Does Segregation Create Winners and Losers? Residential Segregation and Inequality in Educational Attainment

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This article examines the effects of residential segregation on the basis of poverty status and race for high school and college completion. Segregation effects are estimated by contrasting educational outcomes among persons raised in metropolitan areas with varying levels of segregation. This metropolitan-level approach provides two advantages in evaluating segregation effects over neighborhood effects studies: it incorporates effects of residential segregation outside of the affected individuals' neighborhoods of residence and it allows evaluation of gains and losses across groups from segregation. Data are drawn from the Panel Study of Income Dynamics and the decennial censuses. Poor–nonpoor segregation is associated with lower rates of high school graduation among adolescents from poor backgrounds, but has no effect on rates of graduation for students from nonpoor backgrounds. Black–white segregation is associated with lower rates of high school graduation and college graduation for black students, but has no effect on graduation rates for white students. Use of proximity-adjusted segregation measures or instrumental variable estimation gives similar results. The results suggest that residential segregation harms the educational attainment of disadvantaged groups without increasing the educational attainment of advantaged groups. Keywords: segregation; educational attainment; neighborhood effects; inequality; social context.

Despite dramatic changes in race relations, transportation, and economics in American metropolitan areas over the twentieth century, the history of metropolitan residential segregation is more one of continuity than change. Residential segregation on the basis of race was only moderately lower in 2000 than at its recorded peak in 1960; segregation on the basis of income reached its recorded peak in 2007 (Fischer et al. 2004; Reardon and Bischoff 2011). Robert Park's (1926) dictum that spatial distance reflects social distance is as true in the twenty-first century as at any time previously in American history.

What is the consequence of persisting racial and socioeconomic residential segregation for social inequality? Although much research touches on aspects of this question, surprisingly little has attempted to address it directly. By far the most extensive literature considering effects of residential segregation is studies of "neighborhood effects." Yet in understanding residential segregation effects, the neighborhood effects literature has at least two important limitations.

First, although the neighborhood effects literature is sometimes described as estimating "segregation effects," in fact the neighborhood effects literature considers only one part of the likely effect of residential segregation on youth outcomes: the advantage that accrues to individuals from growing up in an affluent neighborhood relative to an impoverished one (or in some studies a white neighborhood relative to a nonwhite one). What this omits are the effects of residential segregation outside of the affected individuals' neighborhoods of residence. As I discuss below, theory suggests that segregation outside of the neighborhood of residence has important influences on youth development and life chances.

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Second, the neighborhood effects literature does little to explore the idea of gains and losses inherent in the concept of segregation. One reason dominant groups may maintain segregation is because there are advantages gained by advantaged groups from segregation that would be lost to disadvantaged groups with desegregation. Indeed, the fear that desegregation will reduce the educational attainment of children from advantaged backgrounds is a major reason affluent and white parents often oppose policies that would contribute to desegregation on economic and race lines (Brantlinger 2003). Another possibility suggested by other scholars (e.g., Kahlenberg 2001), however, is that there need not be one-for-one trade-offs in the effects of segregation across social groups. Studies in the neighborhood effects tradition, however, are ill suited to address potential gains and losses across groups from segregation and, for the most part, have not directly examined this topic.

Instead of contrasting individuals who grew up in poor or affluent neighborhoods, this study examines how educational outcomes vary among persons raised in metropolitan areas with different levels of income and race segregation. This metropolitan-level approach allows consideration of two unresolved questions. First, what is effect of residential segregation on educational outcomes, including segregated space outside of individuals' own neighborhood of residence? Second, does desegregation necessarily result in educational trade-offs among advantaged and disadvantaged groups, or can desegregation produce gains for disadvantaged groups without corresponding losses to advantaged groups?

Theoretical Overview

Although details vary, most theories of residential segregation's effects on educational inequality follow one of three basic explanations. These explanations emphasize the mechanisms of contextual inequality, intergroup attitudes, and intragroup solidarity. Segregation effects in the case of educational attainment are my focus here, but these theories can apply equally well to many other "life chances" outcomes.

Income Segregation and Contextual Inequality

The most frequently invoked argument for why income segregation contributes to inequality emphasizes the role of segregation in creating inequalities in social contexts. As residential segregation on the basis of income increases, by definition, there will be more residential neighborhoods that are affluent and more that are impoverished, and fewer middle-income neighborhoods. To the extent that residence in an affluent neighborhood is an important source of educational advantage and residence in an impoverished neighborhood is an important source of educational disadvantage, increased inequality in the income level of neighborhood contexts will contribute to increased inequality in educational outcomes (Briggs 2005; see also Blau 1977).[1] Moreover, as income segregation increases in a metropolitan area, an increasing share of affluent persons will reside in affluent neighborhoods, and an increasing share of poor persons will reside in poor neighborhoods. Absent perfect segregation, some families experience contexts inconsistent with their income level, but on average income segregation increases the affluence of the neighborhoods of the affluent and the poverty of the neighborhoods of the poor.

While the most direct effect of residential segregation is on inequalities in neighborhood income levels, the effects of residential segregation also ripple through social institutions with composition drawn on a local basis. The family income levels of most public schools' students, for instance, are directly affected by the demographics of local neighborhoods, because most public

1. See Wodtke, Harding, and Elwert (2011) for a good discussion of mechanisms through which impoverished neighborhoods affect the educational attainment of children.

schools draw students from local catchment areas (Saporito and Sohoni 2007). Moreover, residential income segregation creates income inequality in the membership of other local contexts that affect youth, including local governments, community organizations, and labor markets. Because many organizations are funded at least partly on a local area basis, inequalities in contexts create inequalities in levels of institutional funding. Public school districts in most states are funded in substantial part by local property taxes, for instance, and community organizations like churches draw funding directly from donations from their members. Most of the effects of residential segregation on educational inequality likely result from creating inequality across several layers of residentially influenced social contexts. Further, most layers of social context draw their membership and resources from several residential neighborhoods, suggesting segregation effects on most social contexts reflect both neighborhood and supraneighborhood influences.

If the effects of contextual affluence or poverty for all contexts are constant and equal for all population groups, the affluent will gain from income segregation and the disadvantaged will lose from it in equal proportion. In this case, we might view segregation as a social mechanism of intergenerational social closure that increases the advantage of the advantaged and, proportionately, the disadvantage of the disadvantaged.

Yet there are reasons to expect that the effects of social contexts may not be the same across the population, and in fact advantaged group members may be able to avoid many deleterious effects as their metropolitan environment becomes less segregated. First, thresholds in the concentration of affluence or poverty may exist beyond which neighborhoods or schools experience sudden changes in their conditions, as suggested by William Julius Wilson's (1987) discussion of "concentration effects," Jonathan Crane's (1991) "epidemic theory of ghettos," and Richard Kahlenberg's (2001) discussion of the benefits to schools of a "critical mass" of middle-class students. This implies differential effects of segregation across advantaged and disadvantaged groups because advantaged and disadvantaged persons are on average exposed to contexts with different levels of concentration of affluence or poverty. Second, changes in levels of segregation may not result in direct trade-offs in outcomes because affluent individuals can compensate for or avoid the effects of less advantaged contexts by spending private resources. Affluent parents can enroll their children in private schools if they are dissatisfied with the neighborhood public schools, can provide additional tutoring to make up for inadequate classroom instruction, or they can pressure the local public school to make changes to improve the educational environment (Lareau 2003). Changes in levels of segregation could then have little or no effect on outcomes for children of affluent families because they have the private resources to maintain their advantages in the face of an income-integrated environment.

Racial Segregation

Because of inequality in income between racial groups, many of the same arguments regarding the importance of income segregation for contextual affluence can be applied to racial segregation. Race however, differs in important ways from income segregation because race is a more powerful basis of invidious distinction and collective identity than income.

Racial Inequality in Neighborhood Income. The most commonly invoked reason that racial segregation contributes to inequality applies the contextual inequality explanation of income segregation to racial segregation. When racial groups have different levels of average income, segregation on the basis of race contributes to income inequality among the neighborhoods of advantaged and disadvantaged racial groups (Massey 1990; Massey and Denton 1993; Roof 1972). Douglas Massey (1990) provided a series of simple simulations that illustrate this point most clearly, demonstrating that the combination of racial segregation and racial disparities in poverty rates results in much higher levels of neighborhood poverty contact for African Americans than for whites, and generally contributes to the formation of high-poverty neighborhoods (see also Quillian 2012). Racial segregation then contributes to racial inequality through increased contact of disadvantaged racial groups with impoverished neighborhoods and increased contact of advantaged racial groups with affluent neighborhoods. These inequalities in neighborhood environments in turn produce racial inequalities in the income level of schools and other residentially influenced local contexts.

Racial Segregation and Intergroup Attitudes. A second theory of racial segregation as a cause of racial inequality emphasizes the effects that racial segregation may have on group racial attitudes. Following research in social psychology suggesting that equal-status contact across racial lines improves interracial attitudes (Allport 1954), this perspective emphasizes that reduced interracial contact resulting from racial segregation may strengthen racial stereotypes, reduce cross-race sympathy, and contribute to prejudicial attitudes (e.g., Pettigrew 1979; Roof 1972). These negative influences of segregation on attitudes are especially likely to operate in the long term.[2]

Strengthened prejudices among whites then contribute to deleterious nonwhite outcomes because whites are often in positions of power to allocate resources, such as employers or politicians. In the case of education, more hostile white attitudes may produce reduced funding for predominately minority schools or districts, greater white flight of students from relatively diverse districts, or reduced payoffs to the educational credentials of minority applicants in the labor market as a result of employer discrimination.

