

**School Choice, Racial Segregation and Test-Score Gaps:
Evidence from North Carolina's Charter School Program***

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Introduction

Among the most vexing and persistent issues in American education are the racial segregation of students and the achievement gap between black and white students. With the *Brown v. Board of Education* ruling in 1954, *de jure* segregation of schools was prohibited. Nonetheless *de facto* segregation remains, and recent growth in the nonwhite student population has exacerbated the problem, especially in large urban areas. In 2000, for example, more than 70 percent of black students attended majority nonwhite schools (Clotfelter, 2004). Potentially related to the racial segregation of students is the achievement gap between black and white students. Although this gap decreased by half during the 1970s, it has been widening since the late 1980s (Perie, Moran & Lutkus 2005).

Given their salience, it is not surprising that these issues of racial segregation and achievement gaps are part of the public debate about expanding parental choice of schools. Opponents of expanding school choice are concerned that, in the absence of provisions carefully designed to counter such trends, the more motivated and advantaged students will sort into high quality schools with other students largely like themselves, thereby concentrating less motivated, more disadvantaged students in lower quality educational environments. In stark contrast, proponents of school choice argue that expanding parental choice of schools is likely to reduce segregation and achievement gaps. They start with the observation that many disadvantaged students, particularly poor and minority students in urban areas, currently attend some of the most segregated and poorest performing schools in the country. By replacing dysfunctional bureaucratic control with market-like competition, choice proponents assert that policies that expand

parental choice among schools will push the underperforming schools that serve disadvantaged students to improve. Even in the absence of such competitive effects on productivity, expanded forms of school choice will allow many poor and minority students to find their way into less segregated, and higher quality, schools. Thus, at the very least, this argument concludes, disadvantaged students who take advantage of newly available schooling options are likely to benefit.

Some support, albeit disputed, for this argument emerges from the evaluation of privately funded voucher programs in New York, Dayton, and Washington, D.C. conducted by Paul Peterson and his colleagues. These studies find that although access to vouchers did not improve the average test scores of the full set of participating students, African American students who used vouchers to attend a private school exhibited statistically significant positive gains in test scores (Howell *et al.* 2002; Howell and Peterson 2002).¹ In addition, a study by Derek Neal found that although white and suburban students benefit little from attending Catholic schools, urban minorities benefit significantly, primarily because the public schools available to them are so poor (Neal 1997).

How a particular school choice program affects students from disadvantaged groups will, of course, depend both on the new schooling options that the program makes available and on the choices made by their parents. The new schooling options will vary depending on the decisions of school suppliers, including where to locate new schools, what programs to offer, and how to advertise. Parents' choices will reflect not only those supply factors but also their own locational and programmatic preferences.

¹ But see Krueger & Zhu (2004a, 2004b) who dispute the positive findings for African Americans in the New York City voucher program.

In this paper we use the experience of charter school students in North Carolina to examine how one popular approach to expanding school choice – charter schools -- has affected students of different races and socioeconomic backgrounds. In particular, we examine whether and the extent to which black families in North Carolina have used the state’s charter school program to attend more integrated schools and how the student sorting induced by the program has affected the racial achievement gap.² Because race and class are closely intertwined we also look at the effects of charter schools on segregation and achievement gaps by socioeconomic status, measured by the parent’s level of education.

The next two sections provide background on the charter school program in North Carolina and describe our data. Next we compare the peer composition in the charter schools chosen by students of different races and socioeconomic groups to the composition of the traditional public schools they previously attended. We find that charter school families have tended to select schools with students more similar both racially and socioeconomically to their own children than the students in their prior traditional public school. As a result, the charter schools are more racially segregated than the traditional public schools. We then use a conditional logit model to examine whether these patterns of parental choice are best explained by the location and programmatic offerings of charter schools or by parental preferences related to the racial and socioeconomic mix of the school’s students. After this analysis of parental choices, we explore how the racial segregation of the charter schools has affected the quality of

² We focus on the choices made by and effects of charter schools on African-American and white students. Although Hispanics are a rapidly growing group in North Carolina, the number of Hispanic students and other ethnic groups who have selected into charter schools is too small to conduct most of our statistical analyses.

charter schools and the extent to which it has contributed to differential achievement effects across groups. We conclude that the racial- and class-based sorting of students across charter schools in North Carolina has increased racial segregation, has contributed to the poor performance of charter schools and has widened the black-white test score gap. The final section discusses the implications of our findings for school choice policies.

Background on North Carolina's Charter School Program

Legislation authorizing charter schools in North Carolina was passed in 1996, and the first charter schools opened in fall 1997. By 2001-02 there were 93 charter schools serving more than 18,000 students. Charters in North Carolina can be granted by a local district, the state university or the State Board of Education, but final approval for a charter must come from the State Board of Education. The number of charter schools statewide is capped at 100 and the annual growth in the number of schools per district is limited to 5. In addition, local districts are given an opportunity to provide input before charter applications are approved. Together these provisions give North Carolina more control over the establishment of charter schools than is the case in several other states.

Nevertheless, the North Carolina legislation is quite permissive in that it allows any individual or group to apply for a charter and does not require local district approval of a charter application. North Carolina charters operate as independent nonprofit corporations, act as their own employers, and are automatically exempt from several regulations. In addition, they receive operating funding at the same level and are subject to the same testing requirements as traditional public schools. Charter schools are required to develop a transportation plan so that transportation is not a barrier to any

student who resides in the district in which the school is located. Thus, North Carolina's program includes many of the elements recommended by charter school advocates.

A comparison of the first and second columns of Table 1 shows some noteworthy differences between the third-through-eighth grade students in North Carolina charter schools and traditional public schools in 2001-02. Compared to traditional public schools, charter schools enrolled a larger percentage of black students (44 percent vs. roughly 30 percent) and lower percentages of Hispanic and white students.³ At the same time, charter schools served a higher percentage of students whose parents have four-year college degrees (38.7 percent vs. 27.1 percent) and a lower percentage of students whose parents are high school dropouts (4.7 percent vs. 10.5 percent).

Concerned that charter schools might be established to serve as enclaves for white students, state policy makers explicitly required that "within one year after a charter school begins operation, the population of the school shall reasonably reflect the racial and ethnic composition of the general population within the district or of the special population the school seeks to serve residing in the district."⁴ That provision was tested early with the Magellan school in Wake County. Though the district opposed the charter on the ground that, given its location and orientation, it would disproportionately serve white students, the state board approved it on appeal. Since then, the racial compositions of many charter schools throughout the state have differed significantly from the host district, but not generally in the way initially feared by policy makers. Of the 97 charter

³ Figures in Table 1 are for the sample of elementary and middle school students in the five cohorts used in our evaluation of North Carolina charter schools (see discussion below). Comparison of the racial composition of traditional public schools with all charter schools using data from the NCES Common Core show similar proportions of each racial group. See Bifulco and Ladd (forthcoming).

