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New Evidence about *Brown v. Board of Education*: The Complex Effects of School Racial Composition on Achievement

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Abstract

While the goals of the integration of schools legally mandated by *Brown v. Board of Education* are very broad, here we focus more narrowly on how school racial composition affects scholastic achievement. Uncovering this effect is difficult, because racial mixing in the schools is not an accident but rather an outcome of both government and family choices. Our evaluation, made possible by rich panel data on the achievement of Texas students, disentangles racial composition effects from other aspects of school quality and from differences in abilities and family background. The results show that a higher percentage of black schoolmates has a strong adverse effect on the achievement of blacks and, moreover, that the effects are highly concentrated in the upper half of the skill distribution. In contrast, racial composition has a noticeably smaller effect on achievement of blacks with lower initial achievement and of whites—strongly suggesting that the results are not a simple reflection of unmeasured school quality. The uneven distribution of blacks across school districts can explain a significant portion of the black-white achievement gap in Texas.

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INTRODUCTION

Five decades after the landmark 1954 school desegregation case of *Brown v. Board of Education*, a surprising amount of uncertainty still exists about the ultimate effects of school desegregation on academic, social, and labor market outcomes for both minority and white students.[1] The ruling in *Brown* held that separate but equal was unconstitutional in the case of education and led to dramatic changes in schools throughout the country. This paper investigates the contribution of school racial composition to the black-white achievement gap.

Legal forces and the residential location decisions of households have combined to shape the racial composition of schools. The seminal work of Welch and Light (1987) documented both the desegregation of many school districts following *Brown* and subsequent Supreme Court decisions and the countervailing white exodus from many cities and towns that clearly dampened the impact of school desegregation on interracial contact. The intensity of desegregation efforts and the extent of white flight varied considerably across the United States, implying that the current composition of schools is the result of complicated prior family and government decisions.[2]

In Texas public schools, the focus of our analysis, black enrollment remained approximately 15 percent over the period 1968 to 1998, while the white enrollment share fell precipitously from 64 to 45 percent, largely offset by the growth in the Hispanic enrollment share.[3] Even so, the average percentage of blacks' schoolmates who were white increased from 24 to 35 percent between 1968 and 1980 before slipping back to 31 percent in 1998. As with the nation, the unequal distribution of blacks across schools

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[1] *Brown v. Board of Education*, 347 U.S. 483 (195 4).

[2] See also the analyses of Coleman, Kelley, and Moore (1975), Clotfelter (1976), and Reber (2003).

[3] The description of the changing racial and ethnic composition of Texas schools along with the data sources and computational details is found in Hanushek, Kain, and Rivkin (2002b).

today results primarily from residential separation across districts rather than from unequal school distributions within districts.[4]

Again similar to the United States as a whole, the average achievement for blacks is substantially below that of whites in Texas. For example, the average mathematics score for black seventh graders falls 0.7 standard deviations below that of whites, or at the 24th percentile of the white distribution.[5] Further, only 29 percent of blacks score in the top half of the state distribution.

We find these facts to be more than coincidental. Rather the empirical analysis shows that achievement of black students is negatively related to the black enrollment share, and, importantly, the adverse effects of racial composition are concentrated on blacks with higher initial achievement. In contrast, racial and ethnic composition has considerably less influence on the achievement gains of whites or Hispanics, indicating that racial composition is not simply serving as a proxy for general school or teacher quality. Nor is it capturing the effects of racial differences in peer achievement or SES, which are separately considered. Finally, the key component of racial composition for blacks is the black enrollment share, with concentrations of other minority groups, notably Hispanics, not significantly affecting black students.

PRIOR RESEARCH ON RACIAL PEER EFFECTS

The only social science evidence of harm from school segregation cited by the U.S. Supreme Court in *Brown* involved psychological studies of black children that related low self-esteem to segregated schooling.[6] Most early (post-*Brown*) analyses focused on short run effects of purposefully

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[4]Rivkin (1994) shows that in 1988, even if all U.S. school districts had been perfectly integrated such that each school had the district share of all racial groups, housing patterns would still have led to large numbers of blacks having few white schoolmates. Dissimilarity indices from Texas show the same.

[5]The comparable black-white mathematics score gap for students aged 13 in 1996 for the nation is 0.9 standard deviations (U.S. Department of Education (2000)). The gap in Texas state NAEP scores is, however, less than that for the nation (U.S. Department of Education (1997)).

[6]Footnote 11 of *Brown* refers to the doll studies of Kenneth and Mamie Clark (Clark and Clark, 1939) that found that blacks in the segregated South tended to identify with white dolls and not black dolls.

moving students, concentrating on the effects of desegregation on achievement, self-esteem, and racial attitudes (Crain and Mahard, 1978; Cook, 1984; Armor, 1995).

The research most directly related to our work focuses on whether peer racial composition, as opposed to desegregation actions, affects achievement of blacks as well as other demographic groups. The landmark legislatively mandated civil rights report on *Equality of Educational Opportunity* (Coleman et al., 1966) and its offshoot (U.S. Commission on Civil Rights, 1967) provided early empirical evidence that racial isolation harms academic achievement, although this was questioned (Armor, 1972). Subsequent work by Crain (1970), Hanushek (1972), Boozer, Krueger, and Wolkon (1992), Grogger (1996), and Hoxby (2000) found that school racial composition affects academic, social, or economic outcomes. On the other side, Rivkin (2000) finds no evidence that exposure to whites increases academic attainment or earnings for black men or women in the high school class of 1982, and Cook and Evans (2000) indicate that little of the black-white difference in National Assessment of Educational Progress scores can be attributed to racial concentration. Finally, a recent comprehensive review finds the evidence on achievement and psychological differences to be very mixed Schofield (1995).

As highlighted in the next section, the contrasting findings and lack of consensus concerning the importance of school racial composition likely emanate in large part from the difficulty of isolating the causal impact of peer characteristics.

METHODOLOGY

Uncovering the effect of school racial composition on achievement is difficult because racial mixing in the schools is not an accident but rather an outcome of both government and family choices. We directly control for the most obvious confounding family, school, and community factors by (1) concentrating on student achievement gains; (2) controlling for student, school-by-grade, and school attendance zone-by-year fixed effects in gains; (3) including a number of time varying student and school characteristics; and (4) isolating groups of students who are most likely to be affected by peer group changes.

