

Racial Segregation in Modern-Day Public Schools

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Abstract

In much of the United States, school segregation is increasing even as residential segregation declines. We present a model in which a school or district administrator actively manages the degree of interracial contact in public schools in order to accommodate the competing desires of stakeholders such as parents, teachers, and courts. We empirically test the central implications of this model using data on the racial composition of every classroom in the state of North Carolina in the 2000/01 school year. Our results suggest that administrators act differently when deciding on policies influencing segregation between schools and within schools, consistent with the fact that judicial regulation usually applies only to racial balance between schools.

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Abstract

In much of the United States, school segregation is increasing even as residential segregation declines. We present a model in which a school or district administrator attempts to influence segregation levels in order to balance competing pressures to integrate schools and to limit interracial contact. The sources of these pressures are stakeholders such as parents, teachers, and courts. We empirically test the central implications of this model using data on the racial composition of every classroom in the state of North Carolina in the 2000/01 school year. Our results suggest that administrators act differently when deciding on policies influencing segregation between schools and within schools, consistent with the fact that judicial regulation usually applies only to racial balance between schools.

Nearly a half-century after the end of de jure segregation in American public schools, de facto segregation remains an extremely salient public policy issue.¹ Even as America's metropolitan neighborhoods become more racially integrated, and as surveys reveal a general softening of racial attitudes in the population, segregation in public school systems has persisted and may in fact be on the rise (Orfield and Eaton, 1996; Boger 2000; Reber 2002; Clotfelter, Ladd and Vigdor 2003; Glaeser and Vigdor 2003).²

What factors explain the persistence and resurgence of public school segregation? While considerable research effort has been devoted to identifying the causal factors driving cross-sectional and time-series variation in residential segregation (Massey and Denton 1993; Borjas 1998; Cutler, Glaeser and Vigdor 1999; Bayer, McMillan and Rueben 2002), and a number of studies have considered the extent and effects of school segregation (U.S. Commission on Civil Rights 1967; Coleman et al. 1975; Farley and Taeuber 1974; Orfield 1981; Rivkin 1994; Clotfelter 1999; Rivkin 2000; Orfield and Gordon 2001; Hanushek, Kain and Rivkin 2002), comparatively little attention has been devoted to this particular question. Considering the greater tractability of analyzing school segregation, which is largely the product of centralized administrative decisions rather than the outcomes of a decentralized housing market, and the general interest in the implications of school segregation, this lack of interest is surprising.

This paper fills the gap by modeling school segregation as the outcome of centralized

¹ The Supreme Court's 2003 decision in *Grutter v. Bollinger*, which left open the possibility that public schools might pursue racial diversity in student assignment, is one prominent example of recent attention to this issue.

² As an illustration, 37.4% of black public school students in 2000/01 attended schools with 90% or more minority enrollment, up from 33.9% in 1991/92. Almost identical figures describe the segregation of Hispanic students in the nation (Frankenberg, Lee and Orfield, 2003, Table 29).

decisions made by a school or district administrator. The administrator's problem is to maximize a social welfare function, aggregating utility over a set of agents who have preferences regarding the racial composition of schools and classrooms. Agents, including parents, courts, and other actors, may be motivated by perceptions of the relationship between racial composition and education quality, or by a desire to restrict the benefits of investments in particular schools to members of their own racial or ethnic group (as in Alesina, Baqir and Easterly, 1999; Alesina, Glaeser and Sacerdote 2001; Gugerty and Miguel 2002; Luttmer 2001; Vigdor 2003). For simplicity, our model posits two groups with different preferences: the first are those who wish to minimize the level of interracial exposure in public schools, and the second are those who oppose segregation and wish to achieve racial balance in the schools.

The model suggests that recent increases in school segregation can be attributed to some combination of three basic trends: reduced judicial scrutiny, increased minority enrollment, and increased white tolerance. This last counterintuitive effect occurs when marginally more tolerant whites lend support to public schools only in exchange for administrative concessions, expressed or implied, regarding the racial composition of classrooms within schools. For example, white parents may enroll their children in a racially diverse public school only if the school establishes a tracking program that restricts the amount of interracial exposure within classrooms.

We test the model's empirical implications by examining new evidence on school segregation derived from a rich administrative data set covering thousands of individual classrooms in roughly two thousand schools in all 117 North Carolina public school districts. Our empirical findings suggest that the forces determining segregation between schools differ from those determining segregation within schools. Specifically, consistent with an administrative effort to reduce the

potential for segregation across schools, we find that the greater is the racial diversity of a district the lower is the district's propensity to build new schools in response to population growth. This effect is stronger when growth increases the nonwhite share of the school-age population. At the same time, we find that schools in racially diverse districts that have managed to achieve low degrees of segregation *across* schools are more likely to employ academic tracking, a policy that exacerbates segregation across classrooms *within* schools. This finding suggests a pattern of substitution between two forms of segregation, within schools and across them, that we attribute to the tendency of courts to focus their attention on between-school segregation, to the exclusion of within-school segregation. Both between and within schools, we observe a tendency for segregation to be highest in racially diverse districts.

Section I provides a brief background on school segregation in the United States and in North Carolina. Section II outlines our model; Section III reports the results of empirical tests of the model. Section IV presents conclusions.

I. Background

Beginning with the momentous *Brown v. Board of Education* case in 1954, hundreds of court cases and district desegregation plans profoundly affected public schools and their communities nationwide between 1954 and the early 1990s. After two decades of tortuous legal maneuvers, public protest and resigned acceptance, Southern schools became the most racially integrated in the country (Orfield 1983). Beginning in the 1970s, school segregation in Northern cities became an issue of intense debate, provoking a new generation of initiatives aimed at creating racial balance in public schools. Over the past decade, the policy environment for debates over school

desegregation has changed, becoming increasingly constrained by a series of Supreme Court decisions that seemed to signal an end to the era of proactive efforts to integrate public schools (*Board of Education of Oklahoma v. Dowell*, 498 U.S. 237 (1991); *Freeman v. Pitts*, 503 U.S. 467 (1992)). Indeed, as federal courts appeared to become more reluctant to allow districts to use race in making student assignments, some observers feared that the public schools were headed into a period of resegregation (Orfield and Eaton 1996; Boger 2000).

A. Measurement of segregation

A number of studies have tracked the level of segregation across schools within districts over this time period (see, for example, Farley and Taeuber 1974, Coleman et al. 1975, Farley, Richards and Wurdock 1980, Orfield 1983, Rivkin 1994, Clotfelter 1999, and Orfield and Gordon 2001).³ These studies summarize racial balance across schools by computing one or more segregation indices for each district. In this paper, we use two fairly common measures of racial segregation in schools (James 1986; Reardon 1998). We briefly define each measure here and offer a more complete discussion in the Appendix. The first measure of interracial contact is the exposure rate, E , which gives the racial composition of the school attended by the typical student of a given racial group.⁴ For example, the measure of exposure of whites to nonwhites across the schools in a district is expressed as:

³ Much less research has been devoted to measuring interracial contact within schools. To our knowledge the most comprehensive attempt to measure within-school contact is Morgan and McPartland's (1981) examination of classroom assignments in 43,738 public schools in the fall of 1976. Their study, which computed segregation indices for each school rather than each district, found a small amount of intra-school segregation in elementary and middle school grades and a more pronounced amount in high schools.

⁴ Sometimes denoted xP_y in the sociological literature, for the exposure of members of group x to members of group y .

$$(1) E_k^* = \frac{\sum_j W_{jk} n_{jk}}{\sum_j W_{jk}},$$

where j indexes the schools in district k , W_{jk} indicates the number of white students in each school, and n_{jk} denotes the percent nonwhite in each school. Analogous exposure indices can be calculated to measure the exposure across *classrooms* within a district, a measure we denote E_k , or across classrooms *within a school*, which we denote E_{jk} .

The exposure index can be somewhat misleading if used as a measure of the evenness of racial composition across classrooms, since the minimum possible index value varies with the nonwhite share in the relevant district or school. As a measure of evenness, we use a second, "gap-based" segregation index. For example, to measure the degree of segregation across schools within a district we calculate:

$$(2) S_k^B = \frac{n_k - E_k^*}{n_k},$$

which is basically the gap between a district's observed exposure rate and that which would result from a perfectly even racial distribution across classrooms. The superscript B denotes between-school segregation. We similarly calculate the amount of within-school segregation for each district, S_k^W , by measuring the average difference between an even distribution and the actual outcome in each school. We can also calculate a within-school segregation measure for an individual school, which we denote S_{jk} .⁵ When referring to nonwhite shares, exposure and segregation levels generally,

⁵Most previous studies of within-school segregation do not rely on indices to measure such patterns. Gamoran (1992) and Oakes and Guiton (1995), for example, have analyzed the pattern of placements of students into academic tracks and present evidence that students of different racial groups faced different probabilities of being assigned to academic tracks, holding constant their measured achievement levels. Oakes (1994) and Mickelson (2001) have analyzed the effects of such placements on the racial composition of individual classes. In particular, Mickelson's study of high schools in Charlotte-Mecklenburg reveals a marked degree of segregation in some courses. For a related analysis of various means of discrimination in schools, including disproportionate placement in special tracks, see Meier, Stewart and England (1989, pp. 82, 98-99). For an earlier study of interracial contact within a public middle school, see Schofield (1982).

we will omit subscripts.

