Black-White Segregation in Multiethnic Metropolis: How Does Multigroup Context Alter the Effect of Black-White Segregation for Blacks?*

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Abstract

How do the residential dynamics change the nature and impact of racial residential segregation when the American residential landscape becomes increasingly diverse? Although the multigroup segregation method has been developed, its utility in substantive interpretation and hypothesis testing are underdeveloped. This paper first explores the interpretive meaning of multigroup measures of segregation, constructed using the 2000 census. The decomposed components of the multigroup segregation are compared with traditional pairwise measures. By examining three types of cities, we bring life to the abstract measures. We then examine the differential impact of black-white residential segregation under different ethnic diversity levels on black-white income gaps. We test two competing hypotheses about the interaction effect of black-white segregation and diversity on black-white income gaps using the 5% PUMS 2000 data. Our results reject the hypothesis that the racial hierarchy places whites on the top without a clear ordering of racial minorities and favor the hypothesis that blacks are placed at the bottom of the racial hierarchy.

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Introduction

As the American residential landscape becomes increasingly diverse, researchers interested in racial and ethnic segregation must explore how the residential dynamics change the nature and impact of racial residential segregation in a multiethnic context. As a response to this challenge, the multigroup segregation method has been developed. However, the multigroup method's utility in substantive interpretation and hypothesis testing are yet to be developed. In this paper, we first explore the interpretive meaning of multigroup measures of segregation vis-à-vis traditional pairwise measures of segregation; and then we test the hypothesis that the detrimental effect of black-white segregation on African Americans' life chances becomes weaker as the local population becomes more diverse.

Multigroup indices have been used infrequently compared with traditional pairwise measures. This is in part because similar scores on multigroup indices can be associated with a variety of ethnic residential patterns with varying degrees of segregation between any two given racial-ethnic groups. For example, the same multigroup segregation score could describe a context in which all groups have a moderate level of segregation or a context where two groups are highly segregated from each other while other groups are not segregated in a context. This calls for a serious examination of the meaning of multigroup diversity and segregation vis-à-vis more traditional pairwise indices. By examining these measures in conjunction with one another, we provide a meaningful interpretation of multigroup segregation and illustrate its utility in examining the impact of black-white residential segregation on the income of African Americans in racially diverse metropolitan areas.

Our methods are based on Theil's diversity and segregation indexes (Theil 1972) and the decomposition of Theil's segregation index (Firebaugh and Reardon 2001). We construct our diversity indexes and multigroup and pairwise segregation indexes at the metropolitan statistical area (MSA) level using the whole population counts from the Census 2000 SF1 data. We use concrete examples to illustrate the substantive meaning of multigroup segregation, focusing on scenarios such as high black-white segregation in a low or high multigroup segregation context. Using the MSA codes, we merge these indexes with the 2000 PUMS data for individual level analysis of the impact on black-white income gaps of black-white segregation in multiethnic contexts.

Black-White Segregation in the Context of the Multiethnic Metropolis

The intensity and persistence of black-white segregation and its negative impacts on the social mobility for black residents in the United States have been well documented in the sociological literature (e.g., Massey and Denton 1993). The segregation of black residents from white residents is unparalleled by the residential experiences of any other group. Moreover, no other group experiences the level of residential isolation that black residents do in predominately black neighborhoods throughout the United States.

Less is known about how large streams of immigrants change the residential context of the United States, where blacks and whites tend to segregate from each other. The U.S. population has become increasingly racially and ethnically diverse primarily due to the rapid increase in immigrant flows from Asia and Latin America. From 1990 to 2000, the Hispanic population increased by 57.9% and the Asian population increased by 52.4%, whereas the native population increased by only 9.3%. The growing immigrant population becomes an increasingly important issue in understanding the residential dynamics of American cities.

The diversity created by increased immigration is not distributed evenly across MSAs throughout the country. Rather, more than half of the immigrant population is concentrated in 13 MSAs, while in most MSAs immigrants represent less than 10% of the population (Lewis Mumford Center 2003). Furthermore, the proportion of immigrants in a metropolitan area from different countries of origin varies because of different ethnic settlement patterns shaped by ethnic niche markets, refugee settlement programs, chain migration patterns, and historical recruitment efforts.

This growth in racial-ethnic diversity will likely alter the dynamics of residential segregation. While neither Asians nor Latinos ever experience the levels of segregation from whites that African Americans do (Lewis Mumford Center 2001), they move into spaces already occupied by whites or blacks (Alba et al. 1995). With large-scale movement of new immigrants into metropolitan areas throughout the United States, the increasing presence of immigrants, particularly Latinos, is altering both the meaning and patterns of residential segregation between whites and blacks in contemporary America.

Fossett (2001) compares cities in which African Americans experience high or relatively low levels of segregation in 1990. In looking at the five cities where blacks and whites are most segregated--Chicago, Cleveland, Detroit, St. Louis, and Milwaukee--he notes that "each city has a clearly identifiable, centrally located black ghetto (an expanse of contiguous, 80% black neighborhoods)" and that "few neighborhoods are 'mixed' (with no identifiable majority)." He further notes that these neighborhoods are "extremely isolated in terms of contact with other groups." In contrast, among low segregation cities including Phoenix, Sacramento, San Diego, and San Antonio, only San Antonio has a concentration of black residents reaching 80%. Fossett notes that "the fact that the low segregation cities are ethnically diverse, rapidly growing, and located in the Southwest is apparently not a coincidence."

Alba and colleagues (1995) have likewise found that in New York City, immigration has brought changes in residential patterns that particularly impact black neighborhoods; they find that with increased immigration, predominately black neighborhoods have become *black and Latino* neighborhoods. Similarly, Denton and Massey (1991) and Farley and Frey (1996) find that diverse communities, often created through large-scale immigration, tend to diminish black-white segregation. Farley and Frey (1996) note that the presence of other groups in addition to blacks and whites may reduce black-white antagonism in ways that alter the perception of the residential housing market among native-born blacks and whites with Latino and Asian residents serving as "buffers" between segregated black and white communities. Iceland's (2003) work also indicates that increased diversity is associated with a *decline* in segregation of African Americans, even though growing diversity has tended to be associated with an increase in segregation levels overall.

Methodologically, most studies of segregation have used pairwise indices such as the indices of dissimilarity and isolation to examine the levels of segregation between two groups. More recently, a relatively small number of researchers have begun to use diversity and multigroup indices to examine segregation trends and the segregation effects. Iceland (2003), for example, uses the multi-race information index (H) and multi-group entropy (E) to examine how multigroup segregation and diversity impact segregation between groups. While innovative in making the use of multigroup measures, Iceland's work does not exactly get at the issue of the interpretative value of the multigroup measures. Thus, the question of how multigroup segregation relates to spatial patterns of residence within metropolitan areas and their impacts on African Americans remains unanswered.