Empirical Model of Achievement with Peer Influences

A student's achievement today is influenced not just by current family, school, and peer interactions but also by those of the past that establish the base for any current learning. This fundamental relationship is captured by equation (1) that describes achievement (A) for student i found in grade G and school s,

$$(1) \qquad \mathrm{A}_{iGs} = \underbrace{X_{iGs}\beta_G + S_{Gs}\delta_G + \overline{P}_{(-i)Gs}\lambda_G}_{\textit{current inputs}} + \underbrace{\sum_{g=1}^{G-1} X_{igs}\beta_g + \sum_{g=1}^{G-1} S_{gs}\delta_g + \sum_{g=1}^{G-1} \overline{P}_{(-i)gs}\lambda_g}_{\textit{cumulative past inputs}} + \sum_{g=1}^{G} e_{igs}$$

where $\overline{P}$ is peer influence measured by average characteristics of schoolmates (individual i is omitted from the calculation) and X and S are relevant family background and school inputs, respectively. For expositional ease, this representation separates current and past influences.[7]

Much of the existing empirical work on the influences of peers—relying on just contemporaneous data on families, schools, and peers—relates aggregate characteristics of the school such as racial composition or peer average ability to current achievement levels. Yet, current peer group composition is almost certainly correlated with past peer group composition and other current and past determinants of achievement through the systematic choice of neighborhood and school by families. We know from past work that it is very difficult to control for all relevant family and school factors (see Hanushek, 1986, 1997; Hanushek, Kain, and Rivkin, forthcoming). Thus, estimation using ordinary least squares or other single equation methods tends under very general conditions to overstate any influence of peers.[8]

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[7]Presentation of achievement solely in terms of school experiences, ignoring preschool experiences, is done for expositional ease. Given our estimation strategy, it has no effect on the results. Moreover, Fryer and Levitt (2002) point to the importance of school years as opposed to prior conditions in explaining black-white achievement differences. While we constrain current and past parameters to be identical, the actual estimation implicitly allows them to vary.

[8]This is easiest to see when peer influences are measured by average achievement of peers. Consider a simple example where a common omitted factor, κ_G, enters linearly into the achievement of i and of all peers with a coefficient of γ. The bias in the peer effect estimate simplifies to $\gamma^2\,\mathrm{var}(\kappa_G)/\mathrm{var}(\overline{A}_{(-i)G})$. Intuitively, because the common omitted factor appears both in i's achievement and that of peers, peer achievement proxies the omitted

Our approach to estimating achievement relationships begins by taking the first difference of equation (1). Specifically, if A_{G-1} is determined by the same basic relationship as A_G, A_{G-1} includes all of the inputs through grade G-1. The specification of achievement in terms of growth, more commonly referred to as a value-added specification, reduces the data requirements to the inputs relevant for grade G, since all of the historical influences on the current achievement level drop out. Equation (2) describes the value-added specification:

$$(2) \qquad \Delta A_{iGs}^{c} = X_{iGs}^{c}\beta + S_{Gs}^{c}\delta + \overline{P}_{(-i)Gs}^{c}\lambda + \upsilon_{iGs}^{c}$$

where ΔA_{iGs}^{c} is the achievement gain (difference between current grade and previous grade test scores) for student i in grade G in school s in cohort c. This formulation does impose restrictions—chiefly, that the relevant past history is completely summarized by prior achievement, A_{G-1}—but the estimation implicitly relaxes this.[9] Student achievement growth is related to the contemporaneous inputs (which are the flows of these factors over the observed time period), and the generic problems of omitted historical variables are circumvented.[10] Such estimation, which requires data with just two observations on each student, has been considered state of the art in estimation of achievement models (Hanushek, 1986).

Other researchers, lacking microdata on individuals, have attempted to address this set of problems within the constraints of having just aggregate school-level information by constructing aggregate differences across adjacent cohorts. This method, which builds on the intuition that students close in age in the same school have many similar experiences, has been used in a variety of circumstances (e.g., Ehrenberg and Brewer, 1995; Ferguson and Ladd, 1996; and more recently

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factor, and a positive bias is introduced into the estimation of the peer parameter, even if the true peer parameter is zero (see Hanushek et al., 2003; Moffitt, 2001).

[9]An alternative estimation approach is to add a measure of prior achievement to the right-hand side, allowing the parameter on prior achievement to differ from one, but this approach adds other complications with estimation (see Hanushek, 1979; Rivkin, Hanushek, and Kain, 2001).

[10]This formulation assumes that current inputs do not affect the rate of learning in future periods. For example, the impact during the sixth grade of an exceptionally good or exceptionally bad fourth grade teacher is presumed to be captured fully by achievement at the beginning of the sixth grade.

generalized by Hoxby, 2000). Unfortunately, much of the cohort-to-cohort variation in racial composition for students stems from the substantial annual student mobility. In Texas, for example, an average of over 20 percent of all students change schools each year, and mobility rates of black students are significantly higher than those for white and Hispanic students, introducing a serious complication. Hanushek, Kain, and Rivkin (forthcoming a) show that moving students tend to suffer academically in the year of a move and that higher aggregate turnover in a school has a negative impact on all students.[11] When the effects of composition are identified from movers, a correlation with achievement is built in through the negative impacts of individual moving and overall school turnover unless there are adequate controls for student mobility, teacher mobility, and other contemporaneous and background factors—something generally impossible with aggregate data.

The value-added specification does not, however, circumvent problems arising from omitted or mismeasured contemporaneous factors, and the key to the estimation of peer effects is ensuring that none of the components of the error in equation (2) are correlated with the measured peer factors, particularly with racial composition. Our approach uses stacked panel data and available time varying factors to purge this composite error term of factors that would bias the estimated racial composition effects.

From the starting point of equation (2), equation (3) decomposes the error, υ, into a series of components highlighting (in a way that is consistent with our subsequent estimation) those factors most likely to contaminate the peer estimates:

$$(3) \qquad \upsilon_{iGs}^{c} = \underbrace{\omega_i + \omega_{Gs}}_{cross\,sectional} + \underbrace{\delta_{ay} + \theta_{Gs}^{c}}_{temporal} + \varepsilon_{iGs}^{c}$$

The student fixed effects (ω_i) account for all student and family factors that do not vary over the period of achievement observation and that affect the rate of learning—including ability differences, child-rearing practices, general material inputs, consistent motivational influences, and parental attitudes

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[11] Hanushek, Kain, and Rivkin (forthcoming b) also find that year-to-year differences in student racial composition and student demographic variables directly affect teacher exits from schools.

toward schools and peers.[12] Any stable differences in schools that are not perfectly correlated with the student fixed effects or included covariates (S and X)—but typically correlated with peer group composition through school and neighborhood choice—are accounted for by school-by-grade fixed effects (ω_{Gs}). These effects include not only elements of school quality, teacher quality, and curriculum that are fixed for our observation period but also any systematic changes in achievement gains specific to each school and grade as students age. For example, in the latter category, students in high-poverty, high-minority primary schools may suffer much more academically as they enter adolescence. Because multiple primary schools tend to feed into a single middle school, such students will tend to experience less racial isolation in middle school, possibly introducing a positive but spurious correlation between percentage minority and academic achievement.