For a given nonwhite share, the segregation index is a linear transformation of the exposure index. In the theoretical model presented below, we model segregation levels S as administrative choice variables; the resultant levels of exposure depend on the outcome of various reactions to this administrative choice that determine the equilibrium nonwhite share, n . Given a value of n and the administrative choice of S , the equilibrium exposure rate $E = (1-S)n$.

B. The North Carolina data

Our fundamental empirical interest in this paper is to observe and analyze both the assignment of students to schools and to classrooms within schools. To examine these classroom assignments, we are fortunate to have access to detailed unpublished administrative data from the North Carolina Department of Public Instruction, made available to us under strict conditions to insure confidentiality of information on individual students and teachers. The nation's eleventh most populous state, North Carolina has a sizable minority population, and it features many urban as well as rural school districts. Although the state has a small but rapidly growing Hispanic population, African Americans remain the largest minority group by far. In 2000/01 the state enrolled some 1.3 million students in grades K-12 in 2000/01, including students in charter schools.⁶ Detailed information on the data set and our calculations are presented in the appendix.

Table 1 presents average values for classroom-level segregation indices calculated using

⁶ Charter schools were included with the districts in which each was located, although they were administratively independent of those districts.

enrollment data for each school district in North Carolina in 1994/95 and 2000/01.⁷ Average between-school, within-school and overall indices are presented for elementary schools, based on 4th grade data, middle schools based on 7th grade data, and high schools based on 10th grade data.⁸ This table shows that students at higher grade levels are more racially stratified across classrooms in a district, even though the schools they attend are more integrated. At all grade levels, segregation has increased over time, both because schools themselves have become more racially stratified and because students of different races have become more separated within schools. Segregation within schools in elementary grades is low enough to be entirely attributable to random variation, but is markedly higher at the secondary level.⁹ These patterns are consistent with those described by Morgan and McPartland (1981) in their national survey of enrollment patterns undertaken in 1976.

Figures 1 through 4 illustrate the relationship between classroom-level segregation and other characteristics. Segregation tends to be highest in racially mixed districts, as shown in Figure 1.¹⁰ The parabola shown on this graph is the result of a regression of segregation on percent nonwhite enrollment in each district and its square. Predicted segregation levels reach their maximum when

⁷ Table 1 and the remainder of statistical evidence shown in this paper classifies students as either white or nonwhite. The basic insights derived from Table 1 are also applicable to segregation between whites and blacks, between whites and hispanics, and between hispanics and blacks. See Clotfelter, Ladd and Vigdor (2003) for a comparison of calculated indices using alternative racial groupings.

⁸ For further analysis of school segregation patterns in North Carolina, including statistics for individual large districts and regions of the state, see Clotfelter, Ladd and Vigdor (2003).

⁹ We performed a simulation to estimate the degree of segregation that would be observed under complete random assignment of students to classrooms and schools. The degree of within-school segregation derived from our simulation actually exceeds the value observed for elementary students in North Carolina in 1994/95, and equals the 2000/01 value. Between school segregation patterns and within school segregation at the secondary level are inconsistent with the random assignment simulation.

¹⁰ For this figure, as well as figure 3, we calculate the segregation level for a district by taking the weighted average of 1st, 4th, 7th and 10th grade observations, with weights equal to the enrollment at each grade level.

a district's enrollment is roughly 50% nonwhite. Districts that were overwhelmingly white or nonwhite tend to exhibit more modest levels of segregation. Figure 2 shifts the focus to the school level and shows that racially diverse middle and high schools tend to feature higher levels of segregation across classrooms as well.¹¹

Figure 3 shows that classrooms in larger school districts tend to be significantly more segregated than those in smaller districts. Figure 4 presents the relationship between classroom-level segregation in each of North Carolina's 100 counties and a measure of residential segregation based on block-level data from the 2000 Census.¹² Classroom-level segregation tends to be higher in residentially segregated counties, but in 99 out of 100 counties students are more integrated in their classrooms than in their neighborhoods.¹³

III. Why are schools segregated? A theoretical model

We view the extent of racial balance across classrooms within a school or district as the result of a number of decisions made by administrators, parents, and in some cases students themselves. In this section, we model administrators as agents who choose a vector of policies that influence school segregation levels. Such policies include capital investment decisions such as the number of schools to build and where to build them, organizational decisions such as whether to designate magnet schools, and purely instructional policies such as whether to permit ability-grouping in some

¹¹ This pattern does not apply to elementary schools, where classroom segregation is universally low.

¹² For this figure, we created a set of classroom segregation indices across all classrooms in a county for those counties with multiple school districts.

¹³ In North Carolina, the median individual lives on a block with 112 residents, roughly 20% of whom are school-aged children. Thus the number of school-aged children on the typical block closely resembles the number in the typical classroom.

subjects or how many and what type of electives to offer in middle schools and high schools. Another set of policies directly related to segregation, of course, pertains to student assignment to schools – how to assign students living in various neighborhoods to particular schools, and whether to depart from a method of geography-based school assignment.¹⁴

We view the measured segregation in a school district as the result of the school administrators' efforts to balance the wishes of various stakeholders subject to the constraints inherent in the underlying racial composition of the community.¹⁵ The objective function used by the administrator might weight the utility of individual groups differentially, depending on the political or social power each group has to override the administrator's decision. Mathematically, this objective can be stated as follows:

$$(3) \max_S W(n(S), S) = \sum_i \omega_i U_i(n(S), S),$$

where W represents the objective function, i indexes groups of stakeholders, U_i represents their utility, and ω_i is the weight applied to each group's utility. The arguments of U and W are the nonwhite share n , which may itself be a function of segregation levels, and the segregation level selected by the administrator, S .¹⁶

For simplicity, we divide stakeholders into two groups. One group prefers lower over higher

¹⁴ In a more realistic model, the ultimate degree of exposure and segregation in a district would depend both on the administrator's policy choices and circumstances beyond the administrator's direct control. Administrators can use policy to influence the decisions made by parents, students and others, but from the administrative perspective some degree of noise will tend to create divergence between the intended and realized segregation levels. The model presented here could be extended to consider the optimization of expected social welfare, incorporating this uncertainty. Such an extension would have little impact on the comparative statics derived here.

¹⁵ This approach differs from one in which administrators make decisions based on their own preferences alone, for example by aiming to minimize the degree of interracial contact, or alternatively to achieve racially balanced schools and classrooms.

¹⁶ The dependence of n on S suggests "white flight" responses: whites may respond to decreasing segregation by exiting the public schools.

rates of interracial exposure in schools.¹⁷ This group may consist primarily of a subset of white parents. Using the identity between segregation and exposure $E=(1-S)n$, we write this group's aggregate disutility associated with a district's rate of exposure as $F((1-S)n)$, where $F' = f > 0$. This disutility could arise from pure racial prejudice, or it might arise from preferences for attributes associated with schools and classrooms that have higher proportions of whites. The second group of stakeholders are institutions or groups who favor racial balance and oppose segregation.¹⁸ These stakeholders could be courts or other governmental bodies that could be expected to punish a district whose schools show an excessive degree of segregation, or they could be residents who would vote against school leaders whose policies exacerbate segregation.¹⁹ The disutility arising from segregation can be written as $G(S)$, where $G' = g > 0$. In this formulation, the administrator's social welfare maximization problem can be expressed as a cost minimization problem:

$$(4) \min_S C = F((1 - S)n) + \omega G(S),$$

where C represents the objective function, and ω represents the weight the administrator attaches to segregation opponents when the weight attached to exposure opponents is normalized to one. We assume that n can be written as a reduced-form function of the segregation level $n(S)$, with $n_S < 0$,

¹⁷ That this is a reasonable presumption to make is supported by Massey and Hajnal (1995, p. 539): "Over the past 90 years, segregation patterns in the United States have consistently evolved to satisfy one overriding principle – the minimization of white-black contact. What has changed over time is the level at which the segregation has occurred."

¹⁸ It is not necessary for agents in this model to either oppose segregation or oppose exposure. Agents preferring to increase segregation irrespective of its effect on exposure, or increase exposure irrespective of its effect on segregation, could easily be incorporated into the model.

¹⁹ Among the opponents of segregation could also be added advocacy groups such as the NAACP, whose efforts led to many of the court actions that effected desegregation in districts. For a comparative analysis of the politics of desegregation, see Crain et. al (1968).

which would occur if increases in exposure prompted exit by whites, or increases in segregation prompted exit by nonwhites.²⁰ Under these conditions, the first-order condition yields a solution for the cost-minimizing segregation rate:

$$(5) S^* = \frac{fn_s - fn + \omega g}{fn_s}.$$

This relation yields several comparative static results.²¹ Increases in g , the marginal disutility to exposure proponents associated with an increase in segregation, or ω , the social or political weight attached to their preferences relative to anti-exposure constituents, clearly reduce the cost-minimizing segregation level. Intuitively, the growing reluctance of Federal courts to intervene to promote school racial balance can be interpreted as a decrease in the marginal disutility of segregation among proponents of interracial exposure, which leads in turn to higher observed levels of segregation. Alternatively, this growing reticence could also be interpreted as a reduction in ω .