⁴ See charter school legislation, NSCSG 115C-238, 29F(g)(5) and state board of education policy EEO-U-003 for official statement of the state's policy on racial and ethnic balance in charter schools.

schools operating in 2000-01, 30 schools were more than 80 percent nonwhite and 20 had a higher percentage of non-white students than any traditional public school in the same district. Only eight had lower percentages of nonwhite students than any traditional public school in the same district (Manuel 2002).

The large number of charter schools that serve disproportionately high proportions of African Americans might be due to the fact that many applications to establish charter schools have been oriented toward serving educationally disadvantaged students, among whom African Americans tend to be overrepresented. As a result, many of the successful applications were for charter schools located in areas accessible to African Americans. That can be seen quite clearly in Figure 1 for Durham County, the school district with the greatest concentration of charter schools in the state. The figure depicts the location of charter schools against the backdrop of the racial makeup of the county's census tracts. Although Durham is not necessarily typical, it does illustrate how the location of charter schools might influence the racial mix of students in particular schools. As can be seen, many of the charter schools are clustered in areas in which minorities are in the majority, and are typically near the edge, but not in the center of, areas in which minorities account for more than 75 percent of the population. Though these schools could potentially attract white students, their locations clearly make them far more attractive to minority students. At the same time, two of the charter schools are in predominately white areas of the county, and for that reason, are unlikely to attract large numbers of minority students.

In an earlier study based on student test scores longitudinally matched over time, we found compelling evidence that third-through-eighth grade students enrolled in

charter schools in North Carolina exhibited smaller gains in achievement while they were in the charter schools than when those very same students were in traditional public schools (Bifulco & Ladd forthcoming). However, this negative average effect need not mean that every charter school fails its students. Indeed, some charter schools are undoubtedly doing an outstanding job in raising the achievement of their students, and some students have undoubtedly benefited from the opportunity to change schools. Of particular interest in this study are the educational experiences in charter schools of black students and students whose parents do not have a college education.

The North Carolina Data

The data for this study were provided by the North Carolina Education Research Data Center. In order to evaluate North Carolina's charter school program, we assembled individual student-level panels for five cohorts of students—the cohorts of students in third grade in 1996, 1997, 1998, 1999 and 2000. Each cohort contains the universe of students in third grade in North Carolina public schools during the specified year, each of whom is followed through eighth grade or until the 2001-02 school year, whichever comes first.

The information available for each student in each year includes their scale scores on the End-of-Grade (EOG) reading and math tests, their school, whether their school is a charter, their grade, their gender, their ethnicity, and the highest level of education completed by their parents. EOG reading and math tests are multiple-choice tests that measure the achievement of competencies described in the North Carolina *Standard Course of Study*, and are administered in the spring of each year to students in grades 3-8. Individual results are reported as developmental scale scores, which are designed to

measure growth in reading and math, and thus are expected to increase as students move from lower grades to higher grades. In order to ensure comparability of test scores and test scores gains for students in different grades, we use grade-by-year-specific averages and standard deviations to convert the developmental scale scores to standard scores with a mean of zero and standard deviation of one.

The analyses in the next two sections use the sample of students from our five cohorts who are observed transferring from a traditional public school into a charter school, and focus on the school environments of these students during their first year in a charter school and the immediately preceding year. A total of 4,937 students are included in this subset of the data. A comparison of the last two columns of Table 1 shows that this subset is similar demographically to the full sample of charter school students except they are slightly less likely to be black and have slightly high average third grade test scores.

The Choices of Charter School Families

Although Table 1 provides a useful aggregate picture of the students selecting into charter schools, it provides no information on the racial or educational mix of students in individual charter schools, or on how students' peer environments change when they transfer to a charter school. Table 2 provides this information by comparing the characteristics of the other students in the same grade and school during each student's first year in a charter school and during the immediately prior year when the student was enrolled in a the traditional public school (TPS).

As shown in the top panel, black students are selecting a significantly different set of charter schools than white students. Black students move to charter schools in which

close to 70 percent of the students are black, only 30 percent have college educated parents and the average student test scores (lagged one year) are almost half a standard deviation below the average. In contrast, white students move to charter schools that are more than 80 percent non-black, in which 47 percent of the students have college educated parents and in which average student test scores (lagged one year) are well above average.

Table 2 also shows that by moving to charter schools, both black and white students reduce their exposure to students from the other race. Black charter school students moved from schools that were nearly 50 percent non-black (= 1- % black) to charter schools that were only 30 percent non-black on average. Similarly, for white charter school students the move to a charter school resulted in a drop of more than one third in the average percentage of black classmates. Charter schools provide black students with a lower achieving set of peers than they left behind in their traditional public school. In contrast, charter schools provide white students with peers that tend to have more educated parents and who are higher performing than the peer groups they left behind.

In the bottom panel of Table 2, we see that students from families with different educational backgrounds also sort into different types of charter schools. Charter school parents who do not have a four-year degree selected schools in which less than 30 percent of students have college educated parents, while college educated parents selected schools where nearly 60 percent of students have college educated parents. In addition, while children of parents who do not have a four year degree saw a minimal increase in

the percent of students with college educated parents after their transfer into a charter school, students of college educated parents saw a substantial increase.

It is clear from Table 2 that students who choose to enroll in North Carolina charter schools tend to end up in schools and classes with higher percentages of students who look like themselves racially and/or in terms of family background than was the case in their traditional public schools. For black students and children of parents who do not have a four-year degree, this increase in the proportion of students who look like themselves is accompanied by a marked reduction in the average level of achievement among their classmates. The remainder of this paper investigates the motivations for and consequences of this pattern of choices.

Peers, Location or Programs

The fact that families of both races choose charter schools that serve higher proportions of students of their own race than their prior school need not mean that their choices are motivated by racial preferences. Instead the divergent choices of black and white families could potentially result from differences between them in locational or programmatic preferences.

To investigate this issue of motivation, we focus on the set of charter school students who had more than one charter school from which to choose, and we examine how school attributes influenced their choice. Specifically, we use the sample of students observed transferring into a charter school from a traditional public school that had at least two charter schools within 10 miles, and model the choice of school, conditional on having decided to attend a charter school, as a function of peer composition, school location and programmatic offerings.