Racial Segregation and Intragroup Solidarity. Although the view that racial segregation increases racial inequality is the one most commonly offered in sociology, a different contextual mechanism turns this logic on its head, suggesting that segregation may actually be of assistance to a disadvantaged racial or ethnic group. Solidarity explanations emphasize that racial segregation can facilitate building solidarity among members of a racial and ethnic group, which can aid in achieving collective goals. In this view, spatial proximity among co-ethnics contributes to forming group social capital in the form of dense co-ethnic social networks and neighborhood institutions. Such "ethnic capital" may then facilitate information exchange, resource sharing, and collective control of local co-ethnic youths.[3]

Solidarity arguments surrounding ethnic capital are more plausible when the racial or ethnic group has a culture highly distinct from the advantaged group, a condition most clearly satisfied by first-generation immigrants and often applied in discussions of immigrant enclaves (e.g., Portes and Rumbaut 1996; Zhou and Bankston 1998). The solidarity-based argument is also sometimes applied to racial groups such as African Americans, and this application is plausible in theory (e.g., Kifano 1996; see also discussion in Fischer and Massey 2000). Mario Luis Small (2009) recently proposed a somewhat similar theory for income segregation, arguing that poor neighborhoods often contain dense numbers of organizations to aid the poor and that this mitigates other negative effects of high-poverty environments.

Implications for Understanding Segregation Effects

These theories suggest that segregation has influences on educational attainment through a multiplicity of mechanisms operating at several different spatial scales. The total effect of income or race segregation on educational attainment is the sum of these mechanisms, and will likely be significantly different than its effect through any single mechanism. Some mechanisms (solidarity) may also offset other mechanisms (contextual inequality, attitudes), and overall beneficial effects of segregation are possible. Likewise, these theories suggest that the effects of the racial or economic composition of the residential neighborhood or attended

2. In the short term, reductions in segregation may produce an increase in hostile attitudes of whites toward the minority (Blalock 1967).

3. Similarly, in electoral systems based on districts, segregation can produce minority concentrations that give districts majorities of minority members, producing an increase in minority legislative representation.

school are only a part of the total metropolitan segregation effect, because segregation in the metropolitan area outside of the neighborhood of residence (supraneighborhood segregation) may have important effects. Even if a black family resides in a neighborhood with many white families, for instance, if their metropolitan area is highly residentially segregated this may influence the race and economic makeup of their attended school, their local organizations, their proximity to jobs, and the attitudes of local whites toward blacks; all of these may then influence educational attainment.

Empirical Studies

Few empirical studies have examined the overall effects of residential segregation for educational outcomes. Studies have focused instead on understanding the effects of the affluence of individuals' residential neighborhoods or attended schools on outcomes. Neighborhood effects studies focus on the extent to which growing up with affluent or white neighbors is a source of educational advantage, and growing up with poor or nonwhite neighbors is a source of educational disadvantage. School effects studies are similar but focus on the advantages of affluent or white schoolmates, contrasted with poor or nonwhite schoolmates.

These studies have found small to large effects of neighborhood poverty (for reviews, see Duncan and Raudenbush 1999; Leventhal and Brooks-Gunn 2000; Pebley and Sastry 2004; recent empirical studies include Crowder and South 2011; Harding 2003; Owens 2010; Sharkey and Elwert 2011; Wodtke, Harding, and Elwert 2011), moderate to large effects of school poverty (Coleman et al. 1966; Mayer 1991; Owens 2010; Rumberger and Palardy 2005), and highly inconsistent effects of school racial composition (Schofield 1995; Wells and Crain 1997).[4] Because this study focuses on residential segregation, the questions I consider are more aligned with neighborhood effects literature, and I focus this literature for the remainder of the discussion.

Housing Mobility Studies of Neighborhood Effects

Critics have suggested that some or all of the "effects" that neighborhood effects studies have found may actually be capturing selection into neighborhoods related to individual characteristics rather than an actual effect of neighborhoods on persons (Duncan and Raudenbush 1999; Hauser 1970; Ludwig et al. 2008; Tienda 1991). A distinct approach, less subject to this problem of selection, has focused on families in residential mobility programs moving out of public housing (e.g., Orr et al. 2003; Rubinowitz and Rosenbaum 2000). The best-known housing mobility study is the Moving to Opportunity Experiment (MTO), which randomly assigned participants to groups with vouchers that pay for housing. The experimental group was required to move to census tracts with poverty rates below 10 percent. The MTO study found no benefits to low-poverty neighborhood residence on school achievement (Ludwig, Duncan, and Pinkston 2005; Orr et al. 2003).[5]

The MTO results are sometimes treated as providing definitive estimates of neighborhood effects because of its randomized design, but this interpretation is too strong. MTO includes only low-income, nonwhite families residing in distressed public housing. We cannot generalize broadly about the effects of neighborhoods from such a specialized subgroup (Clampet-Lundquist and Massey 2008; Sampson 2008). In addition, the MTO families tended to move short distances from their original residences, even those families in the experimental group, thus experiencing only small changes in contexts often linked to residence such as schools and labor markets.

4. The larger effects of neighborhood poverty have been found by recent studies that better account for history of residence and capture effects of neighborhood poverty through indirect effects on families (Crowder and South 2011; Sharkey and Elwert 2011; Wodtke et al. 2011).

5. The MTO results did find neighborhood poverty rate effects on mental health, physical health, and feelings of safety.

Because of these limitations, the usefulness of MTO in understanding neighborhood effects in general is limited.[6]

Limits of Neighborhood Effects Studies As Segregation Effects Studies

While studies of neighborhood effects are sometimes discussed as indicating residential "segregation" effects, they omit possible effects of residential segregation outside of individuals' residential neighborhoods. This is because neighborhood effects studies use a measure of poverty or affluence (or occasionally percentage white, black, or Latino) of the residential neighborhood as their key predictor, which of course does not capture segregation in space outside of the residential neighborhood. Yet there are multiple mechanisms by which segregation outside of the neighborhood of residence likely affects youth development. I discuss three mechanisms briefly below.

First, residential segregation outside of the neighborhood of residence affects the composition of youth social contexts that draw members from multiple neighborhoods. Many important social contexts draw members from areas outside of the areas used by researchers to proxy for neighborhoods (in the United States, census tracts). Schools (even "neighborhood schools"), for instance, almost always draw students from areas larger than a single census tract; because of this, the race and income of schoolmates is affected by patterns of segregation outside of the residential census tract. Likewise, the friendship networks of school-age youth include many persons who reside outside their own census tract (Mouw and Entwistle 2006). Similarly, organizations like churches and youth groups tend to draw participants from areas larger than a census tract. These supraneighborhood influences on educationally relevant contexts are omitted by studies in the neighborhood effects tradition.

Second, inequalities in funding among schools and organizations are influenced by supraneighborhood mechanisms. Inequalities in school funding, for instance, operate primarily at the level of school districts, which are influenced by levels of segregation outside of each student's residential neighborhood or attended school.[7] Similarly, many local institutions like churches and youth clubs are funded by membership fees or contributions, and most of these organizations have members from outside their own neighborhood; because of this broader patterns of segregation influence their funding.

Third, the effects of segregation in forming attitudes toward disadvantaged groups operate in significant part at a supraneighborhood scale. Cross-group contact often occurs in schools, workplaces, and public spaces outside of the neighborhood residence; patterns of residential segregation beyond individuals' census tracts of residence influence the composition of these contexts and the frequency of these interactions. Reduced cross-group contact resulting from segregation can then decrease the attitudinal benefits of long-term cross-group personal contact noted in the social psychology literature, such as sympathy and reduced group stereotypes.

Neighborhood effect studies are also limited in evaluating segregation effects because they are poorly suited for understanding how segregation may have differential effects across advantaged and disadvantaged groups. For the same reasons that neighborhood effect studies do not estimate total segregation effects, they are not informative about total gains or losses to different groups from segregation. Moreover, neighborhood effect studies usually estimate models that assume a linear effect of neighborhood composition and estimate a single effect of neighborhood composition across all persons. By estimating a single effect of context on the outcome, composition effect studies implicitly assume a one-for-one trade-off between advantaged and disadvantaged groups.

6. Clampet-Lundquist and Massey (2008) argue that the results of MTO are further compromised by the fact that many participants did not comply with the experimental condition, although Ludwig and colleagues (2008) argue that this does not bias estimates from the MTO experiments.

7. A number of states have instituted systems of school funding that are progressive or flat, breaking the tendency for high poverty school districts to have lower funding levels. But at least 20 states still have regressive funding systems that provide lower funding in high-poverty districts, most often due to lower property tax collections in these districts (Baker, Sciarra, and Ferrie 2010).

The few studies that do estimate nonlinear effects of composition lack sufficient precision to allow for detailed accounting of gains and losses that might result across groups with desegregation.

Metropolitan-Level Approaches

Rather than contrasting the outcomes of children who were raised in poor and affluent neighborhoods or white or nonwhite neighborhoods, a handful of recent studies have contrasted educational outcomes between young adults in metropolitan areas with varying levels of residential segregation. By examining how segregation measured over all metropolitan neighborhoods is related to outcomes, metropolitan studies capture effects of segregated space beyond a few blocks around where an individual lives. Further, metropolitan studies allow for direct contrasts of segregation effects over race and income groups.

An additional advantage of a metropolitan approach is that it is less subject to bias resulting from the nonrandom selection of neighborhoods than neighborhood effect studies are (Cutler and Glaeser 1997). Families often carefully select their residential neighborhood with their children's development in mind, a process that suggests that parental characteristics may confound neighborhood effects estimates. By contrast, metropolitan area of residence is much more often guided by job or family history.

David Cutler and Edward Glaeser (1997) first used a metropolitan approach in their study of the effects of black-white residential segregation on educational, family structure, and labor market outcomes of young adults. They found worsened outcomes for black young adults in more segregated environments, including reduced high school graduation probabilities. Also adopting the metropolitan approach, Thetesa Osypuk and Dolores Acevedo-Garcia (2008) contrasted birth outcomes across metropolitan areas by level of black-white segregation to examine segregation effects on health. Elizabeth Oltmans Ananat (2011) examined black-white segregation effects on educational and labor market outcomes using instrumental variables estimation with miles of railroad tracks in a city as an instrument. She found negative segregation effects for African Americans on most outcomes and negative or small positive effects for whites depending on the outcome.