The relationship between the preferences of those opposed to interracial exposure and the cost-minimizing segregation levels is somewhat complex. Under some circumstances, increases in white tolerance lead to increases in the cost-minimizing segregation level. On the one hand, absolute increases in f , the marginal disutility associated with increased exposure, unambiguously increase the cost-minimizing segregation rate:

$$(6) \frac{\partial S^*}{\partial f} = - \frac{n_s \omega g}{(fn_s)^2},$$

²⁰ We envision a structural formulation where n is a function of exposure rates, which are themselves a function of nonwhite share and the chosen segregation rate. The function $n(S)$ presumably incorporates feedback effects from changes in n to changes in E back to changes in n . For empirical evidence supporting "white flight" see Coleman et al. 1975; Clotfelter 1976; Farley et al. 1980; Welch 1987; Lankford and Wyckoff 2000; Clotfelter 2001; Reber 2002.

²¹ The negativity of n_s also implies that equation (5) yields a meaningful solution only when $\omega g < fn_s - n$. This condition would not hold if, for example, anti-segregation constituents receive a very high weight in the objective function. In such a situation, a corner solution, $S^*=0$, would apply. Note also that S^* is undefined when n_s , the enrollment response to changes in segregation, is zero. Reformulating the model with a fixed n yields the first order condition $\omega g/n = f$: intuitively, the optimal segregation level equates marginal costs and benefits.

which, owing to the assumed negativity of n_s , is positive. On the other hand, the effect of changes in the relationship between segregation and nonwhite share, n_s is theoretically ambiguous:

$$(7) \frac{\partial S^*}{\partial n_s} = \frac{fn - \omega g}{fn_s^2},$$

the sign of which is indeterminate. When $fn > \omega g$, a greater likelihood of white flight response (n_s more negative) – usually associated with *greater* racial antagonism – should lead the administrator to *decrease* segregation. Intuitively, if variation in white tolerance is exhibited as a variation in the tendency to exit an integrated school district rather than variation in preferences over classroom racial composition, an administrator's best response, in some cases, is to choose higher segregation levels in districts with more tolerant whites. This type of response is most likely when the marginal impacts of segregation levels on white satisfaction are relatively high. Thus, under certain conditions declining intolerance is compatible with increasing classroom segregation.

Between 1990 and 2000, 99 of North Carolina's 117 school districts experienced an increase in the nonwhite share of the school-age population. The median increase was 4 percentage points.²² A good deal of this increase can be attributed to a quintupling of the state's Hispanic population between Census years. Equation (5) suggests that administrators will respond to an exogenous increase in community nonwhite share by increasing segregation:

$$(8) \frac{\partial S^*}{\partial n} = -\frac{1}{n_s},$$

which owing to the presumed negativity of n_s is positive. The implications of changing community composition are more complicated, however, when changing composition also changes the weights placed on various constituent groups in the population. Consider, for example, the special case

²² For comparison, the median nonwhite share of the school-age population in 1990 was 29%. Increases in nonwhite share were concentrated in districts with low initial nonwhite share. The mean increase in nonwhite share was twice as high among the state's 97 majority-white districts as among the 20 majority-nonwhite districts.

where proponents of interracial exposure are nonwhite parents and anti-exposure constituents are white parents, and the administrator attaches weights to each group proportional to their share in the population. This implies that $\omega = n/(1-n)$, and that the partial derivative of S^* with respect to n is:

$$(9) \frac{\partial S^*}{\partial n} = \frac{\frac{g}{(1-n)^2} - f}{fn_s},$$

which may be either positive or negative. As n approaches 1, the numerator of (9) is more likely to be positive, implying that the entire expression is more likely to be negative. This offers a potential explanation for the concave relationship between nonwhite share and segregation shown in Figure 1 above.

In summary, the model offers three possible explanations for recent increases in classroom segregation. First is reduced opposition to segregation or, alternatively, a lessening of the weight placed on the preferences of those opposed to segregation. Second is a decreased propensity for white flight. And third is increases in the nonwhite population, particularly in districts with a small initial nonwhite share.

B. Within- versus between-school segregation

Although segregation-influencing policies incorporate factors that operate at both levels, to this point the model has not distinguished between- and within-school segregation. This distinction can be important to the extent that certain constituent groups care about one form of segregation but not the other. If opponents of segregation, for example, focus their attention exclusively on between-school segregation, while opponents of exposure are most concerned with interracial contact at the classroom level, it may be possible for an administrator to satisfy both constituent groups

simultaneously.²³ Such a scenario would appear to apply particularly to the opposition to segregation voiced by Federal courts in the United States, which typically mandate remedies for reducing segregation between schools but pay less attention to what goes on within them.²⁴ A mandate to reduce between-school segregation might simply lead administrators to substitute segregation across classrooms within schools.

The empirically testable predictions of the model are clear in some cases but ambiguous in others. Factors enabling white flight, or signaling decreased tolerance for interracial exposure, have ambiguous effects on the predicted segregation level. Factors signaling decreased tolerance for segregation clearly predict lower segregation levels, other things equal. Segregation will increase as administrators give greater weight to the preferences of exposure opponents, and decrease as they attach greater weight to segregation opponents. A higher proportion of nonwhites in the population should generally increase segregation, except perhaps at relatively high levels. Finally, any incongruity in the levels at which constituent groups monitor segregation and exposure could lead to a scenario where the factors determining segregation between and within schools differ considerably one from another.

IV. Examining policy choices

In this section, we focus our attention on two types of policy decisions that have the potential to influence racial balance between and within schools: school construction and policies related to

²³ In a model where the two groups cared exclusively about segregation and exposure at different levels, administrators would choose corner solutions: perfectly integrating schools, for example, but allowing rampant within-school segregation.

²⁴ Federal courts have paid attention to especially egregious cases of within-school segregation, however. See, for example, *People Who Care v. Rockford Board of Education*, School District No. 205, 111 F.3d 528 (1997).

academic tracking.²⁵

District administrators can accommodate enrollment growth in one of two ways: by expanding the capacity of existing schools or by building new schools.²⁶ In general, choosing to expand existing schools rather than build new ones reduces the potential for between-school segregation. At the limit, a district could eliminate all differences in racial composition across schools by having only one school. More generally, in a state like North Carolina, where most school districts are coterminous with counties, and older schools tend to be located in older city neighborhoods, a decision to expand existing schools generally has the effect of channeling a greater proportion of students towards central cities. In contrast, a decision to build new schools generally implies construction in suburban, predominantly white areas of a district.

A simple way of describing administrative policy on school size is to presume that each district adopts a “target” size for its schools (or alternatively, for a representative school)

$$(10) \text{ Enrollment per school} = k(X)$$

where the function k takes as its argument a vector of district characteristics X . Factors generating variation in target school sizes across districts most likely derive from tradeoffs between economies of scale in school construction and operation and the extra transportation costs of forcing students to attend more distant schools. Taking logs of (10), we write the equivalent relation:

$$(11) \ln(\text{Number of Schools}) = \ln(\text{Enrollment}) - \ln k(X).$$

²⁵ The most obvious policy tool administrators may use to influence segregation is the assignment of students to schools. With detailed panel data on the geographic location of school attendance zone boundaries in each district, we could analyze how administrators changed zone boundaries in response to changes in the racial distribution of the population over time. For a study taking advantage of data on attendance zone boundaries, see Black 2000.

²⁶ Analogously, administrators can respond to reductions in enrollment by either closing schools or reducing the size of each school.

One practical problem with estimating equation (11) is the likelihood that the vector X includes many historical factors, such as past levels of enrollment and past racial discrimination, owing to the durability of investments in infrastructure. Economies of scale in school construction, difficulties in renting or selling excess schools, or political opposition to closing existing schools, for example, may lead districts with declining enrollments to operate more schools than otherwise equivalent districts with growing enrollments. Failure to control for historical components of X may result in biased estimates of the relationship between current district conditions and school construction decisions. To escape this bias, we first difference equation (11):

$$(12) \Delta \ln(\text{Number of Schools}) = \Delta \ln(\text{Enrollment}) - \Delta \ln k(X)$$

which, under certain assumptions regarding the functional form of $k(X)$, will have the effect of dropping historical factors predating the first observation of $k(X)$ from the estimated equation.

The regression results reported in Table 2 are based on equation (12), with two essential modifications. First, the school-age population in each district is used as a measure of size rather than public school enrollment, since the latter measure may be more endogenous to district policy choices including school construction decisions. Second, the coefficient on that variable is not constrained to equal one, since district size itself may influence the school size decision. We also assume that the function $k(X)$ is exponential. The specifications analyze the determinants of relative change in the number of schools in each district.

Population growth is a strong predictor of school construction. The first result in Table 2 shows that on average, a 1% increase in a district's annual growth rate over the decade 1990-2000 is associated with a 2.7% increase in the number of schools between 1995 and 2001. Extrapolating the magnitude of this effect to a ten-year time frame suggests that growing districts do not construct

new schools at a rate sufficient to maintain average school size at initial levels. As districts become more dense, administrators act to reduce net transportation costs by opening more schools, and to take advantage of economies of scale by operating larger schools.²⁷

Does racial composition influence the decision to operate larger or more numerous schools? Our model suggests that the effect of a change in the racial composition on cost-minimizing segregation levels is ambiguous and depends on the relationship between the racial composition of the community and the weights administrators place on the preferences of those opposed to segregation. The first empirical evidence on this point is shown in the second regression, which adds a control for change in the nonwhite share of the school-age population between 1990 and 2000. Districts that became more nonwhite over this time period exhibited a marginally significant relative decrease in the number of schools operated. Relative to a district with stable racial composition, a district experiencing a ten percentage point increase in nonwhite share would be expected to operate roughly 3% fewer schools.