With a focus on black-white income gaps, our central question is the role of ethnic diversity in modifying the effect of black-white segregation. First, according the Massey and Denton (1993), black-white segregation has been historically created, maintained and transformed to meet the whites' needs of resource competition and psychic comfort while harming the life chance of blacks in multidimensional, cumulative ways. Thus, a basic hypothesis derived from segregation theory is an effect in opposite direction: positive for whites and negative for blacks. The chief challenge is how ethnic diversity will modify these differential effects. Thus, a key question is whether diversity benefits or hinders life chances for blacks. Racial hierarchies supported by racism within society and its institutions are theorized to be manifested in two different ways. In one conception, blacks exist at the bottom of the racial hierarchy, not only with inferior opportunities to whites but also to other racial-ethnic minorities (Waters 1999). An alternative conceptualization places whites at the top of the racial hierarchy above all racial-ethnic minorities, but leaving less hierarchical structure among all minorities. While both theses depict the racial-ethnic hierarchy, their implications for the role of ethnic diversity in the effect of black-white segregation diverge. The former argument places blacks at the very bottom of the racial-ethnic hierarchy. When more non-white minorities are living in the city, greater competition will impose on blacks that may result in ever more scarce resources and elevated discrimination. Under this argument, we predict that greater ethnic diversity reinforces the detrimental effect of black-white segregation. However, in contrast, the latter argument suggests that increasing ethnic diversity, i.e., more non-white minorities, may create greater opportunities that are open for blacks as the among-minority structure is unclear. Under this argument, greater ethnic diversity weakens the detrimental effect of black-white segregation.

In this paper, we bridge the gap in the literature in two ways. First, we bring life to the highly abstract multigroup segregation index and its decomposition by taking a close look at a number of cities representing a typology of cities based on racial diversity and black-white segregation. We illustrate the internal logical linkage and the real-world meanings of group proportion, diversity of a group relative to the whole population, segregation of the two groups of interest, and the multigroup segregation index. Second, we carry out these internal linkages of components to a multivariate analysis of blacks-white income gaps at the individual level. This analysis offers us evidence to test the two competing hypotheses about the role of ethnic diversity in altering the impact of black-white segregation.

Data and Methods

Data Sources

Our diversity and segregation measures are constructed using SF1 data from the 2000 U.S. census. Summary tables provided by SF1 are at the place level by basic demographic characteristics of the population. From these tables, we can aggregate to census tracts and MSA/PMSAs, which are our definition of subareas and areas for the construction of segregation measures. The diversity and segregation measures are for our first analytic task to identify the substantive meaning of multigroup segregation vis-à-vis black-white segregation. Our second analytic task is examine the segregation effect on African Americans' income. The individual level data are drawn from the 5% Public Use Microdata System (PUMS) of the 2000 census. Our analytic sample include all non-institutionalized individuals aged 25-64. We merge the diversity and segregation measures with the PUMS data using individuals' resident MSA/PMSA FIPS codes.

Measurement

Racial diversity is measured by Theil's Entropy index *E.* For any locality, $E = \sum_m \pi_m \log(1/\pi_m)$ where π_m is the proportion of group m , $m = 1,...,M$. Racial diversity increases with the number of groups and the evenness of group sizes. The values of racial diversity range between $(0, \log M)$. While *E* does not involve sub-areas, Theil's information theory index *H,* a measure of segregation for two or more groups, is a function of the relative diversity of sub-areas within an area, e.g., census tracts within a MSA. Let *T* be the total population of the MSA and t_j the population of the j^{th} tract, we have: $H = 1/TE\sum_j t_j(E - E_j)$, ranging (0,1). The higher the *H*, the more segregated the racial-ethnic groups. To better link to the segregation literature, we also use the dissimilarity index for black-white segregation.
Our substantive interest is black-white segregation within multi-racial, multi-ethnic contexts, not the multi-group segregation *per se*. To this end, we decompose the multi-group *H*. For decomposition, we collapse the multiple groups into *N* super-groups (here two) and calculate the segregation index H_N for the super-groups and the segregation index H_n for each group within super-groups. The decomposition is: $H = (E_N / E) \cdot H_N + \sum_n p_n \cdot (E_n / E) \cdot H_n$, where p_n is the proportion of each super-group.

Individual annual total income is the dependent variable in our second analytic task. A set of key explanatory variables is black-white segregation and racial-ethnic diversity. Because segregation should have differential effects on whites vs. black, we include a set of interaction terms between segregation/diversity measures and race, as well as between segregation and diversity. To separate the racial-ethnic segregation from the socioeconomic condition of MSA/PMSAs, we include the median and coefficient of variation for the MSA-level SES (which is made of individual education and income). Individuals' race is another key variable (black and white). Control variables include gender, age, and enrollment status.

Empirical Model

We use quantile regression to study the segregation effect on income. While OLS estimates the conditional mean of the response variable, quantile regression estimates the entire conditional distribution of the response, which is particularly appealing to inequality studies (Keonker and Bassett 1978; Keonker 2005; Hao and Naiman 2007). Though relatively new in sociological research, quantile regression has been applied to many studies of wage and income inequality in economics (e.g., Buchinsky 1994).

Let y_{it} be the response variable for individual *i* in year *t*, and x_{it} is a vector of individual variables (race-ethnicity and controls), the segregation variables, and the constant, the quantile regression model can be expressed as:

(1) $$y_{it} = \beta_t^{(p)} x_{it} + \varepsilon_{it}^{(p)},$$

where $0 < p < 1$ indicates the cumulative proportion of the population. $Q_t^{(p)}(y_{it} \mid x_{it}) = \beta_t^{(p)} x_{it}$ denotes the conditional p^{th} quantile given x_{it}. The p^{th} conditional quantile is determined by the quantile-specific parameters, $\beta_t^{(p)}$, and the values of the covariates x_{it}. We will choose a 5 quantiles of income in estimation.[1] By testing the equivalence of quantile regression coefficients

[1] We use Stata "sqreg" to perform simultaneous quantile regression estimation with bootstrap standard errors. We are then able to test the equivalence of coefficients for a covariate among quantiles.

of a covariate across quantiles, we can determine whether a covariate has significantly differential effect on selected positions along the income distribution.

To apply this model to our research question about the segregation effects on African Americans' income, we include an interaction term between black-white segregation and the indicator for being black. Let D_i be black-white segregation, E_i multiple group diversity, B_i indicator for being black, x_i a vector of other individual characteristics, and A_i a vector of the other area characteristics of individuals' MSA residence. The quantile regression model is specified as:

$$
\begin{aligned}
(2) \qquad y_i = {} & \beta_0^p + \beta_1^{(p)} B_i + \beta_2^{(p)} H_i + \beta_3^{(p)} H_i \cdot B_i + \beta_4^{(p)} E_i + \beta_5^{(p)} E_i \cdot B_i \\
& + \beta_6^{(p)} H_i \cdot E_i + \beta_7^{(p)} B_i \cdot H_i \cdot E_i + \beta_8 x_i + \beta_9^{(p)} A_i + \varepsilon_i^{(p)}
\end{aligned}
$$

The full set of two-way and three-way transitions allows differential effects of segregation by race and by the level of diversity. When all continuous variables are centered at the mean, the estimated $\beta_3^{(p)}$ measures the effect of black-white segregation for blacks in addition to the main effect, $\beta_2^{(p)}$ (at the mean diversity) and is expected to be negative. The estimated $\beta_7^{(p)}$ measures the additional effect of black-white segregation for blacks and the diversity level is one standard deviation higher than the typical level. The prediction of this coefficient is positive under the hypothesis that racial hierarchy places whites at the top and is negative under the hypothesis that blacks are placed at the bottom of the racial hierarchy. We also test whether these coefficients are different for various quantiles along the income distribution.

