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TECHNICAL
R E P O R T



Achievement and Attainment in Chicago Charter Schools

Kevin Booker, Brian Gill, Ron Zimmer, Tim R. Sass

Sponsored by the Bill and Melinda Gates Foundation, Joyce Foundation,
Smith Richardson Foundation, Stranahan Foundation, and
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Preface

Over the past decade, charter schools have been among the fastest-growing segments of the K–12 education sector across the country. These schools are publicly funded schools that have the flexibility to operate outside normal district control and are intended to provide greater educational choice to families, reduce bureaucratic constraints on educators, and provide competitive pressure to induce improvement in conventional public schools while remaining publicly accountable. In total, 40 states plus the District of Columbia have charter-school laws, and more than 4,000 charter schools are operating, serving more than 1 million students.

The rapid growth of charter schools makes the rigorous evaluation of their effectiveness increasingly important. The Bill and Melinda Gates Foundation, Joyce Foundation, Smith Richardson Foundation, Stranahan Foundation, and William Penn Foundation have provided generous support to examine the impact of charter schools across a number of geographic locations in the United States. In this report, we focus on Chicago charter schools and address several key issues using student-level data provided by Chicago Public Schools (CPS). First, we provide evidence on whether charter schools are attracting high- or low-achieving students and assess the effects of the transfers on racial mix in the city’s public schools. Second, we attempt to assess whether charter schools are producing achievement gains for the students who attend them, relative to district-run schools in CPS, as measured by state test scores. Third, we examine longer-term attainment outcomes, analyzing whether Chicago’s charter high schools are increasing their students’ likelihood of graduating, their scores on the ACT® college-admission exam, and their probability of enrolling in college (again relative to district-run CPS schools).

The attainment analyses, conducted in Chicago and in parallel analysis for charter schools in Florida, represent the first rigorous attempt to examine the effects of charter schools on long-term outcomes. This report, and subsequent reports that will incorporate results from charter schools in other locations, should therefore be of interest not only to readers in Chicago but also to readers interested in charter schools generally and those who grapple with developing strategies for improving graduation and college attendance rates.

This analysis was conducted as a collaborative effort by RAND Education, a unit of the RAND Corporation; Mathematica Policy Research Inc.; and Florida State University.

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Summary

Over the past decade, charter schools have been among the fastest-growing segments of the K–12 education sector in Chicago and across the country. In this report, we address several key issues related to charter schools using student-level data provided by Chicago Public Schools (CPS). First, we provide evidence on whether charter schools are attracting high- or low-achieving students and assess the effects of the transfers on racial mix in the city’s public schools. Second, we attempt to assess whether charter schools are producing achievement gains for the students who attend them, relative to district-run schools in CPS, as measured by state test scores. Third, we examine longer-term attainment outcomes, analyzing whether Chicago’s charter high schools (HSs) are increasing their students’ likelihood of graduating, their scores on the ACT® college-admission exam, and their probability of enrolling in college (again relative to district-run CPS schools).

Charter School Transfers

We began by examining students transferring to charter schools, to provide purchase on two policy issues relevant to the debate over charter schools. First, do charter schools “skim the cream,” serving students who had above-average achievement levels prior to entering charters? We found that, on average, the prior achievement levels of students transferring to charter schools differ only slightly from the citywide average and from the achievement levels of peers in the district-managed CPS schools they exited.

Second, do charter schools exacerbate or ameliorate racial stratification? We examined how transfers affect the racial and ethnic mix of the charter schools and the traditional public schools (TPSs) that the students exited. We found that transferring students are moving to schools with similar or slightly lower proportions of other students of the same race and ethnicity. In sum, transfers from TPSs to charter schools in Chicago do not increase racial stratification across the schools.

Charter School Achievement Effects in Grades 3–8

We gauge the achievement effects of charter schools in elementary and middle grades with a difference-in-differences analysis: For students who have attended charter schools and district-operated CPS schools, we observed whether their annual achievement gains were greater in the charter setting or the CPS setting. Consistent with similar studies in other locations, we found

only small differences in average achievement gains between charter schools and CPS schools, and these differences do not point in consistent directions. The only strong finding regarding achievement is that charter schools do not do well in raising student achievement in their first year of operation.