Ian Gordon and Vassilis Monastiriotis (2006) studied segregation and educational achievement in England and Wales using school-level achievement data. They used a composite measure of segregation that combines segregation on the basis of race and social class into one indicator, and found that segregation is positively related to inequality in educational outcomes, mostly due to higher achievement by the high-achieving in more segregated areas.

These studies are useful: Cutler and Glaeser (1997) and Ananat (2011) in particular provide good evidence that racial residential segregation has deleterious consequences for blacks but little effect for whites. But each of these past studies also has some significant limitations.

Cutler and Glaeser (1997), Ananat (2011), and Gordon and Monastiriotis (2006) use metropolitan residence based on the respondent's residence as a young adult measured simultaneously with the other measures (which is all that is available in their data). This may be appropriate for some outcomes Cutler and Glaeser (1997) and Ananat (2011) considered for which we expect segregation to have an immediate effect, like earnings, but for educational attainment we expect that past levels of segregation have gradual effects over an individual's youth. Young adult residence is at best a noisy proxy for residence during adolescence and its use raises issues of potential confounding due to selective migration after school graduation.[8]

Cutler and Glaeser (1997) and Ananat (2011) focused exclusively on racial segregation. Gordon and Monastiriotis (2006) used a segregation measure that combines race and income segregation together, which has the disadvantage that it is impossible to determine the form(s)

8. Cutler and Glaeser (1997) and Ananat (2011) recognized this problem and employed data on metropolitan area of residence five years earlier to reduce it. But given their samples are composed of persons 20 to 30 years old, at five years earlier most sample members would still have left their parental home and in some cases their parental metropolitan area of residence.

of segregation driving the results. Finally, Gordon and Monastiriotis (2006) relied entirely on aggregate level data at the school level, and thus they lacked control for individual characteristics that drive academic outcomes and may be confounded with segregation measures.

The one study that examined income segregation used U.S. states rather than metropolitan areas, but is otherwise similar in approach. Susan Mayer (2002) examined how spatial economic segregation of all census tracts in a state was related to inequality in educational outcomes among children in the Panel Study of Income Dynamics (PSID). Mayer found that economic segregation increases the years of education completed for high-income children and decreases it for low-income children. Mayer's choice of the state as the unit over which segregation was computed meant that the resulting aggregates used were less meaningful in terms of social and spatial divisions. In using states, the area over which segregation is calculated includes many far-away neighborhoods relatively unconnected to their immediate social environment for many individuals in her data. Segregation for a resident of Syracuse, New York, for instance, was based on segregation calculated over all census tracts in the state, including many hundreds of miles away in New York City. Although Mayer's study is an important early application of a broader approach, further efforts are needed to better establish effects consistent or inconsistent with her results.

Data and Methods

My analysis of segregation effects focuses on poor-nonpoor and black-white segregation. The choice of these two dimensions is based on the fact that race and income are basic dimensions of segregation in American cities and the data supports an analysis using these two dimensions. Data is drawn from the PSID merged with data on segregation from the decennial censuses. Hispanic segregation is not a focus because there are too few Hispanics in the PSID sample to form good estimates of segregation effects on Hispanics, although Hispanic background and segregation measures are included as controls. Poverty status is used to define advantage and disadvantage rather than other income thresholds because this allows the results to address the literature on spatially concentrated poverty (e.g., Wilson 1987) and because household counts above and below the poverty line are consistently reported in aggregated census tabulations across the years used here.[9]

Aggregate Data and Segregation Measures

The segregation measures are computed for each metropolitan area using data on census tract characteristics from the decennial censuses of 1970, 1980, and 1990. The use of tracts—small areas of a few thousand residents drawn by local census tract committees—follows the standard practice of studies of residential segregation.[10] I use tract and metropolitan data from the Census database produced by Geolytics Corporation, which normalizes data from prior censuses to 2000 tract and metropolitan boundaries.

The basic measure of segregation used is Theil's entropy index of segregation (H). I employ Theil's entropy index of segregation rather than the more familiar dissimilarity index (D) because the entropy index better meets desirable properties of an index of segregation than the index of dissimilarity (James and Taeuber 1985:13).[11] I have also estimated all the basic models of the

9. Measures of affluent households, for instance, are not consistently defined across censuses. Future research could usefully examine income segregation results using other measures or cutpoints of the income distribution.

10. For a discussion of why tracts are a logical choice, see Jargowsky (1997:8–9). See also the extended results section below for consideration of proximity-adjusted segregation measures.

11. Specifically, the entropy index has the advantage of being sensitive to population redistribution, which reduces group concentration over the entire range of the distribution, whereas the index of dissimilarity is sensitive only to redistribution across the median percentage in an area.

study using the index of dissimilarity, which provides a pattern of results and substantive conclusions similar to those produced by the entropy index. For the formula for the entropy index of segregation and further discussion of its properties, see David James and Karl Taeuber (1985).

Like the dissimilarity index (D), the entropy index (H) varies from 0 to 1, with 0 indicating no neighborhood segregation and 1 indicating perfect segregation. Like D, H is a measure of the "evenness" of spatial distribution of one group compared to the other. Perfect evenness indicates that the same percentage of the metropolitan population of each group resides in each tract (D and H both are zero), while in perfect "unevenness" there is no overlap in neighborhoods of residence between the two groups. H is similar to a sum of squared deviations and tends to take on lower values than D, a sum of absolute deviations, for most levels of segregation. For example, black–white racial segregation in most American cities generates D scores of .7 but H values of only .4 to .5.

I include in the analysis only metropolitan areas that have at least 10,000 white, black, nonpoor, and poor residents. This restriction is employed because segregation statistics like H or D are nearly meaningless in metropolitan areas with almost no presence of one of the two groups over which segregation is calculated. Similar restrictions are employed in many previous studies (for instance, see U.S. Census Bureau 2002). Mean segregation index values used in the models are shown toward the top of Table 1.

Microdata and Variables

The measures of metropolitan characteristics are matched with data on youths from the PSID from 1968 to 2005. The PSID has followed a nationally representative sample of 5,000 families and their descendants since 1968. The outcomes are high school graduation and college graduation. The high school graduation analysis includes PSID individuals observed at ages 14, 15, or 16 and observed again at ages 24, 25, or 26. The outcome (high school graduation or college graduation) is taken from the oldest observed age of 24, 25, and 26.

Data for all independent variables are taken from the youngest observed age of 14, 15, or 16. This includes the metropolitan measures of segregation and metropolitan controls, which were calculated from census data based on the prior decennial census year (1970, 1980, or 1990) to the PSID year (except individuals observed in 1968 and 1969 in the PSID were matched to the 1970 census). Data is taken from the prior decennial census year since it will often represent conditions experienced by the respondent in childhood or early adolescence, while metropolitan conditions at the later census date would often fall after the individual has left their parental household.

A list of variables employed in the analysis and summary statistics are shown in Table 1. Race and Hispanic origin are measured by self-reported survey questions. Poverty status is indicated by living in a family with income below the USDA needs standard included in the PSID file, adjusted for inflation. This standard is somewhat higher than the official U.S. poverty line, but produces similar poverty rates to other government sources because of lower income underreporting in the PSID than most government surveys (Hill 1991).

Parental education is coded into dummy variables for levels, including one category for missing information on parental education. The parental education variables are based on parental reports from the oldest age at which the respondent is observed living with the parent up to age 16.

Other than parental education, the only independent variables for which cases are missing in the base samples are the income/poverty measures (missing for 345 cases).[12] These cases were dropped, leaving 3,533 individuals in the high school graduation sample. The college graduation analysis includes the 2,818 persons from the high school sample who have graduated from high school by age 26 (or 24 or 25, if not observed at 26).

12. Cases missing on poverty status were somewhat more likely to graduate high school than the full sample (87 versus 80 percent graduated). There was little correlation between the segregation measures and missing status on high school graduation ($r = -.06$ or $-.07$ with black/white and poor/nonpoor segregation) or college graduation ($r = .01$ for black/white and poor/nonpoor segregation).

Table 1 • *Descriptive Statistics: High School Graduate and College Graduation Samples, Panel Study of Income Dynamics*

	HS Graduation		*College Graduation*	
	Mean	*SD*	*Mean*	*SD*
Segregation measures (MSA)				
Seg., poor/nonpoor (H)	.122	.035	.121	.035
Seg., black/white (H)	.454	.157	.449	.158
Seg., Hispanic/white (H)	.223	.103	.221	.103
Individual-level characteristics				
R's family below poverty income	.256	.436	.211	.408
Respondent black	.543	.498	.504	.500
Respondent Hispanic	.040	.195	.033	.178
Male	.482	.500	.473	.499
Number of siblings	3.627	2.599	3.386	2.479
Mother's education (dummies)				
8th grade or less	.095	.293	.072	.258
9th–12th grade	.210	.407	.171	.377
High school graduate	.402	.490	.425	.494
Some college	.187	.390	.207	.405
College graduate	.046	.209	.055	.227
Grad/prof. degree	.042	.200	.051	.220
Mother not in household	.019	.136	.020	.140
Father's education (dummies)				
8th grade or less	.108	.311	.089	.284
9th–12th grade	.105	.307	.092	.289
High school graduate	.217	.413	.237	.425
Some college	.116	.320	.135	.342
College graduate	.063	.242	.074	.262
Grad/prof. degree	.063	.242	.077	.267
Father not in household	.328	.470	.296	.456
Region				
Northeast	.17	.38	.19	.39
Midwest	.25	.43	.24	.43
South	.45	.50	.43	.50
West	.13	.34	.14	.34
Decade				
Decade age 14 = 1980s or later	.39	.49	.42	.49
MSA percentage poor	11.91	4.47	11.76	4.37
MSA percentage black	17.56	9.62	17.15	9.68
MSA percentage Hispanic	5.15	7.54	5.18	7.46
MSA percentage foreign born	5.58	5.25	5.77	5.42
MSA percentage employed in manufacturing	33.63	6.58	33.52	6.63
MSA employment to population ratio	.41	.05	.42	.05
MSA population (logged)	14.22	1.03	14.21	1.03
Individuals (*N*)	3533		2818	
Metropolitan areas	277		172	

Note: Independent variables are measured at the youngest observed age of 14, 15, or 16.