Finally, the attendance zone-by-year fixed effects (δ_{ay}), defined uniquely for each middle school and its associated feeder primary schools, capture the year-to-year differences in average school and school district quality that are likely to affect both student outcomes and parental choices of schools. It does this in a much more flexible way than specifications that either include measured attributes or remove linear or even polynomial trends. Since attendance zones tend to be geographically based, this term removes in a very general way all variation over time in individual neighborhood and local economic conditions that likely affect mobility patterns, including the existence of "transitional neighborhoods." Of particular relevance to this work are race-related policies, perhaps arising from desegregation plans and other legal actions. This range of policies potentially affects student achievement directly along with being correlated with student movements into schools and districts—either because they are causally related through parental and district behavior or because they are simply coincidental in timing across districts in the state. But these—along with school district policies and actions including hiring practices and pay, teacher and principal assignments to schools, the determination of school

[12]Note that the student fixed effects implicitly relax the assumption that past experiences and prior achievement enter without depreciation, because the growth path is adjusted for each student.

attendance boundaries and placement rules, and the like—are fully incorporated into the estimation strategy.

Whether this fixed-effects method identifies the causal effect of peer composition depends on the magnitude of the remaining variance in peer composition following removal of the fixed effects, of the correlation between the remaining error components and school racial composition, and of the reaction of students and teachers to year-to-year changes in peer composition. The fixed effects remove much of the variation in peer composition, leaving only differences across grades and years within school attendance zones to identify the school racial composition effects. Such differences arise from two sources: (1) mobility of students into and out of schools, and (2) cohort differences in the change in racial composition during the transition from primary to middle school in areas with more than one feeder primary school. Because of the high mobility of students in Texas public schools, sizeable year- and grade-specific differences in peer composition remain even after the removal of attendance zone-by-year and school-by-grade fixed effects.

Of course, this mobility raises the possibility that time-varying student, school, and neighborhood factors associated with or causing school switches (beyond the extensive controls for observable and unobservable student and school factors) biases the estimates. The possibility that endogenous mobility contaminates the estimates depends in large part on both the systematic nature and speed with which families relocate in response to expected problems in the coming school year. Residential moving is a costly process and frequently involves multiple children in different grades. The implied adjustment process suggests that movement due to parental selectivity of schools is almost certainly much slower than the movement of peer characteristics found in natural year-to-year variations.

With the removal of attendance zone-by-year fixed effects, the only concern is idiosyncratic grade-specific variations (i.e., θ_{Gs}^{c}) or family-specific shocks (ε) that are systematically correlated with changes in racial composition in a specific grade. For example, a common negative income shock that leads families to relocate to a lower SES school does not bias the estimates because of the removal of school attendance zone-by-year fixed effects. Alternatively, parents may anticipate changes in teacher quality, but information about individual teacher assignments is not generally available before the year begins.[13] Moreover, the assumption that most families also react slowly (i.e., not in the current year) to specific variations in teacher quality also seems natural, suggesting that year-to-year changes in teacher quality are unlikely to be systematically linked with contemporaneous changes in peer group composition. Families are much more likely to react to overall changes in neighborhood or school and grade-specific factors, which are removed by the school-by-grade and attendance zone-by-year fixed effects.[14]

Nevertheless, because endogeneity related to mobility potentially presents the largest challenge to identification, we go further to address these concerns directly. First, we control for intertemporal changes in measured teacher and school characteristics and student mobility in order to eliminate problems caused by these potentially confounding factors.[15] The grade-specific teacher and school characteristics include information on teacher experience, turnover, and class size. Comprehensive information on student mobility includes both a full set of dummies that control for the timing, frequency, and destination of individual student moves and grade-specific controls for average student turnover.

Second, we estimate separate racial composition effects for nonmovers who remain in the same school, for students transitioning between primary and middle school, and for those transferring to a different school in order to ensure that school switchers are not driving the results. We are also concerned about potential heterogeneity related to peer formation. Small adjacent cohort differences in the year-to-year change in peer composition for nonmovers who retain most of their friendship group are likely to have a smaller impact on achievement than changes experienced by others. Students transitioning to

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[13]Variations in teacher quality across grades from a stable teacher force in a school are directly incorporated in the school-by-grade fixed effects. As discussed below, individual student-teacher matching is allowed for by averaging across the schools within a grade.

[14]Our direct analysis of student mobility also suggests that within district moves (which are particularly important for changes in racial composition) are not strongly motivated by "Tiebout" choices of school quality (Hanushek, Kain, and Rivkin, forthcoming a).

[15]The specification of time-varying factors comes from our prior analyses identifying specific teacher and school factors (Rivkin, Hanushek, and Kain, 2001) and the relevant dimensions of student mobility (Hanushek, Kain, and Rivkin, forthcoming a).

middle school tend to experience more pronounced changes in classroom composition and contact with other students more generally with the interweaving of students from multiple feeder schools and with the frequent introduction of schedules involving changes in classrooms and classmates across periods. Those who transfer schools experience the most striking changes in peer environment, but the other disruptions associated with moving plus possible endogeneity of move decisions raise concerns about the validity of estimates based on these students.

Peer Structure

The common conceptual discussion of peers revolves around social interactions in terms of motivations, direct educational inputs, or even the externalities in the classroom through, say, the quality of individual discussion, attitudes or expectations of teachers and questions, or pure disruptive behavior (cf. Lazear, 2001). Most quantitative investigations of peers, however, do not measure any attributes of actual behavior but instead include aggregate observable characteristics of the students such as race, income, or ability. This approach, which we also follow, essentially extracts common elements of average behavior.

Equation (4) follows convention and describes the link between peer behavior and measured peer composition in each year as a simple linear function of classmate aggregates excluding each individual i:

$$\text{(4)} \qquad \overline{P}_{(-i)Gs} = B_{(-i)Gs}\gamma_B + H_{(-i)Gs}\gamma_H + \Gamma_{(-i)Gs}\gamma_A + Y_{(-i)Gs}\gamma_Y + u_{(-i)Gs}$$

where B is proportion black, H is proportion Hispanic, Γ is peer average ability or cognitive skill, Y is a measure of peer family income, and *u* is an error term that captures all other influences on peer behavior. The substitution of proportion black, proportion Hispanic, and peer average ability (measured by past achievement of the current collection of classmates) in place of peer composition in equation (3) produces the reduced-form specification that forms the basis of our empirical analysis. We also explore the possibilities that the racial composition effects are nonlinear or differ by initial achievement, race, or ethnicity.