Stronger evidence of a link between race and school construction decisions appears in the third regression, which introduces a control for nonwhite share of the school-age population in 1990 and interacts that variable with the population growth measure. In this specification the main growth effect and change-in-nonwhite-share effects increase in magnitude and the coefficient of the change in nonwhite share attains significance at the 5% level. The interaction term is large, negative and statistically significant. To consider the implication of this result, consider two districts identical except for racial composition, one of which is entirely white and the other evenly divided between

²⁷ In this analysis, changes in (log) population are equivalent to changes in (log) density since district boundaries are fixed. There were several school district consolidations in the period under study; for purposes of this analysis we carried the consolidations backward to keep the number of districts constant over time.

white and nonwhite students. In response to a unit increase in the annual growth rate of the school-age population, the white district is predicted to open between 4 and 5 schools for every one opened in the evenly divided district. Racial heterogeneity, in other words, tends to suppress the impulse to build new schools when growth occurs. If population growth is accompanied by an increase in nonwhite share, of course, the predicted response is even weaker. The exhibited tendency of racially heterogeneous districts to take actions that restrict the potential for greater between-school segregation is consistent with the theoretical extension motivating equation (9) above, wherein the weight attached to the preferences of segregation opponents increases with nonwhite share.

An alternative explanation for this result is that the racial composition of a district is a proxy for district wealth, and that districts that are more nonwhite and poorer have a harder time raising capital to build new schools when faced with population growth. The final regressions in Table 2 check this possibility, first by introducing controls for changes in the income distribution in each district, and then by adding initial levels of the income distribution variables and interacting them with the growth measure. The income distribution variables are based on decennial Census data, and capture the share of households with income below \$20,000 in 1999 dollars, as well as the share of households with income above \$100,000 in 1999 dollars.²⁸

Controls for the distribution of income have little impact on the estimated interaction term between initial racial composition and population growth. The addition of interaction terms between initial income distribution and population growth reduce the precision of the main growth effect dramatically, and neither added interaction term is statistically significant. Although the addition

²⁸ The respective cutoff points for the initial year, 1990, are \$15,000 and \$75,000. The Consumer Price Index rose by roughly one-third between 1989 and 1999.

of controls for changes and initial levels of income, plus interactions of initial levels with growth rate, renders statistically insignificant the effect of the change in nonwhite share, the coefficient is similar in magnitude to initial estimates. Overall, this evidence supports the view that the estimated effects of racial composition should be interpreted as the effects of race, rather than socioeconomic status.

If all administrative decisions in racially mixed districts were guided by a desire to limit the potential for classroom segregation, we would expect racially heterogeneous districts to avoid academic tracking of students within schools. To the extent that there are racial differences in the proportions of students assigned to each track, tracking will tend to increase racial segregation.²⁹ The results reported in Table 3 suggest that the exact opposite pattern holds: as would be expected in scenarios where those opposed to segregation are more concerned with racial patterns between schools than within them, heterogeneous districts tend to employ greater degrees of tracking, except when segregation across schools is relatively high.

To analyze tracking decisions, we formed a “tracking index” based on administrative data on the racial composition of each English class in North Carolina secondary schools. These data identify the “academic level” of each class taught in each school, including standard, honors/advanced/academically gifted, special education, and advanced placement categories, among others. Indexing academic levels t , with enrollment in each level e_t , the tracking index is calculated using the formula:

$$(13) \text{ Tracking Index} = 1 - \sum_t \left(\frac{e_t}{\sum_t e_t} \right)^2.$$

²⁹ In Table 6 below, we provide evidence that tracking does indeed increase classroom segregation.

This index, which resembles a standard Herfindahl index, or fragmentation indices common in recent public economics literature (Alesina, Baqir and Easterly 1999; Vigdor 2003), can be interpreted as the probability that two students randomly selected from a grade within a school will belong to different academic levels or tracks. When all students are enrolled in a single track, the index equals zero. As students are divided into more numerous small tracks, the index approaches one. Appendix Table A1 shows that the average tracking index among 7th grade English students in academic year 2000/01 was relatively small, 0.036. Fewer than 20% of all public middle schools tracked 7th grade English students. High schools were considerably more heavily tracked on average, with a mean index value of 0.602. More than 96% of North Carolina public high schools used some degree of tracking in 10th grade English.

Simple bivariate tests of the relationship between district-level racial composition and the degree of tracking in a secondary school, shown in the first and fourth columns of Table 3, show mixed results.³⁰ There is evidence of a significant link between the nonwhite share of a district's school-age population and tracking at the 7th grade level, but not the 10th grade level. This discrepancy in results disappears in the next set of regressions, which add controls for the level of between-school segregation in each school's district, and the interaction of nonwhite share with segregation. These regressions reveal an intriguing and statistically significant pattern. In both middle and high schools, an increase in nonwhite share in a district with no between-school segregation leads to a significant increase in the use of tracking: a one-standard-deviation increase

³⁰ In these regressions, the unit of observation is the individual school, while nonwhite share is measured at the district level. Standard errors have been adjusted to reflect the potential correlation of error terms within districts. Schools with exceptionally small enrollment – 23 or fewer students, representing the bottom 10% of all schools – in the grade of interest are omitted from the sample, since tracking may be infeasible when enrollment is small. Results are robust to changes in the sample selection criteria.

in nonwhite share predicts a one-third to one-half-standard deviation increase in the tracking index. Among districts with a high degree of between-school segregation, however, the link between nonwhite share and tracking is either negligible or negative. These results suggest that pressure to implement tracking in racially heterogeneous districts is eased by the presence of segregation between schools.

Greater racial heterogeneity in a school district thus predicts the adoption of policies that limit the potential for between-school segregation and increase the potential for within-school segregation. As discussed above, such a pattern is consistent with a scenario in which opponents of segregation focus primarily on between-school measures, while opponents of exposure are most concerned with classroom-level measures.

Not all evidence in the tracking regressions supports the notion that between- and within-school segregation are substitutes. The significant, positive main effect of between-school segregation implies that between- and within-school segregation covary positively in predominantly white districts. Such a pattern could arise, for example, if those opposed to segregation, including the courts, take little notice or have little standing in overwhelmingly white districts, allowing variation in the preferences of opponents of exposure to determine both between- and within-school segregation patterns. In majority-nonwhite districts, higher between-school segregation predicts lower degrees of tracking within each school.

The final regressions in Table 3 add a number of covariates intended to capture variation in the feasibility of implementing tracking, regional patterns, and differences in the competitive environment schools face. More complete tracking is presumably more feasible in larger schools. Hence a control for the logarithm of enrollment in each school is added. To capture differences in

the competitive environment, the regressions control for district land area and a lagged measure of private school market share.³¹ A measure of income heterogeneity captures the potential demand for tracking stemming from wealthy parents' desire to limit their children's exposure to peers of low socioeconomic status. Across specifications, there are few consistent patterns among these additional control variables. None are significant with the same sign in both specifications. Incorporating these controls does not change the general pattern of coefficients among the variables of interest, although the coefficients of the between-school segregation control and interaction term become insignificant in the specification for middle schools. The magnitude and significance of coefficients in the high school regression increase.

The evidence presented in this section suggests that school and district administrators achieve a compromise between simultaneous pressures to integrate schools and limit interracial exposure. Relative to overwhelmingly white districts, racially heterogeneous districts build fewer schools in response to population growth. Opting for larger schools rather than a greater number of schools places limits on the amount of between-school segregation that can occur, especially in districts where new schools would otherwise have been built near new suburban neighborhoods that are occupied predominantly by white families. At the same time, the results imply that administrators in racially heterogeneous districts are more likely to resort to academic tracking in secondary schools, especially when between-school segregation is low. From an educational standpoint, these policy choices may have adverse consequences to the extent that small school size and interaction of students with varying ability would promote achievement for disadvantaged students (Lee and

³¹ The use of lagged private school market share measures is intended to address the concern that private school enrollment is a function of current policy decisions.

Smith 1995; Pittman and Haughwout 1988; Figlio and Page 2002).

V. Examining Between- and Within-school Segregation Patterns

While our analysis of policy choices uncovers some evidence consistent with our model, we cannot hope to identify and quantify all the policy decisions that might be sensitive to considerations of interracial contact within classrooms and schools, such as where to draw attendance zone boundaries and where to offer elective courses likely to appeal disproportionately to students of one racial group. The remainder of our empirical analysis therefore looks directly for evidence that segregation levels in North Carolina's districts and schools are influenced by the types of factors suggested by our model.

In Table 4, we begin by explaining cross-sectional variation in between-school segregation for North Carolina districts in the 2000/01 school year. Our analysis focuses on three grade levels: fourth, seventh and tenth, representing elementary, middle and high schools. In each grade level, we begin by examining the basic relationship between segregation and the racial composition of the district and then add a number of additional controls that may capture variation in preferences, group political power, or availability of outside options.³²

As in the preceding tables, racial composition is measured using decennial Census measures of the entire school-age population in each district. At all grade levels, the results confirm the basic pattern shown in Figure 1: districts serving racially heterogeneous populations tend to have higher

³² One observation is dropped from our 4th and 7th grade specifications. In our 4th grade segregation data, one district (Clay County) is dropped because the entire student body in that grade was white in 2000/01. In our 7th grade data, one district (Clinton City) is dropped because the entire student body in that grade was nonwhite in 2000/01.

between-school segregation levels than either predominantly white or predominantly nonwhite districts. The maximum predicted segregation level is associated with districts that are fairly close to 50% nonwhite.