Models

To examine effects of segregation on educational transitions, I use hierarchical multilevel models with variance components at the individual and metropolitan level (see Raudenbush and Bryk 2002). Because the outcomes of high school graduation and college graduation are dichotomous, models are estimated with population-averaged, multilevel logistic models estimated using generalized estimating equations (GEE). The population average coefficients can be interpreted as describing how segregation affects high school graduation probabilities on average over the population. I also estimate unit-specific logistic regressions for all basic models, which produced similar estimates and the same substantive conclusions.[13]

In the individual-level model, the logit of the probability of graduating high school or graduating college is a function of family poverty (*poor*), black race (*black*), and a series of control variables. If p_{im} is the probability of high school graduation or college graduation for the ith individual in the mth metropolitan area, the individual-level model can be written as:

$$\ln(p_{im}/(1 - p_{im})) = \beta_{0m} + \beta_{1m} poor_{im} + \beta_{2m} black_{im} + \sum_{k=3}^{K} \beta_k indcontrol_{imk}$$

The individual-level control variables (*indcontrol*) include basic demographic characteristics: age, gender, parents' education, number of siblings, region of the country, Hispanic origin, and decade of survey.

The multilevel model allows the effects of poverty and black race to vary as a function of segregation and the other metropolitan characteristics as specified in the following second-level equations:

Intercept equation: $\beta_{0m} = \gamma_{00} + \gamma_{01} H_m^{poor-nonpoor} + \gamma_{02} H_m^{black-white} + \sum_j \gamma_{0j} metcontrol_{mj} + \zeta_0$

Equation for "poor" slope: $\beta_{1m} = \gamma_{10} + \gamma_{11} H_m^{poor-nonpoor} + \sum_j \gamma_{1j} metcontrol_{mj} + \zeta_1$

Equation for "black" slope: $\beta_{2m} = \gamma_{20} + \gamma_{21} H_m^{black-white} + \sum_j \gamma_{2j} metcontrol_{mj} + \zeta_2$

Each of the H terms represents the extent of segregation between members of the two groups, indicated by the superscripted terms. The coefficients of the H terms in the intercept equation indicate how each form of segregation affects educational outcomes among persons who are in the advantaged group (i.e., nonpoor, white). The coefficients of the H terms in the "poor" and "black" slope equations indicate how segregation affects the difference in educational outcomes between members of the advantaged group (nonpoor or white) and the indicated disadvantaged group (poor or black). The zetas (ζ) represent error terms, which are assumed to be uncorrelated with the independent variables and jointly normally distributed. The population-averaged coefficients shown in the tables are relatively robust to violation of the error distribution assumption (see Raudenbush and Bryk 2002:303–04).

Metropolitan-level controls (*metcontrol*) are added in some models. In the simplest model the only metropolitan control is Hispanic-white segregation and its interaction with Hispanic origin. Later models allow for poverty segregation to affect race differences and race segregation to affect poverty status differences, add other metropolitan population characteristics as controls, and include the tract poverty rate and tract racial composition measures as predictors. These controls are discussed further in the results section. Means for the metropolitan-level predictor variables weighted by the number of observations in each metropolitan area are shown toward the bottom of Table 1.

Results

How are patterns of high school completion and college completion related to metropolitan spatial segregation on the basis of race and income? Estimates of the multilevel models provide an answer. The basic multilevel high school graduation model is shown in Table 2. The model results

13. The unit-specific and population-averaged models have small differences in the interpretation of coefficients and assumptions. For more discussion, see Raudenbusch and Bryk (2002) chapter 10, and Fitzmaurice, Laird, and Ware (2004) chapter 13.

Table 2 • *Multilevel Logistic Models of High School Graduation on Metropolitan and Individual Characteristics*

	Coef.	*SE*
Segregation measures (MSA) and interactions with individual characteristics (age 14–16)		
Seg., poor/nonpoor (H)	−2.402	1.640
Seg. poor/nonpoor * below poverty	−5.920	2.790 * (***)
Seg., black/white (H)	.194	.593
Seg. black/white * black	−1.555	.550** (**)
Individual-level characteristics (age 14–16)		
Family below poverty income (vs. not)	−.353	.107***
Respondent black (vs. not)	.223	.150
Respondent Hispanic (vs. not)	−.369	.447
Male (vs. female)	−.337	.086***
Number of siblings	−.074	.022***
Mother's education (dummy variables, reference = HS graduate)		
8th grade or less	−.666	.175***
9th–12th grade	−.680	.116***
Some college	.186	.167
College graduate	.630	.506
Grad/prof. degree	.955	.369**
Mother not in household	.226	.418
Father's education (dummy variables, reference = HS graduate)		
8th grade or less	−.857	.191***
9th–12th grade	−.987	.156***
Some college	.433	.266
College graduate	.452	.447
Grad/prof. degree	1.871	.784*
Father not in household	−.810	.135***
Age 14 in 1980 or later (vs. 1979 or earlier)	.304	.143*
Region (dummy variables, reference = South)		
Northeast	.425	.160**
Midwest	.160	.199
West	.098	.223
Hispanic segregation controls		
Seg., Hispanic/white (H)	1.750	.736*
Seg. Hispanic/white * Hispanic	.652	3.562

Notes: Parenthesized asterisks indicate p-value for hypothesis test that the sum of the segregation main effect and the corresponding interaction of segregation with poor or black is zero. Models include an intercept although the intercept is not shown. Results are from the population averaged multilevel logistic model. The results from subject-specific models are similar.
* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

are shown in reduced form, meaning that each model is shown as a single column with second-level predictors of first-level coefficients shown as interactions between the individual-level variable and the second-level predictor.[14]

Looking at the segregation coefficients, shown at the top of the table, as residential segregation of the poor and nonpoor increases, there is no statistically significant effect on the high school graduation probabilities of the nonpoor; the main effect of poor-nonpoor segregation is not significant. By contrast, there is a negative and statistically significant difference in the slope for the poor contrasted to the nonpoor (significant interaction term), indicating reduced graduation probabilities as segregation increases for the poor relative to the nonpoor. By summing the main effect and the interaction we get the estimated slope of poor-nonpoor segregation for poor persons, which is −8.322

14. The reduced form is obtained by substituting the second-level equations into the first-level equation.

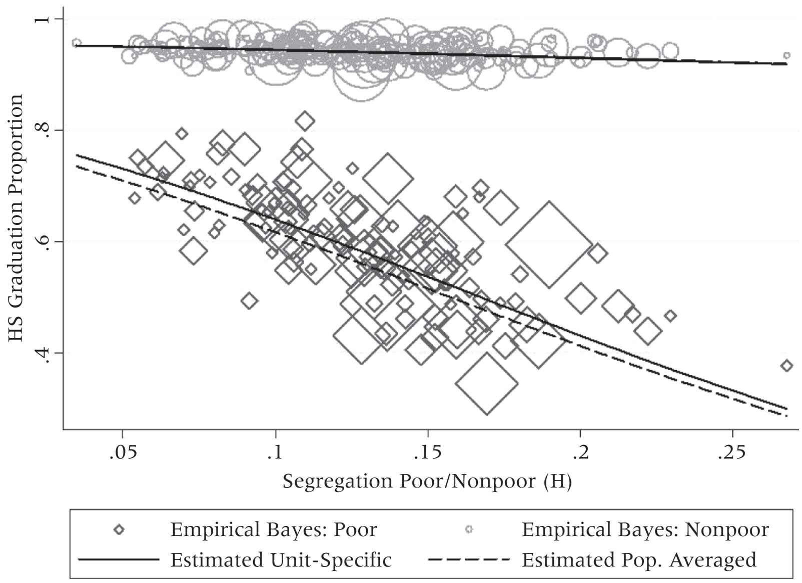

Figure 1 • *Poor/Nonpoor Segregation and High School Graduation Probabilities at Age 26, PSID*

Notes: Fitted values are estimated from the model in Table 2. Individual-level variables are held constant at modal (dummy) or mean (continuous) nonpoor or poor values. Circles and diamonds are Empirical Bayes estimates. Sizes of circles and diamonds are proportional to observations for the metropolitan area.

(−2.402 + −5.920). The statistical significance of the poor-nonpoor segregation effect for the poor (sum of the main and interaction term) is indicated in Table 2 by the asterisks in parentheses. The poor-nonpoor segregation effect for the poor is highly statistically different from zero. The patterns of these results support the conclusion that rates of high school completion for the poor decline as poor-nonpoor metropolitan segregation increases.

The black-white segregation effects show a similar pattern to the poverty segregation results. The lack of a significant main effect shows that, for white students, there is no statistically significant change in the likelihood of graduation as black–white segregation increases. In contrast, the probability of high school graduation for black students declines as black-white segregation increases. Like the results for poverty status segregation, the general pattern is that segregation harms the disadvantaged group without benefit for the advantaged group.[15]

How strong are the segregation effects? Figure 1 shows the predicted probability of high school graduation as a function of poor–nonpoor segregation. Predicted probabilities for each group are shown as two lines, one for the population averaged logit model (estimates shown in the tables), and the other for the unit-specific logit model (coefficients not shown) (also, see footnote #13). Diamonds or circles show estimates for each metropolitan area of the high school graduation proportion for students from poor (diamonds) and nonpoor (circle) families: these are based on the estimated empirical Bayes residual for each metropolitan area added to the unit-specific model estimate.[16] Figure 2 shows a similar graph to Figure 1 but for black-white segregation. Contrasting the most and least segregated metropolitan areas—a difference of around

15. When either income or race segregation is included in the model alone (without the other form of segregation), the coefficients of segregation effects on disadvantaged groups increase in magnitude, but only marginally (not shown).