It is especially important to separate any race effects from peer achievement, because the two suggest both different interpretations and quite different policy implications. Here, we employ the average of peers' achievement two years earlier (for current classmates) rather than current achievement. This captures stable cognitive ability differences but does not include any contemporaneous innovations in achievement that might reflect interactive behavior. Inclusion of current achievement raises the essentially insoluble reflection problem described by Manski (1993).[16] (Nonetheless, empirically we find that the pattern of changes in the racial composition coefficients is virtually identical regardless of whether lagged or current achievement is used to capture peer achievement differences.) Finally, peers are measured at the grade rather than classroom level, precluding any problems due to the purposeful selection of students into classrooms—a potentially common feature of many schools.[17]

UTD TEXAS SCHOOLS DATA

The cornerstone of the analysis of racial composition effects on achievement is a unique stacked panel data set of school operations constructed by the UTD Texas Schools Project, a project conceived of and directed by John Kain. The data we employ track the universe of three successive cohorts of Texas public elementary students as they progress through school. For each cohort there are over 200,000 students in over 3,000 public schools. Unlike many data sets that sample only small numbers from each school, these data enable us to create quite accurate measures of peer group characteristics. We use data for grades 4 through 6 for the last cohort and grades 4 through 7 for two earlier cohorts. The most recent cohort attended fifth grade in 1996, while the earliest cohort attended fifth grade in 1994. Only black, Hispanic, and white students are included in the achievement analysis, although all students are used in

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[16]Our approach takes the "characteristics" view of ability as opposed to the "behavioral" view, as described in and extended by Brock and Durlauf (2001). See also Moffitt (2001) and Hanushek et al. (2003).

[17]This estimator is equivalent to using the grade average as an instrumental variable. Other approaches for dealing with within school placement may conceptually be available, but our data do not permit such matching, and we do not pursue any such strategies here. Clotfelter, Ladd, and Vigdor (2002) investigate segregation by district, school, classroom, and academic track for seventh graders in North Carolina. They find significant variations in racial composition of classrooms along with large differences in the probability of new teachers for blacks, but they do not address implications for student performance.

the calculations of peer characteristics. (The relatively small numbers of Asian and Native American students are excluded in order to simplify estimation of the models).

The student data contain a limited number of student, family, and program characteristics including race, ethnicity, gender, and eligibility for a free or reduced price lunch (the measure of economic disadvantage) and Title I services. The panel feature of the data, however, is exploited to account implicitly for a more extensive set of background characteristics by removing time-invariant individual effects on achievement gains. An important feature is that students who switch schools can be followed as long as they remain in a Texas public school.

Beginning in 1993, the Texas Assessment of Academic Skills (TAAS) was administered each spring to eligible students enrolled in grades 3 through 8. The tests, labeled criteria referenced tests, evaluate student mastery of grade-specific subject matter. This paper presents results for mathematics, although the results are qualitatively quite similar for reading. Consistent with the findings of our previous work on Texas, schools appear to exert a larger impact on math than on reading in grades 4 through 7 (see Hanushek, Kain, and Rivkin, 2002a, and Hanushek, Kain, and Rivkin, forthcoming a).[18] Each math test contains approximately 50 questions. Because the number of questions and average percentage right varies across time and grades, we transform all test results into standardized scores with a mean of zero and variance equal to one, which transforms the outcome into a measure of relative position in the achievement distribution. In the empirical analysis, an additional fixed factor (τ_{Gy}) is introduced to capture grade-by-year differences in the testing regime, thus allowing test difficulty to vary by year for each grade. The regression results are robust to a number of transformations including the raw percentage correct. To avoid complications associated with classification as limited English proficient (LEP) or disabled, all LEP and special education students are dropped from the direct achievement analysis, although again these students are included in the peer calculations.

[18]Part of the difference between math and reading might relate specifically to the TAAS instruments, which appear to involve some truncation at the top end. For math, the outcomes are less bunched around the passing scores than they are for reading.

Another important feature is that the student database can be linked to information on teachers and schools. The school data contain detailed information on individual teachers including grade and subject taught, class size, years of experience, highest degree earned, and student population served. While individual student-teacher matches are not possible, students and teachers can be uniquely related to a grade on each campus. Each student is assigned the average class size and the distribution of teacher experience and turnover for teachers in regular classrooms for the appropriate grade, school, and year.

EMPIRICAL RESULTS

The investigation begins with simple models of the level and gain in achievement and moves to more refined specifications with individual, school-by-grade, and attendance zone-by-year fixed effects, measured teacher and school characteristics, and the achievement level of peers.[19] Throughout the analysis, the effects of racial composition and other peer characteristics are estimated separately for black, white, and Hispanic students.[20]

Baseline Results

Table 1 presents estimated racial composition effects for progressively richer specifications. Column 1 shows that the level of math achievement is negatively related to proportion black for both blacks and whites, though the coefficient is not significant at conventional levels for blacks. If

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[19]A number of included variables, reported in the tables, are based on prior findings about specific factors affecting achievement growth (Rivkin, Hanushek, and Kain, 2001; Hanushek, Kain, and Rivkin, forthcoming a). All specifications include indicators for different types of school-to-school moves and an indicator for free lunch eligibility for each student and year. Specifications that do not remove fixed effects contain dummy variables for the race, gender, and ethnicity of each student, a full set of grade-by-year indicators, and dummy variables for community type. Estimates involving measured teacher and school characteristics include the rate of school transfers by students, the proportion of teachers with zero years of experience, and class size (all calculated by grade). Preliminary specifications also included a measure of teacher turnover that was found to have no significant effect, and its exclusion had virtually no impact on the other coefficients. Because some prior work suggests that class size and experience effects are larger for lower-income students, these variable effects are permitted to differ for blacks and Hispanics.

[20]Results for Hispanics are similar to those for whites but are not reported. We are concerned about the heterogeneity of the Hispanic population. Some are very recent immigrants with English language deficiencies, while others have been Texas residents for many generations. Follow-on analysis is designed to provide background and programmatic detail for analysis of the Hispanic population.

TABLE 1
Effects of Peer Racial Composition on Mathematics Achievement Level and Achievement Gains[a]
(absolute value of Huber –White adjusted t-statistics in parentheses)

	Level (A_i)	**Achievement growth (ΔA_i)**				
		With Student Fixed Effects (ω_i)	With Student and School-by-Grade Fixed Effects ($\omega_{i,}$, ω_{Gs})	With Student, School-by-Grade, Attendance Zone-by-Year Fixed Effects ($\omega_{i,}$, ω_{Gs}, δ_{ay})		
		Without measured teacher and school characteristics			*With measured teacher and school characteristics[b]*	
Blacks						
Proportion black (γ_B)	-0.07	0.29	-0.30	-0.31	-0.25	-0.25
	(1.65)	(7.23)	(3.18)	(3.52)	(2.85)	(2.84)
Proportion Hispanic (γ_H)	0.03	0.08	-0.03	0.05	0.12	0.09
	(0.06)	(1.38)	(0.36)	(0.70)	(1.89)	(1.26)
Peer math achievement (γ_A)						0.01
						(0.59)
Whites						
Proportion black (γ_B)	-0.12	-0.01	-0.09	-0.10	-0.10	-0.10
	(3.62)	(0.40)	(1.01)	(1.15)	(1.17)	(1.19)
Proportion Hispanic (γ_H)	-0.04	0.02	0.07	0.14	0.12	0.12
	(2.33)	(0.93)	(1.01)	(2.08)	(1.89)	(1.88)
Peer math achievement (γ_A)						0.00
						(0.17)
Test of black-white equality for proportion black effect[c]	$p=0.34$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$
Sample size	386,914			1,171,935		

[a]For description of the complete specifications, see equations 3 and 4 and footnote 21. Level model includes indicator variables for the race, gender, and ethnicity of each student, a full set of grade-by-year indicators, and indicator variables for community type. All gain equations include indicator variables for free lunch eligibility, type of individual school to school move, and a complete set of grade-by-year indicators.