The appropriate empirical model for such an analysis is the conditional logit, which typically is derived from a random utility model.⁵ In this type of analysis, the utility that family m obtains by enrolling a child in school j is a function of school attributes, x_{mj} , including attributes that are the same for all households such as racial composition and attributes that might vary across households such as locational convenience, and a random component, ε_{mj} : $U_{mj} = U(x_{mj}, \varepsilon_{mj})$. Assuming that a family chooses a school if and only if $U_{mj} > U_{mk}$ for all $k \neq j$ in the family's choice set, the probability that a family chooses the j th alternative equals $P_{mj} = P(U_{mj} \geq U_{mk}, \text{ for all } k \neq j)$. Assuming further that the utility function is linear in its parameters and that ε_{mj} is independently distributed with type I extreme value distribution, yields the conditional logit, $P_{mj} = \exp(x_{mj}\beta) / \left[\sum_{j=0}^J \exp(x_{mk}\beta) \right]$, which is estimated using maximum likelihood.

Provided the assumptions of the model are satisfied, the coefficients on the school attributes, x_{mj} , obtained from the estimated conditional logit can be interpreted as the contribution of each attribute to a family's utility, or, in other words, as an indication of the strength of preference the average family has for that school attribute. The attributes that we include in our analysis are detailed in Table 3.

The first three variables, PBLK, PCOLL and AVGACH, are measures of peer composition, each lagged one year,⁶ The percent of peers who are black (PBLK) picks up the effects of racial preference; PCOLL and AVGACH are included to distinguish

⁵ For a good introduction see Ben-Akiva and Lerman (1987).

⁶ Because a school's student composition during the current year cannot be observed until all families have made their choices, it is unknown to most families at the time they choose schools for their children. Thus, we assume that the expected student composition, rather than the actual student composition influences a family's choice, and interpret the school's student composition during the preceding year as the best indicator available to families of what the student composition is likely to be.

those racial preferences from the roles played by preferences to send one's child to school with educationally advantaged (PCOLL) and/or higher achieving peers (AVGACH). We do not have access to students' home addresses and thus cannot use distance from home as measure of locational convenience. Instead, we use as a proxy for that variable the distance between the charter school and the student's previous traditional public school. (DISTANCE). An indicator of whether or not the school is located in an urban area (URBAN) is intended to account for another potentially important aspect of a school's location. The pupil/teacher ratio (PTRATIO) is the only available measure of school resources; we would expect it to have a negative coefficient if families prefer smaller class-sizes.

Log of school enrollment (LOGENR) is included in the model for two reasons. First, substantively, charter school parents might be attracted to smaller schools that provide more intimate learning environments. If so, we would expect the coefficient on this variable to be negative. Second, enrollment serves as a good proxy for the availability of seats. All else equal, families will be more likely to select larger schools with more available seats, which would lead to a positive coefficient on the LOGENR variable. Thus, the coefficient on LOGENR will reflect both the desirability of smaller schools and the greater availability of seats in larger schools, thereby making it difficult to predict the sign of the coefficient and to interpret the results.

The remaining variables are all binary indicators of programmatic offerings. These indicators were developed from the statements of mission and purpose included in each school's charter application. These statements range from one to nine pages in length, but are typically three to five pages long. The statements were independently

coded into programmatic offerings by one of the authors and a graduate assistant, with any coding disparities resolved through joint discussion.

To assess differences in preferences between black and white families, we estimated the model separately for black and white students. The results are reported in Table 4. The first and fourth columns report the results of models that include only student composition variables. Most striking in these models are the different signs of the PBLACK variable. While black families apparently put a positive value on having their children in schools with other black students, white families appear to place a negative value on that outcome. In addition, the models suggest that both black and white families value peers whose parents are more educated and who have higher average levels of achievement (although the latter variable falls short of statistical significance for white students.) variation in the three peer variables explains much more of the variation in the choices of white families than of black families (pseudo R-squared of 0.445 compared to 0.051).

A different picture, particularly of the preferences of black families, emerges from the second and fifth columns of Table 4, which include the locational and programmatic attributes. First, notice that the log likelihood values and the pseudo R-squareds increase substantially for both black and white students, indicating that locational and programmatic attributes are important determinants of school choice for both groups. With respect to the model for black students, the most important finding is that, after the locational and programmatic attributes are controlled for, the coefficient on the percentage of black peers is no longer statistically significant. This finding casts doubt on the view that black families generally prefer schools with higher proportions of black

students. Nor does the proportion of students with college educated parents or the average achievement of students appear to influence the choices made by black families. For white families, in contrast, peer groups continue to matter. White families exhibit a preference for charter schools with lower percentages of blacks, higher percentages of college educated parents, and higher levels of average achievement.

In the third and the final columns of Table 4, we allow the percentage of black peers to enter nonlinearly into families' utility functions.⁷ The results for black students indicate that the presence of more black peers does increase the attractiveness of a school for black families but only if the school has a low percentage of blacks. At higher proportions, the value of additional black peers steeply diminishes. The point estimates in the third column imply that the preferred racial composition for black families is roughly 50 percent black (i.e. 53.7 percent). The results in the final column indicate that although white families are indifferent to differences in racial composition when the percentage of black peers is very low, once that percentage exceeds a particular threshold, a higher percentage significantly decreases the typical white family's preference for the charter school. The point estimates indicate that this threshold for the typical white family is 15 percent black.

This final model 1 confirms that neither the percent of peers with college educated parents nor the average level of peer achievement matter for the average black family, while the typical white family prefers schools with higher proportions of college educated parents and higher average levels of achievement. It also highlights the importance of location for both black and white families. The greater is the distance

⁷ We also estimated nonlinear specifications for each of the student composition variables, but only percent black showed strong evidence of a nonlinear relationship.

between a charter school and the student's traditional public school, the weaker is the student's preference for the charter school. We also see that while black families prefer schools located in urban areas, white families tend to avoid charter schools in those areas. Together these two locational variables account for the lion's share of the increases in the log likelihood and the pseudo R-squares that result from including the locational and programmatic variables.

Despite their more limited overall explanatory power, the programmatic variables generate some interesting results. Neither black nor white families show a strong preference for small classes, as proxied by low pupil-teacher ratios. With respect to charter school size, the positive effect of more available places apparently dominates any potential negative value of attending a larger charter school, especially for blacks, as is evident from the positive and statistically significant coefficient on the log of enrollment in the model for black students. Because most charter schools are far smaller than traditional public schools, however, this finding sheds no light on the larger policy debate about whether small schools are generally preferred to large schools.