Adding controls for a number of covariates reduces the magnitude and significance of the relationship between racial composition and segregation at all three grade levels. The set of introduced control variables includes regional and urban district effects, measures of district land area and lagged private school market share which capture the ease of exit from each district, and three variables describing the income distribution in each district: the income heterogeneity index used in Table 3, as well as measures of the relative density of high-income households in the white and nonwhite populations. These income measures could capture information about the distribution of preferences or political power by race in each district. The only control variable entering significantly in each regression, however, is the logarithm of the school age population served in each district, as measured in the 2000 Census.

Based on these results, it appears that the relationship between racial composition and school segregation is confounded with the positive correlation between segregation and the size of the district. The absence of a strong link between the racial composition of the district and between-school segregation aligns with the earlier finding that districts with a higher proportion of nonwhites tend to restrict the number of new schools created. In both cases, the evidence suggests that administrators resist pressure to increase between-school segregation in heterogeneous districts.

Table 5 replicates the regression specifications of Table 4, substituting a measure of within-school segregation – the extent to which the racial composition of English classes in each school departs from that of the school itself – as the dependent variable for each district. We focus on

middle and high school grades in this table, since within-school segregation is uniformly low in the elementary grades. The first and third regressions in the table show that within-school segregation, like its between-school counterpart, tends to be higher in racially heterogeneous districts.

Unlike between-school segregation, racial separation within secondary schools still varies with the racial composition of the district, controlling for other factors. In both middle and high schools, the coefficients on the linear and quadratic nonwhite share terms are reduced in magnitude. The linear term retains significance, however, and the coefficients continue to suggest that the greatest racial separation within schools occurs in racially heterogeneous districts.

No statistical relationship emerges between the size of population a district serves and the degree of within-school segregation. The tendency for larger districts to exhibit greater segregation between schools but equivalent levels of segregation within them is consistent with the observation that districts operating more schools tend to be more segregated regardless of actual demand for racial separation. Among control variables, the only factors entering significantly relate to the income distribution within the white and nonwhite population. Districts with larger shares of high-income white households tend to have more segregation within their middle and high schools. Higher nonwhite income is associated with no such effect; in fact districts with more high-income nonwhite households tend to have significantly less within-high school segregation. There are several ways to interpret these results. First, if white resistance to racial integration is based in part on differences in socioeconomic status between students of different races, larger income differences should lead to greater resistance. Second, the weight that administrators place on the wishes of respective factions may depend on the income levels of those factions. Third, these measures of relative affluence by race may simply reflect the degree of income inequality in a district, which may

in turn influence tracking and decisions about the offerings of electives independently of racial considerations. This last possibility seems unlikely, however, since the estimated effect of income inequality, as measured by the heterogeneity index, on within-school segregation is neither consistent nor statistically significant.

Within-school segregation is in essence a school-level, rather than a district-level variable. Table 6 conducts analysis similar to Table 5, replacing districts with schools as the unit of observation.³³ At the school level, evidence of a link between district racial composition and within-school segregation levels is uniformly strong and robust to the inclusion of control variables. Estimates for both middle and high schools suggest that the most segregated schools are generally found in districts where slightly less than half the underlying school-age population is nonwhite.

As in Table 5, there is evidence of an asymmetric response of within-school segregation to district-level measures of income among white and nonwhite households. In these specifications, two additional factors appear as strong and often significant predictors of within-school segregation. Holding other factors constant, physically larger school districts, which presumably operate in a less competitive environment than smaller districts, tend to feature more racially mixed classrooms. The administrators in such districts apparently have less reason to satisfy the wishes of white parents concerned about interracial exposure than do administrators in smaller districts which white families may threaten to leave. Heterogeneity in household income is associated with lower levels of within-

³³ Because most of the control variables listed in Table 6 are measured at the district level, the new estimates effectively give greater weight to districts with a larger number of secondary schools. Standard errors in Table 6 have been corrected according to the Huber-White procedure to allow for the possibility of correlation in error terms within districts.

school segregation, and significantly so among middle schools.³⁴

The third and sixth regressions in Table 6 add the Herfindahl-style tracking index analyzed in Table 2 to the list of control variables. As posited above, greater degrees of tracking within a school are associated with higher levels of segregation at that school.³⁵ The effect is strongest across middle schools, where a one-standard-deviation increase in tracking predicts a one-fifth standard deviation increase in within-school segregation. The addition of the tracking index has surprisingly little effect on other coefficients estimated in the regression. Thus, if we accept the notion that factors such as nonwhite share and the distribution of income affect administrators' choices of cost-minimizing segregation levels, the role of academic tracking as a mechanism influencing segregation appears to be relatively small. Other policy decisions, and perhaps decisions by other actors including parents and students, explain most of the link between district racial composition and within-school segregation.

Taken together, our evidence on the determinants of between-school and within-school segregation in North Carolina suggests that very different sets of forces operate at the two levels. Moreover, there is a rational explanation for the difference. Between-school segregation, which is the form most likely to be regulated by court order, is relatively insensitive to district-specific factors aside from sheer size. Recent school construction decisions in racially heterogeneous districts suggest that administrators try to limit the potential for segregation across campuses. Relatively less-regulated within-school segregation, by contrast, shows a much stronger and more robust

³⁴ This pattern casts further doubt upon the third explanation for the asymmetric response of segregation to white and nonwhite income proposed above.

³⁵ This finding corroborates largely anecdotal evidence cited in debates over the merits of academic tracking: see Loveless 1999; Oakes 1994; Oakes 1993; Oakes 1987.

relationship to racial composition, the presence of geographically proximate alternative districts, and the distribution of income within a district. Evidence also suggests that districts substitute between the two forms of segregation.

VI. Conclusion

While they are not high by national standards, segregation levels between and within North Carolina's public schools have increased in recent years. This paper provides evidence to suggest that district and school administrators actively manage the degree of interracial contact in public schools in order to accommodate the competing desires of their constituents. The model introduced here posits that some stakeholders possess limited tolerance for exposure to nonwhites, and others exhibit limited tolerance for segregation. In this model, the factors determining the cost-minimizing distribution of racial composition across classrooms include the strength of preferences within stakeholder groups, the sensitivity of "white flight" responses to racial composition, and the underlying racial composition itself.

The model provides several non-mutually exclusive explanations for recent patterns in North Carolina. Decreases in judicial scrutiny almost certainly have the effect of leading to higher segregation levels, at least between schools.³⁶ In the model, weakening opposition to segregation, or reduced attention of administrators to those who oppose segregation, unambiguously predicts higher cost-minimizing segregation levels. Growth in North Carolina's nonwhite population, driven primarily by Hispanic immigration over the past decade, may also explain increases in segregation, depending on whether this growth has been accompanied by proportionate increases in the weight

³⁶ For an analysis of recent federal court decisions, see Boger (2000)

administrators assign to segregation opponents when making policy decisions. The model also explains why increased racial tolerance on the part of white households might not be sufficient to offset the forces leading to higher segregation. In our model, the impact on segregation of a lower probability of white flight or greater tolerance for interracial contact is theoretically ambiguous.

Future research into the mechanisms underlying continued school segregation might further exploit administrative data of the type we employ in this paper. In particular, researchers might explore the provisions of school assignment and “controlled choice” plans or the course selection patterns of individual students to more accurately gauge the role that parent and student choices have in limiting interracial contact within classrooms at the secondary level. Data on individual students linked across years could provide information on how the probability of student exit from the public school system varies with interracial exposure. Understanding school segregation as an equilibrium phenomenon will yield critical insights, both to researchers interested in understanding racial attitudes and policymakers interested in changing patterns of interracial contact in twenty-first century public schools.

Appendix: Data Sources and Variable Definitions

All data used in this paper are available from the authors upon request.

School segregation indices

To summarize the extent of segregation across schools, we employ an index based on the exposure rate, which is defined here as the percentage of nonwhite students enrolled with the typical white student. As conventionally calculated, based on school-level data, this exposure rate in district k is

$$(A1) E_k^* = \frac{\sum_j W_{jk} n_{jk}}{\sum_j W_{jk}}$$

where W_{jk} is the number of whites in school j in district k and n_{jk} is its nonwhite percentage. This exposure rate is simply a weighted average of school racial compositions where white enrollments are used as the weights. If all schools in a district were racially balanced, the exposure rate would reach its maximum value, which is equal to the nonwhite percentage in the district, a value we denote n_k . At the other extreme, if whites and nonwhites attended entirely separate schools, the exposure rate would be zero, indicating that the average white student attended a school with no nonwhites.

Using data at the classroom level, denoted by subscript i , the district-level exposure rate can be defined more accurately than by using only school-level enrollment data. This more exact exposure rate is

$$(A2) E_k = \frac{\sum_j \sum_i W_{ijk} n_{ijk}}{\sum_j \sum_i W_{ijk}}$$

where W_{ijk} and n_{ijk} are, respectively, the number of white students in the grade of interest and the percentage nonwhite in classroom i , school j . Unless the classrooms in each school are racially balanced at that school's racial composition, this classroom-based exposure rate will be lower than the school-based exposure rate defined above. That is, $E_k \leq E_k^* \leq n_k$.