[b]Models include teacher characteristics (experience categories), class size, and grade level student turnover.

[c]P-values from t-test on the effect of black composition for H_o: $\gamma_{black} = \gamma_{white}$; H_1: $\gamma_{black} \neq \gamma_{white}$.

achievement gain is used in place of achievement level as the dependent variable in this non-fixed effect specification, all coefficients on proportion black are close to zero and insignificant (not shown). Of course, such simple models are subject to the influences of numerous confounding factors that may bias the estimates either up or down.

Columns 2–5 provide estimates from achievement gain models that incorporate progressively more detailed characterizations of individual, school, and district factors that might affect achievement growth. There is a clear divergence in the results for blacks depending on whether school-by-grade fixed effects are included. If only individual fixed effects are included as is the case in Column 2, there is a strong, positive association between percentage black and achievement, an estimate to which we return below. Once school-by-grade fixed effects are added (columns 3 and above), however, the coefficients become negative and highly significant. The coefficient on proportion black for blacks is invariant to the addition of school attendance zone-by-year fixed effects (column 4). Because the addition of school attendance zone-by-year fixed effects dramatically changes the source of variation used to identify the coefficients, the stability of the estimates across these specifications provides strong evidence that unobservable factors are not confounding the results. Finally, the reduction of the black racial composition effect by 20 percent with the introduction of controls for class size and student mobility (column 5) demonstrates the importance of controlling for determinants of achievement that may be linked mechanically with year-to-year perturbations in racial composition.

The apparently anomalous result in column 2 is best understood through consideration of the sources of variation used to identify the coefficients in the various specifications. One such source is the transition from primary to middle school. In cases where multiple primary schools feed into a single middle school, black concentration will tend to fall for blacks attending the most racially isolated primary schools. If students starting in more racially isolated schools tend to have greater academic difficulties with the school transition or with adolescence, a spurious relationship between achievement and percentage black is introduced. The evidence provides strong support for this hypothesis. Blacks in the top quartile in terms of percentage black in the final year in primary school experience both an average decline in annual achievement gain of 0.22 standard deviations and a decline in percentage of schoolmates who are black of 5 percentage points following the transition to middle school. The pattern is even sharper for blacks in the most racially isolated schools—those in the top decile of the primary school race distribution—whose achievement gain falls by 0.32 standard deviations while percentage black declines by 14 percentage points following the transition. In contrast, blacks in the other three quartiles experience virtually no average change in percentage black and a much smaller decline (0.08 standard deviations) in annual achievement gain. This problem also raises serious doubts about the validity of any specification not including school-by-grade fixed effects.

These patterns make crystal clear the need to control for systematic changes as students progress through school. The inclusion of school-by-grade fixed effects implies that only between-cohort differences in changes in racial composition are used to identify the estimates. Such differences are much more likely to be generated by random cohort-to-cohort differences in composition of peers and therefore provide a valid source of identification.

The prior estimates do constrain the school-by-grade and attendance zone-by-year effects to be the same for blacks and whites. If, however, tracking or class placement differed for blacks and whites and was correlated with the proportion black, the racial composition effects may simply reflect these other aspects of school quality. Additional regressions run separately by demographic group (thus allowing complete interactions of all such factors with race) provide no evidence in support of this alternative explanation. Rather we actually find slightly stronger impacts of racial composition on blacks (-0.32 instead of -0.25) in the black-only regressions. (This larger impact is also consistent with the prior discussion about differential transition effects of "aging" for blacks transitioning from high racial concentration schools.)

An important question is whether percentage black is serving as a proxy for other student characteristics such as minority status, income, or academic preparation. The estimates consistently refute these alternative explanations. First, all specifications include percentage Hispanic, and it is never significantly related to achievement of blacks. Second, preliminary regressions (not shown) reveal that the coefficients on percentage black for all demographic groups are completely insensitive to the inclusion of percentage low income. Finally, column 6 shows that the inclusion of peer average achievement has absolutely no effect on the percentage black estimate. This insensitivity of racial composition effects holds regardless of whether average achievement is calculated over all schoolmates or only those of the same race/ethnic group or whether average reading achievement is included as an additional variable.

The magnitude of the proportion black coefficient for blacks of –0.25 in the full model suggests that a reduction of 10 percentage points in percentage black would raise annual achievement growth by 0.025 standard deviations. These estimated effects apply to the growth of annual achievement and thus accumulate across grades, implying a substantial role for school racial composition in the determination of the racial achievement gap.

We think the estimated racial composition effects are most clearly interpreted as pure peer effects and not, for example, unmeasured other aspects of schools. Nonetheless, under two strong assumptions the estimated impact of racial composition on whites can be used to establish a lower bound for the black peer effect. If whites are subject to *no* black peer effects and if the white coefficient simply reflects any reduced school quality correlated with higher concentrations of blacks, the difference in the black and white coefficients could be interpreted as the lower bound for black peer effects.[21] As demonstrated below, this lower bound estimate still represents a very substantial effect.

Extended Specification Check

The preceding analysis provides strong support for the belief that racial composition affects achievement for blacks. Nonetheless, it is important to explore further the sources of variation used to

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[21]This ignores the statistical insignificance of the white estimates and relies simply on point estimates. The aggregate estimates for Hispanics are very similar in magnitude to those for whites and are also statistically insignificant. Thus, the lower bounds calculated from Hispanics are essentially the same as those for whites.

identify the coefficients to ensure that confounding influences are not driving the results. We divide the students into three categories: students who remain in the same school in successive years; students who transition from primary to middle school; and students who transfer schools. As noted above, endogenous student mobility evokes particular concern, and a finding that students in the third group were driving the results would cast serious doubts on their veracity.[22] We also hypothesized that students transitioning from primary to middle school and those switching schools are likely to be more sensitive to small changes in peer composition. Note that the school-by-grade fixed effects and student mobility indicators account for any systematic pattern directly related to these various transitions including, for example, any common patterns of family relocation at the time of transition from primary to middle school in particular areas.

Table 2 shows clearly that the prior results are not being driven by the students who move. These models use the most refined specifications (the final column of Table 1) but fully interact percentage black and peer achievement by transition category. The estimated effect of racial composition for blacks based on structural transitions to middle school is actually larger than that based on those switching schools. And as suspected, the estimated effect based on nonmovers is significantly smaller than those for the other two groups.[23] As found previously, all estimates for whites remain small and statistically insignificant.

In sum, there is no evidence that endogenous mobility drives the peer effect estimates.

