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Metropolitan Structure and Neighborhood Attainment: Exploring Intermetropolitan Variation in Racial Residential Segregation

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Abstract

Using data from the 1981, 1991, and 2001 waves of the Panel Study of Income Dynamics and several decennial censuses, we examine how characteristics of metropolitan areas are associated with black and white households' neighborhood racial composition. Results from hierarchical linear models show that about 20% to 40% of the variation in the percentage of households' tract population that is non-Hispanic white or non-Hispanic black exists across metropolitan areas. Over time, white households' exposure to non-Hispanic white neighbors has declined, and their exposure to non-Hispanic black neighbors has increased; the reverse trends are observed for blacks. These trends cannot be attributed to changes in the ecological structure of metropolitan areas. Blacks have fewer white neighbors in large metropolitan areas containing sizable minority populations, and blacks have more white neighbors in metropolitan areas with high government employment. Whites have more black neighbors in metropolitan areas with high levels of government employment and ample new housing; whites have fewer black neighbors in metropolitan areas with a high level of municipal fragmentation. The association between metropolitan-area percentage black and tract percentage black is weaker among whites than among blacks, suggesting that whites are especially motivated to self-segregate in metropolitan areas with large black populations.

Keywords

Neighborhood; Race; Metropolitan area; Segregation; Stratification

Introduction

In American cities, blacks and whites rarely share the same neighborhoods, and the pernicious social and economic consequences of this racial residential segregation—for African Americans in particular—have been well documented (Charles 2006; Massey et al. 1988, 1991; Massey and Denton 1993). Quantitative studies of the determinants of racial residential segregation have adopted two main approaches. The most common research

design is aggregate, computing measures of segregation between racial and ethnic groups for cities or metropolitan areas, and examining how these levels of segregation are related to other metropolitan-area characteristics (e.g., Farley and Frey 1994; Frey and Farley 1996; Iceland 2004; Krivo and Kaufman 1999; Logan et al. 2004; Massey and Denton 1987, 1993; White and Glick 1999; see Charles 2003 for a review). The degree to which blacks and other minorities are “hyper-segregated” from whites is also explored in this research tradition (Massey and Denton 1989; Wilkes and Iceland 2004). Although studies in this genre occasionally disaggregate measures of racial residential segregation by social class (Fischer 2003; Iceland et al. 2005; Iceland and Wilkes 2006; Massey and Fischer 1999; St. John and Clymer 2000), by ethnicity and nativity (Iceland 2009; Iceland and Scopilitti 2008; Scopilitti and Iceland 2008), and by other characteristics (Clark and Blue 2004; Holloway et al. 2005), these studies focus primarily on metropolitan-area-level determinants of residential segregation.

A second research design explores the determinants of residential segregation at the individual level through models of locational attainment. These studies typically use cross-sectional data to examine the associations between individual-level characteristics and the racial and ethnic composition of individuals’ neighborhoods (e.g., Adelman 2005; Alba and Logan 1993; Alba et al. 2000; Bayer et al. 2004; Freeman 2000; Logan et al. 1996; White and Sessler 2000; Woldoff 2008). Although studies in this tradition occasionally include a few metropolitan-area characteristics as predictors, their focus is primarily on the influence of individual characteristics, particularly indicators of socioeconomic status, such as education, income, and homeownership.

In this article, we bridge these two approaches to the study of racial residential segregation. We take individuals as our units of analysis, as in the locational attainment tradition, but focus on the influence of metropolitan-area characteristics that typically appear in aggregate-level studies. We use three waves of individual-level data spanning two decades from the Panel Study of Income Dynamics (PSID), to which we have appended data describing the racial composition of respondents’ census tract of residence and the demographic, ecological, and economic structure of respondents’ metropolitan areas. Because the individuals in our sample are nested within metropolitan areas, we apply hierarchical modeling techniques to these multilevel data.

We begin by examining an implicit assumption of aggregate-level studies of racial residential segregation: namely, that metropolitan areas have important influences on the racial composition of blacks’ and whites’ neighborhoods. Despite aggregate-level studies’ almost exclusive focus on between-metropolitan-area variation in racial residential segregation, we actually know little about the degree to which black and white households’ neighborhood racial composition varies across, rather than within, metropolitan areas. We address this fundamental question by decomposing the variance in neighborhood racial composition into its between-metropolitan-area and within-metropolitan-area components. We also know little about the extent to which changes over time in racial groups’ exposure to other groups reflect changes in the characteristics of black and white households and/or changes in the ecological structure of metropolitan areas. Accordingly, we also examine changes during the 1980s and 1990s in black and white households’ exposure to white and black neighbors, with and without controlling for household and metropolitan-area characteristics. We then turn to an examination of how metropolitan-area characteristics—such as their size, racial composition, industrial structure, and level of suburbanization—help to explain variation across metropolitan areas in blacks’ and whites’ neighborhood racial composition, while controlling for a wide array of established individual-level predictors. Here, we seek to identify not only the metropolitan-area characteristics that are associated with the neighborhood racial composition of individual householders but, more

directly related to racial segregation, how those characteristics are differentially associated with the locational attainments of blacks and whites.

Background and Hypotheses

Theories of residential attainment are often silent regarding the potential role of metropolitan context. The residential satisfaction perspective (Landale and Guest 1985; Speare et al. 1975) focuses on personal and life-course characteristics that influence residential choices. The spatial assimilation model (Alba et al. 1999; Massey 1985) emphasizes socioeconomic characteristics as the main predictors of residential outcomes. Although life-course indicators, housing characteristics, and socioeconomic resources are strong predictors of neighborhood selection (South and Crowder 1997), both the residential satisfaction model and the spatial assimilation perspective generally ignore the broader geographic context in which residential attainment processes play out.

Two other theoretical perspectives point to potentially important effects of economic, political, and demographic structures in the metropolitan area. The place stratification model draws attention to the barriers to residential mobility faced by blacks, especially in the form of discrimination within metropolitan housing markets (Galster 1991; Massey and Denton 1993; Yinger 1995). White stereotyping of, and hostility toward, black residents also impedes blacks' access to racially mixed or predominantly white neighborhoods (Charles 2006; Krysan and Farley 2002; Quillian and Pager 2001). The place stratification model also highlights the unwillingness of whites to share neighborhoods with minority residents (Crowder 2000; Crowder and South 2008; Krysan 2002).

The housing availability model (South and Crowder 1997) holds that the likelihood of gaining access to a particular type of neighborhood, and racially integrated neighborhoods in particular, is contingent on the quantity and quality of destination opportunities generated by local housing markets and ecological structures. In those areas where desirable destination opportunities are lacking, individuals will be unable to satisfy their residential preferences. Although this theoretical perspective is still developing, some evidence exists that the ecological conditions and residential opportunities afforded by the metropolitan area significantly influence neighborhood attainment processes (Crowder 2000; Crowder and South 2005).

In combination with aggregate studies of racial residential segregation, these theoretical arguments provide the basis for a number of hypotheses regarding possible effects of metropolitan-area characteristics on the composition of neighborhoods occupied by black and white households. One metropolitan-area characteristic that is especially germane to these models is the overall level of population suburbanization. Logan et al. (2004) found in a sample of 286 metropolitan areas in 2000 that suburbanization (as measured by the percentage of the population living outside of the central cities of the metropolitan area) is positively associated with black-white residential segregation. However, how this metropolitan-area characteristic influences underlying race-specific patterns of neighborhood attainment, independent of the effects of individual-level determinants of residential outcomes, is unclear. The place stratification model implies that high levels of suburbanization inhibit black residential exposure to white populations while providing opportunities for white householders to insulate themselves in predominantly white neighborhoods.