A Hypothetical Example for Diversity and Segregation

We illustrate why it is important to consider the multi-group context within which the pair-wise segregation is of substantive interest using a hypothetical example. In this example, black-white segregation is of our interest. We look at two metropolitan areas, each of which consists of three census tracts. Table 1 lays out the population differences between the two areas. In Area 1, only blacks and whites resided in the area. In Area 2, 20 Hispanics live in the area while the number and the residential pattern of blacks and whites are the same as Area 1. Thus, Area 1 represents a case of a two-group context and Area 2 a case of three-group context. Note that the Hispanics presence diversifies Area 2 as well as its two of the three tracts.

Table 2 shows the pair-wise segregation index, the multi-group segregation index and its decomposed components, using the corresponding formulas laid out in the method section. If we focus on black-white segregation while ignoring the Hispanics presence in Period 2, the pairwise measures of segregation (H) and diversity (E) are exactly the same for the two periods: blacks and whites are completely segregated so the pairwise H is 1 and the population diversity is 0.611. However, the area has undergone population changes by Period 2. This can be clearly shown using the multi-group method. Although the number and settlement patterns of blacks and whites remain the same, the multi-group segregation is 0.609, much smaller than 1, and the diversity index is 0.960, much greater than Period 1's diversity.

What does the multigroup segregation mean for black and white residents who are still completely separated? A useful way to understand this question is to find out how much the black-white segregation contributes to the multigroup segregation. The multigroup H is decomposable. This simple case has two components: the so-called "supergroup segregation", where we put blacks and whites in a supergroup and Hispanics in another supergroup. The supergroup segregation measures the degree to which blacks and whites combined are segregated from Hispanics. In this example, Hispanics moved in the black neighborhood and one of the two white neighborhood. Thus, the supergroup segregation is relatively low (0.170). How much the supergroup segregation contributes to the multigroup segregation is determined by the diversity of the supergroups relative to the diversity of multigroups in the area, which is 0.451. In other words, nearly half of the supergroup segregation constitutes a component of the multigroup segregation.

A second component involves the black-white pairwise segregation within one supergroup. Blacks and whites remain completely segregated in Period 2. How much of this complete segregation contribute to the total multigroup segregation depends on two factors: the proportion of blacks and whites combined (.833 in Period 2) and the black-white diversity relative to the total diversity (.637). The two factors work in a multiplicative manner (.833*.637=.531) to determine that just a little over half of the black-white segregation contributes to the total multigroup segregation.

In this simple example, a third component which exists in a general case, is the corresponding measures within the other supergroup, which consists only Hispanics. As a result, all the corresponding measures discussed for the supergroup consisting of blacks and whiles are effectively zero, making this component zero. In this example, the two non-zero components exactly make up the total multigroup segregation: .451*.170+.883*.637*1=.609.

In sum, this hypothetical example shows that population diversification and settlement patterns of the more diverse residents invoke a social process whereby the impact of the black-white segregation should be evaluated by simultaneously considering diversity and the impact of black-white segregation in various context of racial-ethnic diversity. These variables simultaneously determine blacks' outcomes. We expect that the negative impact of black-white segregation is smaller in a more diverse context than in a less diverse one.

Diversity, Segregation and H Values

Because the decomposed components of H have weights that are determined by the proportion of groups and relative diversity, we examine their relationship with the overall H value. We note that very high H values are the cases with very high black/white segregation and low diversity. Medium range H values can be heterogeneous but diversity must be high. Low levels of diversity in the context where there is a large white population and relatively small percentages of blacks and other minorities tend to have low H values as well. In this paper we focus on metro areas with moderate to high values of H because we are interested in understanding how the group proportions, relative diversity, and residential patterns impact H. Moreover, cities in such situations are more well known. As a standard, we refer to H values below 20 as low, between 20-29 as moderate, 30-40 as high and above 40 as extreme. In examining the relationship between dissimilarity scores and the H value for Census 2000, we note that the 2000 empirical H seems to be highly correlated with several factors including: 1) the severity of black/white segregation, 2) the overall diversity, particularly when there exists a sufficiently large third group, 3) the proportion of the various groups in the metro area, and 4) the segregation of the third group. In instances where black/white segregation is particularly high, we also see a fairly high H value, particularly when there is not a substantial presence of a third group. These two issues may be related, that is, black/white segregation is often particularly high in places where there are few other groups. However, even when there is a third group present, an extreme level of segregation between blacks and whites can substantially raise the H value.[2]

[2] With large-scale immigration of Latinos to urban areas, the relative importance of black/white segregation on the H value may decline somewhat in the future and we can envision a scenario in which it might be plausible to say that any two sufficiently large groups that are highly segregated may raise the H value, but for now the impact of black/white segregation on the H value must be recognized.

These two issues, the level of black-white segregation and the overall diversity (for practical purposes meaning that a third group, usually Latinos, has to be large enough to impact the overall residential patterns) are particularly important. Based on the SF1 data of the Census 2000, we construct multigroup segregation H (ranging from .021 to .486), group diversity E (from .160 to 1.386), black-white dissimilarity D (from .229 to .855), and black-white H (from .029 to .712).

Let's take the example of Baltimore, with an H value of .348. In a case like Baltimore, a city with high black-white segregation and relatively low diversity, the relatively low level of segregation between Latinos and whites (d=.358.) does not bring the H value down to the moderate level because the Latino population is too small to make a big impact on the H value, particularly because the two larger groups, blacks and whites, are so highly segregated. The relative lack of diversity is confirmed by looking at the E value for Baltimore which is .887.

Multigroup Segregation: the Rust Belt and the Sun Belt

After we produce a list of large metropolitan areas falling into moderate or high levels of H, we see the following breakdown:

- Low (.30 or lower): Los Angeles, Houston, Dallas, Miami, Washington DC, Boston
- Medium (above .30): New York, Philadelphia, Chicago, Cincinnati, Buffalo, Baltimore, Newark
- High (above .40): Detroit, Cleveland, Milwaukee.

What is striking about this categorization of multigroup segregation is that the divides seem to neatly replicate the old economy (rust bell) / new economy divide (sun belt). This raises a question of whether residential characteristics of "new economies," that is technological, information, research and the service industries that rise around them bringing new immigrants to fill occupational demands, define and/or create more residentially integrated environments.