Black families are more attracted than white families both by schools that target at-risk students and schools that target gifted students. The apparent aversion of white families to schools that target gifted students is surprising. Perhaps white students have more adequate access to gifted programs through the traditional public schools than do black students. Both white and black families are attracted to community-oriented schools.

Contrary to speculation that the availability of charter schools offering Afro-centric curricula has been a major contributor to the large number of predominantly black

charter schools in North Carolina, we were able to identify only four schools that offered such a curriculum. Moreover, the results in the third column of Table 4 indicate that when other charter schools are available, the typical black charter school family does not favor them. Such schools were not in the choice set of enough white students to estimate the influence of an Afro-centric curriculum on the choices of white charter school students.

Black families are either not attracted by or actually appear to avoid schools offering special curricular or instructional approaches. In particular, black families are significantly less likely to choose a school if it emphasizes character education, experiential learning or individualized educational plans, and show no preference for schools that offer arts-based instruction or alternative assessments. In contrast, white families tend to prefer schools that offer arts-based instruction, experiential learning, individualized educational plans and alternative assessments. Such differences by race might reflect differences in the forms of education valued by black families and white families. Alternatively, they might reflect differences between the two groups in access to information, either information about the programs schools offer or information about the benefits various educational programs provide. Finally, while white families prefer charter schools that emphasize parental involvement and require parental participation, black families tend to avoid such schools.

In sum, white and black charter school families appear to have markedly different preferences for various school attributes. Whites prefer predominantly white schools with more educationally advantaged and higher achieving peers located in the suburbs that offer special curricular approaches and emphasize parental involvement. Blacks, in

contrast, prefer community-oriented schools in urban areas that target at-risk and/or gifted students. Although the two groups are similar in preferring charter schools that are near their regular school, the presence of residential segregation means that blacks and whites prefer different charter schools. Overall the findings suggest that the racial isolation of blacks in North Carolina charter schools result more from differences in the locational and programmatic preferences between black and white parents, combined with the reluctance of white charter school parents to enroll their children in schools with substantial percentages of black students, than from the desire of black families to enroll their children in predominantly black schools.

Underlying this analysis are two key assumptions: the independence of irrelevant alternatives (IIA) and that the choice set we have defined for each individual includes only feasible alternatives. If either assumption is violated, the conditional logit will be inconsistent.⁸ Provided IIA holds, then reestimating the model without some of the alternatives in the originally defined choice sets should not significantly change the results, an observation that provides the basis for empirically testing that assumption (Hausman & McFadden 1984). Similarly, if charter schools close to 10 miles away from the student's previous traditional public school are truly feasible alternatives, then including them does not bias the model estimates, and estimates should be similar whether or not the more distant alternatives are included. Thus, to test these two key assumptions we reestimated the models reported in the third and the final columns of Table 4 dropping from the choice sets charter schools located between 8 and 10 miles away from the student's previous public school. This modification did not significantly

⁸ See Ben-Akiva and Lerman (1987) for a discussion of the IIA assumption and Quigley (1985) for a discussion of including infeasible alternatives in the choice set.

change the results, which provides some assurance that the key assumptions of the model are satisfied.⁹

The estimates in Table 4 represent average preferences for black and white families, and ignore possible differences in preferences within racial groups. In Table 5 we estimate the conditional logit model separately for groups defined not only by the student's race but also by the level of the parent's education. We find that preferences do not differ much across black families with different levels of parental education. The exceptions are that black students with college educated parents show significantly greater preference for Afro-centric curriculums and black students whose parents are not college educated show greater aversion to parental involvement requirements. Preferences differ much more by parental education level among white families. Specifically, college educated, white parents tend to have stronger preferences for educationally advantaged and higher achieving peers, more aversion to urban locations, less attraction to community-oriented schools, and stronger attraction to schools that offer special instructional approaches and those that emphasize parental involvement.

The point estimates for PBLACK and PBLACK SQUARED suggest that within racial groups, parents with different levels of education have somewhat different racial preferences. The preferred percentage of black peers for black parents with a college education is 34.3 and for black parents without a college degree is 59.8. The threshold at which higher percentages of black peers begins to reduce the attractiveness of a school for white parents with a college education is 29.9 percent black compared to 2.6 percent for white parents without a college degree. These results suggest that it would be easier

⁹ Specifically, a Hausman test could not reject the null hypotheses that estimated coefficients from the separate estimations were the same at the 0.10 level of significance. Results of the alternative estimates and the Hausman tests are available upon request.

to achieve racial integration among students with college educated parents, than among students with less well educated parents. It is important to note, however, that differences in the point estimates on PBLACK and PBLACK SQUARED between families of the same race with different levels of parental education, although substantively significant, are not statistically significant.

The Consequences of Sorting for Student Achievement in Charter Schools

If peer composition influences the quality of education that schools provide, the fact that black and white students sort themselves into charter schools with different peer groups suggests that charter schools might differentially affect their achievement levels. One possibility is that, all else equal, charter schools with high proportions of low achieving and educationally disadvantaged students provide a lower quality education than other charter schools. If that were the case, we would predict that charter schools would have a less positive – or more negative – effect on black students than on white students, and on students whose parents lack a college education than on those with college educated parents. Another possibility is that low-achieving or educationally disadvantaged students could be better off in schools with classmates similar to themselves than in schools with more advantaged classmates. That might be the case if such concentrations permit schools and teachers to tailor programs and activities more closely to the needs of their low-achieving students. In addition, other factors such as the quality of teachers or school leadership may help charter schools provide high quality educational experience despite serving concentrations of disadvantaged students.

To test whether the sorting patterns documented in the previous sections generate differential achievement effects we extend the analysis of how charter school affect

student achievement presented in Bifulco and Ladd (forthcoming). Specifically, we use test score results for our five cohorts of North Carolina students to estimate the impact of charter schools by the race of the student and by the educational attainment of the student's parents. In addition, we investigate how the racial segregation of charter schools affects student achievement.

Because charter school students are self-selected, they are likely to differ in unobserved ways from otherwise similar students who choose to remain in traditional public schools. As a result, simply comparing either the test score levels or gains of charter school students to those of traditional public school students is likely to provide biased estimates of the achievement effects of charter schools. Our data set allows us to address this thorny problem of self-selection because it provides repeated observations of test scores gains for individual students. Repeated observations allow us to compare the test score gains of students in charter schools to the test score gains made by the same students while they were in traditional public schools.