Similarly, the level of political fragmentation within the metropolitan area may significantly structure opportunities for residence in racially integrated neighborhoods. Farley and Frey (1994; Frey and Farley 1996) argued that regional differences in levels of racial residential segregation are partly a function of the fact that metropolitan areas of the Northeast and

Midwest tend to encompass a multitude of suburban municipalities that have traditionally utilized their autonomy to erect land-use regulations and zoning ordinances to exclude minority groups. In contrast, annexation and county-wide governance in many metropolitan areas of the West and South have historically made exclusionary land-use policies less common. Thus, we expect that the level of political fragmentation in the metropolitan area will be negatively associated with blacks' exposure to white neighbors but positively associated with whites' exposure to white neighbors.

Several features of the population of the metropolitan area may have important influences on racially differentiated patterns of neighborhood location. Aggregate studies have indicated that the level of racial segregation in a city is directly related to the size of the population (Farley and Frey 1994; Logan et al. 2004), providing support for the traditional ecological argument that large population aggregations give rise to spatial differentiation (Wirth 1938). However, it is not clear whether this broad ecological factor influences individual residential outcomes after the micro-level characteristics that affect residential location are taken into account.

The housing availability and place stratification perspectives also have implications for the effects of metropolitan-area racial composition on access to various types of neighborhoods. If the effects of metropolitan-area racial composition simply reflect demographic opportunities to move to a neighborhood of a given racial/ethnic composition, as implied by the housing availability model, then we would expect these effects to operate similarly for black and white householders. Specifically, we would expect the relative size of the black population in the metropolitan area to increase the concentration of black neighbors in the neighborhoods occupied by both black and white householders. On the other hand, members of different racial and ethnic groups may respond differently to metropolitan-area racial composition. For example, whites may respond to larger black populations by attempting more vigorously to segregate themselves from black populations, perhaps using discriminatory methods implicated in the place stratification model. This argument is consistent with group-threat arguments implying that discrimination against minorities increases with the size of the minority group (Blalock 1967; Lieberman 1980).

The overall economic health of the metropolitan area may also shape race-specific processes of residential attainment. Poor economic conditions in the metropolitan area may be accompanied by relatively small class differences by race, thereby producing more similar residential outcomes for black and white householders. At the same time, high levels of poverty are likely to produce relatively unattractive conditions (e.g., poor housing stock, high crime, and low-quality schools) in many neighborhoods of the metropolitan area. To the extent that poverty and related social dislocations are concentrated in predominantly black neighborhoods (Jargowsky 1997; Massey and Denton 1993), such conditions may lead individual householders to avoid neighborhoods with high concentrations of blacks. Following the place stratification model, white householders may be especially motivated to distance themselves from relatively unattractive areas and may adhere to discriminatory practices that constrain blacks' residential options.

In their studies of intermetropolitan variation in levels of black-white segregation, Farley and Frey (1994) and Logan et al. (2004) found that segregation between blacks and whites tends to vary significantly with the functional specialization of the metropolitan area. Levels of segregation tend to be relatively high in those metropolitan areas with an economic base heavily dependent on manufacturing and relatively low in areas with a specialization in government activities. Farley and Frey (1994) attributed these variations in segregation to a combination of population and ecological factors: differences in the type of housing available in cities with different economic foci, differences in the educational level and

general social characteristics of the populations in these areas, and the impact of these population and housing characteristics on the adoption of fair housing legislation. Thus, it remains to be seen whether the functional specialization of the metropolitan area has a similar influence on the residential location of black and white householders net of the effects of individual- and household-level characteristics that affect neighborhood choice.

Finally, integral to the housing availability perspective is the assumption that characteristics of the metropolitan-area housing stock play a role in shaping patterns of neighborhood attainment. Farley and Frey (1994) and Logan et al. (2004) found that the supply of new housing in the metropolitan area is inversely associated with black-white segregation, an effect that has been interpreted as a function of both the availability of housing options and anti-discrimination legislation governing new housing. Farley and Frey (1994) argued that new housing developments usually lack the exclusionary reputations of older, predominantly white areas and have frequently been subjected to more audits and other measures aimed at detecting and redressing discriminatory housing practices. Following this argument, the availability of new housing may open up opportunities for attaining residence in integrated neighborhoods, but is likely to have a particularly strong impact on residential opportunities for black householders.

Data and Methods

The PSID is a well-known survey of U.S. residents and their families (Hill 1992). Starting in 1968, members of the initial panel of approximately 5,000 families were interviewed annually until 1995 and biennially thereafter. New families have been added to the panel as children and other members of original panel families form their own households. By 2005, a cumulative total of more than 9,000 families had been included in the survey panel, providing information on more than 67,000 individuals over the course of the study.

For this analysis, we select black and white respondents who were household heads (or “householders”) in the 1981, 1991, or 2001 PSID waves. We select household heads rather than all PSID sample members because the decision about which neighborhood to live in is most often a family decision, and selecting only household heads avoids double-counting the same locational decision for all family members. We select these years rather than decennial census years because the PSID did not conduct interviews in 2000. Using data from waves 10 years apart aligns our study closely with census-based studies. We treat these three waves of data as repeated cross-sections. Given our focus on the effects of metropolitan-area characteristics on households’ neighborhood racial composition, we restrict the sample to individuals who were residing in a census-defined metropolitan area at the time of the interview. To avoid building inertia into the sample, we randomly select a single year’s observation for those household heads who were initially represented in more than one survey year. Our sample consists of 8,767 PSID household heads, who were nested within 269 metropolitan areas.

A particularly valuable feature of the PSID for our purposes is the availability of restricted-access Geocode Files that allow us to determine householders’ census tract and metropolitan area of residence at each interview. We use this information to append to each householder’s data record information describing their tract and metropolitan area. Following most prior work in both the aggregate and locational attainment traditions, we use census tracts as our approximation of neighborhoods. Our first dependent variable is the percentage of the tract population that is non-Hispanic white. Building on the recommendation of Wright et al. (2005), we also report the results of analyses that use the percentage of the tract population that is non-Hispanic black as the outcome. These supplementary analyses acknowledge that

the residential integration of blacks and of whites often means living with members of other racial and ethnic groups, such as Hispanics and Asians (Iceland 2004; Logan et al. 2004).

Tract-level census data are drawn from the Neighborhood Change Data Base (NCDB), in which data from earlier censuses (1970, 1980, and 1990) have been normalized to 2000 tract boundaries, allowing us to produce consistent measures of neighborhood racial composition (GeoLytics 2008). To estimate the values of tract percentage non-Hispanic white and tract percentage non-Hispanic black for 1981, 1991, and 2001, we use linear interpolation and extrapolation with endpoints defined by adjacent census years.

Measuring the Independent Variables

Our focal independent variables are characteristics of the PSID households' metropolitan area of residence as of the interview wave. Metropolitan-area population size is measured in logged form to reduce skewness. We also include the percentages of the metropolitan-area population that are non-Hispanic black, Hispanic, and Asian, as well as the percentage living in households with an income below the poverty level. Our measures of metropolitan-area industrial structure refer to the percentage of the labor force employed in manufacturing and the percentage working in local, state, or federal government. New housing construction is measured by the proportion of housing units built in the prior 10 years. All these variables are computed from the 1980, 1990, and 2000 U.S. Census of Population and Housing Summary Files (U.S. Department of Commerce 1984, 1992, 2004). The percentage of the metropolitan-area population residing in the suburban ring of the metropolitan area is taken from the U.S. Department of Housing and Urban Development's State of the Cities Data Systems (U.S. Department of Housing and Urban Development 2009). Our measure of political fragmentation, adapted from Bischoff (2008), uses data on the number and size of municipal governments in each metropolitan area as given in the U.S. Census of Governments (U.S. Department of Commerce 2008). This measure captures the probability that two randomly selected individuals from the same metropolitan area live in different municipalities. Formally, the measure is defined as

$$frag = \sum_{d=1}^k p_d (1 - p_d),$$

where p is the proportion of individuals in a metropolitan area with k municipalities living in municipality d . There is complete fragmentation if all metropolitan-area residents live in different municipal districts, and there is complete incorporation if all individuals live in a single metropolitan-wide municipality. As with the measures of census tract racial composition, we use linear interpolation and extrapolation to estimate metropolitan-level values of these characteristics for the years 1981, 1991, and 2001.