Sassen (1988) notes that the characteristics of global cities include both high-skilled workers in the information, research and technology sectors as well as low-skilled workers who provide the personal and professional services that are required by the high skilled labor. The service positions in this type of economic arrangement are often filled by immigrant labor. This pattern of economic relations may spread from large-scale global cities to smaller cities with information, technology, and knowledge industries. The kinds of structural economic changes in "global cities" that Sassen describes coincide also with changing residential patterns of immigrants. Alba and colleagues (1999) find that some immigrants now move directly to the suburbs, a previously uncommon phenomenon for new immigrants. The economic structural change and immigrant settlement change are relevant to racial and ethnic residential patterns within cities. Perhaps new economies support employment-based residential patterns, which may promote racial-ethnic integration.

However, even if residential integration is taking place, not all groups seem to be impacted the same way by changing residential patterns in the multiethnic context. Similar to Krivo and Kaufman's (1999) work, we find that a comparison of dissimilarity scores and H reveal that even in areas with moderate multigroup segregation, African Americans tend to have high levels of segregation from whites and other groups. That is, in cities with moderate H values we see a pattern of greater integration of whites and groups other than African Americans and relatively high segregation of African Americans from both whites and other non-whites. Even in a context of greater diversity and moderate H levels, African Americans remain highly segregated from whites, although typically – but not always – less so than in cities with higher H values. If we return to our list of cities with moderate (Miami, Washington DC, Los Angeles, Houston, Dallas, and Boston) and high (Baltimore, Philadelphia, Chicago, New York City, Newark, Buffalo) H values, we see that only in one case does a city with a moderate H value, Miami, have a black-white dissimilarity score over .70, while all cities of high H values have dissimilarity scores above .70 or .80, with the sole exception of Baltimore, with a black-white dissimilarity score of .665.

A Closer Look Into Multigroup Segregation: Detroit and Miami

The utility of multigroup statistics in understanding the segregation context of a particular group, in this case African Americans, can be illustrated with a simple comparison of two cities with high black-white dissimilarity scores, but very different multigroup contexts. The black/white dissimilarity scores for Miami and Detroit respectively are .729 and .855 meaning that in the Miami metropolitan area nearly 73% of black residents, and over 85% in Detroit, would have to move in order equally distributed, that is, for each tract to have the same proportion of black and white residents as that in the metro area. The H score for Miami is .307, while the H score for Detroit is .485 indicating that more groups are highly segregated in Detroit than in Miami. An important difference between these metropolitan areas is the level of diversity. While Detroit is predominantly black and white, with only a small Latino population, Miami has a large Latino population due to immigration and refugee settlements. The E statistic indicates a value for Miami of E=1.087 that is markedly greater than that of Detroit where E=.864. Both the overall diversity of the population and the settlement patterns of the groups within the area play a role in determining the multigroup segregation score. In other words, the diversity of subareas relative to the diversity of the whole area determine multigroup segregation.

We know based on the black/white dissimilarity scores that in both cases blacks and whites are highly segregated. In Miami, African Americans are highly segregated from whites (dissimilarity score=.773), but non-Hispanic whites are only moderately segregated from Latinos (dissimilarity score=.439). Thus Miami reflects a situation in which one group is highly segregated from the others, while the other groups have relatively lower levels of segregation from each other. In Detroit non-Hispanic whites are also moderately segregated from Latinos (dissimilarity=.456), but because Detroit has a relatively small Latino population (less than 3% of the population), the multigroup segregation context reflected by the H value are highly impacted by the extreme level of segregation between blacks and whites.

Different Populations, Similar H values: New York and Cincinnati

The interpretation of H indicating the level of multigroup segregation is not straightforward. A given score for H may be the same in highly different multigroup segregation scenarios. For example, a metropolitan area where several groups are moderately segregated from each other could have the same score as a metropolitan area where two groups are highly segregated from one another, but other groups are relatively interspersed. Likewise, two metro areas with similar H values may have different populations in terms of diversity. New York and Cincinnati have similar H values .364 and .368 respectively, but the racial-ethnic makeup of the populations living in the cities are quite different. In New York, about 40% of the population is white, nearly 23% is black and about 25% is Latino. Cincinnati has a population that is nearly 84% white, 13% black and only about 1% Latino. New York is, of course, an immigrant gateway (Clark and Blue 2004) while Cincinnati is not and this reflected in their values of E, which indicates the level of diversity; New York has an E value of 1.386 while Cincinnati has a value of .572. Among Latinos, an important third group in the city, New York serves as a primary magnet for Dominicans (Newbold 2002). Large scale immigration in New York occurs with a simultaneous out-migration of the native-born population creating a situation of "population exchange" (Hemstead 2002, p. 103) while Cincinnati has a more stable population over time. Both cities have high black-white dissimilarity scores. Cincinnati has a low level of segregation (dissimilarity=.275) between whites and the very small Latino community, while New York has a fairly high level of segregation between whites and Latinos (dissimilarity=.667).

A Third Group and Immigrant Residential Patterns: Washington DC and Chicago

The presence of a third group is important, and several authors have noted that the presence of new immigrant groups may serve to buffer the effects of segregation. However, in and of itself, diversity is not enough to substantially lower the value of H as well as the impact of black-while segregation. While a substantial presence of new immigrant groups, particularly Latinos, appears to play a role in lowering the multigroup segregation value of H, it is not a sufficient factor. Take, for example, a comparison of Chicago and Washington DC. If we compare the basic population statistics for the two cities we see that the two cities have a similar percentage of the population that is non-Hispanic white. Washington DC has a larger percentage of the population that is African American population than Chicago and a substantially smaller percentage of the population that is neither non-Hispanic black nor non-Hispanic white, with a particularly smaller Hispanic/Latino population than Chicago. The E values are similar in the two cities. And yet, the H value for Washington DC (.264) is substantially smaller than that of Chicago (.422). This is so because multigroup segregation reflects something more than the mere presence of multiple groups in a metropolitan area. The segregation levels of the third group, in this case Latinos, are also important in the multigroup segregation index. Both blacks and Latinos *and* whites and Latinos are less segregated from one another in Washington DC than in Chicago. Also Washington D.C. has a significant population of immigrant blacks who tend to have somewhat different residential patterns than native blacks. In Washington D.C. more than 11% of the foreign born population is African compared to "less than 3% of the foreign-born population in the entire United States" (Freidman et al. 2005, p. 211). Residential patterns of immigrants tend to be different in the two cities. Freidman et al. (2005) have noted that in Washington D.C. "immigrant newcomers tend to bypass the central city …and live in the suburbs" while in "traditional immigrant gateways, …such as Chicago, this appears to be less often the case" (p. 211, See also Singer et al 2001).

Black-White Income Gaps for Selective Cities

Because of the intersection between race and class, it is important to extend our attention from the average racial gap to gaps along the entire income distribution. We first select five positions on the race-specific income distribution: the 10th, 25th, 50th, 75th, and 90th percentiles (see Table 4). The top panel are the percentiles for whites, the middle for blacks, and the bottom shows the black-white income gaps. The first observation is that at least 10% of blacks living in the 18 selected cities have no income or negative income whereas whites in only 8 cities mirror such a situation. Second, the spread is much wider for whites than for blacks. For instance, Miami and New York see the white spread doubling the black spread. Third, although the black-white income gap monotonically increases with percentiles, some cities, such as Miami and New York, exhibit steeper increases and others, such as Cincinnati and Detroit, exhibit a flatter increase.