16. See Raudenbush and Bryk (2002) chapter 3.

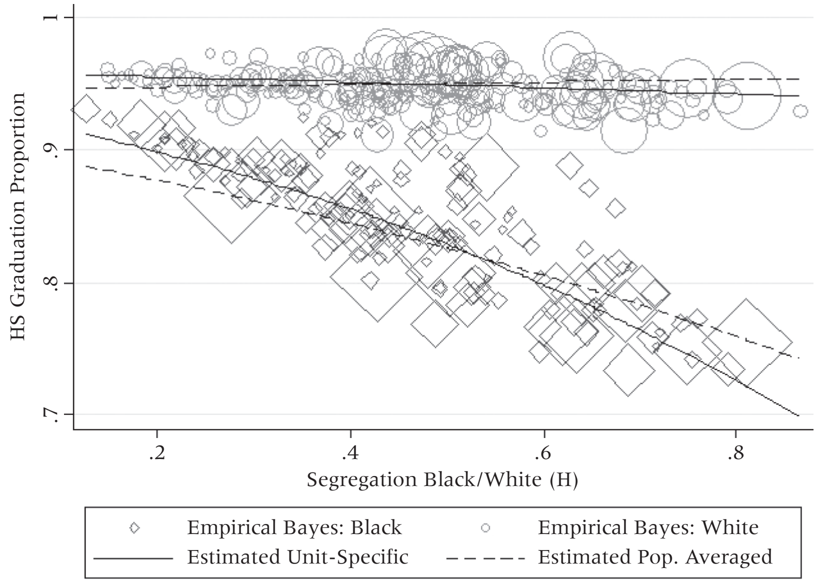

Figure 2 • *Black/White Segregation and High School Graduation Probabilities at Age 26, PSID*

Notes: Fitted values are estimated from the model in Table 2. Individual-level variables are held constant at modal (dummy) or mean (continuous) nonpoor or poor values. Circles and diamonds are Empirical Bayes estimates. Sizes of circles and diamonds are proportional to observations for the metropolitan area.

four standard deviations—the difference is a large and important impact on educational attainment for disadvantaged groups.

The models in Table 2 include few controls for metropolitan characteristics. Table 3 shows key coefficients from models successively adding a larger number of controls for metropolitan characteristics and tract composition. In Model 1, I predict the metropolitan intercept and the slopes of poverty and black with measures of the metropolitan population composition and with all of the metropolitan segregation measures. For instance, in the second-level model the "poor" slope is predicted by metropolitan percentage poor, percentage black, percentage Hispanic, and segregation indexes for black-white, Hispanic-white, and poor-nonpoor. These same predictors are also included as predictors of the intercept and the black slope. As is shown in Model 1 of Table 3, with these additional controls the pattern in Table 2 is unchanged: poor-nonpoor and black-white segregation are associated with lower high school graduation probabilities for the poor and blacks, respectively, but no significant increase for the nonpoor and whites. Model 2 shows results with additional metropolitan controls for total population (logged), share of employment in manufacturing, employment to population ratio, and percentage immigrants. The basic results are unchanged with the additional controls.

Model 3 of Table 3 adds further controls for the percentage poor and percentage black of the census tract of residence. The tract composition measures are also interacted with individual poverty status and race. In general, the coefficients of the composition effects are not significant, other than the result that share poor in the tract has a less negative relationship to high school graduation for poor persons than for nonpoor persons, although the effect is not statistically different from zero for either poor or nonpoor. Further, the metropolitan segregation coefficients become only a little smaller with the addition of the tract composition measures. Holding constant the percentage black and percentage poor of the respondent's residential census tract, segregation on race

Table 3 • *Segregation Coefficients from High School Graduation Models with Additional Metropolitan-Level Controls*

Independent Variables	*Model 1 MSA Seg. and Composition*		*Model 2 Adds Pop., Employment*		*Model 3 Adds Tract Composition*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
Seg., poor/nonpoor (H)	−2.004	3.258	−1.518	3.394	−1.059	3.337
Seg. poor/nonpoor * below poverty	−8.671	3.105**(**)	−7.263	3.436*(+)	−7.385	3.510*(+)
Seg., black/white (H)	−1.518	3.394	−.313	.736	−.632	.747
Seg. black/white * black	−7.263	3.436*(**)	−2.000	.755**(**)	−1.830	.854*(**)
Percent poor in residential census tract					−.880	.609
Percent poor in residential census tract * below poverty					1.601	.600**
Percent black in residential census tract					−.993	.880
Percent black in residential census tract * black					.817	.904

Notes: Parenthesized asterisks indicate *p*-value for hypothesis test that the sum of the segregation main effect and the corresponding interaction of segregation with poor or black is zero. Models include an intercept although the intercept is not shown. Results are from the population averaged multilevel logistic model. The results from subject-specific models are similar.
Metropolitan variables in level-two models (all models also include variables shown in Table 2): Model 1, segregation poor-nonpoor, segregation white-black, segregation white-Hispanic, percent poor, percent black, percent Hispanic (N = 3,533); Model 2, variables in Model 1 plus metropolitan population (logged), percentage employed in manufacturing, percentage immigrants, employment to population ratio (N = 3,533); Model 3, variables in Model 2 plus tract composition and interactions (coefficients shown) (N = 3,456 due to missing census tract identifiers for some cases).
$^+ p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

and poverty status in the metropolitan area remain significant predictors of deleterious educational outcomes for disadvantaged groups. This indicates that the effects of metropolitan segregation capture something beyond the composition effect of the immediate neighborhood an individual resides in, consistent with the idea that segregated metropolitan space outside an individual's own residential neighborhood is important.

Table 4 shows models of college graduation (four-year college or BA) among respondents who have graduated from high school. Because this analysis includes only high school graduates, the results do not capture the mechanical dependence that high school graduation is required to enter college. The results show a negative interaction coefficient of black-white segregation with black, suggesting a deleterious effect of segregation for black adolescents, which persists beyond high school graduation. There is no statistically significant effect for poor-nonpoor segregation. The results show no evidence that the advantaged group "gains" from segregation in college attendance.[17]

As poor–nonpoor and black-white segregation increases, the disadvantaged group's high school graduation probability decreases. This is a general pattern that holds in point estimates of all models and is statistically significant in most tests. The advantaged groups' likelihood of high school graduation or college graduation—nonpoor and white—are not significantly changed by segregation.

Extended Results

I consider two additional sets of analyses in this section that extend the basic results and aid in their interpretation: proximity-adjusted measures of residential segregation and instrumental variables estimates.

17. The addition of the metropolitan controls shown in Table 3 does not change this result.

Table 4 • *Multilevel Logistic Model of College Graduation (Bachelor's) on Metropolitan and Individual Characteristics*

	Coef.	*SE*
Segregation measures (MSA) and interactions with individual characteristics (age 14–16)		
Seg., poor/nonpoor (H)	1.916	2.139
Seg. poor/nonpoor * below poverty	7.432	6.452
Seg., black/white (H)	–.145	.566
Seg. black/white * black	–1.470	.673*(+)
Individual-level characteristics (age 14–16)		
Family below poverty income	–.736	.220***
Respondent black	–.463	.152**
Respondent Hispanic	.311	.500
Male (vs. female)	–.177	.105+
Number of siblings	–.105	.034**
Mother's education (dummy variables, reference = HS graduate)		
8th grade or less	–.312	.388
9th–12th grade	–.478	.225*
Some college	.417	.163*
College graduate	1.127	.204***
Grad/prof. degree	1.348	.223***
Mother not in household	.342	.402
Father's education (dummy variables, reference = HS graduate)		
8th grade or less	–.461	.304
9th–12th grade	–.415	.286
Some college	.327	.194+
College graduate	1.529	.222***
Grad/prof. degree	1.445	.232***
Father not in household	.151	.219
Age 14 in 1980 or later (vs. 1979 or earlier)	–.303	.163+
Region (dummy variables, reference = South)		
Northeast	.462	.176**
Midwest	.179	.194
West	–.712	.229**
Hispanic segregation controls		
Seg., Hispanic/white (H)	–.984	.795
Seg. Hispanic/white * Hispanic	8.395	4.623

Notes: Parenthesized asterisks indicate p-value for hypothesis test that the sum of the segregation main effect and the corresponding interaction of segregation with poor or black is zero. Models include an intercept although the intercept is not shown. Results are from the population averaged multilevel logistic model. The results from subject-specific models are similar.
$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Proximity-Adjusted Segregation Measures. One limitation of the Theil index and other traditional segregation measures, such as the index of dissimilarity, is that they do not account for the spatial positioning of the census tract units used to compute them. The tract units over which metropolitan segregation is computed are treated as unrelated units. Some segregation effects may be better captured by a measure incorporating the spatial positioning of census tracts, which will indicate higher segregation when white or black neighborhoods, or rich or poor ones, are clustered together and lower segregation when they are spatially mixed.

To examine whether spatial positioning might enrich the measurement of segregation in a way that alters model estimates, I employ a spatially adjusted version of the Theil Entropy Index of Segregation, computed approximately following Sean Reardon and David O'Sullivan (2004) and Reardon and associates (2008). In this approach, entropy and segregation are computed as they apply to the "local environment," which includes the respondent's census tract, but is also a distance-weighted function of surrounding census tracts. Details of these measures and formulas are provided in the Appendix.

I compute versions of the spatial measures at two spatial levels suggested by Reardon and associates (2008) and Barrett Lee and associates (2008). These use definitions of the "local environment" based on a 1,000-meter radius and a 4,000-meter radius in place of the census tract. A 1,000-meter radius gives the local environments an area that approximately represents a "location institutional neighborhood" according to Reardon and associates (2008), which is "roughly the size of a typical primary school attendance area or police substation zone" (p. 502–03). A 4,000-meter radius corresponds to an area of almost 20 square miles that is larger than all but the largest supraneighborhoods area ("think of Chicago's South Side" [Reardon et al. 2008:502]). These two metrics provide a range of segregation scales to assess segregation effects.