We control for an array of individual-level predictors of neighborhood racial composition. These controls help to adjust for differences in population composition across metropolitan areas that could confound associations between metropolitan-level ecological characteristics and levels of residential segregation. Householder's race is a dummy variable scored 1 for black respondents and 0 for white respondents. Householder's sex is a dummy variable scored 1 for female household heads and 0 for male household heads. Householder's age is measured with a series of dummy variables. Married respondents (and long-term cohabitators) are distinguished from unmarried respondents by a dummy variable. The number of children in the household is a continuous measure. Homeowners are distinguished from renters with a dummy variable taking a value of 1 for those living in an owner-occupied dwelling. Household crowding is measured by the number of persons per room in the dwelling. Householder's educational attainment is measured by completed years of schooling. Family

income refers to total taxable income for householders and (if present) spouses, in constant 2000 U.S. dollars. A dummy variable distinguishes employed householders from nonemployed householders. Finally, we control for the PSID interview year with indicators for the 1991 and 2001 waves contrasted with the preceding period. To facilitate interpretation of their effects, all continuous independent variables are grand-mean centered.

Analytical Strategy

We use hierarchical linear modeling (Raudenbush and Bryk 2002) to examine the impact of metropolitan-area characteristics on PSID householders' census tract racial composition. The multilevel analysis proceeds in two parallel steps. First, random intercept models are estimated for blacks and whites separately. These race-specific regression models include a random intercept at the metropolitan level. The random intercept corrects for the observational clustering within metropolitan areas and decomposes the variance in neighborhood racial composition into its within-metropolitan-area and between-metropolitan-area components. Estimating models separately for blacks and for whites allows for a comparison of the variance components across groups. The race-specific random intercept models take this general form:

$$\text{Level 1: } Y_{ij} = \beta_{0j} + \beta_{1j} \mathbf{X}_{ij} + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01} \mathbf{W}_j + u_{0j}$$

where Y_{ij} is tract racial composition for individual i in metropolitan area j ; β_{0j} and β_{1j} are Level 1 coefficients; \mathbf{X}_{ij} are Level 1 (individual) predictors; γ_{00} and γ_{01} are Level 2 coefficients; \mathbf{W}_j are Level 2 (metropolitan area) predictors; and r_{ij} and u_{0j} are Level 1 and Level 2 random effects, respectively.

A second series of multilevel models pools the black and white samples. These models include a random intercept at the metropolitan level and a random slope for householder's race. The random-slope equation captures the difference in neighborhood racial composition between blacks and whites across metropolitan areas. Estimating pooled models for whites and blacks provides information about how individual-level characteristics and metropolitan-level characteristics shape racial differences in neighborhood racial composition. The racially pooled random intercept and random slope models take this general form:

$$\text{Level 1: } Y_{ij} = \beta_{0j} + \beta_{1j} \mathbf{X}_{ij} + \beta_{2j} \text{black} + \beta_{3j} \text{black}(\mathbf{X}_{ij}) + r_{ij}$$

$$\begin{aligned} \text{Level 2 } \beta_{0j} &= \gamma_{00} + \gamma_{01} \mathbf{W}_j + u_{0j} \\ \beta_{2j} \text{black} &= \gamma_{10} + \gamma_{11} \mathbf{W}_j + u_{1j} \end{aligned}$$

The pooled models share similar notation with the race-specific models with the exception of an equation for the effect of black (β_{2j}) as a random slope that varies across metropolitan areas. In the pooled models, the random effects (u_{0j} , u_{1j}) have an estimated variance (τ_{00} , τ_{11}) and a covariance (τ_{01}).

Results

Table 1 presents descriptive statistics for all variables used in the analysis separately for the black and white PSID householders. Immediately apparent is the pronounced difference between blacks and whites in neighborhood racial composition. Black householders reside in census tracts that are, on average, 28% non-Hispanic white and 63% non-Hispanic black. In contrast, white PSID householders reside in tracts that are, on average, 84% non-Hispanic white and less than 7% non-Hispanic black. These sharp racial differences in neighborhood racial composition underscore the high levels of residential segregation between blacks and whites in U.S. metropolitan areas.

With one exception, these black and white PSID householders inhabit metropolitan areas with generally similar values on the focal explanatory variables. The exception is racial composition: black respondents reside in metropolitan areas that average 23% non-Hispanic black. In contrast, white respondents reside in metropolitan areas that are, on average, only 12% non-Hispanic black.

Table 2 presents a series of multilevel linear models predicting blacks' and whites' neighborhood racial composition, here measured as the percentage of the tract population that is non-Hispanic white. Model 1 is a one-way analysis of variance (ANOVA) with random effects. The variance components, used to compute the intraclass correlation coefficient (ICC), allow us to determine the percentage of the variance in neighborhood racial composition that exists across metropolitan areas. For blacks, 37% of the variance in the percentage of the residential tract that is non-Hispanic white is between metropolitan areas ($380.88 / (380.88 + 639.81)$); the corresponding figure for whites is 32% ($104.24 / (104.24 + 216.87)$). Thus, although a substantial proportion of the (within-race) variation in blacks' and whites' exposure to non-Hispanic white neighbors is attributable to their location in different metropolitan areas, it is also clear that most of the variation exists within metropolitan areas.

Model 2 of Table 2 includes as independent variables the two dummy variables for the 1991 and 2001 survey years. Among black households, between 1981 and 1991, there was a statistically significant increase of more than 2 points in the percentage of the tract population that is non-Hispanic white, followed by a nonsignificant drop of 0.71 points between 1991 and 2001. In contrast, white households' exposure to white neighbors fell monotonically over this period, dropping by more than 2.5 percentage points between 1981 and 1991 and then by another 4.2 percentage points from 1991 to 2001. This trend is consistent with declining levels of white-nonwhite residential segregation observed during this period (e.g., Logan et al. 2004; Timberlake and Iceland 2007). The asymmetry of trends for black and white respondents is consistent with faster growth of nonwhite, nonblack populations in white neighborhoods than in black neighborhoods.

Model 3 of Table 2 adds as predictors the individual-level covariates. Black households that are headed by older individuals, that are more crowded, and that have more children tend to reside in neighborhoods with comparatively fewer non-Hispanic whites. Black households that include a married (or cohabiting) couple, that have higher incomes, and whose head has more education tend to live in neighborhoods with comparatively more non-Hispanic white residents. For black householders, the individual-level covariates account for 5% of the variance in tract percentage non-Hispanic white at the individual level and about 14% of the variance in tract percentage non-Hispanic white at the metropolitan level (computed from changes in variance components from Model 2 to Model 3).

Controlling for the individual-level covariates completely erases the increase in black households' tract percentage non-Hispanic white from 1981 to 1991, and causes the decline

from 1991 to 2001 to become borderline significant. Thus, during this period, black households would have actually become exposed to fewer non-Hispanic white neighbors if these households had not experienced changes in the individual-level covariates of neighborhood location. Supplementary analyses indicate that it is primarily the controls for education and income that account for the differences between Model 2 and Model 3 in the trend in blacks' exposure to white neighbors.

A fairly similar but not identical set of predictors emerges for whites. White households headed by older persons and that are more crowded tend to reside in neighborhoods with comparatively fewer non-Hispanic whites. White households that own their home, that have higher incomes, and in which the head has more education tend to reside in census tracts with comparatively more whites. Comparing again the variance components in Models 2 and 3, the individual-level covariates are seen to explain only 3% of the variance in tract percentage non-Hispanic white at the individual level and less than 2% of the variance in tract percentage non-Hispanic white at the metropolitan level.