(Table 4 about here)

Table 5 selects five cities to offer a close look at the black-white income inequality in multi-racial segregation and diversity contexts. Miami and New York are the two cities exhibiting high black-white income gaps. Both cities are in the middle range of multigroup segregation (.307 and .364), diversity (1.087 and 1.386) and black-white segregation (.533 and .670). New York has a substantially higher level of black-white segregation and multigroup segregation than Miami. Yet, New York is much more diverse. The similar inequality observed in both cities could be the result of the cancellation of a harmful effect of black-white segregation and a beneficial effect of diversity. This possibility is challenged by bringing Chicago for comparison. With a similar level of black-white segregation to but a much lower level of diversity than New York, Chicago shows a lower level of racial inequality than New York. A plausible reason is the scale of income differs between the two cities, which will be controlled in our later multivariate analysis. Finally, by comparing Cincinnati and Detroit, we see a possibility that high black-white segregation may be even more detrimental in a more diverse context (Detroit) than in a less diverse context (Cincinnati).

(Table 5 about here)

To gain a complete view of the black-white income gaps, we draw the quantile functions by race in five selected cities in Figure 1. The proportion of population is on the x-axis and quantiles in $1,000 are on the y-axis. The curve traces 99 quantiles for whites and blacks. Miami and New York have similarly large black-white income gaps along the income distribution. On the other hand, Detroit and Cincinnati exhibit smaller back-white gaps along the income distribution.

(Figure 1 about here)

Multivariate Results

Within the multivariate framework, we perform two sets of analyses. First we use the conventional OLS regression to yield conditional mean of income on individual and contextual factors. To provide a link to the literature which widely uses the dissimilarity index and seldom consider the multigroup context. Model 1 considers personal total income as a function of individual characteristics (age, age-squared, gender, race, and education) and contextual factors at the MSA level (median SES, SES inequality, and black-white dissimilarity index). In Model 2, we replace black-white dissimilarity index with black-white Theil's information index. In Model 3, we further consider multigroup context by including group diversity (Theil's entropy index). Given the theoretical rationale discussed in the conceptual framework section, racial spatial distribution magnifies racial hierarchy so that the effect of spatial distribution should have opposite effects for whites vs. blacks. For this reason, we include necessary interaction terms between race and segregation/diversity measures. Moreover, because segregation and diversity are two different dimensions, we address their potential interaction. That is, we ask will black-white segregation exacerbate under low diversity. This requires an interaction between black-white segregation and diversity. We then further ask whether blacks will benefit from group diversity when the black-white segregation remains the same. This requires a three-way interaction among black-white segregation, diversity and race.

Table 6 shows the results from estimating the three models based on black and white individuals aged 16 to 64. The baseline model shows that age, gender, race and education all determine income in their expected directions and the effects are highly significant. The age effect is almost linear, with a very small diminishing rate. Thirty years more experiences can contribute to about \$60,000 more in annual income. Gender is decisive too as men earn more than \$20,000 at the conditional mean than women do. Formal education contributes a large increase in income: 4 more years education can bring in \$20,000 more in annual income. The effect dwarfs the racial effect. Ceteris Paribus, blacks on average earn about \$6000 less than whites. These individual level variables explain 22% of the variations in income and the additional contextual variables explain 1% additional variations in the next three models. Moreover, the contextual variables in M1-M3 largely do not alter the estimates for individual level variables. The effect of being black, however, will be complicated by the inclusion of its interaction terms with contextual variables.

(Table 6 about here)

The two black-white segregation measures, dissimilarity and Theil's information index are not on the same scale. To aid comparison, we standardize both as well as Theil's entropy index for diversity such that one unit change means one standard deviation change. In addition, to aid interpretation of interaction terms, we center all MSA-level variables including Median SES and SES inequality, black-white segregation and group diversity variables and their interaction terms with race.

Model 1 adds median SES and SES inequality (measured by coefficient of variation in SES, divided by 100), black-white dissimilarity index, and the interaction term between SES inequality with race and between dissimilarity and race. The median SES serves as a control of MSA income scale since cross-city income variation is high. We control for SES inequality to obtain more precise estimate of racial segregation effect because racial segregation and class segregation are intertwined. SES inequality is negative for everyone but this negative effect is very small for whites (-6.45) and just mild for blacks (-6.45-14.53=-20.98).

The effect of black-white segregation runs in an opposite direction for whites vs. blacks as segregation theory predicts. An increase in one standard deviation in black-white dissimilarity increase whites' income by $1,635 but decrease blacks' income by $181 (1635-1816=-181), which is tested significantly different from zero. Now the coefficient for being black is -$5,869, indicating that blacks living in median-SES level, mean SES inequality, and mean black-white segregated MSA have $5,869 lower in income than their white counterparts. This estimate is not significantly different from that in the baseline model. By contrast, for blacks living in MSA with one standard deviation higher in dissimilarity index, their income will be $6,050 lower.

Model 2 substitutes dissimilarity index with Theil's information index for black-white segregation. The results are very similar to those in Model1. In Model 3, we further introduces diversity and the corresponding two-way and three-way interaction terms. Diversity benefits whites with a positive effect of $1,435 for an increase of one standard deviation in diversity, whereas it hurts blacks with a negative effect of -$947 (1435-2382). This is in contrast to the prediction/conjecture of most previous literature (Frey and Farley 1996; Krivo and Kaufmann 1999). The addition or increase of a third group in an MSA surely increases diversity and may decrease black-white segregation. This analysis shows that increased diversity, however, exerts a strong negative effect for blacks. Moreover, the black-white segregation and diversity reinforce each other to produce an additional positive effect for whites. The interaction term between segregation and diversity is positive for whites ($438) and negative for blacks ($438-$578). That is, blacks living in MSAs with high black-white segregation and simultaneously high diversity face additional disadvantages.

At this point, we would like to clarify the interpretation of the results from M3 given the many interaction terms included. First the coefficient for being black ($5,658) capture the race effect (as compared to whites) for blacks living in median SES level, mean SES inequality, mean black-white segregation, and mean diversity. Any increase in these variables from this collectively mean situation will exacerbate the adversity facing blacks.

In the method section, we laid out the rationale why examining the contextual effect along the income distribution is more illuminating than only at the mean. Quantile regression is a natural extension suitable for this purpose. Moreover, quantile regression can handle the top- and bottom-coding of income data often practiced in survey data for confidentiality reasons. We estimate four quantile regression models at .25th, .50th, .75th, and .90th simultaneously, using bootstrap methods to produce robust estimates of standard errors. Because the sample size is huge, more than 4 millions, and because the estimation of quantile regression models uses linear programming that involving iterations that are geometrically related to the sample size, and to avoid many ties, we use a 1% random sample of the 4 millions, almost 50,000 individuals. We tested this sensitivity by estimating the OLS model using the whole sample and the 1% sample, and the results are identical.