I reestimate the basic models, replacing the traditional measures of segregation with the proximity-adjusted measures. Key coefficients of the models with the two radius parameters are shown in Table 5. Compared to the models with the traditional (aspatial) segregation measures, the standard errors tend to be a larger in the spatial models and the results correspondingly somewhat less significant. Race segregation effects appear a bit stronger in the 1,000-meter radius definition, while income segregation effects a bit stronger in the 4,000-meter radius definition. Fundamentally, however, the pattern of results is similar to the results using the traditional segregation measures.

Instrumental Variables Estimation. Typical of observational studies, a concern is the possible omission of metropolitan-level variables that cause certain metropolitan areas to have both higher segregation and worse schooling outcomes for children from disadvantaged groups. A similar concern is that low levels of education for poor or black youth might result in migration producing higher levels of segregation, rather than segregation causing individual outcomes.

Reestimating results using instrumental variables estimation is one approach to addressing these potential problems (see Wooldridge 2003; chapter 15). An instrument is a variable the causes the independent variable of main interest (segregation) but is otherwise unlikely to be a cause of the outcome (educational attainment). Following the approach of prior studies, my study uses features of the geography of cities fixed in the distant past that predict current segregation as instruments. The instrumental variables estimators form

Table 5 • *Segregation Estimates with Proximity-Adjusted Segregation Measures*

	High School Graduation		*College Graduation*	
	Coef.	*SE*	*Coef.*	*SE*
Segregation measures (MSA) and interactions with individual characteristics, 4,000 meters distance (r = 4,000 m)				
Seg., poor/nonpoor (H)	−1.661	2.268	1.901	2.864
Seg. poor/nonpoor * below poverty	−6.158	2.996*(**)	6.138	8.758
Seg., black/white (H)	−1.190	.720	−.150	.647
Seg. black/white * black	−1.198	.765(***)	−1.210	.901
Segregation measures (MSA) and interactions with individual characteristics, 1,000 meters distance (r = 1,000 m)				
Seg., poor/nonpoor (H)	−1.372	2.085	1.653	2.392
Seg. poor/nonpoor * below poverty	−4.728	3.188(+)	8.430	6.214
Seg., black/white (H)	−.875	.629	.167	.572
Seg. black/white * black	−1.843	.697**(***)	−1.663	.818*(+)

Notes: Models also include all variables shown in Tables 2 (high school) and 4 (college), but coefficients are not shown. Parenthesized asterisks indicate p-value for hypothesis test that the sum of the segregation main effect and the corresponding interaction of segregation with poor or black is zero. Results shown are from population average multilevel logistic model.
$^{+}$ $p < .10$ * $p < 05$ ** $p < .01$ *** $p <. 001$ (two-tailed tests)

estimates of the effect of the independent variable using only increments of segregation caused by these geographic features. Because these geographic features are not responding to recent metropolitan conditions, this purges the estimates of possible inflation due to recent metropolitan conditions that might serve as confounders.

Following the approach of David Cutler and Edward Glaeser (1997), I use measures of local government fragmentation in the past as instruments.[18] The local government fragmentation measures are a count of municipal and township governments within the metropolitan area in 1962 and a count of counties in the metropolitan area in 1970. Data on number of local governments were taken from Cutler and Glaeser (1997), who took them from the *The Census of Governments* (1962). I compute the number of counties from 1970 census data. Since I am predicting both the poverty segregation and black-white segregation and interactions with indicator variables for poor and black, respectively, these variables are instrumented using the two metropolitan fragmentation variables plus their interactions with individual race and poverty status.[19]

A first condition for valid instruments is that they predict segregation. Empirically, I find that both the number of metropolitan governments and number of counties are predictive of current segregation on the basis of race and income.[20] Others have also found number of metropolitan governments to be predictive of segregation (Bischoff 2008; Cutler and Glaeser 1997); my study is the first to use number of counties as an instrument. These are likely predictive of segregation because governments provide socially meaningful, visible boundaries that come to be race and income typed and that individuals recognize and use to select residential areas (Bischoff 2008).

A second condition for valid instruments is that they cause segregation without responding to segregation or conditions acting as a common cause of segregation and educational attainment. While my measures of metropolitan fragmentation were measured in 1964 and 1970, these boundaries were largely fixed much earlier in the century. The number of local governments in metropolitan areas has remained overwhelmingly stable since the early twentieth century when the last municipal systems in the continental United States were established (Cutler and Glaeser 1997). The number of counties is even more stable; there are only a tiny handful of counties have been created, deleted, or significantly redrawn since 1930 outside of Alaska and Hawaii (The Newberry Library 2014).[21] City and county boundaries were determined before segregation took its modern form in most cities with the "great migration" of African Americans into cities, the suburbanization of the white population, and the post-1965 increase in Hispanic and Asian immigration. From these facts, it seems unlikely these measures could be responding in significant part to segregation in the recent past or contemporary schooling conditions.

The instrumental variable estimates are shown in Table 6. I use two-stage least squares to estimate the models. Although nonlinear models are often preferred for binary outcomes, the strong additional assumptions regarding joint error distribution required for instrumental-variable probit (the alternative to two-stage least squares for a binary outcome) make me prefer two-stage least-squares linear probability models.[22] I contrast these results to a standard linear probability model as a baseline (shown as the left two columns in Table 6). All models adjust for sample clustering on metropolitan area.

18. Cutler and Glaeser (1997) also use counts of number of rivers and intergovernmental revenue transfers as instruments. I found that neither number of rivers nor intergovernmental transfers strongly and consistently predicted both income and race segregation. (My counts of rivers were taken from Rothstein 2007.)

19. Each variable is interacted with both race and poverty status, forming a total of six variables. Cutler and Glaeser (1997) used a similar procedure.

20. OLS regressions of segregation on these two variables give: income segregation = −.002 (.003) × ln(local govt's) + .017 (.004) × ln(counties) + .101; race segregation = .092 (.015) × ln(local govt's) − .031 (.014) × ln(counties) + .138. Numbers in parentheses are standard errors.

21. No cities in Alaska and Hawaii met the population size criteria for inclusion in this analysis.

22. Instrumental variables logit models have not been developed. The robust standard errors correct standard errors for the heteroskedasticity implicit in linear probability models.

Table 6 • *Instrumental Variables Estimates of Segregation Effects on High School Graduation*

	Linear Probability Model (OLS)		*2SLS with Instruments: Number of Municipal Governments, Number of Counties*	
Independent Variables	*Coef.*	*SE*	*Coef.*	*SE*
Seg., poor/nonpoor (H)	−.218	.189	−1.805	1.356
Seg. poor/nonpoor * below pov.	−1.333	.520**(**)	−2.789	1.491^{+}($^{+}$)
Seg., black/white (H)	−.058	.064	−.1634	.237
Seg. black/white * black	−.284	.066***(***)	−.2020	.147($^{+}$)

Notes: Instruments are number of municipal governments and counties and their interactions with indicator variables for poverty and race. Models also include all control variables shown in Table 2 but coefficients are not shown. Parenthesized asterisks indicate p-value for hypothesis test that the sum of the segregation main effect and the corresponding interaction of segregation with poor or black is zero. Standard errors adjusted for clustering on metropolitan area.
+ $p < .10$ * $p <$ 05 ** $p < .01$ *** $p <$. 001 (two-tailed tests)

With the instrumental variable estimates, the pattern and magnitude of the coefficient estimates is roughly similar to what we found with the multilevel model. Standard errors, however, tend to be larger, reflecting the fact that the instrumental variable estimates only use some of the variability in segregation. The results show statistically significant negative effects of segregation for poor and black persons. Coefficients for nonpoor and nonblack persons are not statistically different from zero.

While the larger standard errors make the results less strong than the multilevel models, the general pattern of coefficients and significance is consistent with the multilevel estimates. Although it is always difficult to disentangle causality in macrosociological studies, the instrumental variable findings provide further evidence consistent with the conclusion that the results indicate causal processes of segregation on educational attainment.

Contrasts to Prior Area Segregation Studies

These results are consistent with prior studies that have used metropolitan comparisons to examine black-white segregation effects on educational attainment, notably Cutler and Glaeser (1997) and Ananat (2011). This study adds to their findings that poor-nonpoor segregation has deleterious consequence for the poor, but not for the nonpoor. Moreover, the results here demonstrate the black-white segregation effects found by these prior studies hold in data sets other than Census microdata, hold accounting for poverty status segregation, hold when outcomes are evaluated after segregation (reflecting the expectation of time-lagged segregation effects), and are capturing more than individuals' tract race or economic composition.

The results are partially consistent with Gordon and Monastiriotis's (2006) study of segregation effects on school exam passing rates and university entrance in England and Wales. They found segregation increased inequality in educational outcomes in a region and was associated with increased attainment among high achieving students. They used a measure of segregation that combines segregation on race/ethnicity, social class, and unemployment rates, and thus they were not able to distinguish effects of these types of segregation. Their study also lacked individual control variables because it used only aggregated data on school passing rates.

The results are partially consistent with Mayer (2002), who found both that educational attainment of low-income persons decreased, and of high-income increased, with greater segregation. Among possible reasons for the partial discrepancy in results are that Mayer used a different (continuous) measure of income segregation, Mayer divided between high-income and low-income at median income rather than using the poverty line, and Mayer calculated segregation measures over entire U.S. states. This last point—using U.S. states as the units—in particular, lines up less well with the concept of using segregation measures calculated over areas that are likely to be influential on individuals' lives, since states are areas that are much larger than individuals typically experience. We would not, for instance, typically expect segregation patterns in San Diego to have much influence on educational attainment among children living in San Francisco.

The differences in results across these studies suggest that the finding that segregation increases the disadvantage of the disadvantaged, but not the advantage of the advantaged, may be specific to the outcome (here high school graduation and college entrance), exact forms of segregation (here black-white and poor-nonpoor), and the general context (here U.S. metropolitan areas). For other outcomes influenced by segregation, other forms of segregation, and other contexts, results have yet to be established.