Model 4 of Table 2 adds to Model 3 the metropolitan-level covariates. Together, these covariates explain about 65% of the Model 3 metropolitan-level variance in black households' exposure to non-Hispanic white neighbors $((322.24 - 112.72) / 322.24)$ and just over 90% of the metropolitan-level variance for white households $((105.23 - 10.90) / 105.23)$. Thus, for both groups, the metropolitan-area characteristics shown in past research to affect aggregate segregation patterns explain a substantial proportion of cross-metropolitan variation in neighborhood racial composition. However, a somewhat different set of metropolitan predictors emerges as important for black versus white households. Among blacks, five of these variables take on statistically significant coefficients. The percentage of black households' tract population that is non-Hispanic white is lower in larger metropolitan areas and in metropolitan areas that have relatively large black, Hispanic, and Asian populations. Blacks' neighborhood exposure to whites is higher in areas characterized by high levels of government employment.

As was the case for blacks, white households' exposure to non-Hispanic white neighbors is significantly lower in metropolitan areas containing relatively large black, Hispanic, and Asian populations. However, unlike the effects for black households, the percentage of the population that is white in white householders' tracts is comparatively smaller in metropolitan areas characterized by a large supply of newly constructed housing and high government employment, and this percentage is higher in metropolitan areas with greater political fragmentation.

It is worth noting that after the metropolitan-level covariates are controlled, the coefficients for the time-trend dummy variables among black householders become positive and significant at a borderline level. Changes in metropolitan structure, and particularly the growth of nonwhite and Hispanic populations, tend to suppress increases in black householders' exposure to white neighbors. Thus, blacks' exposure to white neighbors would have grown more than it did had it not been for growth in the black, Hispanic, and Asian metropolitan populations during this period. In contrast, the reduction in the time-trend coefficients between Models 3 and 4 for white households indicates that a sizable part of whites' declining exposure to white neighbors reflects the increasing concentration of nonwhites and Hispanics in metropolitan areas.

Studies of the effects of metropolitan-level characteristics on racial residential segregation imply both that racial differences in neighborhood attainment vary significantly across metropolitan areas and that metropolitan-level characteristics differentially affect the neighborhood attainments of blacks and whites. The models presented in Table 3 address

these issues more formally by analyzing the pooled sample of black and white PSID households. The first model (Model 1) is a random-coefficient model in which the effect of being black on the percentage of the tract population that is non-Hispanic white is allowed to vary across metropolitan areas. In the average metropolitan area, black households reside in tracts that are 37 percentage points less white than are the tracts that white households reside in. Equally important, the black slope is shown to vary significantly across metropolitan areas ($\tau_{11} = 414.22, p < .001$). That is, the racial difference in the percentage of neighbors who are non-Hispanic white differs significantly from one metropolitan area to the next.

The remaining models in Table 3 include product terms capturing the interactions between respondent's race and the explanatory variables. (Main effects are omitted from the table because they are provided in Table 2.) Thus, these models examine how survey year and the individual-level and metropolitan-level covariates are associated with the racial difference in exposure to non-Hispanic white neighbors. Model 2 adds the interactions between race and the period dummy variables. Both coefficients are statistically significant. The black-white difference in the percentage of the tract population that is non-Hispanic white dropped by 4.7 points between 1981 and 1991 (i.e., the negative black slope became less negative), and then by almost another 3.4 percentage points between 1991 and 2001. As shown in Table 2, these trends were generated more by declines in whites' exposure to non-Hispanic white neighbors than by increases in blacks' exposure to non-Hispanic white neighbors.

Model 3 adds the interactions between race and the individual-level covariates. The racial difference in exposure to non-Hispanic white neighbors is especially pronounced among householders age 50 to 59, households with children, and homeowners, and (at a borderline significance level) is less pronounced among married couples compared with single householders. The black-white difference in exposure to white neighbors is smaller at higher levels of education and income. About 14% of the intermetropolitan variance in the black-white difference in tract percentage non-Hispanic white is explained by racial differences in the individual-level covariates ($(398.24 - 344.02) / 398.24$).

Of central relevance for this study are the coefficients for the cross-level interactions between race and the metropolitan-area covariates added to Model 4. Five of these are statistically significant. First, metropolitan-area population size (logged) is associated with diminished exposure to white neighbors more among black households than among white households. Although in large metropolitan areas, both blacks and whites tend to reside in neighborhoods with comparatively fewer non-Hispanic whites (Table 2, Model 4), this association is significantly stronger among blacks. Thus, metropolitan-area population size is associated with higher levels of black-white residential segregation (Logan et al. 2004) primarily because it reduces blacks' exposure to white neighbors. In contrast, metropolitan-area population size is weakly associated with whites' neighborhood racial composition (Table 2).

Second, the percentage of the metropolitan-area population that is black is more negatively associated with black households' exposure to white neighbors than with white households' exposure to white neighbors. This finding supports the group-threat hypothesis. Although both whites and blacks live in "less white" neighborhoods in metropolitan areas with large black populations—likely a consequence of the simple availability of nonwhite neighbors—the association is weaker for whites than for blacks, perhaps suggesting that whites consciously attempt to counteract opportunities to share their neighborhoods with blacks when blacks are numerically well represented in the metropolitan area as a whole.

Third, at a borderline significance level ($p < .10$), the percentage of the metropolitan-area population that is Hispanic conditions the (negative) black slope. The greater the relative

size of the Hispanic population, the smaller is the black-white difference in exposure to non-Hispanic white neighbors. Fourth, in metropolitan areas with high levels of government employment, the black-white difference in neighborhood exposure to non-Hispanic whites is comparatively small. And fifth, municipal fragmentation is associated with a larger racial difference in the percentage of the tract population that is non-Hispanic white ($p < .10$). Compared with metropolitan areas with less municipal fragmentation, in metropolitan areas containing more independent municipalities, whites tend to live in much whiter neighborhoods than do blacks. Overall, about 45% of the Model 3 intermetropolitan variance in the black slope is explained by the metropolitan-area characteristics ($(344.02 - 189.09) / 344.02$).

It is worth noting that the period changes in the differential exposure of black and white households to white neighbors are not explained by changes in the measured metropolitan-area characteristics, including changes in racial and ethnic composition; the coefficients for the year dummy variables remain significant—in fact, they grow slightly larger—when these other characteristics are held constant in Model 4. These net changes in black and white households' exposure to non-Hispanic white neighbors suggest that other factors, such as an increased tolerance for other-race neighbors (Schuman et al. 1997) or the more rigorous enforcement of fair housing laws (Ross and Turner 2005), may play a role in accounting for declines in racial residential segregation.

Exposure to Non-Hispanic Black Neighbors

Households' exposure to non-Hispanic white neighbors is, of course, only one dimension of locational attainment; their levels of exposure to other racial groups are also important markers of spatial assimilation (Wright et al. 2005). Moreover, given the rise of multiethnic cities and neighborhoods (Fong and Shibuya 2005), the conceptualization and measurement of neighborhood ethnic/racial composition using only the proportional representation of non-Hispanic whites may obscure important variation in neighborhood locational attainment. Accordingly, we now examine the determinants of black and white households' exposure to non-Hispanic black neighbors. The percentage of the tract population that is non-Hispanic black and the percentage that is non-Hispanic white are, of course, inversely correlated, but the presence of other racial (and ethnic) groups means that these two variables are not perfect mirror images of each other.

Table 4 repeats the analysis presented in Table 2 using the percentage of households' tract population that is non-Hispanic black as the outcome. Model 1, the random-effects ANOVA, shows that about 35% of the variance in black households' exposure to non-Hispanic black neighbors is between metropolitan areas ($431.97 / (431.97 + 788.46)$). Among white households, only 20% of the variance in the percentage of the tract population that is non-Hispanic black is at the metropolitan level ($27.44 / (27.44 + 108.24)$). Thus, white households' proximity to black neighbors does not vary greatly from one metropolitan area to the next.