Table 7 presents the quantile regression coefficients for contextual variables only from Model 3 that also include individual variables. The interpretation of quantile regression coefficients follows the manner of OLS coefficients except that the effects are located at particular conditional quantile rather than the conditional mean. The quantile regression estimates are revealing because they not only provide evidence for the magnitude of changes in effects across quantiles but also for substantively different findings from the OLS estimates. Below we interpret the results along these two lines.

(Table 7 about here)

First, the positive black-white segregation effect for whites increases as moving rightward. While this is not surprising since individual income are ordered from low to high, the sign of the effect for blacks changes. It is negative at about $250 for blacks at the .25th and .50th quantiles but positive and not significantly different from zero at the .75th and .90th quantiles.

Second, the diversity effect for whites changes from negative at the .25th quantile to positive and increasing at the three higher quantiles. The diversity effect for blacks is negative at the .25th quantile and positive at the .50th quantile because the interaction term between diversity and race is insignificant at both positions. However, as the quatile moves to the top portion of the distribution, diversity significantly harm blacks at the .90th quantile.

Third, black-white segregation and multigroup diversity feed each other to produce greater benefits for whites, evident at the median and two higher quantiles. The interaction effect at the 90th triples that at the 75th. Blacks around the median share this positive reinforcement with whites. Blacks, however, lose this benefit completely at the .75th quantile but then regain it at the .90th quantile.

Fourth, the coefficient for black represents typical residential MSA contexts discussed before: median SES, mean SES inequality, mean black-white segregation, and mean diversity. The black effect increases monotonically as the quantiles become larger. However, the increase rates are smaller than the constant, which represents the whites' income living in the same typical residential MSA. This suggests that blacks located at the lower tail of the distribution are more disadvantaged than those at the upper tail of the distribution.

Conclusions

The motivating question in this paper was how to improve a substantive and systematic understanding of today's multi-racial, multi-ethnic context of American cities, mainly brought about by massive immigration since three decades ago. We combine qualitative illustrations with concrete empirical information of selected cities and quantitative techniques of multigroup segregation index and its decomposition to understand the relationship among black-white segregation, racial-ethnic diversity, and racial gaps in income. Economic restructuring, post-industrialization, clustering settlement patterns of immigrants, particularly the overwhelming majority of Hispanic immigrants, all contribute to the complex dynamics of residential transformation, manifested in the increasing racial-ethnic diversity and the declining black-white segregation. However, few researchers ask how black-white spatial segregation impact racial income gaps under different scenarios of racial-ethnic diversity. This paper moves from concrete illustrations of possible relationships to a systematic analysis. It pays particular attention to allowing differential effects of contextual factors for racial income gaps at different income levels using quantile regression models.

As ethnic diversity of a city rises when more minority groups settle there, the resulting new opportunities should be open to all minorities including blacks if the hypothesis that racial hierarchy places whites at the top holds. If the hypothesis that blacks are placed at the bottom of the racial hierarchy holds, however, the entry of new minority groups can mean drawing more resources away from blacks. These competing hypotheses are tested in the paper.

The first finding of the paper is the vital importance of race-specific effects of segregation and diversity variables. Failure to distinguish them will find a null effect since the two opposite effects tend to cancel each other. Our finding about the differential effect of segregation by race is consistent with segregation theory (Massey and Denton 1993) and our finding about the differential effect of diversity defies the argument that places whites at the top of the racial hierarchy rather and supports theory that places blacks at the bottom. In our findings diversity does not improve opportunities for blacks.

Second, to prevent confounding the segregation/diversity effect with socioeconomic contextual effect, we control for the median and inequality of city-aggregate SES. Our analysis provides evidence that SES inequality has a differential effect by race.

Our quantile regression models offers several revealing findings. The detrimental black-white segregation effect fall more heavily onto median and lower income blacks than blacks at the upper half of the income distribution. The diversity effect differs within blacks: no effect at the lower half but a negative effect for higher-income blacks. In addition, our analysis shows that, under high ethnic diversity, the black-white segregation effect remains positive and becomes stronger for whites, whereas it remains negative for all blacks and becomes stronger for blacks in the top 25% of the income distribution.

Our findings strongly suggest that more systematic, appropriate analyses of the linkage between residential segregation, diversity and individual outcomes are needed. Many replications will address the potentially sensitive and non-robust problems. Future research also needs to address the causal mechanism by which residential contexts affect individual outcomes.

Table 1. Total Population and Racial-Ethnic Subpopulations in Two Areas: A Hypothetical Example

		Area 1				Area 2		
	Total	White	Black	Hispanic	Total	White	Black	Hispanic
Total	100	70	30	0	120	70	30	20
Tract 1	30	0	30	0	30	0	30	10
Tract 2	30	30	0	0	30	30	0	10
Tract 3	40	40	0	0	40	40	0	0

Source: Authors' compilation.

Table 2. Pair-wise Segregation and Multi-Group Segregation and Its Components: The Hypothetical Example

Measures	Area 1	Area 2
Pairwise H	1.000	1.000
Pairwise E of the area	0.611	0.611
Multi-group H	n.a.	0.609
Multi-group E of the area	n.a.	0.960
Decomposition	n.a.	
Supergroup H (b/w vs. h)	n.a.	0.170
Supergroup-to-total relative E	n.a.	0.451
Black-white pairwise component H	n.a.	1.000
Proportion of black-white combined	n.a.	0.833
Black-white to total relative E	n.a.	0.637

Source: Authors' compilation.

Table 3. Racial Segregation and Diverity Indices for Selected Cities

City	H	E	Dbw	Dhw	Dbh
Los Angeles	0.291	1.306	0.690	0.631	0.551
Houston	0.281	1.242	0.672	0.551	0.520
Dallas	0.260	1.148	0.596	0.537	0.511
Miami	0.307	1.087	0.729	0.439	0.734
Washington D.C.	0.264	1.166	0.635	0.480	0.565
Boston	0.260	0.767	0.673	0.587	0.449
New York	0.364	1.386	0.825	0.667	0.571
Cincinnati	0.368	0.572	0.750	0.275	0.625
Philadelphia	0.380	0.899	0.730	0.601	0.598
Chicago	0.423	1.140	0.810	0.611	0.777
Buffalo	0.395	0.639	0.780	0.562	0.643
Baltimore	0.348	0.873	0.682	0.358	0.561
Newark	0.386	1.123	0.809	0.650	0.615
Detroit	0.456	0.864	0.855	0.456	0.791
Cleveland	0.446	0.760	0.781	0.577	0.760
Milwaukee	0.427	0.835	0.833	0.595	0.792

Source: Authors' compilation based on Census 2000 SF1 data.

Note: H indicate multigroup segregation index, E group diversity, Dbw black-white dissimilarity index, Dhw Hispanic-white dissimilarity index, Dbh black-Hispanic dissimilarity index.