Charter High School Effects on Graduation, College Entry, and ACT Scores

We estimated attainment and ACT effects of Chicago’s charter HSs using a quasi-experimental design in which both the treatment group (charter-HS students) and the comparison group (CPS-HS students) attended charter schools in eighth grade, prior to entering HS. This method allowed us to address the selection bias that is inherent in comparing charter students who have chosen their schools with TPS students who may have been assigned to their schools. In this analysis, both the treatment students and the comparison students previously chose charters. In many instances, whether they went on from a charter middle school to a charter HS depended simply on whether their existing charter middle school included HS grades, rather than on a second active choice. Four of the eight charter HSs operating in Chicago during the years included in our analysis were multi-grade charters that included not only grades 9–12 but also grades for younger students (i.e., they served grades K–12, 6–12, or 7–12). Before entering ninth grade, charter eighth-graders who went on to charter HSs were very similar to charter eighth-graders who went on to district-run CPS HSs. Comparing their subsequent ACT scores, graduation rates, and college-entry rates (with statistical adjustments for baseline differences) should therefore provide useful information on how the charter HSs affected those outcomes.

We found evidence that Chicago’s charter HSs may produce positive effects on ACT scores, the probability of graduating, and the probability of enrolling in college—but these positive effects are solidly evident only in the charter HSs that also included middle school grades. For the average eighth-grade charter student in Chicago, continuing in a charter HS is estimated to lead to

- an advantage of approximately half a point in composite ACT score (for which the median score for the students included in the analysis is 16)
- an advantage of 7 percentage points in the probability of graduating from HS
- an advantage of 11 percentage points in the probability of enrolling in college.

We cannot be sure whether these positive effects are attributable to charter status or to the unconventional grade configurations that eliminate the change of schools between eighth and ninth grade. In one respect, there is no need to distinguish the two possible explanations. Eliminating the middle school–to-HS switch is an inherent part of the educational model of these four charter schools; they have unconventional grade configurations because they are charter schools. The state’s charter school policy led to the creation of schools that are producing improved educational outcomes, one way or another.

Nonetheless, the ambiguity about possible interpretations suggests the need for caution in drawing broader inferences for policy. Further research will be needed before we can say definitively whether charter HSs produce positive effects in conventional 9–12 grade configurations—

and whether district-run schools can produce positive effects by incorporating middle school (and perhaps elementary) grades.

For now, the large, positive attainment results in Chicago (as well as in Florida, as reported in Booker, Sass, et al., 2008) suggest promise for (at least) multi-grade charter HSs and demonstrate that evaluations limited to test scores may fail to capture important benefits of charter schools. If charter schools (or other multi-grade HSs) have positive effects on graduation and college entry, they have the potential to make a substantial, long-term difference in the life prospects of their students.

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Abbreviations

CPS	Chicago Public Schools
HS	high school
ISAT	Illinois Standards Achievement Test
ITBS	Iowa Test of Basic Skills
IV	instrumental variable
TPS	traditional public school

Introduction

Over the past decade, charter schools have been among the fastest-growing segments of the K–12 education sector in Chicago and across the country. Nationally, more than 4,000 charter schools have been established since the early 1990s, and they serve more than 1 million students. Charter schools have existed in Chicago since the 1997–98 school year, when three schools started operating. By 2007–08, Chicago’s charter sector served more than 20,000 students in 28 charter schools on 56 campuses. These numbers are likely to grow further, because charter schools are a key component of Chicago’s Renaissance 2010 initiative, which is in the process of creating 100 new schools across the city, including 32 new charters created between 2005 and 2007 (CPS, undated).

Charter schools have spurred a contentious debate since their establishment. Charter school advocates argue that they can improve student achievement and attainment, serve as laboratories for innovation, provide choice to families that have few options, and promote healthy competition with traditional public schools (TPSs). Critics worry that charter schools do not perform any better than TPSs, that they may exacerbate stratification by race and ability, and that they harm the students left in TPSs by skimming away financial resources and motivated families.

In this report, we analyze student-level data in Chicago provided by the Chicago Public Schools (CPS) to address several of these disputes. First, we examine the population of students who are transferring to charter schools to provide evidence on whether charter schools are attracting high- or low-achieving students and to assess the effects of the transfers on racial stratification. Second, we attempt to assess whether charter schools are producing achievement gains for the students who attend them, relative to district-run schools in CPS, as measured by state test scores. Third, we examine longer-term attainment outcomes, analyzing whether Chicago’s charter high schools (HSs) are increasing their students’ likelihood of graduating, their scores on the ACT®, and their probability of enrolling in college (again relative to district-run CPS schools). In a follow-up report to be released later this year, we will assess whether there is any evidence that charter school competition is producing positive or negative effects on the achievement levels of students who remain in district-operated CPS schools.