To derive an estimator based on within-student changes in test score gains, we estimate the following model of student achievement:

$$\Delta Y_{iGT} = Y_{iGT} - Y_{iG(T-1)} = \alpha CH_{iGT} + X_{iGT} \mathbf{B} + \gamma_i + \mu_{GT} + e_{iGT}$$

Here student i 's test score gain in grade G during year T , $Y_{iGT} - Y_{iG(T-1)}$, is a function of charter school status, CH_{iGT} ; observed student characteristics, X_{iGT} ; an individual fixed-effect, γ_i ; a grade-by-year effect, μ_{GT} ; and a purely random error, e_{iGT} . The charter school effect, α , is thus estimated using the "within" student, or fixed effect, estimator (Baltagi 1995). The combination of school-level and individual-level variables in the model calls

for the use of robust standard errors, which can be estimated using the Huber/White/Sandwich estimator of variance.

Using gains in test scores as the dependent variable eliminates the need to control for previous educational experiences, and the fixed-effects estimation controls for the effect on test score gains of any unobserved differences between charter school and traditional public school students that remain constant overtime.¹⁰ Note that the estimated effects of charter schools that emerge from this model are based on the experiences of only those students who have test scores gains observed at least once in a charter school and at least once in a traditional public school. Thus, estimation of this model requires three or more observations for each student.

Because the model parameters are estimated using changes over time for individual students, the effects of specific individual characteristics that remain constant over time cannot be estimated. The only student level variables that we include in the model are whether or not a student has changed schools in the last year. We distinguish structural school changes, i.e. moves from elementary to middle school, from other school changes. Including these variables allows us to distinguish the effect of moving into a charter school from the effect of moving per se.

Differential Effects by Characteristics of the Students

Although the effect of time invariant individual characteristics on test score gains cannot be estimate in our fixed effect model, the effect of interactions between the charter school variable and specific individual characteristics can be estimated. We examine two such interactions here: one between the charter school variable and whether or not the

¹⁰ For a more rigorous discussion of the assumptions required to identify charter school effects using this approach see Bifulco and Ladd (forthcoming).

student is black and the other between the charter school variable and an indicator that takes on a value of 1 if the student's parents do not have a four-year college degree and zero otherwise.¹¹

The results for math are presented in the first three columns of Table 6. The test score measures used to calculate gains are from the statewide End-of-Grade (EOG) testing program, and have been converted to standard scores with a mean of zero and a standard deviation of one. The coefficient on the charter school variable indicates how many standard deviations the average charter school student's achievement changes in a year as the result of attending a charter school. The estimate in the first column of Table 6 is taken from Bifulco and Ladd (forthcoming) and indicates that the typical charter school student suffers a substantial loss in achievement as the result of attending a charter school. Charter school students exhibit gains 0.16 standard deviations smaller in math, on average, than the gains those same students made while they were enrolled in traditional public schools. Assuming such losses compounded annually, a student enrolled in charter schools for five years would score eight-tenths of a standard deviation lower in math than they would if they remained in traditional public schools.

As shown in the second column of Table 6, negative effects emerge in math for both white and black students. The negative effects, however, are nearly 40 percent larger for blacks than for whites. In the third column we see that a student's race and the level of parental education both have statistically significant, independent influences on the size of the charter school effect. The model implies that black children of less educated parents are the group most adversely affected by charter schools. More

¹¹ We also estimated models that included a three-way interaction of the charter school indicator, the black indicator and the indicator of parental education. However, the estimated coefficient for this variable was negligible and statistically insignificant.

specifically, the negative effect of charter schools on the math achievement of black students whose parents do not have a four year college degree is 0.209 standard deviations per year, twice as large as the already substantial loss experienced by white students with college educated parents, which is 0.104 standard deviations per year.

The last three columns of Table 6 presents the same analyses of reading test score gains. Although still substantial, the negative effect of attending a charter school on reading achievement is smaller than the negative effect on math achievement. In the case of reading, the effects of attending a charter school do not appear to differ significantly across racial or educational groups.

Given that black students are disproportionately represented in charter schools relative to white students in North Carolina, the finding that attending a charter school has, on average, had substantial negative effects on student achievement suggests that the introduction of charter schools has increased the black-white test score gap in North Carolina. That the negative effect of charter schools is larger for black students, at least in math, than for white students magnifies the impact of charter schools on that gap, especially for black children of less educated parents.

Achievement Effects of Racial Segregation

We also investigated the extent to which the substantial number of segregated, predominantly black, charter schools contributes to the poor average performance of students in charter schools. To do so we drop observations of students in charter schools during their first year of operation in order to distinguish the influence of segregation on charter school performance from the influence that start-up challenges are known to have

during a charter school's first year. (Bifulco and Ladd, forthcoming). Table 7 reports the results for math achievement.

In the first column of Table 7, we allow the effects on student performance to differ for charter schools with more than 80 percent black students from those of other charter schools. The negative sign of the relevant point estimate is consistent with the hypothesis that predominantly black charter schools exhibit larger negative impacts than other charter schools, but the difference is not statistically significant. This insignificant finding might simply reflect the observation that the students in predominantly black charter schools are not necessarily the students who have experienced relatively large changes in peer composition as a result of transferring to a charter school.

Hence, in subsequent columns we refine the comparison groups. In the second column, the group is all students in charter schools in which the percentage of black students exceeds that in the same district by 10 percentage points; in the third column it is those charter schools further restricted to those in which the schools are more than 50 percent black; and finally in the fourth column, the group is charter schools that have more than 50 percent black students and for which the students who moved into them experienced more than a 10 percentage point increase in the share of black students. The statistically significant negative coefficients on the peer group variable in all three specifications indicate that segregation in the charter schools matters for student achievement. More specifically, greater segregation accounts for close to half of the negative effects of charter schools on student achievement.

We estimated the same set of models for test score gains in reading. The pattern of results is very similar, with segregated charter schools showing larger negative impacts

than other charters. However, the difference in effects on reading between segregated charter schools and other charter schools are smaller than they are for math and are not statistically significant.

Finally, in Table 8, we estimate a model of math achievement that includes the charter school indicator variable interacted both with individual student characteristics and with one or more measures of the segregating effects of the charter school. The measure of racial segregation is the one used in the last column of Table 7. Namely, the measure is set to one if the average increase in the percentage of black peers that results from the transfer into a charter school for all the students in the school is greater than ten and the school is more than 50 percent black, and zero otherwise. As shown in the first column, the inclusion of this second interaction term eliminates the difference in charter school effects between black and white students. This result indicates that all of the estimated difference in charter school achievement effects between white and black students is attributable to the large negative effects of charter schools that provide substantially more segregated environments for black students. Thus, it appears that the tendency of black students to sort into highly segregated charter schools is the primary mechanism through which the existence of charter schools in North Carolina exacerbates the black-white test score gap. Given our previous finding that this sorting results from locational and programmatic preferences of black families, rather than their preferences for racially segregated schools, we believe this finding is cause for policy concern.