Table 4. Black-White Income Gaps at Selected Percentiles: Selected Cities

City		Percentile				
		10	25	50	75	90
Los Angeles	Black	0	8,000	28,300	54,640	94,300
Houston		0	7,200	28,000	50,000	87,000
Dallas		0	10,000	30,000	50,000	87,000
Miami		0	6,100	25,000	49,530	90,000
D.C.		1,000	13,500	36,000	65,000	101,000
Boston		960	10,000	30,000	52,000	86,000
New York		0	7,000	30,000	57,000	100,000
Cincinnati		400	8,000	24,000	40,700	65,040
Philadelphia		0	8,200	27,100	48,000	75,000
Chicago		50	10,000	30,000	52,300	85,900
Buffalo		470	7,200	21,000	39,110	60,000
Baltimore		600	10,000	28,820	48,800	75,000
Newark		0	9,800	32,400	60,000	100,000
Detroit		0	8,000	26,000	50,000	76,200
Cleveland		270	8,000	24,250	42,000	65,000
Milwaukee		1,700	10,500	27,000	45,000	67,000
Los Angeles	Black	0	3,000	15,000	34,200	53,165
Houston		0	2,500	15,000	30,000	45,800
Dallas		0	5,000	18,000	31,500	48,200
Miami		0	720	11,100	24,070	39,630
D.C.		0	7,000	24,404	40,000	60,040
Boston		0	3,500	18,000	32,000	50,000
New York		0	1,400	15,280	32,000	50,000
Cincinnati		0	4,200	15,000	28,110	44,400
Philadelphia		0	3,400	15,800	30,400	47,000
Chicago		0	2,800	15,000	32,000	50,000
Buffalo		0	2,600	10,500	24,600	40,300
Baltimore		0	4,700	18,000	32,000	49,500
Newark		0	3,800	18,000	35,000	52,000
Detroit		0	4,000	15,800	32,900	54,000
Cleveland		0	4,000	15,000	28,900	44,500
Milwaukee		0	2,200	12,000	26,300	41,500
Los Angeles	Gap	0	5,000	13,300	20,440	41,135
Houston		0	4,700	13,000	20,000	41,200
Dallas		0	5,000	12,000	18,500	38,800
Miami		0	5,380	13,900	25,460	50,370
D.C.		1,000	6,500	11,596	25,000	40,960
Boston		960	6,500	12,000	20,000	36,000
New York		0	5,600	14,720	25,000	50,000
Cincinnati		400	3,800	9,000	12,590	20,640
Philadelphia		0	4,800	11,300	17,600	28,000
Chicago		50	7,200	15,000	20,300	35,900
Buffalo		470	4,600	10,500	14,510	19,700
Baltimore		600	5,300	10,820	16,800	25,500
Newark		0	6,000	14,400	25,000	48,000
Detroit		0	4,000	10,200	17,100	22,200
Cleveland		270	4,000	9,250	13,100	20,500
Milwaukee		1,700	8,300	15,000	18,700	25,500

Source: Authors' compilation based on Census 2000 PUMS data.

Table 5. Black-White Income Gaps and Racial Segregation and Diversity: Selected Cities

City		Income Percentile					Racial Segregation and Diversity		
		10	25	50	75	90	H	E	Hwb
	white	0	6,100	25,000	49,530	90,000			
Miami	black	0	720	11,100	24,070	39,630	0.307	1.087	.533
	gap	0	5,380	13,900	25,460	50,370			
	white	0	7,000	30,000	57,000	100,000			
New York	black	0	1,400	15,280	32,000	50,000	0.364	1.386	.670
	gap	0	5,600	14,720	25,000	50,000			
	white	50	10,000	30,000	52,300	85,900			
Chicago	black	0	2,800	15,000	32,000	50,000	0.423	0.810	.672
	gap	50	7,200	15,000	20,300	35,900			
	white	400	8,000	24,000	40,700	65,040			
Cincinnati	black	0	4,200	15,000	28,110	44,400	0.368	0.572	.526
	gap	400	3,800	9,000	12,590	20,640			
	white	0	8,000	26,000	50,000	76,200			
Detroit	black	0	4,000	15,800	32,900	54,000	0.456	0.864	.710
	gap	0	4,000	10,200	17,100	22,200			

Source: Authors' compilation based on Census 2000 SF1 and PUMS data.

Note: H indicate Theil's information index for multigroup segregation, E Theil's entropy score for racial-ethnic diversity, Hbw black-white Theil's segregation index.

Table 6. Individual and Contextual Factors and Black-White Income Gaps: OLS Estimates

Variables	M0	M1	M2	M3
age	1,989**	1,966**	1,967**	1,972**
	(10)	(10)	(10)	(10)
age2	-18**	-18**	-18**	-18**
	(0)	(0)	(0)	(0)
male	20,693**	20,684**	20,683**	20,674**
	(36)	(36)	(36)	(36)
black	-5,796**	-5,869**	-5,902**	-5,658**
	(51)	(52)	(53)	(56)
Yeas of schooling	5,298**	5,062**	5,056**	5,038**
	(7)	(7)	(7)	(7)
Enrollment status	-4,535**	-4,767**	-4,769**	-4,778**
	(63)	(62)	(62)	(62)
MSA Median SES	--	29,862**	29,658**	25,656**
		(145)	(145)	(167)
MSA SES inequality	--	-6.45**	-5.16**	-5.24**
		(1.14)	(1.14)	(1.14)
Black*SES inequality	--	-14.53*	-15.95*	-16.34*
		(6.87)	(6.87)	(6.86)
Dwb	--	1,635**	--	--
		(20)		
Black*D	--	-1,816**	--	--
		(53)		
Hwb	--	--	1,753**	1,381**
			(20)	(21)
Black*Hwb	--	--	-1,908**	-1,052**
			(54)	(62)
E (Theil's entropy)	--	--	--	1,435**
				(23)
Black*E	--	--	--	-2,382**
				(66)
Hwb*E	--	--	--	438**
				(18)
Black*Hwb*E	--	--	--	-578**
				(61)
Constant	24,488**	24,614**	24,648**	24,606**
	(28)	(28)	(28)	(29)
Observations	4971321	4971321	4971321	4971321
R-squared	0.22	0.23	0.23	0.23

Source: Authors' analyses based on Census 2000 PUMS data.

Note: Standard errors are in parentheses. Estimate are based on the whole sample of black and white individuals aged 16 to 64. Dbw is black-white dissimilarity index, Hwb is black-white Theil's information index, E is theil's entropy index for diversity..