Model 2 of Table 4 shows that, over time, black households have become less exposed to non-Hispanic black neighbors. The average percentage non-Hispanic black in black households' census tracts dropped by 3.8 percentage points from 1981 to 1991, and by another 3.6 percentage points from 1991 to 2001. These changes were matched by opposite, although much smaller, changes in white households' exposure to black neighbors. The average percentage non-Hispanic black in white households' census tracts changed little between 1981 and 1991 but increased by a statistically significant percentage point from 1991 to 2001.

Model 3 adds the individual-level covariates and Model 4 adds the metropolitan-area covariates. For black households, three of the metropolitan-area predictors that emerged as statistically significant in the models of exposure to non-Hispanic white neighbors also emerge as significant in the model of proximity to non-Hispanic black neighbors. Metropolitan-area population size and percentage black are positively associated with the tract percentage non-Hispanic black: mirror images of the corresponding effects on the tract percentage that is non-Hispanic white (Table 2). The percentage of the metropolitan-area population that is Hispanic is inversely associated with black households' exposure to non-Hispanic black neighbors, while the percentage of the metropolitan-area labor force employed by government is significantly and inversely associated with black households' exposure to black neighbors. The metropolitan-level covariates together explain 68% of the (Model 3) metropolitan-level variance in black households' exposure to non-Hispanic black neighbors $((363.92 - 117.84) / 363.92)$.

Four metropolitan-area covariates exhibit significant associations with white households' exposure to non-Hispanic black neighbors. The larger the relative size of the non-Hispanic black population in the metropolitan area, the greater is the percentage non-Hispanic black in white households' tract of residence. In metropolitan areas with much newly built housing and government employment, whites reside in tracts with more non-Hispanic blacks. And, in metropolitan areas characterized by high municipal fragmentation, whites are exposed to fewer blacks in their neighborhoods. As a group, the metropolitan-level covariates explain more than 73% of the (Model 3) metropolitan-level variance in white households' exposure to non-Hispanic black neighbors $((27.74 - 7.54) / 27.74)$.

Worth noting is that the trends in blacks' and whites' neighborhood exposure to non-Hispanic blacks cannot be explained by changes in the ecological structure and demographic composition of metropolitan areas over recent decades. Indeed, comparing Models 3 and 4 shows that blacks' declining exposure to non-Hispanic blacks grows substantially more pronounced with controls for these metropolitan-area characteristics. Somewhat similarly, whites' exposure to black neighbors would have increased even more than it did between 1981 and 1991 had these metropolitan-area characteristics not changed as they did. Changes in metropolitan structure tended to suppress declines in blacks' exposure to black neighbors and increases in whites' exposure to black neighbors.

The analysis presented in Table 5 repeats the Table 3 analysis, now using tract percentage non-Hispanic black as the outcome, to highlight the factors modifying racial differences in exposure to black neighbors. Model 1, the random-coefficient model, indicates that in the average metropolitan area, black households reside in tracts that are, on average, 33 percentage points more non-Hispanic black than are the tracts in which white households reside. And the slope for black race varies significantly across metropolitan areas ($\tau_{11} = 446.27, p < .001$).

The remaining models include interactions between respondent's race and the predictors. For the most part, these effects mirror the effects of the covariates on the racial difference in the tract percentage non-Hispanic white shown in Table 3. Model 2 adds the interaction between race and the period dummy variables. The black-white difference in the percentage of the tract population that is non-Hispanic black declined significantly during both the 1980s and 1990s. As shown in Table 4, this shift was due more to a decline in blacks' exposure to black neighbors than to an increase in whites' exposure to black neighbors.

Model 3 adds the interaction between race and the individual-level covariates. The black-white difference in exposure to non-Hispanic black neighbors is especially pronounced among older householders and homeowners, and is weaker among married couples. The

racial difference is muted at higher levels of education and income. About 12% of the intermetropolitan variance in the black-white difference in tract percentage non-Hispanic black is explained by racial differences in the individual-level covariates $((425.05 - 372.08) / 425.05)$.

Several of the cross-level interactions are also significant, as indicated by the results in Model 4. The racial difference in exposure to black neighbors increases with the metropolitan area's population size. Metropolitan-area percentage black also increases black households' exposure to black neighbors more than white households' exposure to black neighbors, again providing support for group-threat theory. The percentage of the metropolitan-area population that is Hispanic more strongly diminishes black households' than white households' exposure to black neighbors. And, in metropolitan areas in which a large percentage of the labor force works in government, the racial difference in exposure to non-Hispanic black neighbors is smaller. In total, the metropolitan-area covariates explain about 46% of the (Model 3) intermetropolitan variance in the black slope $((372.08 - 199.43) / 372.08)$. Thus, structural and economic conditions are generally more important than compositional differences in explaining metropolitan variations in racial residential stratification.

Additional Analyses

We performed several additional analyses with these data. First, although the preceding analysis sheds indirect light on the determinants of blacks' and whites' neighborhood exposure to nonblack minorities, we examined this issue directly by estimating regression models using tract percentage Hispanic and tract percentage Asian as dependent variables (results not shown). Between 1981 and 2001, both blacks' and whites' exposure to Hispanics increased, but this trend was stronger among blacks than among whites. Socioeconomic status (education and income) was unrelated to blacks' exposure to Hispanics but was negatively associated with the proportion Hispanic in whites' tracts. The only strong metropolitan-level predictor of tract percentage Hispanic was the percentage Hispanic in the metropolitan area, and controlling for this variable almost completely eliminated the trends in blacks' and whites' exposure to Hispanics. We also observed significant increases in blacks' and whites' neighborhood exposure to Asians, with the trend stronger among whites than blacks. For both whites and blacks, the indicators of socioeconomic status were positively and significantly associated with tract percentage Asian. Parallel to the analyses of tract percentage Hispanic, the only strong metropolitan-level predictor of tract percentage Asian was the percentage Asian in the metropolitan area, and trends in Asians' representation at the metropolitan level largely explained trends in blacks' and whites' exposure to Asians at the tract level.

Second, we estimated models in which the effects of the predictors of blacks' and whites' neighborhood racial composition were allowed to vary over time. We found little evidence that these effects have changed over recent decades. Among blacks, the positive effect of income on exposure to non-Hispanic white neighbors became slightly stronger over time, while the effect of income weakened among whites. But for most other predictors, including the metropolitan-area covariates, we could not reject the null hypothesis that their effects were constant across survey years.

Third, we estimated multilevel models in which the effects of education and income were allowed to vary by the values of the metropolitan-area characteristics. Few of these interactions were significant. Among blacks, the effect of education on neighborhood exposure to non-Hispanic whites was less positive in metropolitan areas with high government employment. Among whites, the effect of education on neighborhood exposure to non-Hispanic blacks was significantly more negative in metropolitan areas with large

black populations and much new housing, and the effect of income was significantly more negative in metropolitan areas with large suburban rings.

Discussion and Conclusion

More than 40 years since the passage of the 1968 Fair Housing Act, high levels of racial residential segregation remain a defining feature of the American urban landscape. Studies of the determinants of segregation have tended to adopt one of two analytical approaches. Aggregate-level studies focus primarily on the characteristics of cities and metropolitan areas that are associated with high or low levels of segregation. Individual-level locational attainment studies focus mainly on the characteristics of individuals and households that are associated with the racial composition of their neighborhoods. We merge these two approaches by exploring the characteristics of metropolitan areas that are associated with black and white households' neighborhood racial composition. Multilevel analysis of three waves of data—spanning two decades—from the PSID and the decennial census yields several important insights to the dynamics of residential segregation.

First, although most of the variance in blacks' and whites' neighborhood racial composition exists within metropolitan areas, about 20%–40% of the variance exists across metropolitan areas. This finding serves to justify aggregate studies' focus on intermetropolitan variation in racial residential segregation. At the same time, however, comprehensive accounts of why some households of a given race share neighborhoods with households of a different race will need to attend both to individual-level determinants that operate within metropolitan areas, including households' demographic and economic characteristics, and the structural and ecological characteristics of metropolitan areas.