We define the segregation index S as the percentage gap between the maximum exposure rate, n_k , and the actual exposure rate of whites to nonwhites. This index measures the degree to which the actual distribution of students across schools or classrooms in the district diverges from a racially balanced distribution. For district k , the school-level (equivalently, between-school, denoted by the superscript B) gap-based segregation index is calculated as

$$(A3) S_k^B = \frac{n_k - E_k^*}{n_k},$$

and the classroom-level segregation, which incorporates differences both between schools and within schools, index as

$$(A4) S_k = \frac{n_k - E_k}{n_k}.$$

For a district in which all schools reflect the overall racial composition of students, S_k^B takes on its minimum value of zero. By contrast, when schools are completely segregated, so that $E_k^* = 0$, the index takes on its maximum value of one. Analogously, S_k equals zero in a district in which all classrooms reflect the district's overall racial composition and one in a district where no students share a classroom with a member of a different race.

The difference between the school and classroom level segregation indices represents the classroom-level segregation in a district that can be attributed to disparities in racial composition within schools, rather than across them. This quantity can be expressed as

$$(A5) S_k^W = \frac{E_k^* - E_k}{n_k},$$

where the superscript W denotes "within."

It is worth noting that S_k^W is a characteristic of a district and is not designed to answer the question, "how segregated are the classrooms in school j ?" To address this school-level question, we simply define an index of segregation that can be applied to each school. Where n_{jk} is the proportion nonwhite in school j , this index is defined analogously to previous indices as:

$$(A6) S_{jk} = \frac{n_{jk} - E_{jk}}{n_{jk}},$$

where the school's exposure rate, E_{jk} is

$$(A7) E_{jk} = \frac{\sum_i W_{ijk} n_{ijk}}{\sum_i W_{ijk}}.$$

This measure is based upon the gap between a school's racial composition and the exposure rate, where the relevant gap is based on the school's, rather than the district's, racial composition. We use this school-level measure of segregation in the paper to test hypotheses about within-school segregation that make no reference to district-level segregation.

In summary, we employ three basic measures of segregation:

- S_k^B , between-school segregation in district k ;
- S_k^W , within-school segregation in district k ; and
- S_{jk} , segregation within school j .

As defined up to this point, all of these measures are based on disparities in enrollment patterns defined in terms of whites and nonwhites. The measures can easily be modified, however, to assess segregation between any two racial groups.

The central dataset used in this analysis, referred to as the School Activity Report (SAR), lists the set of all classes, or "activities," that meet in a given school, along with the number, grade level, and racial breakdown of students enrolled in each of them. We used the SAR database to examine racial balance in the classrooms of 1st, 4th, 7th and 10th grade students.

The notion of classroom assignment is complicated by the fact that students at all grade levels ordinarily have instruction in more than one class over the course of a day or week, ranging from pull-out reading instruction and music in elementary schools to the dozens of

classrooms among which high school students scurry each hour when the bell rings. Since we were most interested in interracial contact during academic instruction time, we chose to focus on the classes that most nearly approximated the basic academic instruction at each grade level. To ensure that our assignment of students to classrooms included all the members of a school, we checked the sum of enrollments from the SAR data against an independent statewide tally of school enrollments.³⁷

At the elementary level, in most cases we were able to assign individual students to an “activity” that resembles the archetypal elementary classroom: a class where students receive instruction in multiple subjects from a single teacher. However, for approximately 17% of the 1st grade population, and 27% of the 4th grade population, we were unable to make this assignment to a basic classroom. In these cases, we grouped students into classes using data on enrollment in other courses, such as music, reading, or math. We operated under the presumption that elementary students typically proceed through their daily schedule with a constant set of peers, unlike secondary students, who may have different peers in different classes, and our data were fully consistent with this presumption.

In grades 7 and 10, we determined the racial balance of schools and districts by examining the racial composition of English courses.³⁸ English is a required course of instruction for secondary students in the State of North Carolina. Our calculations were complicated by the fact that not all schools have classes that can be easily classified as “English” and “not English.” In 42% of schools containing a 7th grade, for example, we were best able to match independent data on the size of the grade in each school by counting all English courses, including reading courses and courses combining language arts with other subjects; but in another 27% of schools the best fit meant excluding reading and combined courses. For high schools, the best match to the validating dataset at the 10th grade level was to combine all English-related courses, a combination that worked best in 83% of schools. Our methodology is described in greater detail in Clotfelter, Ladd and Vigdor (2003).

School district characteristics, 1990

We obtained information on the size and racial composition of the school-age population, proportion of households with low income (defined as less than \$15,000 in the year prior to the Census) and high income (greater than \$75,000), and private school market share from the School District Data Book. Sixteen district consolidations occurred in North Carolina between

³⁷ Enrollment based on activity reports might not exactly match enrollment figures from the independent data source (membership reports) because these surveys were undertaken on different dates in the fall.

³⁸ It could be argued that, owing to the significant number of students for whom English is not the first language, English classes may be subject to more segregation than those of other academic subjects. To explore this possibility, we employed an analogous approach, based on math courses rather than English courses, to calculate segregation within schools. Because it has no effect on the distribution of students across schools, this alternative approach has no effect on between-school segregation. Within-school segregation based on math courses is, however, less than that based on English courses, especially in grade 10, where the alternative approach yields an average index of 0.11 for the state, compared to the basic calculation of 0.15. We continue to use the indices based on English courses because English is required for all students, but we note the difference made by this decision.

1990 and 2000; we merged 1990 data for districts that consolidated with one another during the subsequent decade.

School district characteristics, 2000

We obtained information on the size and racial composition of the school-age population from block-level Census data in Summary File 1A, aggregated to the school district level. These data were also used to compute the land area of each district. Data on the proportion of households with low income (defined as less than \$20,000 in the year prior to the Census) and high income (greater than \$100,000), as well as the household income heterogeneity index, were derived from block group-level Census data in Summary File 3A, aggregated to the school district level. The household income heterogeneity index is calculated by computing the share of households in each of 16 income brackets, ranging from less than \$10,000 to greater than \$200,000, and summing the squared group shares. The resulting value is then subtracted from one to generate a variable that equals zero when all households are in a single income bracket, and approaches one as households are divided more evenly across brackets.

Regional and urban indicators

We classified as urban all districts in counties that were 45% or more urban in 1990 and all city districts in any county with enrollments of at least 2,000 in 2001/02, not counting charter school enrollments. The boundaries between Coastal, Piedmont, and Mountain counties were taken from the state publication "Carolina State Parks and Recreation Areas, Yours to Discover" (1998).

Number of schools

Our count of the number of schools in each district uses SAR data from 1995 and 2001, and excludes charter schools operating in each district.

Tracking index

The tracking index is calculated according to the formula in equation (13), using SAR data.

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Table 1: Classroom-level Segregation in North Carolina School Districts, 1994/95 and 2000/01

	1994/95			2000/01		
	Total S_k	Between Schools S_k^B	Within Schools S_k^W	Total S_k	Between Schools S_k^B	Within Schools S_k^W
Elementary (4 th Grade)	0.14	0.12	0.02	0.20	0.16	0.04
Middle (7 th Grade)	0.18	0.09	0.09	0.23	0.11	0.12
High (10 th Grade)	0.20	0.08	0.12	0.23	0.09	0.15

Source: North Carolina Department of Public Instruction, North Carolina Education Research Data Center; School Activity Report Data, 1994/95 and 2000/01; authors' calculations. See text for segregation index formulas.

Table 2: Factors influencing school opening and closing decisions, 1995-2001

Independent Variable	Dependent variable: $\Delta \ln(\text{number of schools, 1995-2001})$				
Annual growth rate of school-age population, 1990-2000	2.737** (0.638)	2.941** (0.642)	5.683** (1.359)	5.591** (1.417)	8.687 (5.549)
Change in nonwhite share of school-age population, 1990-2000	—	-0.276* (0.152)	-0.344** (0.153)	-0.407** (0.176)	-0.259 (0.197)
Initial nonwhite share of school-age population (1990)	—	—	-0.073 (0.064)	-0.130* (0.076)	-0.065 (0.089)
Initial nonwhite share* annual growth rate	—	—	-8.861** (3.915)	-10.05** (4.065)	-8.389** (4.236)
Change in low-income household share of population, 1990-2000	—	—	—	0.270 (0.377)	-0.163 (0.503)
Change in high-income household share of population, 1990-2000	—	—	—	0.437 (0.754)	-0.173 (0.908)
Urban district	—	—	—	0.007 (0.023)	-0.008 (0.025)
Piedmont region	—	—	—	0.032 (0.028)	0.021 (0.030)
Coastal region	—	—	—	0.006 (0.030)	0.001 (0.031)
Initial low-income household share of population (1990)	—	—	—	—	-0.343 (0.268)
Initial high-income household share of population (1990)	—	—	—	—	0.202 (0.754)
Initial low-income share* annual growth rate	—	—	—	—	-12.43 (13.34)
Initial high-income share* annual growth rate	—	—	—	—	-4.482 (41.06)
N	117	117	117	117	117
R ²	0.138	0.162	0.199	0.227	0.252

Note: Standard errors in parentheses. Sample consists of all public school districts in the state of North Carolina. See data appendix for variable definitions and data sources.

*Denotes a coefficient significant at the 10% level; ** the 5% level.