In the second column of Table 8, we see that the relatively large negative impact of charter schools that provide more segregated environments for their black students accounts for none of the difference in charter school impacts between educationally

advantaged and educationally disadvantaged students. Nor does allowing the charter school effect to vary by the percentage of students in the school whose parents lack a four-year college degree significantly reduce the estimated difference in charter school impacts between educationally advantaged and educationally disadvantaged students (see third column). Apparently, the larger negative effects of charter schools on students whose parents lack a college education is not attributable to the peer composition of the charter schools chosen by these students. Perhaps these students are selecting charter schools with lower quality teachers or less effective leadership.

Conclusions and Policy Implications

The findings in this paper raise serious concerns about North Carolina's charter school program. One key finding is that both black and white charter school families tend to choose schools with peers who are more similar to their own children racially and socioeconomically than would be the case in their regular public school. Further, many black students have moved into charter schools with higher proportions of black peers than their previous public schools despite lower average levels of student achievement in those schools. .

Importantly, the fact that black charter school students tend to end up in predominantly black charter schools does not appear to be driven their families' preferences for racially segregated schools. Our analysis suggests that the typical black charter school family prefers a school that is around 50 percent black to one that is predominantly black. Rather, racially segregated charter schools appear to emerge for three sets of reasons. The first is residential segregation. Given that both black and white families tend to prefer charter schools that are close to their regular school, any

residential segregation will foster segregated charter schools. The second is differing preferences by race concerning program offerings, which could reflect differences between the races in access to information or in underlying values. The third is that the racial composition of the charter school preferred by the typical black charter school family is about 50 percent black, which is far higher than the 15 percent or less preferred by the typical white charter school family. This difference is likely to create tipping phenomena such that charter schools with black populations above a certain threshold may be attractive only to black families.

One consequence of black charter school students selecting into more racially isolated environments with lower achieving peers is that charter schools have had larger negative effects on the achievement of black students, and particularly on black students with less well educated parents, than on white students. Also, the high concentration of black students in many charter schools appears to contribute to the particularly large negative achievement effects of North Carolina's charter school program. As a result, not only has North Carolina's charter school program increased racial segregation, but it has also served to widen the black-white test score gap.

Whether these outcomes are typical of the charter school programs that have been adopted in 39 other states and the District of Columbia is difficult to say. On the one hand, one national study of fourth graders suggests that charter school students, on average, perform consistently less well relative to students in nearby public schools in North Carolina than in other states (see Hoxby 2004), which suggests charter school programs might be unfolding differently in North Carolina than elsewhere.¹² Moreover,

¹² Roy and Mishel (2005) raise questions about the validity of the Hoxby (2004) analysis. Other studies using methods similar to those we have used with data from Texas (Hanushek, Rivkin and Kain 2002) and

as is true for most states in the South, traditional public schools in North Carolina have been subject to extensive desegregation efforts, and as a result tend to be more racially integrated than public schools elsewhere. Charter school programs might foster different choices and outcomes in Northeastern and Midwestern states where racial segregation is more severe, or in Western states where African-American populations are much smaller. On the other hand, North Carolina is not the only state where charter schools are more segregated racially than traditional public schools (Gill et al. 2001; Roy and Mishel 2005), and other studies have found that when given the opportunity to choose, parents select more racially isolated environments (Henig 1996). More research on the effects of charter school programs on racial segregation, minority achievement and black-white test score gaps in other states is clearly needed.

Nonetheless, our results for North Carolina cast serious doubt on the expectation that minority students whose families take advantage of expanded opportunities to choose will find their way into less segregated and more effective schools. Our results need not imply, however, that efforts to expand parental choice ought to be abandoned. It is hard to argue that only wealthy parents should enjoy the privilege of choosing where their child will go to school. Although, on average, charter school students have not benefited academically from expanded opportunities to choose, some students undoubtedly have, and even those who have not benefited academically, might have benefited in other ways. Instead, our results highlight the importance of recognizing that any non-academic benefits of expanded school choice may well come at the expense of other important

Florida (Sass forthcoming) have also found that charter schools have negative effects. The negative effects found in those studies, however, are considerably smaller than the negative effects we found for North Carolina charter schools.

public policy goals such as more racially integrated schools and smaller black-white achievement gaps.

Our analysis suggests ways that some of the negative effects of expanding school choice can be reduced. The preference for nearby schools and thus the connection between residential segregation and school segregation might be reduced by ensuring that convenient transportation options are provided to parents regardless of the school they choose. Also, attention in the chartering process to the strategic location of schools might also help foster integration. For instance, schools in low poverty areas that are accessible to substantial black populations, and that offer programs that are desirable to white students might have a better chance of achieving integrated enrollments. Finally, if differences in programmatic preferences between black and white students reflect differences in access to information, rather than underlying value differences, then efforts to distribute information more equally might help.

At the same time, our results suggest that designing unrestricted parental choice policies that promote integration and help to reduce achievement gaps will be difficult. As long as white families prefer schools that are 15 percent or less black, and black families prefer schools that are closer to 50 percent black, unconstrained parental choice is likely to result in segregated schools. Managed choice programs that provide families choice among a range of schools and that take into account both family preferences and public policy goals in determining student assignments hold out more promise for reducing school segregation and academic achievement gaps.

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Table 1: Descriptive Statistics for Study Sample

	Students observed:		
	Only in traditional public schools	At least once in a charter school	Transferring from a traditional public to a charter school ^a
Number of students	487,198	8,745	4,937
<i>Ethnicity</i>			
% black	30.4	44.0	38.9
% Hispanic	3.4	1.4	1.1
% white	63.0	52.7	54.9
<i>Parent Education</i>			
% less than high school	10.5	4.7	3.8
% high school graduate	43.6	37.1	38.5
% some college, but did not graduate	5.0	5.5	6.4
% 2-year college degree	13.6	13.6	13.2
% 4-year college degree	21.9	31.5	30.5
% graduate school degree	5.2	7.2	7.7
Average Third Grade Reading Score ^b	0.003	-0.142	-0.076
Average Third Grade Math Score ^b	0.005	-0.251	-0.144

a. Students observed in a charter school and in a traditional public school during the year immediately preceding their first year in a charter school.

b. EOG test scores converted to standard scores with mean of 0 and standard deviations of 1. Grade specific means and standard deviations were used to make the conversions.