Second, between 1981 and 2001, black households' exposure to non-Hispanic white neighbors increased, and their exposure to non-Hispanic black neighbors decreased; and these changes cannot be attributed entirely to changes in the ecological structure or demographic composition of metropolitan areas or to changes in observed householder characteristics. We also find that after we control for relevant individual-level and metropolitan-level predictors, white households experienced a decrease in the proportion of their neighbors that are non-Hispanic white and an increase in the proportion of their neighbors that are non-Hispanic black. As with the residual change over time in neighborhood racial composition among black households, these changes may perhaps be attributable to changes in racial and ethnic groups' willingness to share neighborhoods with each other, although we cannot, of course, dismiss the possibility that changes in other unmeasured individual or metropolitan-area characteristics could also explain these trends. Declines in housing discrimination against blacks, perhaps resulting from more rigorous enforcement of fair housing laws, may also have played an important role.

Third, our analysis provides important new insights about the operation of metropolitan-area characteristics shown in past studies to be correlated with aggregate segregation patterns. Our analysis confirms that together, these metropolitan characteristics explain a sizable share of the intermetropolitan variation in neighborhood composition for blacks and whites, and that several of the metropolitan-area characteristics that have previously been identified as salient predictors of metropolitan-level segregation—especially population size and metropolitan racial composition—are particularly important in this regard. However, several metropolitan variables highlighted in past aggregate-level research—such as metropolitan poverty levels, manufacturing employment, and levels of suburbanization—are relatively unimportant in shaping neighborhood racial composition net of the effects of established individual-level predictors of residential attainment.

Perhaps more important is the finding that metropolitan-area characteristics shape aggregate segregation patterns by differentially affecting the residential patterns of black and white householders. For example, the size of the metropolitan black population is positively associated with exposure to black neighbors for both black and white households, but in a finding consistent with group-threat theory, the effect is stronger for whites than for blacks. Segregation levels are higher in more populous metropolises because larger populations tend to shape the residential experiences of black households—reducing their exposure to white neighbors and increasing their exposure to other blacks—and not because they increase the share of white residents in the neighborhoods occupied by white households. In contrast, political fragmentation appears to be more important in shaping neighborhood racial composition for white than for black householders, bolstering segregation by providing white households greater opportunities to sequester themselves in more exclusively white neighborhoods. More broadly, these racially differentiated effects should move future research beyond the identification of aggregate-level correlations to a focus on how specific ecological conditions shape divergent opportunity structures for members of different racial and ethnic groups.

Further research on the metropolitan-level determinants of neighborhood racial/ethnic composition might profit by addressing some of the limitations of this analysis. One limitation is the sample size. Although the PSID holds some important advantages for studying the individual-level and metropolitan-level determinants of neighborhood attainment, the sample is not large, at least compared with census data. More importantly, the PSID does not allow for the analysis of racial groups other than whites and blacks over this study's time frame. Analyses of the metropolitan-level predictors of neighborhood racial and ethnic composition using larger samples would enhance confidence in our results and allow them to be extended to other racial and ethnic groups. Distinguishing clearly between compositional and contextual effects of metropolitan-area characteristics on neighborhood racial composition is also an important objective for research in this area.

Future research might also attempt to incorporate information on individuals' residential preferences into models of neighborhood attainment (e.g., Adelman 2005). The absence of data on individuals' expressed preferences for neighborhoods of a given racial composition is a limitation of the PSID. A particularly important task is to isolate the causes of trends in black and white households' neighborhood racial composition. Our analysis suggests that these changes cannot be explained by shifts in the distribution of either individual social and economic attributes or metropolitan-area characteristics. However, the extent to which these increases in blacks' and whites' tendency to share neighborhoods with each other can be attributed to changes in residential preferences, declines in housing discrimination, or some other mechanism, awaits further research.

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Table 1

Descriptive statistics for variables used in analysis of census tract racial composition: Black and white respondents from the 1981, 1991, and 2001 waves of the Panel Study of Income Dynamics

	Black		White	
	Mean	SD	Mean	SD
Dependent Variables				
% non-Hispanic white in tract	27.91	29.39	84.33	17.62
% non-Hispanic black in tract	62.80	32.74	6.31	11.64
Independent Variables				
Year 1981	0.37	0.48	0.33	0.47
Year 1991	0.34	0.47	0.35	0.48
Year 2001	0.29	0.46	0.32	0.47
Individual characteristics				
Age 18–29	0.34	0.47	0.29	0.45
Age 30–39	0.26	0.44	0.24	0.43
Age 40–49	0.16	0.37	0.16	0.37
Age 50–59	0.10	0.30	0.12	0.33
Age >60	0.13	0.34	0.19	0.39
Female (1 = yes)	0.49	0.50	0.28	0.45
Married (1 = yes)	0.38	0.48	0.62	0.49
Number of children	1.20	1.36	0.73	1.05
Homeowner (1 = yes)	0.35	0.48	0.63	0.48
Persons per room	0.70	0.45	0.52	0.31
Education (in years)	11.81	2.88	13.52	3.16
Family income (\$1,000s)	33.49	29.23	61.57	59.24
Employed (1 = yes)	0.65	0.48	0.76	0.43
Metropolitan characteristics				
Population size (ln)	14.37	0.98	13.93	1.19
% non-Hispanic black	22.54	9.43	12.40	9.52
% Hispanic	7.20	10.20	7.95	10.49
% Asian	2.68	3.17	2.79	3.67
% in poverty	12.32	3.27	11.40	3.23
% of labor force in manufacturing	14.89	6.18	16.28	6.73
% of labor force in local, state, or federal government	16.14	5.93	14.16	4.39
% new housing	22.51	9.15	20.76	9.81
% living in suburban area	62.89	16.20	60.72	18.81
Municipal fragmentation	0.69	0.23	0.73	0.23
Number of Respondents	3,879		4,888	

Table 2

Multilevel models of census tract percentage non-Hispanic white: Black and white respondents from the 1981, 1991, and 2001 waves of the Panel Study of Income Dynamics (standard errors in parentheses)

Independent Variables	Model 1		Model 2		Model 3		Model 4	
	Black	White	Black	White	Black	White	Black	White
Intercept	45.548*** (2.007)	84.773*** (0.758)	44.291*** (2.087)	88.223*** (0.829)	46.534*** (2.378)	85.580*** (1.189)	33.238*** (2.574)	77.811*** (1.112)
Year 1991 (ref. = 1981)			2.102* (0.980)	-2.634*** (0.511)	-0.500 (1.009)	-3.366*** (0.513)	5.010* (1.995)	-2.319** (0.733)
Year 2001 (ref. = 1991)			-0.707 (1.042)	-4.214*** (0.527)	-1.798 [†] (1.044)	-4.865*** (0.525)	4.334* (1.799)	-1.912** (0.631)
Individual Characteristics								
Age 30–39 (ref. = 18–29)			0.620 (1.072)	-0.302 (0.619)	0.620 (1.072)	-0.302 (0.619)	0.734 (1.069)	-0.112 (0.609)
Age 40–49 (ref. = 18–29)			-1.441 (1.269)	-0.636 (0.690)	-1.441 (1.269)	-0.636 (0.690)	-1.433 (1.266)	-0.547 (0.679)
Age 50–59 (ref. = 18–29)			-6.646*** (1.509)	-1.669* (0.762)	-6.646*** (1.509)	-1.669* (0.762)	-6.512*** (1.507)	-1.323 [†] (0.747)
Age >60 (ref. = 18–29)			-3.993*** (1.538)	-1.591 [†] (0.825)	-3.993*** (1.538)	-1.591 [†] (0.825)	-4.051** (1.533)	-1.077 (0.811)
Female (1 = yes)			-0.399 (1.043)	-0.603 (0.595)	-0.399 (1.043)	-0.603 (0.595)	-0.338 (1.041)	-0.590 (0.583)
Married (1 = yes)			2.654* (1.146)	0.560 (0.591)	2.654* (1.146)	0.560 (0.591)	2.864* (1.143)	0.511 (0.580)
Number of children			-0.762* (0.372)	0.245 (0.264)	-0.762* (0.372)	0.245 (0.264)	-0.813* (0.371)	0.175 (0.259)
Homeowner (1 = yes)			0.659 (1.007)	2.842*** (0.523)	0.659 (1.007)	2.842*** (0.523)	0.702 (1.004)	2.768*** (0.512)
Persons per room			-3.053** (1.094)	-1.889** (0.828)	-3.053** (1.094)	-1.889** (0.828)	-2.938** (1.094)	-1.458 [†] (0.813)
Education (in years)			0.934*** (0.162)	0.333*** (0.073)	0.934*** (0.162)	0.333*** (0.073)	0.961*** (0.162)	0.333*** (0.071)
Family income (\$1,000s)			0.110*** (0.018)	0.018*** (0.004)	0.110*** (0.018)	0.018*** (0.004)	0.107*** (0.018)	0.019*** (0.004)
Employed (1 = yes)			1.101 (0.990)	0.376 (0.656)	1.101 (0.990)	0.376 (0.656)	1.109 (0.988)	0.401 (0.646)