* p < .05 ** p < .01

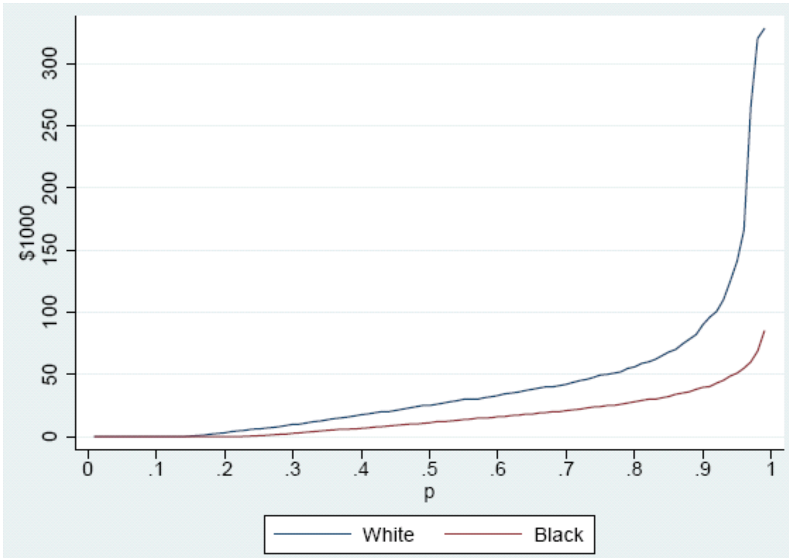
Table 7. Contextual Factors and Black-White Income Gaps: Quantile Regression Estimates

Variables	Q.25	Q.50	Q.75	Q.90
Black	-2,558**	-4,264**	-4,937**	-6,205**
	(53)	(162)	(344)	(518)
MSA Median SES	6,029**	15,586**	29,446**	45,586**
	(1,509)	(1,822)	(1,079)	(3,910)
MSA SES ineq.	1.77	7.74**	9.35	-8.75**
	(1.02)	(1.72)	(5.29)	(2.50)
Black*SES ineq.	-20.44	25.45	-9.84	-38.83
	(363)	(44.25)	(245)	(442)
Hwb	427**	746**	1,204**	1,677**
	(131)	(107)	(105)	(274)
Black*Hwb	-682**	-992**	-1,188**	-1,721**
	(211)	(129)	(158)	(277)
E (Theil's entropy)	-207*	554**	1,448**	3,430**
	(102)	(61)	(200)	(333)
Black*E	262	-247	-1,447**	-5,446**
	(287)	(490)	(551)	(965)
H*E	9	236**	522*	1,477**
	(118)	(77)	(261)	(498)
Black*H*E	-222	-270	-442**	-790**
	(174)	(239)	(129)	(278)
Constant	9,971**	22,025**	34,349**	49,635**
	(122)	(88)	(101)	(336)
Observations	49,713	49,713	49,713	49,713
R	0.11	0.19	0.21	0.21

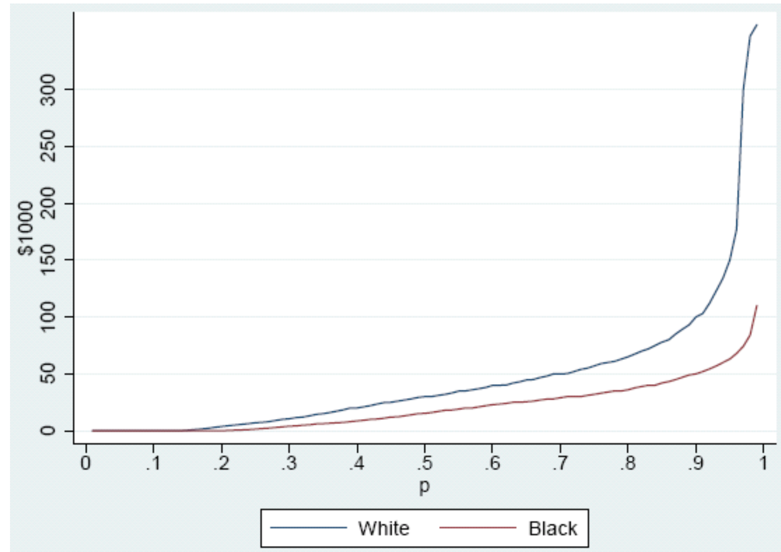
Source: Authors' analyses based on Census 2000 PUMS data.
Note: The model specification is as M3 in Table 6. Estimates for individual factors except for "black" are not presented in the table. Standard errors are in parentheses. To overcome the ties problem, we estimated a 1% random sample of black and white individuals aged 16-64.
* $p < .05$ ** $p < .01$

Figure 1. Black-White Gap along the Income Distribution: Selected Cities

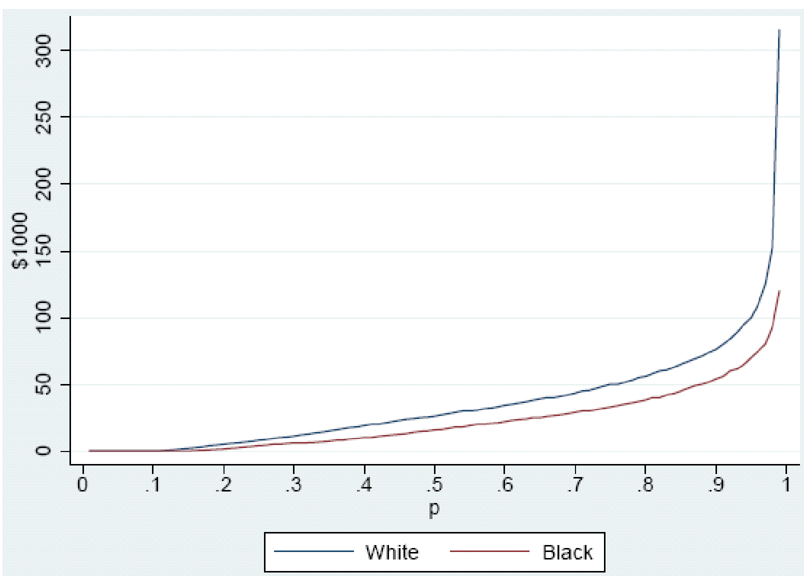
(a) Miami



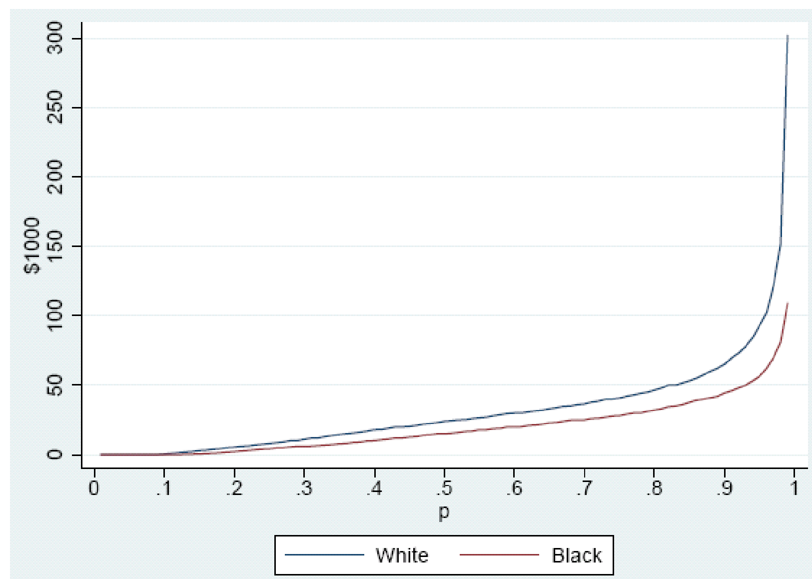
(b) New York City



(c) Detroit



(d) Cincinnati



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