Discussion

Despite a long history of studies measuring residential segregation and large literatures assessing and measuring neighborhood effects, few studies have examined the gains and losses across racial and economic groups from segregation. The main finding of this article is that in more segregated metropolitan areas, the rates of high school graduation of children from disadvantaged backgrounds is lower, but the high school graduation and college completion rates of children from advantaged backgrounds are no higher. These results hold for poor–nonpoor segregation and for black–white segregation. The results hold under controls for many metropolitan population characteristics and for the poverty and racial composition of tract of residence. They hold using spatially adjusted segregation measures. And they hold when measures of government boundaries in the past are used to form instrumental variables estimates. For the outcomes considered here, segregation increases the disadvantage of disadvantaged groups without increasing the advantage of advantaged groups.

It remains possible that desegregation negatively affects adolescents from advantaged backgrounds on educational outcomes not considered in this analysis. I cannot directly examine outcomes like achievement test scores because these measures are not present in the PSID. Yet the lack of segregation effects on college completion among adolescents from advantaged backgrounds makes me skeptical of this explanation. College completion would likely be affected if the advantaged group had their academic skills or their test scores seriously reduced because of their residence in a less segregated metropolitan environment.

The lack of trade-offs in educational outcomes between advantaged and disadvantaged youths with desegregation may reflect the fact that schools or neighborhoods markedly improve in educational terms when they have a critical threshold of middle-class or affluent students, which is achieved more often in class-integrated metropolitan areas. Such critical thresholds could produce notable improvements in educational outcomes for disadvantaged youth with desegregation without significant loss for advantaged students. This explanation is consistent with arguments made by Kahlenberg (2001) and Gerald Grant (2009) based on case studies.

Another reason students from advantaged backgrounds may not have their educational attainment decline in more integrated environments may be because in more socioeconomically or racially integrated environments advantaged parents employ alternative or compensatory schooling arrangements, such as private schools and tutoring, or pressure their local public schools to change in ways that reduce disadvantages to the children of the advantaged. If this is the explanation of the lack of segregation effects on advantaged youth, it is notable that these practices do not undermine the benefits of reduced segregation for children of disadvantaged backgrounds. This might be because advantaged parents in economically or racially diverse districts continue to pay taxes and affect local neighborhoods and governments even if they send their children to private school.

The estimates in this study aim to capture the total effect of segregation on rates of high school graduation and college entrance. By "total effect" I mean the effect of segregation in the broad spatial environment that is likely to influence educational and life chances outcomes. The metropolitan area of a city and surrounding suburbs are used as the unit since it captures an area in which a resident is likely to live and work. I find that measures of segregation across this space are better predictors of high school graduation than census tract racial composition or poverty rates. This finding suggests effects of segregation in the broader context outside of the respondent's own small-area neighborhood are important.

A limitation of this study is that it is not possible to distinguish the mechanisms through which these effects operate; this study leaves these effects as something of a black box. While a better knowledge of the mechanisms of segregation effects is important, knowledge of the total effect is equally important. Because segregation effects likely operate through many mechanisms at several spatial scales, even a very good understanding of any specific mechanism would not be sufficient to estimate the total effect of segregation. Yet the total effect of segregation is essential to understanding the effects of policies that alter segregation levels.

Advantaged parents have long resisted efforts to reduce segregation because of the concern that in a less segregated environment, the quality of their children's educational environments will decline. The results of this study suggest that such trade-offs need not follow from desegregation on the basis of income or race. Remarkably, in less class- and race-segregated metropolitan areas, disadvantaged groups do better, while advantaged groups do no worse.

The results of this study also suggest that future studies of contextual effects should further consider the influence of segregation over contexts beyond the small-area residential neighborhood, which is overwhelmingly represented in U.S. studies by census tracts. Most individuals spend much of their time outside of their residential neighborhood, and may be influenced by broader contexts of segregation, for instance through segregation fostering stereotypes or attitudes that have consequences for group members, or by influencing distance to more affluent areas with better job prospects, or through influencing the composition of attended schools. The use of a metropolitan segregation measure is one approach to this problem, but others grounded in use of composition measures weighted by spatial distance or calculated across multiple types of boundaries should be explored as well, since they may provide a better representation of the spatial scales over which segregation is most consequential. These represent a promising area for future research into neighborhood and segregation effects on individuals' lives.

Recent efforts to reduce class and race gaps in educational attainment have emphasized school reform. While efforts to improve the quality of many urban educational systems are clearly needed, the change that can be effected through improved curriculum and instruction alone are limited because family and residential factors powerfully affect students' learning and also their school environments (Coleman 1966; Rothstein 2004). The results in this article suggest that policies to reduce the income and race segregation of metropolitan residence can play an important role as part of the broader remedy to improve high school graduation rates and increase equity in educational outcomes.

Appendix: Spatial Segregation Measures

To examine whether spatial positioning might enrich the measurement of segregation in a way that alters model estimates, I employ a spatially adjusted version of the Theil Entropy Index of Segregation, computed approximately following Reardon and O'Sullivan (2004) and Reardon and associates (2008). The corresponding segregation index is similar to the aspatial Theil's Entropy Index of Segregation I use elsewhere in the article (see James and Taeuber 1985 on the aspatial index), but adjusted to account for spatial dispersion of populations. The measures are defined as:

Theil's Proximity-Adjusted Segregation Index: $\widetilde{H}_m = 1 - \frac{1}{T_m E_m} \sum_{im} T_{im} \widetilde{E}_{im}$

Theil's Entropy in local environment of tract i: $\widetilde{E}_{im} = \widetilde{P}_{im} \ln \widetilde{P}_{im} + (1 - \widetilde{P}_{im}) \ln \widetilde{P}_{im}$

These are the same formula as the basic Theil segregation measure, but they use concepts as they apply to the *"local environment"* of tract i in metropolitan area m, rather than just the respondent's census tract. The percentage of a group in the local environment of tract i is defined as:

$$\widetilde{P}_{im} = \frac{1}{\sum_{j=1}^{J} c_{ijm}} \sum_{j=1}^{J} P_{ijm} c_{ijm}$$

where c_{ijm} is a spatial proximity distance-decay function. The distance-decay function gives more weight to points closer to the focal tract. For the distance decay function (c_{ijm}) I use a biweight kernel proximity function, suggested by Reardon and associates (2008) and Barret Lee and associates (2008). The distance weight function between points i and j in metropolitan area m is

$$c_{ijm} = \begin{cases} \left[1 - \left(\frac{d_{ijm}}{r}\right)^2\right]^2 & \text{if } d_{ijm} < r, \\ 0 & \text{otherwise} \end{cases}$$

Where d_{ijm} is the distance between tracts i and j in kilometers and r is a radius parameter governing the scale of the local environments over which segregation is computed. The biweight kernel function takes on a shape similar to a Gaussian distribution centered at zero within the distance radius, and zero outside that radius. I treat the population of each tract as if it is located as the centroid of the tract for purposes of computing the distance-decay function.

Reardon and associates (2008) allocated population through space in estimating spatial measures by spatially smoothing and allocation population counts from block-level census data. Because the U.S. Census Bureau does not release block-level poverty counts, their exact procedure could not be used; smoothing from tract data would require additional assumptions about the position of population within the tract area.

The radius parameter defines the scale of the local environments that individuals experience and are used as the basis of segregation calculation. Areas outside the radius are not counted as part of the individual's local environment. I calculate spatial segregation measures using a radius of 1,000 meters and 4,000 meters.

References

Allport, Gordon. 1954. *The Nature of Prejudice*. Cambridge, MA: Addison Wesley.

Ananat, Elizabeth Oltmans. 2011. "The Wrong Side(s) of the Tracks: The Causal Effects of Racial Segregation on Urban Poverty and Inequality." *American Economic Journal: Applied Economics* 3:34–66.

Baker, Bruce, David Sciarra, and Danielle Farrie. 2010. "Is School Funding Fair? A National Report Card." Education Law Center, Newark, NJ. Retrieved May 5, 2014 (www.schoolfundingfairness.org/National_Report_Card_2010.pdf).

Bischoff, Kendra. 2008. "School District Fragmentation and Racial Residential Segregation: How Do Boundaries Matter?" *Urban Affairs Review* 44(2):182–217.

Blalock, Hubert M. 1967. *Toward a Theory of Minority-Group Relations*. New York: John Wiley and Sons, Inc.

Blau, Peter. 1977. *Inequality and Heterogeneity: A Primitive Theory of Social Structure*. New York: Free Press.

Brantlinger, Ellen. 2003. *Dividing Classes: How the Middle Class Negotiates and Rationalizes School Advantage*. New York: Rougledge Falmer.

Briggs, Xavier de Souza. 2005. "More Pluribus, Less Unum? The Changing Geography of Race and Opportunity." Pp. 17–44 in *The Geography of Opportunity: Race and Housing Choice in Metropolitan America*, edited by Xavier de Souza Briggs. Washington, DC: Brookings Institution Press.

Clampet-Lundquist, Susan and Douglas Massey. 2008. "Neighborhood Effects on Economic Self-Sufficiency: A Reconsideration of the Moving to Opportunity Experiment." *American Journal of Sociology* 114(1): 107–43.

Coleman, James S., Ernest Q. Campbell, Carol J. Hobson, James McPartland, Alexander M. Mood, Frederic D. Weinfeld, and Robert L. York. 1966. *Equality of Educational Opportunity*. Washington, DC: U.S. Office of Education.

Crane, Jonathan. 1991. "The Epidemic Theory of Neighborhood Effects on Dropping Out and Teenage Childbearing." *American Journal of Sociology* 96(5):1226–59.

Crowder, Kyle and Scott J. South. 2011. "Spatial and Temporal Dimensions of Neighborhood Effects on High School Graduation." *Social Science Research* 40:87–106.

Cutler, David and Edward Glaeser. 1997. "Are Ghettos Good or Bad?" *Quarterly Journal of Economics* 112(3): 827–72.

Duncan, Greg J. and Stephen Raudenbush. 1999. "Assessing the Effects of Context in Studies of Child and Youth Development." *Educational Psychologist* 34(1):29–41.