Table 2: Changes in Peer Environment Experienced by Students Upon Entering Charter School^a

	Black Students			White Sstudents		
	Charter	TPS	Average Change ^c	Charter	TPS	Average Change ^c
N	1918	1918	1918	2714	2714	2714
% black	0.702	0.534	0.168	0.180	0.294	-0.114
% with college educated parents	0.306	0.279	0.027	0.474	0.347	0.127
Average lagged EOG reading score ^b	-0.418	-0.104	-0.314	0.247	0.101	0.146
Average lagged EOG math score ^b	-0.510	-0.134	-0.376	0.183	0.098	0.085
	Parents without 4 Year Degree			Parents with 4 Year Degree		
	Charter	TPS	Average Change ^c	Charter	TPS	Average Change ^c
N	3050	3050	3050	1887	1887	1887
% black	0.446	0.408	0.038	0.301	0.360	-0.059
% with college educated parents	0.279	0.257	0.022	0.585	0.413	0.172
Average lagged EOG reading score ^b	-0.222	-0.070	-0.152	0.213	0.134	0.079
Average lagged EOG math score ^b	-0.294	-0.076	-0.218	0.147	0.108	0.039

a. Averages for all students observed at least once in a charter school and once in a traditional public school prior to entering charter school. Columns labeled "Charter" report average characteristics of students in the same grade and school during first year in a charter school, and columns labeled "TPS" report same figure for the closest year preceding entrance to a charter school spent in a traditional public school. The sum of black students and white students does not equal the total number of students reported in Table 1, because the latter total includes students in other ethnic groups.

b. Individual test scores converted to standard scores with mean a zero and standard deviation of one.

c. All differences are statistically significant at 0.01 level

Table 3: Definition of Variables Used in Conditional Logit Models

PBLACK	Percent black students in the same grade as the transferring student during the previous school year
PCOLL	Percent of students who parents have a four year degree in the same grade as the transferring student during the previous school year
AVGACH	Average of math and reading scores on End of Grade tests for students in the same grade as the transferring students during the previous school year. Average taken after converting each test score to a standard score with mean of zero and standard deviation of one using grade-by-years mean and standard deviations for entire sample of students.
URBAN	=1 if school located in an urban area, =0 otherwise (alternatives are rural and suburban areas)
DISTANCE	Miles between charter school and the student's prior traditional public school
PTRATIO	Pupil/teacher ratio during previous school year
LOGENR	Log of enrollment during previous school year
ATRISK	=1 if mission and purpose statement outlined specific interventions or recruitment efforts targeted to students at-risk of academic failure, =0 otherwise
GIFTED	=1 if mission and purpose statement outlined specific interventions or recruitment efforts targeted to gifted students, =0 otherwise
COMMUN	=1 if mission and purpose statement indicates use of community based learning sites, goal of maximizing community involvement, or commitment to "the village concept."
AFRCUR	=1 if mission and purpose statement indicates use of African-centric curriculum or curriculum emphasizing African-American experience, =0 otherwise
ARTS	=1 if mission and purpose statement indicates use arts integrated curriculum or curriculum emphasizing arts-based instruction, =0 otherwise
CHAR	=1 if mission and purpose statement indicates emphasis on character or moral education, =0 otherwise
EXPER	=1 if mission and purpose statement indicates use of experiential, constructivist, or inquiry-based instruction, =0 otherwise
IEP	=1 if mission and purpose statement indicates development of a specific educational plan for each child similar to Individual Education Plans required for special education students, =0 otherwise
ALTASS	=1 if mission and purpose statement emphasize use of alternative assessments, =0 otherwise
PARINV	=1 if mission and purpose statement indicated specific parent/family interactions or requirements, =0 otherwise

Table 4: Estimated Preferences for School Attributes from Conditional Logit Analysis, By Race

	Black Students			White Students		
PBLACK	2.450** (0.258)	0.363 (0.654)	4.123** (1.349)	-3.371** (0.320)	-2.225** (0.704)	1.556 (1.451)
PBLACK SQUARED			-3.841 (1.208)			-5.040** (1.745)
PCOLL	0.545** (0.273)	0.031 (0.285)	-0.307 (0.448)	3.155** (0.444)	2.942** (0.844)	2.066** (0.886)
AVGACH	0.677** (0.126)	0.103 (0.285)	-0.112 (0.296)	0.248 (0.156)	2.060** (0.383)	1.520** (0.406)
URBAN		2.430** (0.503)	2.206** (0.477)		-3.421** (0.583)	-3.016** (0.596)
DISTANCE		-0.241** (0.027)	-0.243** (0.027)		-0.322** (0.036)	-0.341** (0.037)
PTRATIO		-0.033** (0.012)	-0.014 (0.013)		-0.033 (0.024)	-0.025 (0.024)
LOGENR		0.789** (0.120)	0.606** (0.134)		0.571* (0.330)	0.409 (0.347)
ATRISK		0.599** (0.277)	0.986** (0.306)		0.028 (0.305)	0.267 (0.304)
GIFTED		0.619 (0.383)	1.042** (0.414)		-4.976** (0.830)	-4.361** (0.927)
COMMUN		2.406** (0.344)	2.197** (0.343)		1.776** (0.566)	1.530** (0.569)
AFRCUR		0.134 (0.360)	0.109 (0.368)			
ARTS		-0.350 (0.893)	-0.494 (0.915)		6.402** (1.340)	5.231** (1.483)
CHAR		-0.868** (0.293)	-1.259** (0.321)		0.558 (0.363)	0.207 (0.377)
EXPER		-1.165** (0.240)	-1.143** (0.244)		3.904** (0.561)	3.609** (0.627)
IEP		-0.440** (0.135)	-0.428** (0.137)		0.734** (0.259)	0.468* (0.271)
ALTASS		0.031 (0.178)	0.096 (0.185)		1.125** (0.276)	1.012** (0.283)
PARINV		-1.618** (0.275)	-1.549** (0.277)		3.794** (0.728)	3.440** (0.764)
Number of observations	4375	3961	3961	3204	3049	3049
Number of cases	976	911	911	896	894	894
Log Likelihood	-1132.7	-684.3	-679.3	-502.2	-279.2	-274.8
Pseudo R-squared	0.051	0.328	0.333	0.445	0.681	0.686

* significant at 0.10 level, ** significant at 0.05 level

Table 5: Estimated Preferences for School Attributes from Conditional Logit Analysis, By Race and Parental Education

