree	0.002	0.004	-0.008	0.018
age 25-44	0.000	0.002	-0.011	0.010
age 45+	0.002	0.003	-0.002	0.011
% Black with less than College Degree	0.001	0.020	-0.060	0.142
age 25-44	-0.002	0.012	-0.039	0.057
age 45+	0.003	0.010	-0.021	0.085
% White with College Degree	0.023	0.023	-0.035	0.125
age 25-44	-0.011	0.014	-0.061	0.049
age 45+	0.035	0.016	-0.003	0.103
% White with less than College Degree	-0.066	0.057	-0.179	0.593
age 25-44	-0.056	0.031	-0.107	0.257
age 45+	-0.009	0.033	-0.106	0.336
Log(Population)	0.177	0.175	-0.161	1.009
Log(Median Household Income)	0.344	0.055	0.188	0.542
Manufacturing Share	-0.046	0.039	-0.196	0.037
Percent Black	0.005	0.013	-0.038	0.051

Notes: This table is based on a sample of 214 MSAs.

Appendix Table 5: Segregation and Metropolitan Composition -- Age Profile in 2000

***Coefficient on interaction between black and metropolitan segregation* (*dissimilarity index*)**

Dependent Variable:	College Graduation	Ln(Earnings)	High School Graduation	Idle
	(1)	(2)	(3)	(4)
Age Category:				
20-24	-0.137***	-0.478***	-0.271***	0.321***
	(0.026)	(0.103)	(0.037)	(0.053)
25-30	-0.101**	-0.187***	-0.151***	0.291***
	(0.044)	(0.072)	(0.034)	(0.042)
20-30	-0.118***	-0.299***	-0.207***	0.304***
	(0.033)	(0.074)	(0.032)	(0.040)
31-50	0.005	0.026	-0.104***	0.237***
	(0.035)	(0.058)	(0.039)	(0.027)
31-40	-0.038	-0.087	-0.138***	0.247***
	(0.037)	(0.074)	(0.040)	(0.031)
41-50	0.047	0.148**	-0.063	0.223***
	(0.036)	(0.062)	(0.044)	(0.028)
51-70	0.084***	0.306***	-0.037	0.076***
	(0.033)	(0.088)	(0.058)	(0.027)
51-60	0.095**	0.305***	-0.034	0.126***
	(0.041)	(0.091)	(0.053)	(0.028)
61-70	0.063**	0.307*	-0.030	0.013
	(0.031)	(0.162)	(0.076)	(0.040)

Notes: This table reports interaction coefficients using the same specifications underlying Table 4, though using 2000 rather than 1990 Census data. *** denotes significance at the 1-percent level, ** denotes significance at the 5-percent level, and * denotes significance at the 10-percent level.

Appendix Table 6

Summary Statistics for 2000 Micro Data

Variable	Age 20-24 White	Age 20-24 Black	Age 25-30 White	Age 25-30 Black	Age 31-50 White	Age 31-50 Black	Age 51-70 White	Age 51-70 Black
Education								
High school graduate	85.8%	76.1%	87.7%	82.0%	89.5%	80.9%	83.8%	66.1%
College graduate	13.7%	6.2%	33.1%	16.4%	32.2%	16.7%	27.3%	13.8%
Work and income								
Idle	14.3%	29.1%	17.6%	28.1%	18.8%	29.3%	43.6%	52.1%
ln(earnings)	9.6	9.3	10.1	9.9	10.4	10.1	10.3	10.1
Demographic variables								
Black	13.9%		12.9%		12.3%		10.6%	
Asian	5.4%		6.1%		5.0%		4.1%	
Other nonwhite	15.1%		13.6%		9.0%		5.1%	
Hispanic	21.2%		19.9%		13.3%		8.5%	
Female	49.5%		50.3%		50.9%		52.4%	
N	640,546		823,613		3,019,416		1,724,116	