Fischer, Claude, Gretchen Stockmayer, Jon Stiles, and Michael Hout. 2004. "Distinguishing the Geographic Levels and Social Dimensions of U.S. Metropolitan Segregation, 1960–2000." *Demography* 41(1):37–59.

Fischer, Mary J. and Douglas S. Massey. 2000. "Residential Segregation and Ethnic Enterprise in U.S. Metropolitan Areas." *Social Problems* 47(3):408–24.

Fitzmaurice, Garrett, Nan Laird, and James Ware. 2004. *Applied Longitudinal Analysis*. Hoboken, NJ: Wiley-Interscience.

Gordon, Ian and Vassilis Monastiriotis. 2006. "Urban Size, Spatial Segregation, and Inequality in Educational Outcomes." *Urban Studies* 43(1):213–36.

Grant, Gerald. 2009. *Hope and Despair in the American City: Why There are No Bad Schools in Raleigh.* Cambridge, MA: Harvard University Press.

Harding, David J. 2003. "Counterfactual Models of Neighborhood Effects: The Effect of Neighborhood Poverty on Dropping Out and Teenage Pregnancy." *American Journal of Sociology* 109(3):676–719.

Hauser, Robert M. 1970. "Context and Consex: A Cautionary Tale." *American Sociological Review* 75(4):645–64.

Hill, Martha. 1991. *The Panel Study of Income Dynamics: A User's Guide*. Beverly Hills, CA: Sage.

James, David R. and Karl Taeuber. 1985. "Measures of Segregation." *Sociological Methodology* 14:1–32.

Jargowsky, Paul. 1997. *Poverty and Place: Ghettos, Barrios, and the American City*. New York: Russell Sage Foundation.

Kahlenberg, Richard D. 2001. *All Together Now: Creating Middle-Class Schools through Public School Choice*. Washington, DC: Brookings Institution Press.

Kifano, Subira. 1996. "Afrocentric Education in Supplementary Schools: Paradigm and Practice at the Mary McLeod Bethune Institute." *Journal of Negro Education* 65(2):209–18.

Lareau, Annette. 2003. *Unequal Childhoods: Race, Class, and Family Life*. Berkeley: University of California Press.

Lee, Barrett A., Sean F. Reardon, Glenn Firebaugh, Chad R. Farrell, Stephen A. Matthews, and David O'Sullivan. 2008. "Beyond the Census Tract: Patterns and Determinants of Racial Segregation at Multiple Geographic Scales." *American Sociological Review* 73:766–91.

Leventhal, Tama and Jeanne Brooks-Gunn. 2000. "The Neighborhoods They Live In: The Effects of Neighborhood Residence on Child and Adolescent Outcomes." *Psychological Bulletin* 126(2):309–37.

Ludwig, Jens, Greg Duncan, and Joshua Pinkston. 2005. "Housing Mobility Programs and Economic Self-Sufficiency: Evidence from a Randomized Experiment." *Journal of Public Economics* 89(1): 131–56.

Ludwig, Jens, Jeffrey Liebman, Jeffrey Kling, Greg Duncan, Lawrence Katz, Ronald Kessler, and Lisa Sanbonmatsu. 2008. "What Can We Learn about Neighborhood Effects from the Moving to Opportunity Experiment?" *American Journal of Sociology* 114(1):144–88.

Massey, Douglas. 1990. "American Apartheid." *American Journal of Sociology* 96(2):329–57.

Massey, Douglas and Nancy Denton. 1993. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, MA: Harvard University Press.

Mayer, Susan E. 1991. "How Much Does a High School's Racial and Socioeconomic Mix Affect Graduation and Teenage Fertility Rates?" Pp. 321–41 in *The Urban Underclass*, edited by Christopher Jencks and Paul Peterson. Washington, DC: Brookings Institution Press.

——— 2002. "How Economic Segregation Affects Children's Educational Attainment." *Social Forces* 81(1): 153–76.

Mouw, Ted and Barbara Entwisle. 2006. "Residential Segregation and Interracial Friendships in Schools." *American Journal of Sociology* 112(2):394–441.

Newberry Library, The. 2014. *Atlas of Historical County Boundaries*. Retrieved January 26, 2014 (http://publications.newberry.org/ahcbp/index.html).

Orr, Larry, Judith Feins, Robin Jacob, Erik Beecroft, Lisa Sabonmatsu, Lawrence Katz, Jeffrey Liebman, and Jeffrey Kling. 2003. *Moving to Opportunity Interim Impacts Evaluation*. U.S. Department of Housing and Urban Development Office of Policy Analysis and Research, Washington, DC. Retrieved May 5, 2014 (www.huduser.org).

Osypuk, Theresa L. and Dolores Acevedo-Garcia. 2008. "Are Racial Disparities in Preterm Birth Larger in Hypersegregated Areas?" *American Journal of Epidemiology* 167(11):1295–1304.

Owens, Ann. 2010. "Neighborhoods and Schools as Competing and Reinforcing Contexts for Educational Attainment." *Sociology of Education* 83:287–311.

Park, Robert. 1926. "The Urban Community as a Spatial Pattern and Moral Order." Pp. 3–18 in *The Urban Community*, edited Earnest W. Burgess and Robert E. Park. Chicago: University of Chicago Press.

Pebley, Anne R. and Narayan Sastry. 2004. "Neighborhoods, Poverty, and Children's Well-Being." Pp. 119–46 in *Social Inequality*, edited by Kathryn M. Necerman. New York: Russell Sage.

Pettigrew, Thomas F. 1979. "Racial Change and Social Policy." *Annals of the American Academy of Political and Social Science* 441:114–31.

Portes, Alejandro and Ruben Rumbaut. 1996. *Immigrant America: A Portrait*. Berekely: University of California Press.

Quillian, Lincoln. 2012. "Segregation and Poverty Concentration: The Role of Three Segregations." *American Sociological Review* 77(3):354–79.

Raudenbush, Stephen W. and Anthony Bryk. 2002. *Hierarchical Linear Models: Application and Data Analysis Methods*. 2d ed. Newbury Park, CA: Sage Publications.

Reardon, Sean F. and David O'Sullivan. 2004. "Measures of Spatial Segregation." *Sociological Methodology* 34:121–62.

Reardon, Sean F. and Kendra Bischoff. 2011. "Residential Segregation of Families by Income, 1970–2009." U.S. 2010 Project. Retrieved May 5, 2014 (www.s4.brown.edu/us2010/Data/Report/report111111.pdf).

Reardon, Sean F., Stephen A. Matthews, David O'Sullivan, Barrett A. Lee, Glenn Firebaugh, Chad R. Farrell, and Kendra Bischoff. 2008. "The Geographical Scale of Metropolitan Racial Segregation." *Demography* 45(3):489–514.

Roof, W. Clark. 1972. "Residential Segregation of Blacks and Racial Inequality in Southern Cities: Toward a Causal Model." *Social Problems* 19(3):393–407.

Rothstein, Jesse. 2007. Public Use Version of the Replication Archive [machine-readable data set]. Retrieved July 15, 2010 (http://gsppi.berkeley.edu/faculty/jrothstein/hoxby/documentation-for-hoxby-comment).

Rothstein, Richard. 2004. *Class and Schools: Using Social, Economic, and Educational Reform to Close the Black-White Achievement Gap*. New York: Teacher's College Press.

Rubinowitz, Leonard and James Rosenbaum. 2000. *Crossing the Class and Color Lines: From Public Housing to White Suburbia*. Chicago: University of Chicago Press.

Rumberger, Russell W. and Gregory Palardy. 2005. "Does Segregation (Still) Matter? The Impact of Student Composition on Academic Achievement in High School." *Teachers College Record* 107(9):1999–2045.

Sampson, Robert J. 2008. "Moving to Inequality: Neighborhood Effects and Experiments Meet Social Structure." *American Journal of Sociology* 114(1):189–231.

Saporito, Salvatore and Deenesh Sohoni. 2007. "Mapping Educational Inequality: Concentrations of Poverty among Poor and Minority Students in Public Schools." *Social Forces* 85(3):1227–53.

Schofield, Janet W. 1995. "Review of Research on School Desegregation's Impact on Elementary and Secondary Students." Pp. 597–616 in *Handbook of Research on Multicultural Education*, edited by J. A. Banks. New York: Macmillan.

Sharkey, Patrick and Felix Elwert. 2011. "The Legacy of Disadvantage: Multigenerational Neighborhood Effects on Cognitive Ability." *American Journal of Sociology* 116:1934–81.

Small, Mario Luis. 2009. *Unanticipated Gains: Origins of Network Inequality in Everyday Life*. Cambridge, MA: Oxford University Press.

Tienda, Marta. 1991. "Poor People, Poor Places: Deciphering Neighborhood Effects on Poverty Outcomes." Pp. 244–62 in *Macro-Micro Linkages in Sociology*, edited by Joan Huber. Newbury Park, CA: Sage Publications.

U.S. Census Bureau. 1962. The Census of Governments. Washington, DC: U.S. Department of Commerce.

———. 2002. *Racial and Ethnic Residential Segregation in the United States: 1980–2000*. Series CENSR-3. Washington, DC: U.S. Government Printing Office.

Wells, Amy Stuart and Robert L. Crain. 1997. *Stepping Over the Color Line: African-American Students in White Suburban Schools*. New Haven, CT: Yale University Press.

Wilson, William Julius. 1987. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago: University of Chicago Press.

Wodtke, Geoff, David J. Harding, and Felix Elwert. 2011. "Neighborhood Effects in Temporal Perspective: The Impact of Long-Term Exposure to Disadvantage on High-School Graduation." *American Sociological Review* 76:713–36.

Wooldridge, Jeffrey M. 2003. *Introductory Econometrics: A Modern Approach*. Mason, OH: South-Western.

Zhou, Min and Carl Bankston. 1998. *Growing Up American: The Adaptation of Vietnamese Adolescents in the United States*. New York: Russell Sage.