	Black Students		White Students	
	College Educated Parent	Parents Less than College Education	College Educated Parent	Parents Less than College Education
PBLACK	5.123** (2.318)	5.779** (1.801)	3.550 (2.493)	0.248 (2.531)
PBLACK SQUARED	-7.473** (2.078)	-4.828** (1.617)	-5.918** (2.959)	-6.030** (2.922)
PCOLL	-0.500 (0.844)	0.125 (0.590)	3.299** (1.408)	0.028 (1.504)
AVGACH	-0.652 (0.440)	-0.372 (0.391)	2.486** (0.651)	0.126 (0.595)
URBAN	3.035** (0.828)	2.643** (0.656)	-4.694** (1.238)	-1.901* (1.058)
DISTANCE	-0.217** (0.045)	-0.247** (0.035)	-0.375** (0.051)	-0.254** (0.070)
PTRATIO	-0.011 (0.019)	0.016 (0.017)	-0.053 (0.039)	0.013 (0.044)
LOGENR	0.221 (0.220)	0.514** (0.175)	1.158* (0.637)	-0.200 (0.530)
ATRISK	2.110** (0.600)	0.789** (0.377)	-0.423 (0.515)	0.282 (0.635)
GIFTED	0.954 (0.657)	-0.351 (1.007)	-5.068** (1.768)	-4.041** (1.870)
COMMUN	3.062** (0.676)	2.140** (0.482)	-0.181 (1.028)	2.581** (1.058)
AFRCUR	1.425** (0.597)	-0.820 (0.524)		
ARTS		-1.946 (1.219)	6.009** (2.759)	1.925 (2.084)
CHAR	-2.255** (0.413)	-1.258** (0.397)	1.344** (0.637)	-1.128* (0.675)
EXPER	-0.918** (0.419)	-1.576** (0.469)	2.906** (1.260)	1.890** (0.950)
IEP	-0.870** (0.298)	-0.402** (0.164)	0.827* (0.475)	-0.132 (0.485)
ALTASS	0.364 (0.370)	0.042 (0.241)	2.482** (0.644)	0.022 (0.513)
PARINV	0.004 (0.514)	-3.009** (0.540)	4.811** (1.454)	1.570 (1.114)

Number of observations	1243	2718	2296	753
Number of cases	280	631	651	243
Log Likelihood	-221.2	-422.5	-171.0	-274.8
Pseudo R-squared	0.370	0.373	0.750	0.686

* significant at 0.10 level, ** significant at 0.05 level

Table 6: Estimated Impacts of North Carolina Charter Schools on Achievement Gains, by Student Characteristics

	Mathematics			Reading		
	Charter school	-0.160** (0.021)	-0.138** (0.028)	-0.104** (0.030)	-0.095** (0.014)	-0.099** (0.017)
Charter school * Black student		-0.055** (0.025)	-0.040* (0.024)		0.009 (0.019)	0.016 (0.021)
Charter school * Parents no college degree			-0.065** (0.024)			-0.027 (0.020)
Changed schools in –last year	-0.027** (0.005)	-0.028** (0.004)	-0.027** (0.004)	-0.013** (0.004)	-0.013** (0.002)	-0.013** (0.002)
Made structural change in last year	-0.061** (0.001)	-0.061** (0.002)	-0.061** (0.002)	-0.056** (0.001)	-0.056** (0.001)	-0.056** (0.001)
Total observations ^c		1,502,339			1,494,885	
Total students ^c		425,654			424,066	
Students with at least one test score gain observed in a charter and a traditional public school		5,741			5,721	

a. All models include grade/year fixed effects and are estimated using the "within" student estimator. Dependent variable is annual gain in EOG development scale scores expressed as standard scores with mean of zero and standard deviation of one. Figures in parentheses are robust standard errors calculated using generalization of Huber/White Sandwich estimator and are robust to clustering within schools.

b. Sample count includes only those observations of students with at least three valid test score measures, which is the minimum required to identify fixed effects and effect estimates for non-constant variables.

* indicates statistical significance at 0.10 level, ** indicates statistical significance at the 0.05 level.

Table 7: Estimated Impacts of North Carolina Charter Schools on Math Achievement by Measures of School Level Racial Isolation

Charter school	-0.117** (0.029)	-0.081** (0.032)	-0.098** (0.031)	-0.098** (0.025)
Charter school * >80% black	-0.039 (0.044)			
Charter school * Exceeds average %black in district by more than 10		-0.107** (0.040)		
Charter school*Exceeds average % black in district by more than 10 & >50% black			-0.076** (0.038)	
Charter School*Avg. increase in % for entering students > 10 & >50% black				-0.081** (0.035)
Changed schools in last year	-0.025** (0.005)	-0.026** (0.005)	-0.026** (0.005)	-0.025** (0.005)
Made structural change in last year	-0.060** (0.010)	-0.060** (0.010)	-0.060** (0.010)	-0.060** (0.010)

a. All models include grade/year fixed effects. Observations of students in first year charter schools not included. Dependent variable is annual gain in EOG development scale scores expressed as standard scores. Figures in parentheses are robust standard errors calculated using generalization of Huber/White Sandwich estimator and are robust to clustering within schools.

* indicates statistical significance at 0.10 level, ** indicates statistical significance at the 0.05 level.

Table 8: Estimated Impacts of North Carolina Charter Schools on Math Achievement Gains, by Student Characteristics Controlling for School-Level Measure of Segregation

Charter school	-0.126** (0.029)	-0.086** (0.034)	-0.121** (0.042)
Charter school * Black student	-0.001 (0.023)	0.014 (0.024)	0.023 (0.024)
Charter school * Parents no college degree		-0.068** (0.029)	-0.054* (0.029)
Charter school * Avg. increase in %black for entering students > 10 & >50% black	-0.098** (0.033)	-0.099** (0.031)	-0.078** (0.036)
Charter school * Avg. increase in % students whose parents lack a 4 yr degree for entering students			-0.208 (0.150)
Changed schools in last year	-0.028** (0.004)	-0.027** (0.004)	-0.027** (0.004)
Made structural change in last year	-0.061** (0.002)	-0.061** (0.002)	-0.061** (0.002)

a. All models include grade/year fixed effects and are estimated using the "within" student estimator. Dependent variable is annual gain in EOG development scale scores expressed as standard scores with mean of zero and standard deviation of one. Figures in parentheses are robust standard errors calculated using generalization of Huber/White Sandwich estimator and are robust to clustering within schools.

* indicates statistical significance at 0.10 level, ** indicates statistical significance at the 0.05 level.

Figure 1: Charter Schools and Tract Demographics, Durham County, 2002, (percent black and Hispanic)