DIFFERENTIAL IMPACTS

The previous section finds strong evidence that racial composition affects average achievement of black students, and a crucial policy question is whether these effects vary along a number of dimensions

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[22]Hanushek, Kain, and Rivkin (forthcoming a) document that moves are motivated by a wide variety of family circumstances unrelated to school quality. The analysis here allows for the possibility that the subsequent schooling choice could still be correlated with racial composition of schools.

[23]P-values for tests of parameter equality between nonmovers and those who transition and between nonmovers and those switching schools are both less than 0.02.

TABLE 2
Effects of Peer Racial Composition on Mathematics Achievement Gains by Race of Student and Source of Variation[a]
(absolute value of Huber –White adjusted t-statistics in parentheses)

	Nonmovers	Movers	Structural Movers
Blacks			
Proportion black (γ_B)	-0.20	-0.24	-0.30
	(2.31)	(2.65)	(3.26)
Peer math achievement (γ_A)	0.02	0.06	-0.07
	(0.68)	(1.67)	(2.00)
Whites			
Proportion black (γ_B)	-0.14	-0.03	-0.09
	(1.67)	(0.31)	(1.00)
Peer math achievement (γ_A)	-0.01	0.04	0.03
	(0.85)	(1.93)	(1.57)
Test of black-white equality for proportion black effect[b]	p=0.04	p=0.12	p=0.03

[a]Coefficients come from a single regression. The specification includes student, school-by-grade, and attendance zone-by-year fixed effects; class size, teacher experience categories, and student turnover for the grade and school; indicator variables for free lunch eligibility and type of individual school to school move; and a complete set of grade-by-year indicators.

[b]P-values from t-test on the effect of black composition for H_o: $\gamma_{black} = \gamma_{white}$; H_1: $\gamma_{black} \neq \gamma_{white}$

including academic preparation, a district's desegregation history, percent black, and gender. This section reports the results of investigations of the differential impacts along each of these dimensions.

Achievement Interactions

One oft-discussed question is whether the effect of peers is constant across the achievement distribution or whether peers exert differential effects according to location in the skill distribution. To examine possible variations, we interacted the proportion black with indicators for a student's position in the overall state achievement distribution. Specifically, we divided students into achievement quartiles on the basis of their lowest standardized mathematics test score in grades 3, 4, or 5, producing four separate estimates of the percentage black effect for black and for white students.[24]

The results in Table 3 show that higher-achieving blacks are much more sensitive to school racial composition: the coefficients increase monotonically along the initial achievement distribution, and the impact in the top half of the distribution is twice that in the bottom half. The hypothesis of equal effects of black composition across the achievement distribution is rejected at the 1 percent level for blacks. In addition, the estimated effects for whites remain uniformly smaller and less significant than those for blacks—particularly in the top half of the distribution—indicating that a higher proportion black does not appear to affect all higher-achieving students similarly via curriculum decisions or other paths common to all students in the school.

The distributional results indicate that the uneven distribution of blacks across schools is working to squeeze the upper end of the black achievement distribution toward the median. This likely reduces black rates of college attendance, graduation, and employment in highly skilled and rewarding occupations. School racial composition appears to have a far smaller impact on blacks at the lower end of the achievement distribution.

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[24]Students are divided based on the test score distribution in the particular grade and year. The specification includes time-varying teacher, school, and other student characteristics along with student, school-by-grade, and attendance zone-by-year fixed effects.

TABLE 3
Effects of Peer Racial Composition on Mathematics Achievement Gains by Quartile of the Mathematics Test Score Distribution[a] and Race of Student[b]
(absolute value of Huber –White adjusted t-statistics in parentheses)

	Quartile of Achievement Distribution:			
	Bottom Quartile	Second Quartile	Third Quartile	Top Quartile
Blacks				
Proportion black (γ_B)	-0.20	-0.23	-0.46	-0.50
	(2.10)	(2.50)	(4.91)	(4.89)
Peer math achievement (γ_A)	-0.03	0.06	-0.01	0.06
	(0.73)	(1.76)	(0.33)	(1.34)
Whites				
Proportion black (γ_B)	0.06	-0.17	-0.21	-0.13
	(0.55)	(1.80)	(2.34)	(1.50)
Peer math achievement (γ_A)	-0.02	0.00	0.00	0.02
	(0.55)	(0.25)	(0.16)	(0.97)
Test of black-white equality for proportion black effect[b]	$p<0.01$	$p<0.05$	$p<0.001$	$p<0.001$

[a]Quartiles of the test score distribution are calculated according to each individual's earliest observed math score lagged two years and calculated in terms of the appropriate state grade distribution.
[b]Coefficients come from a single regression. The specification includes student, school-by-grade, and attendance zone-by-year fixed effects; class size, teacher experience categories, and student turnover for the grade and school; indicator variables for free lunch eligibility and type of individual school to school move; and a complete set of grade-by-year indicators.
[c]P-values from t-test on the effect of black composition for H_o: $\gamma_{black} = \gamma_{white}$; H_1: $\gamma_{black} \neq \gamma_{white}$. An F-test of the probability that the black composition effects are equal across the achievement distribution equals 10.82 (p value less than 0.001) for blacks and 3.44 (p value less than .01) for whites.

One policy-relevant question is whether the essential element is where a student falls in the overall state ability distribution (absolute achievement) or where the student falls in the school distribution (skill relative to schoolmates). As noted, we do not observe peer interactions but instead infer their character from the achievement outcomes, leaving unanswered questions about underlying causal mechanisms. Table 4 provides some evidence on this issue by categorizing students on the basis of both the overall state achievement distribution and the school distribution. For blacks, the estimated impact continues to rise along with the position in the state achievement distribution, but there are much smaller differences by position in the school distribution.[25] Moreover, separate estimates by position in the school achievement distribution alone (not shown) reveal no systematic ordering for blacks. For whites, the point estimates remain much smaller and statistically insignificant except for those in the middle part of the overall distribution. Here it appears that position in the school distribution might matter, as those in the bottom third fair far worse than those higher up the distribution.

The distributional results also hold when the estimation is allowed to vary by source of change in the racial composition along with achievement quartile (not shown). Blacks in the top half of the state achievement distribution show sharply decreased achievement growth when the proportion black increases, regardless of whether this occurs from staying in the same school, from a school transfer, or from a transition to middle school. The effect is uniformly larger than observed for the bottom half of the distribution. The black reactions to racial composition are also uniformly larger than those of whites for all categories of moves.[26]

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[25]Note that students are divided into thirds of the distribution in order to have reasonable numbers of black students within each state-school cell. Still, some of the cells (e.g., top third of the state distribution and bottom third of the school distribution) are essentially empty—less than 0.2 percent of the students—and estimates are not reported for them.

[26]The only quantitative difference for blacks by source of variation and achievement quartile is a slightly smaller estimate for nonmovers in the bottom half of the distribution when compared to structural moves. For whites, the point estimates tend to move around across move-achievement categories but show no pattern by source of variation and are always less than the corresponding black estimates.