Independent Variables	Model 1		Model 2		Model 3		Model 4	
	Black	White	Black	White	Black	White	Black	White
Metropolitan Characteristics								
Population size (ln)							-6.936*** (1.641)	-0.439 (0.460)
% non-Hispanic black							-1.063*** (0.165)	-0.401*** (0.050)
% Hispanic							-0.474** (0.149)	-0.709*** (0.043)
% Asian							-0.783** (0.278)	-0.722*** (0.087)
% in poverty							-0.118 (0.378)	0.083 (0.129)
% of labor force in manufacturing							0.009 (0.237)	-0.060 (0.071)
% of labor force in local, state, or federal government							0.564** (0.272)	-0.199* (0.092)
% new housing							0.115 (0.116)	-0.124** (0.042)
% living in suburban area							-0.064 (0.084)	-0.034 (0.025)
Municipal fragmentation							-4.719 (7.483)	7.065*** (2.097)
Variance Components								
Level 2: τ_{00} Random intercept (MSA)	380.88	104.24	375.76	107.29	322.24	105.23	112.72	10.90
Level 1: σ^2 Residual variance	639.81	216.87	639.56	209.33	605.42	202.45	605.49	199.78
Pseudo- R^2 Level 2			.01	.00	.14	.02	.65	.90
Pseudo- R^2 Level 1			.00	.03	.05	.03	.00	.01
Likelihood Ratio Test χ^2 (df)			4.76 (2)	163.27*** (2)	234.00*** (12)	172.67*** (12)	94.41*** (10)	379.37*** (10)
Log-Likelihood (df)	-18,155 (3)	-20,294 (3)	-18,152 (3)	-20,213 (5)	-18,035 (17)	-20,126 (17)	-17,988 (27)	-19,937 (27)
AIC	36,315	40,595	36,315	40,436	36,105	40,287	36,030	39,927
BIC	36,334	40,614	36,346	40,468	36,211	40,397	36,199	40,103
N	3,879	4,888	3,879	4,888	3,879	4,888	3,879	4,888

† $p < .10$

*
 $p < .05$
**
 $p < .10$

 $p < .001$

Table 3

Multilevel models of the black-white difference in census tract percentage non-Hispanic white: Black and white respondents from the 1981, 1991, and 2001 waves of the Panel Study of Income Dynamics (standard errors in parentheses)

Independent Variables	Model 1	Model 2	Model 3	Model 4
Intercept	84.833*** (0.764)	88.255*** (0.886)	85.613*** (1.466)	77.752*** (1.404)
Black	-36.669*** (2.027)	-41.012*** (2.099)	-36.367*** (2.534)	-42.221*** (2.884)
Fixed Effects on Black-White Difference				
Year 1991 (ref. = 1981)		4.712*** (1.049)	2.868** (1.066)	5.914** (2.020)
Year 2001 (ref. = 1991)		3.377** (1.098)	2.961** (1.096)	4.825** (1.809)
Individual Characteristics				
Age 30–39 (ref. = 18–29)			1.038 (1.201)	0.847 (1.189)
Age 40–49 (ref. = 18–29)			-0.707 (1.381)	-0.787 (1.368)
Age 50–59 (ref. = 18–29)			-4.903** (1.587)	-5.154** (1.570)
Age >60 (ref. = 18–29)			-2.308 (1.663)	-3.049 [†] (1.646)
Female (1 = yes)			0.259 (1.160)	0.254 (1.148)
Married (1 = yes)			2.173 [†] (1.218)	2.365* (1.205)
Number of children			-1.049* (0.466)	-0.963* (0.460)
Homeowner (1 = yes)			-2.347* (1.073)	-2.123* (1.059)
Persons per room			-1.090 (1.427)	-1.577 (1.409)
Education (in years)			0.593*** (0.163)	0.595*** (0.161)
Family income (\$1,000s)			0.092*** (0.015)	0.088*** (0.015)
Employed (1 = yes)			0.728 (1.194)	0.594 (1.181)
Metropolitan Characteristics				
Population size (ln)				-6.431*** (1.801)
% non-Hispanic black				-0.615*** (0.176)
% Hispanic				0.258 [†] (0.155)
% Asian				-0.159 (0.276)

Independent Variables	Model 1	Model 2	Model 3	Model 4
% in poverty				-0.335 (0.371)
% of labor force in manufacturing				-0.009 (0.235)
% of labor force in local, state, or federal government				0.593* (0.271)
% new housing				0.125 (0.115)
% living in suburban area				0.052 (0.093)
Municipal fragmentation				-13.214 [†] (7.952)
Variance Components				
Level 2: τ_{00} Random intercept (MSA)	84.96	87.38	87.35	5.82
Level 2: τ_{11} Random slope (black)	414.21	398.24	344.02	189.09
Level 2: τ_{01} Covariance (intercept, slope)	-24.15	-19.50	-23.43	-15.17
Level 1: σ^2 Residual variance	404.88	400.58	381.51	378.01
Pseudo- R^2 Level 2 Intercept		.00	.00	.93
Pseudo- R^2 Level 2 Slope		.04	.14	.45
Pseudo- R^2 Level 1 Residual		.01	.05	.00
Likelihood Ratio Test χ^2 (<i>df</i>)	850.11*** (2) ^a	93.75*** (4)	455.4*** (24)	422.06*** (20)
Log-Likelihood (<i>df</i>)	-39,048 (6)	-39,001 (10)	-38,773 (34)	-38,562 (54)
AIC	78,107	78,021	77,614	77,232
BIC	78,150	78,092	77,855	77,614
N	8,767	8,767	8,767	8,767

^aThe null model for the likelihood ratio test is a random intercept model only. The two additional degrees of freedom in Model 1 are attributed to a random slope (black, τ_{11}) and the covariance (τ_{01}) between the random intercept and random slope.