Table 3: Factors influencing tracking decisions, 2000/01

Independent variable	Dependent variable: Herfindahl-style tracking index					
	Middle: 7 th grade			High: 10 th grade		
Nonwhite share of school-age population in district, 2000	0.058** (0.027)	0.106** (0.031)	0.080** (0.033)	-0.010 (0.060)	0.105** (0.051)	0.160* (0.077)
Same grade level between-school segregation in district, 2000/01	—	0.267** (0.121)	0.158 (0.114)	—	0.554* (0.310)	0.702** (0.341)
Nonwhite share* Between-school segregation	—	-0.582** (0.288)	-0.397 (0.269)	—	-1.832** (0.924)	-1.867** (0.900)
Urban district	—	—	-0.009 (0.010)	—	—	-0.023 (0.024)
Piedmont region	—	—	0.012 (0.012)	—	—	-0.040* (0.021)
Coastal region	—	—	-0.006 (0.012)	—	—	0.010 (0.033)
ln(enrollment in grade)	—	—	-0.007 (0.007)	—	—	0.058** (0.010)
Private school market share in district (1990)	—	—	0.316* (0.158)	—	—	-1.132* (0.676)
District land area in thousands of square miles	—	—	-0.010 (0.018)	—	—	-0.001 (0.035)
District household income heterogeneity index	—	—	0.492 (0.916)	—	—	-0.632 (1.494)
N	527	527	527	356	356	356
R ²	0.012	0.019	0.041	0.0002	0.028	0.176

Note: Standard errors, corrected using the Huber-White procedure to reflect clustering at the school district level, in parentheses. Sample consists of secondary schools with at least 24 students enrolled in English courses in the relevant grade. See data appendix for variable definitions and data sources.

* Denotes a coefficient significant at the 5% level; ** the 1% level.

Table 4: Explaining segregation between schools, 2000/01

	Elementary: 4 th grade		Middle: 7 th grade		High: 10 th grade	
Nonwhite share of school-age population in district, 2000	0.387** (0.141)	0.314** (0.151)	0.290** (0.132)	0.163 (0.149)	0.248** (0.102)	0.136 (0.111)
Nonwhite share squared	-0.334* (0.177)	-0.246 (0.193)	-0.316* (0.167)	-0.222 (0.192)	-0.272** (0.129)	-0.178 (0.142)
ln(school age population, 2000)	—	0.050** (0.014)	—	0.045** (0.014)	—	0.046** (0.010)
Urban district	—	-0.024 (0.021)	—	-0.012 (0.021)	—	-0.018 (0.016)
Piedmont region	—	-0.014 (0.021)	—	-0.006 (0.021)	—	3.54*10 ⁻⁷ (0.016)
Coastal region	—	0.003 (0.023)	—	0.021 (0.023)	—	0.025 (0.017)
Private school market share, 1990	—	-0.071 (0.279)	—	-0.166 (0.284)	—	-0.356 (0.209)
Land area in thousands of square miles	—	0.057 (0.048)	—	0.059 (0.049)	—	-0.006 (0.036)
Household income heterogeneity index	—	-0.841 (1.864)	—	-1.661 (1.878)	—	-1.561 (1.395)
Share of white households with 1999 income over \$100,000	—	0.163 (0.289)	—	0.248 (0.292)	—	0.275 (0.216)
Share of nonwhite households with 1999 income over \$100,000	—	0.028 (0.399)	—	-0.400 (0.398)	—	-0.085 (0.295)
N	116	116	116	116	117	117
R ²	0.116	0.470	0.045	0.360	0.054	0.413

Note: Standard errors in parentheses. Unit of observation is the school district. Missing observations attributable to complete racial homogeneity within some grades in some districts. See data appendix for variable definitions and data sources.

*Denotes a coefficient significant at the 10% level; ** the 5% level.

Table 5: Explaining within-school segregation levels across districts, 2000/01

Independent variable	Middle: 7 th grade		High: 10 th grade	
Nonwhite share of school-age population in district, 2000	0.332** (0.086)	0.219** (0.109)	0.365** (0.126)	0.323** (0.154)
Nonwhite share squared	-0.338** (0.109)	-0.217 (0.140)	-0.459** (0.159)	-0.322 (0.197)
ln(school age population, 2000)	—	0.001 (0.010)	—	-0.007 (0.014)
Urban district	—	0.015 (0.015)	—	0.015 (0.022)
Piedmont region	—	0.003 (0.015)	—	-0.032 (0.022)
Coastal region	—	0.012 (0.017)	—	-0.058 (0.024)
Private school market share, 1990	—	-0.217 (0.208)	—	-0.292 (0.291)
Land area in thousands of square miles	—	-0.031 (0.036)	—	-0.024 (0.050)
Household income heterogeneity index	—	-0.774 (1.373)	—	1.461 (1.939)
Share of white households with 1999 income over \$100,000	—	0.495** (0.213)	—	0.737** (0.300)
Share of nonwhite households with 1999 income over \$100,000	—	0.365 (0.291)	—	-0.926** (0.411)
N	116	116	117	117
R ²	0.145	0.281	0.163	0.261

Note: Standard errors in parentheses. Unit of observation is the school district. Missing observations attributable to complete racial homogeneity within some grades in some districts. See data appendix for variable definitions and data sources.

* Denotes a coefficient significant at the 10% level; ** the 5% level.

Table 6: Explaining within-school segregation across schools, 2000/01

	Dependent variable: school-specific segregation index					
	Middle: 7 th Grade			High: 10 th Grade		
Nonwhite share of school-age population in district, 2000	0.500** (0.084)	0.363** (0.094)	0.339** (0.091)	0.346** (0.104)	0.428** (0.139)	0.433** (0.136)
Nonwhite share squared	-0.538** (0.115)	-0.471** (0.117)	-0.448** (0.112)	-0.440** (0.112)	-0.550** (0.155)	-0.557** (0.153)
ln(school age population, 2000)	—	0.005 (0.009)	0.007 (0.010)	—	0.011 (0.012)	0.009 (0.012)
Urban district	—	0.014 (0.012)	0.016 (0.012)	—	-0.019 (0.024)	-0.019 (0.024)
Piedmont region	—	-0.012 (0.012)	-0.014 (0.013)	—	1.75*10 ⁻⁴ (0.017)	0.001 (0.017)
Coastal region	—	-0.027* (0.015)	-0.027* (0.015)	—	0.028 (0.024)	0.028 (0.023)
Private school market share, 1990	—	-0.098 (0.172)	-0.119 (0.165)	—	0.029 (0.346)	0.030 (0.349)
Land area in thousands of square miles	—	-0.062** (0.026)	-0.062** (0.027)	—	-0.068* (0.039)	-0.071* (0.039)
Household income heterogeneity index	—	-3.244** (1.219)	-3.229** (1.224)	—	-2.260 (1.482)	-2.159 (1.514)
Share of white households with 1999 income over \$100,000	—	0.362** (0.157)	0.308** (0.155)	—	0.472** (0.245)	0.536** (0.245)
Share of nonwhite households with 1999 income over \$100,000	—	0.153 (0.261)	0.124 (0.264)	—	-0.832** (0.420)	-0.812** (0.427)
Herfindahl-style tracking index	—	—	0.195** (0.097)	—	—	0.077* (0.040)
N	544	544	544	378	378	378
R ²	0.071	0.119	0.156	0.029	0.070	0.101

Note: Standard errors, corrected using the Huber-White procedure to reflect clustering at the school district level, in parentheses. Sample consists of all secondary schools in North Carolina. See data appendix for variable definitions and data sources.

*Denotes a coefficient significant at the 5% level; ** the 1% level.