TABLE 4
Effects on Math Achievement Gains of Proportion Black Students by Position in Statewide and in School-wide Distribution of Ability[a]
(absolute value of Huber –White adjusted t-statistics in parentheses)

	Blacks		**Whites**	
Student achievement position	Coefficient (γ_B)	Sample Frequency	Coefficient (γ_B)	Sample Frequency
Bottom third of state distribution				
Bottom third of school distribution	-0.20 (2.21)	44.65	-0.02 (0.24)	23.13
Middle third of school distribution	-0.15 (1.67)	6.85	-0.05 (0.45)	2.22
Top third of school distribution	b	b	b	B
Middle third of state distribution				
Bottom third of school distribution	-0.40 (3.05)	5.04	-0.38 (3.23)	8.43
Middle third of school distribution	-0.32 (3.46)	21.99	-0.22 (2.39)	25.63
Top third of school distribution	-0.31 (3.37)	4.35	-0.17 (1.82)	2.81
Top third of state distribution				
Bottom third of school distribution	b	b	b	B
Middle third of school distribution	-0.60 (4.59)	3.18	-0.09 (0.90)	8.78
Top third of school distribution	-0.53 (5.36)	13.80	-0.13 (1.52)	28.83

[a]Coefficients come from a single regression. The specification includes student, school-by-grade, and attendance zone-by-year fixed effects; class size, teacher experience categories, and student turnover for the grade and school; indicator variables for free lunch eligibility and type of individual school to school move; and a complete set of grade-by-year indicators.

[b]Cell includes less than 0.2 percent of student distribution.

Overall, the pattern of results is consistent with a variety of existing hypotheses. In particular, a number of researchers, commentators, and community leaders emphasize that some blacks discourage others from excelling academically, but this view remains controversial. The early discussions, drawing on a number of perspectives and reaching different conclusions, can be found in Fordham and Ogbu (1986), Cook and Ludwig (1997), Steele and Aronson (1998), Ainsworth-Darnell and Downey (1998), Ferguson (1998a, 2001), McWhorter (2000), and Bishop et al. (2001). More recently, a series of analyses have focused on cultural issues, including economic models that determine cultural behavior (Austen-Smith and Fryer, 2003; Fryer and Levitt, 2003; Ogbu, 2003; and Thernstrom and Thernstrom, 2003). Others have suggested that teachers lower expectations for black students or that schools might adjust placement in academic tracks as the black concentration increases (see Ferguson, 1998b). The difficulty with the latter explanations, as opposed to the direct social interaction effect, is that time-invariant components of expectations and tracking for each school have been removed, leaving only the cohort-to-cohort innovations in racial composition. Nonetheless, each of these explanations would tend to produce a stronger relationship between achievement and proportion black for blacks at the higher end of the initial achievement distribution. Unfortunately, our data do not enable the identification of causal mechanisms underlying the racial composition effects.

Patterns of Racial Composition and Change

The state of Texas is a composite of communities with different histories and development patterns in terms of racial composition. Because prior research into court-ordered desegregation suggests that the dynamics of integration within communities are important (Rivkin, 2000), we consider how the evolution of racial composition and the current black enrollment share might affect the impact on achievement.

Unfortunately, even though many large districts still operate under court-supervised desegregation plans, no consistent data are available across Texas districts on even the existence of such legal plans let alone their nature. Nor is systematic information available on the community reactions to court-ordered or voluntary integration of schools, whether current or past. As an alternative, we concentrate on the sample of 62 districts surveyed consistently over time by the Office of Civil Rights and categorize districts according to changes in black exposure to white students (by school) between 1968 and 1992: (1) those increasing exposure of 10 percent or more (27 districts); (2) those decreasing exposure of 10 percent or more (15 districts); and (3) those remaining approximately the same (20 districts). The smaller samples yield much less precise estimates (not shown), but the point estimates indicate no obvious pattern across categories.

Nonlinearities and Gender Differences

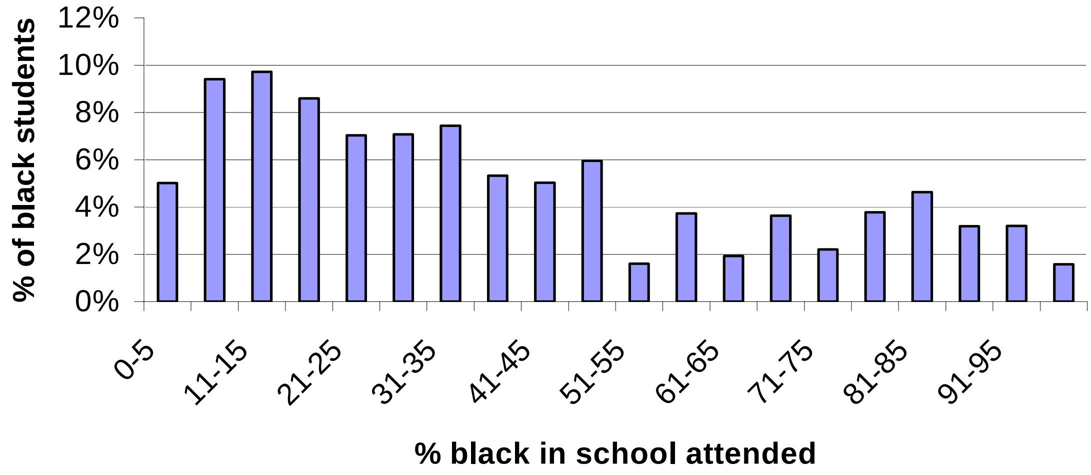
Districts in Texas also vary dramatically in terms of the levels of racial exposure, suggesting possible nonlinear effects of racial composition. As shown in Figure 1, there are a number of districts with few minority students, while other districts have very high levels of minority concentration. However, after looking at up to quartic relationships in racial composition, we found little or no evidence of systematic nonlinearities. In perhaps the most persuasive analysis, we divided schools into those with 0–33, 34–66, and 67–100 percent black and considered differential effects of racial composition. The estimates, though imprecise particularly in the bottom range, show the same basic effects, and coefficient equality could not be rejected at standard levels.

Finally, while some authors have suggested that the peer influences on black boys differ from those on black girls (Ferguson, 2001), we found no differences in the effects of compositional differences by gender on achievement (not shown).

CONCLUSIONS AND POLICY IMPLICATIONS

The difficulties of isolating school and peer group effects have been well documented. The role of peers, particularly in the context of racial integration, can be complex. By using a very large, matched panel data set from the state of Texas, we overcome many of the myriad methodological problems that impede the estimation of these effects.