[†] $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Multilevel models of census tract percentage non-Hispanic black: Black and white respondents from the 1981, 1991, and 2001 waves of the Panel Study of Income Dynamics (standard errors in parentheses)

Independent Variables	Model 1		Model 2		Model 3		Model 4	
	Black	White	Black	White	Black	White	Black	White
Intercept	42.407*** (2.158)	6.042*** (0.423)	46.505*** (2.224)	5.437*** (0.482)	44.216*** (2.588)	7.523*** (0.785)	50.690*** (2.767)	9.506*** (0.830)
Year 1991 (ref. = 1981)			-3.817*** (1.082)	0.280 (0.366)	-1.510 (1.121)	0.580 (0.370)	-4.387* (2.163)	1.511** (0.547)
Year 2001 (ref. = 1991)			-3.611** (1.151)	1.113** (0.376)	-2.542** (1.159)	1.493*** (0.378)	-5.581** (1.953)	1.526** (0.467)
Individual Characteristics								
Age 30–39 (ref. = 18–29)			-0.467 (1.190)	0.194 (0.446)			-0.402 (1.185)	0.137 (0.443)
Age 40–49 (ref. = 18–29)			1.539 (1.410)	0.170 (0.497)			1.689 (1.404)	0.159 (0.494)
Age 50–59 (ref. = 18–29)			6.379*** (1.676)	0.402 (0.549)			6.585*** (1.670)	0.344 (0.543)
Age >60 (ref. = 18–29)			3.872* (1.708)	0.735 (0.595)			4.227* (1.699)	0.589 (0.590)
Female (1 = yes)			0.339 (1.159)	0.283 (0.428)			0.220 (1.154)	0.247 (0.424)
Married (1 = yes)			-4.046** (1.273)	-0.304 (0.426)			-4.105** (1.267)	-0.523 (0.422)
Number of children			0.482 (0.413)	-0.136 (0.190)			0.494 (0.411)	-0.136 (0.188)
Homeowner (1 = yes)			1.600 (1.118)	-1.323*** (0.377)			1.261 (1.113)	-1.339*** (0.373)
Persons per room			3.226** (1.216)	1.177* (0.597)			3.429** (1.212)	1.083 [†] (0.591)
Education (in years)			-0.834*** (0.180)	-0.111* (0.053)			-0.882*** (0.179)	-0.111* (0.052)
Family income (\$ 1,000s)			-0.122*** (0.020)	-0.009** (0.003)			-0.114*** (0.020)	-0.009** (0.003)
Employed (1 = yes)			-0.816 (1.100)	-0.873 [†] (0.473)			-0.962 (1.095)	-0.933* (0.470)

Independent Variables	Model 1		Model 2		Model 3		Model 4	
	Black	White	Black	White	Black	White	Black	White
Metropolitan Characteristics								
Population size (ln)							7.694 ^{***} (1.736)	-0.055 (0.359)
% non-Hispanic black							1.244 ^{***} (0.176)	0.471 ^{***} (0.039)
% Hispanic							-0.452 ^{**} (0.159)	-0.004 (0.033)
% Asian							-0.297 (0.301)	-0.010 (0.066)
% in poverty							0.257 (0.410)	0.009 (0.098)
% of labor force in manufacturing							0.022 (0.256)	0.081 (0.054)
% of labor force in local, state, or federal government							-0.674 [*] (0.293)	0.158 [*] (0.070)
% new housing							-0.176 (0.126)	0.073 [*] (0.032)
% living in suburban area							0.100 (0.089)	0.023 (0.019)
Municipal fragmentation							4.100 (7.940)	-3.364 [*] (1.610)
Variance Components								
Level 2: τ_0 Random intercept (MSA)	431.97	27.45	413.93	27.76	363.92	27.74	117.84	7.55
Level 1: σ^2 Residual variance	788.46	108.24	780.92	107.91	747.21	106.02	744.50	105.39
Pseudo- R^2 Level 2			.04	.00	.12	.00	.68	.73
Pseudo- R^2 Level 1			.01	.00	.04	.02	.00	.01
Likelihood Ratio Test χ^2 (df)			42.32 ^{***} (2)	14.73 ^{***} (2)	190.92 ^{***} (12)	95.98 ^{***} (12)	111.65 ^{***} (10)	201.61 ^{***} (10)
Log-Likelihood (df)	-18,556 (3)	-18,542 (3)	-18,535 (5)	-18,535 (5)	-18,439 (17)	-18,487 (17)	-18,384 (27)	-18,386 (27)
AIC	37,118	37,091	37,080	37,080	36,913	37,008	36,821	36,826
BIC	37,137	37,110	37,111	37,112	37,019	37,118	36,990	37,002
N	3,879	4,888	3,879	4,888	3,879	4,888	3,879	4,888

† $p < .10$ * $p < .05$

1000 > .001

p < .01
**

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Table 5

Multilevel models of the black-white difference in census tract percentage non-Hispanic black: Black and white respondents from the 1981, 1991, and 2001 waves of the Panel Study of Income Dynamics (standard errors in parentheses)

Independent Variables	Model 1	Model 2	Model 3	Model 4
Intercept	6.017*** (.477)	5.439*** (.641)	7.385*** (1.334)	9.574*** (1.380)
Black	32.906*** (2.082)	37.463*** (2.137)	33.675*** (2.576)	36.623*** (2.924)
Fixed Effects on Black-White Difference				
Year 1991 (ref. = 1981)		-4.045*** (1.051)	-2.079 [†] (1.073)	-3.185 (2.037)
Year 2001 (ref. = 1991)		-4.570*** (1.098)	-3.907*** (1.101)	-4.351* (1.832)
Individual Characteristics				
Age 30–39 (ref. = 18–29)			-0.728 (1.208)	-0.480 (1.200)
Age 40–49 (ref. = 18–29)			1.357 (1.390)	1.446 (1.381)
Age 50–59 (ref. = 18–29)			5.997*** (1.596)	6.191*** (1.584)
Age >60 (ref. = 18–29)			3.163 [†] (1.673)	3.806* (1.661)
Female (1 = yes)			-0.113 (1.167)	-0.063 (1.159)
Married (1 = yes)			-3.714** (1.226)	-3.603** (1.217)
Number of children			0.587 (0.468)	0.558 (0.464)
Homeowner (1 = yes)			2.892** (1.077)	2.766** (1.069)
Persons per room			2.136 (1.433)	2.520 [†] (1.421)
Education (in years)			-0.700*** (0.164)	-0.728*** (0.162)
Family income (\$1,000s)			-0.110*** (0.016)	-0.107*** (0.016)
Employed (1 = yes)			0.051 (1.200)	0.158 (1.192)
Metropolitan Characteristics				
Population size (ln)				7.887*** (1.843)
% non-Hispanic black				0.684*** (0.179)
% Hispanic				-0.627*** (0.158)
% Asian				-0.152 (0.279)

Independent Variables	Model 1	Model 2	Model 3	Model 4
% in poverty				0.516 (0.372)
% of labor force in manufacturing				0.148 (0.237)
% of labor force in local, state, or federal government				-0.572* (0.272)
% new housing				-0.107 (0.114)
% living in suburban area				-0.022 (0.094)
Municipal fragmentation				7.122 (8.101)
Variance Components				
Level 2: τ_{00} Random intercept (MSA)	17.87	18.16	18.53	2.41
Level 2: τ_{11} Random slope (black)	446.27	425.05	372.08	199.43
Level 2: τ_{01} Covariance (intercept, slope)	20.96	21.62	16.87	-7.52
Level 1: σ^2 Residual variance	408.51	405.02	389.15	385.76
Pseudo- R^2 Level 2 Intercept		.00	.00	.87
Pseudo- R^2 Level 2 Slope		.05	.12	.46
Pseudo- R^2 Level 1 Residual		.00	.04	.00
Likelihood Ratio Test χ^2 (<i>df</i>)	933.60*** (2) ^a	81.426*** (4)	379.15*** (24)	267.19*** (20)
Log-Likelihood (<i>df</i>)	-39,006 (6)	-38,965 (10)	-38,776 (34)	-38,642 (54)
AIC	78,024	77,950	77,619	77,392
BIC	78,066	78,021	77,860	77,774
N	8,767	8,767	8,767	8,767

^aThe null model for the likelihood ratio test is a random intercept model only. The two additional degrees of freedom in Model 1 are attributed to a random slope (black, τ_{11}) and the covariance (τ_{01}) between the random intercept and random slope.

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$