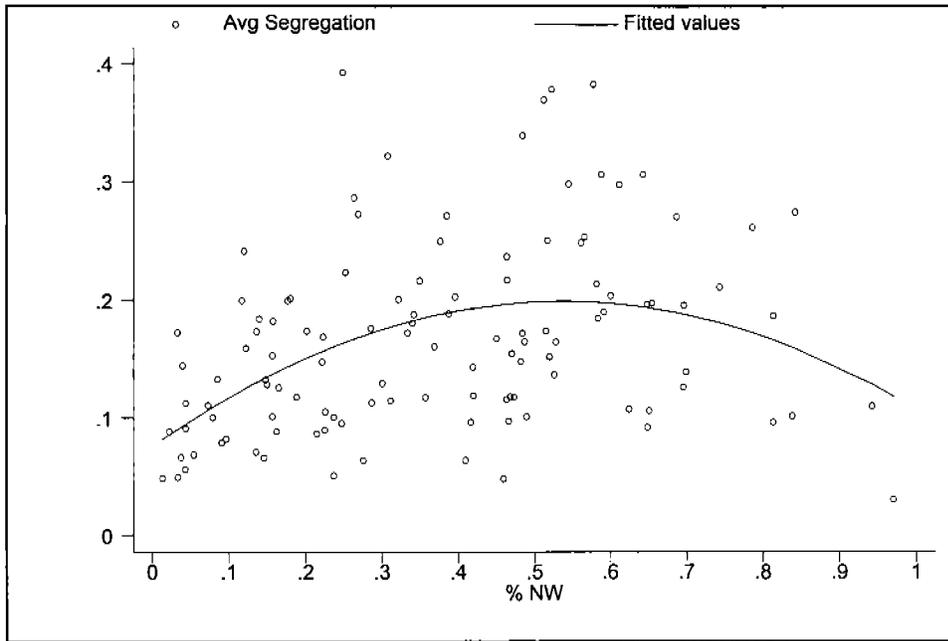


Figure 1. Classroom-level segregation and nonwhite share, by school district

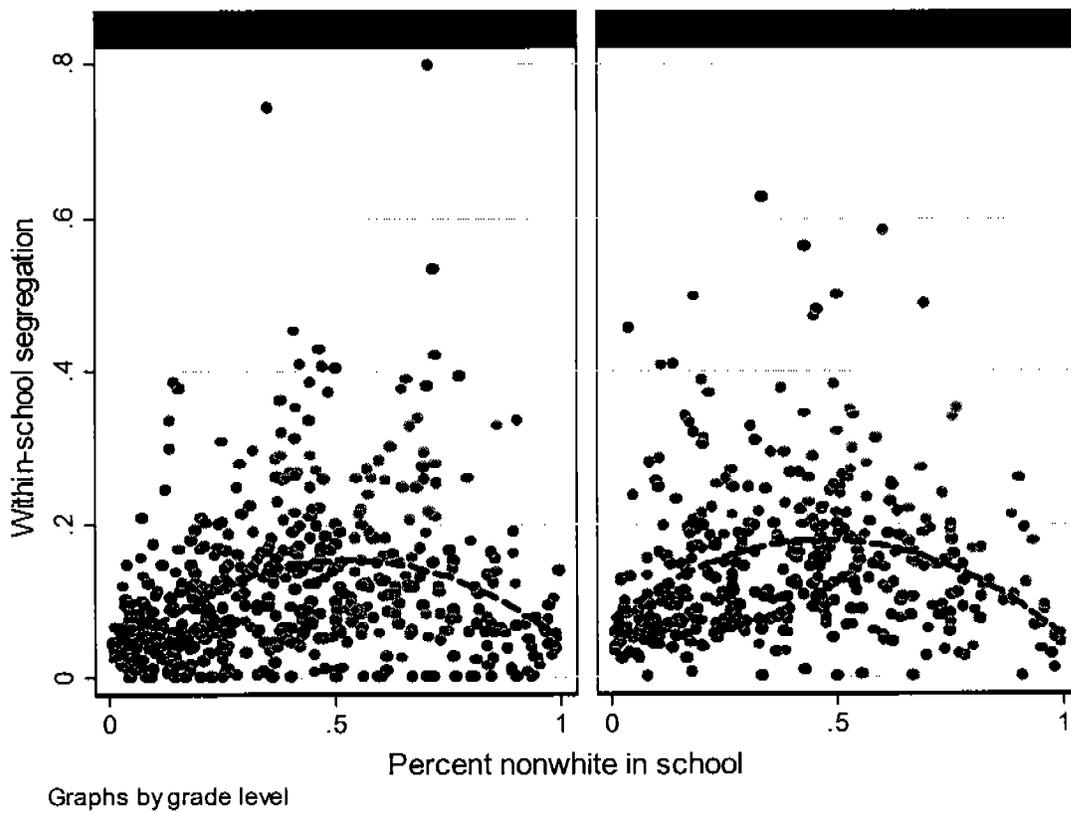


Figure 2. Average classroom level segregation by percent nonwhite for individual schools.

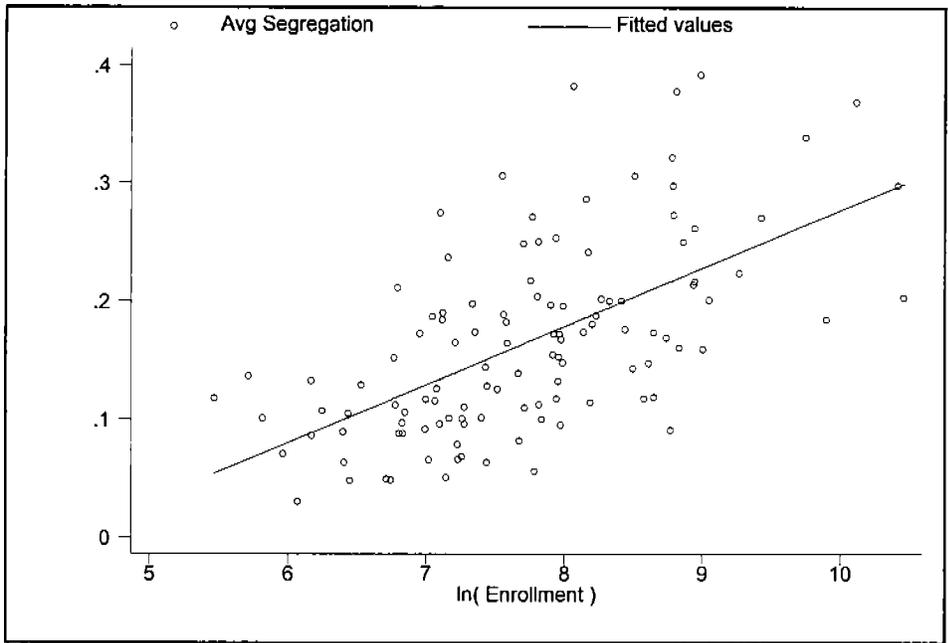


Figure 3. Classroom-level segregation and total enrollment, by school district.

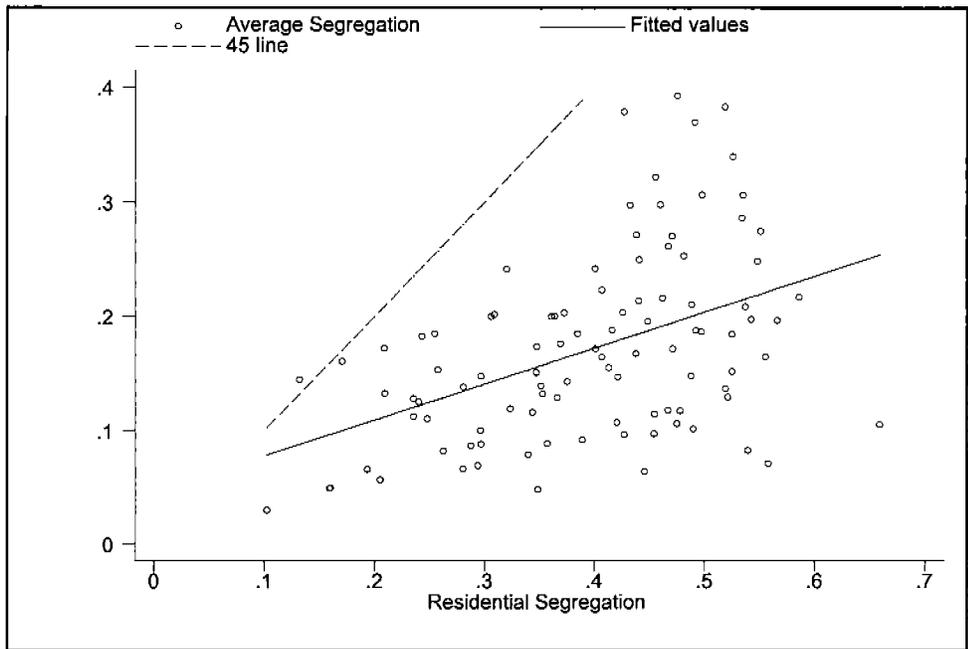


Figure 4. Classroom-level segregation and residential segregation, by county.

Table A1: Summary statistics for regression covariates

Variable	Mean	Std. Dev.	Minimum	Maximum
District level variables ($N=117$ unless otherwise indicated)				
Between-school segregation, 4 th grade ($N=116$)	0.103	0.090	0	0.338
Between-school segregation, 7 th grade ($N=116$)	0.066	0.083	0	0.403
Between-school segregation, 10 th grade	0.042	0.065	0	0.317
Within-school segregation, 7 th grade ($N=116$)	0.108	0.057	0.018	0.300
Within-school segregation, 10 th grade	0.144	0.080	0.030	0.472
$\Delta \ln(\text{number of schools, 1995-2001})$	0.050	0.105	-0.288	0.288
Annual growth rate of school-age population, 1990-2000	-0.003	0.014	-0.035	0.036
Change in nonwhite share of school-age population, 1990-2000	0.051	0.060	-0.089	0.321
Nonwhite share of school-age population, 2000	0.354	0.206	0.030	0.858
Initial nonwhite share of school-age population, 1990	0.303	0.204	0.001	0.800
Change in low-income share of population, 1990-2000	-0.035	0.027	-0.118	0.034
Change in high-income share of population, 1990-2000	0.022	0.014	-0.008	0.076
Urban district	0.325	—	—	—
Piedmont region	0.410	—	—	—
Coastal region	0.248	—	—	—
$\ln(\text{school age population, 2000})$	8.869	1.001	6.609	11.736
Share of white households with 1999 income over \$100,000	0.077	0.038	0.027	0.237
Share of nonwhite households with 1999 income over \$100,000	0.032	0.019	0	0.105
Initial low-income household share of population (1990)	0.318	0.070	0.166	0.457
Initial high-income household share of population (1990)	0.043	0.022	0.015	0.136
Private school market share, 1990	0.059	0.033	0.002	0.211
Land area, in thousands of square miles	0.409	0.229	0.008	0.931
Household income heterogeneity index	0.918	0.007	0.891	0.928
7 th grade school level variables $N=544$				
Within school segregation	0.113	0.101	0	0.797
$\ln(\text{enrollment})$	4.920	0.978	0.693	6.608
Tracking index	0.035	0.100	0	0.662
10 th grade school level variables $N=378$				
Within school segregation	0.147	0.102	0	0.625
$\ln(\text{enrollment})$	5.327	1.181	0.693	7.102
Tracking index	0.614	0.162	0	0.840