Figure 1: Distribution of Black Students by Percentage Black in School



Four primary aspects of the analysis give us confidence that we have isolated the peer component of school racial composition. First, we concentrate on achievement growth, allowing us to eliminate initial differences across students that reflect historical factors of families, schools, neighborhoods, and peers. Second, we incorporate very general measures of systematic differences in individuals, schools, grades, and years through fixed effects that absorb family and ability, neighborhood change, curriculum, school leadership, peers, teachers, and school-specific patterns of achievement change across grades that remain constant over our limited observation period, regardless of whether we can identify and measure the specific factors. This estimation strategy effectively allows us to predict achievement growth for a student based on her own historical growth and what is expected in the specific neighborhood, school, and grade and then to focus on deviations from this growth that arise from other factors that are observed to change. Third, we control for time-varying factors that may be related to changes in racial composition: teacher experience, class size, school mobility rates, and school switches brought about by family economic changes or other shocks. Fourth, we distinguish among different sources of variation in peers: changes caused by other students moving in and out of the school, changes resulting from school switches, and changes resulting from transitions to middle school. In combination, these analytical components are designed to minimize the chance that any relationship between achievement and racial composition is spurious.

The pattern of estimates provides very strong evidence that school proportion black negatively affects mathematics achievement growth for blacks, particularly those higher up the initial achievement distribution. This effect does not appear to be driven by school quality differences, achievement differences of classmates, or even the specific distribution of ability within the school (as opposed to across the entire state distribution). Black concentration has a much smaller and less certain effect on white achievement, and Hispanic concentrations have little effect on either whites or blacks.

The magnitude of the black composition effects is significant. The typical black student (regardless of achievement quartile) has 30 percent more black classmates than the typical white and has

25 percent more black classmates than would be obtained with a completely even distribution of blacks across the state (see Appendix Table 2). From our overall estimate of the impact of racial composition on black performance (Table 1), equalizing the black distribution throughout the entire state for just grades 5–7 (our observation period) would be consistent with an increase in black seventh grade achievement of 0.19 standard deviations.[27] This amounts to over one-quarter of the seventh grade achievement gap between blacks and whites.

Of course the fact that the estimated adverse impact of racial composition increases in magnitude with the student's own achievement level indicates that the negative effects of black concentration on the racial achievement gap are disproportionately borne by blacks with higher academic achievement. Blacks in the different quartiles of the ability distribution face essentially the same distribution of school racial composition in Texas; e.g., blacks in the bottom quartile in terms of third grade math achievement averaged 39 percent black classmates, while those in the top quartile averaged 43 percent (Appendix Table 2). Twenty-nine percent of black students fall in the top half of the third grade state math distribution (Appendix Table 1). By the estimates from Table 3, they suffer *half* of the aggregate loss from the uneven racial distribution. Blacks in the top quartile represent fewer than 10 percent of the black students but bear 19 percent of the cost of the existing segregation of students across schools. This skewed impact has obvious deleterious ramifications for future academic success and college attendance.

Note, moreover, that these are estimates of the pure racial composition effect. They say nothing about whether the school quality faced by the typical black is above or below average. Within this study, for example, the inclusion of time-varying school characteristics reduces the estimated "pure impact" of racial composition by 20 percent, indicating that school quality tends to go down with increased black

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[27]Equalizing the distribution of black students would reduce the average percentage of black classmates from 40 percent to the state percentage of blacks, 15 percent. If the impact in Table 1 (-0.25) is accumulated for the three grades, the result would be a 0.19 standard deviation improvement in scores.

concentration. Differences in quality between schools in urban centers and suburban areas also support this general concern.[28]

The policy implications of these findings are, nonetheless, unclear, because of both the imbalance in the distribution of students across jurisdictions and the possibility that expanded exposure to nonblacks following additional desegregation activity could have a much different effect on achievement than that estimated from the current distribution of students among schools. Moreover, the *Brown* decision and refinements through subsequent cases sharply restrict the circumstances in which interdistrict remedies are permissible (Armor, 1995). Thus, the room for direct school policy action to alter the overall racial composition of schools is currently very limited. One possible approach is the expansion of special academic schools within districts (such as magnet or charter schools) that might ameliorate the negative effects of composition on higher-achievement black students. Although such policies have been pursued in a number of court-managed desegregation plans, little evidence of their effectiveness is known, and they remain limited by district boundaries.

An alternative supported by a range of prior investigations would emphasize a change in focus to housing policy. Over three decades ago, Kain and Persky (1969) suggested that: "*De facto* school segregation is another widely recognized limitation of Negro opportunities resulting from housing market segregation. A large body of evidence indicates that students in ghetto schools receive an education that is much inferior to that offered elsewhere." This led them to argue for more aggressive policies promoting housing desegregation as opposed to expensive compensatory strategies that left ghettos unaffected. More recently, the outcomes of the Gautreaux Program (Rosenbaum, 1995) and the Moving to Opportunity experiments (Ludwig, Ladd, and Duncan, 2001) have reinforced the possibility of favorable outcomes

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[28]Our prior investigation of Tiebout choice of schools found that, after correcting for individual selection effects, blacks in Texas on average attend poorer schools and face much more disruption in their schools from student mobility (Hanushek, Kain, and Rivkin, forthcoming a). While not considering racial composition explicitly, schools with higher concentrations of blacks are located most frequently in the urban centers of Texas where schools on average are lower quality.

from housing dispersal programs.[29] Policies that support the continued suburbanization of black Americans and the slow but steady decline in black-white segregation that has marked the last two decades (Cutler, Glaeser, and Vigdor, 1999; Iceland and Weinberg, 2002) would, by the results of this paper, lead to improved schooling outcomes—particularly for higher achieving black students.

Finally, the dramatic decline in the rate of achievement growth at the time of the transition to middle school experienced by blacks from primary schools having a high proportion of blacks evokes particular concern. It is clear that much must be done to prevent or at the very least lessen the drop-off in learning that seriously damages the academic and subsequent career opportunities for these students.

[29]Ludwig, Ladd, and Dun (2001) find that moves to low poverty areas lead to significant increases in student achievement, but they cannot identify the source of such differences.

APPENDIX TABLE 1
Achievement Distribution for Blacks and Whites by Quartile of State Math Test Score Distribution

	Quartile of Distribution of Third Grade State Scores:				
	Bottom Quartile	Second Quartile	Third Quartile	Top Quartile	All
Placement in achievement distribution					
Black students	41.4	30.0	19.1	9.5	100
White students	14.7	21.6	28.5	35.2	100

APPENDIX TABLE 2
Percentage of Racial and Ethnic Classmates for Black and White Students by Quartile of State Math Test Score Distribution

	Quartile of Distribution of Third Grade State Scores:				
	Bottom Quartile	Second Quartile	Third Quartile	Top Quartile	All
Black classmates for:					
Black students	38.5	38.1	39.9	42.8	39.2
White students	9.4	9.3	9.2	9.3	9.3
Hispanic classmates for:					
Black students	21.6	21.4	20.9	21.0	21.4
White students	19.3	18.4	17.6	17.3	18

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