The examination of these issues in Chicago is part of a multi-state study of charter schools, with a larger report due to be released in the fall of 2008. By examining these issues across a variety of geographic locations, we hope to gain insight into the policies and environments that produce effective charter schools.

Background on Chicago Charter Schools

Illinois passed the law authorizing charter schools in 1996. The law allowed 15 charter schools in Chicago and gave preference in the application process to schools serving at-risk children. The law did not forbid charters from opening multiple campuses, and many Chicago charter schools did so. In 2003, the cap was raised to 30 schools, but the new schools could not open multiple campuses. Our analyses treated each campus as a separate school, even though multiple campuses sometimes operate under a single charter.

Charter schools in Chicago receive their charters from the Chicago Board of Education, and these charters may be revoked if the school fails to make adequate progress toward student-performance goals or fiscal standards. An annual audit process by the CPS charter school office monitors charter compliance with charter school regulations.

Charter schools in Chicago are not included in the district's collective-bargaining agreement and may employ noncertified teachers. Funding for Chicago charter schools passes through the CPS, and the amount of funding per student is negotiated between the charter school and the district, within a range of between 75 and 125 percent of per-pupil funding in the district. Charter schools are required to have open enrollment and to use a lottery to assign slots if they are oversubscribed (Lake and Rainey, 2005).

Students Transferring to Charter Schools

We begin with a descriptive examination of students transferring to charter schools. Examining transfer students provides purchase on two policy issues relevant to the debate over charter schools. First, do charter schools “skim the cream,” serving students who had above-average achievement levels prior to entering charters? This question is relevant not only in its own right but also because it may have secondary achievement effects as a result of changing the abilities of students’ peers (see, e.g., Zimmer and Toma, 2000; Booker, Zimmer, and Buddin, 2005; Frankenberg and Lee, 2003). Second, how do the transfers affect the racial and ethnic mixes of the charter schools and the TPSs left behind? Do transfers to charter schools tend to reduce or increase the stratification of schools by race and ethnicity? We use longitudinal data for Chicago students in elementary and middle school grades to address both of these issues.¹

Admittedly, examining transfer students provides only a partial answer to both of these questions. Ideally, we would like to use information on all charter students, not only those who have transferred from TPSs, to address these issues. But for students who have never attended a TPS, we have no way to observe their achievement prior to entering a charter school, nor can we compare racial or ethnic distributions in their charter schools with their TPSs. We therefore examine all of the charter students who can be observed previously attending TPSs. Specifically, we look at students who switched to Chicago charter schools between the 1997–98 and 2006–07 school years, in grades 1 through 12—excluding students who had to move because they had reached the terminal grade of their existing schools.

Prior Achievement of Students Transferring to Charter Schools

First, we examine the prior achievement levels of students who enter charters, as compared with average districtwide achievement levels and with the achievement levels of other students in the TPSs from which they transferred. Table 3.1 shows the average standardized prior math and reading scores of charter movers and of their peers in the same grade at the TPSs that the movers exited (weighted by the number of transferring students from each TPS). Original scores are scaled scores on the Iowa Test of Basic Skills (ITBS) for 2004–05 and prior, and Illinois Standards Achievement Test (ISAT) scaled scores for 2005–06 and 2006–07. To make the results comparable across grades and subjects, we standardized

¹ Comparing the racial and ethnic composition of charter schools with that of the surrounding schools, districts, or the state in which the charter is located may be useful for examining aggregate differences in school composition, but it does not address what the racial and ethnic composition would have been at the school that the charter mover would have attended if he or she had stayed in a TPS.

Table 3.1
Average Prior Math and Reading Scores of Charter Movers and Other Students at the TPSs That They Leave

Average Prior Score	Overall	Black Students	Hispanic Students	White Students
Math, movers	-0.03	-0.05	0.06	0.30
Math, TPS peers	-0.12	-0.17	0.03	0.36
Math, difference between movers and TPS peers	0.09*	0.12*	0.03	-0.06
Reading, movers	0.02	0.01	0.02	0.35
Reading, TPS peers	-0.09	-0.12	-0.03	0.36
Reading, difference between movers and TPS peers	0.11*	0.13*	0.05	-0.01

NOTE: * indicates that the difference is significant at the 5-percent level.

them relative to the districtwide distribution in each grade and subject. Scores in the table are standardized z-scores, with negative scores below the districtwide average and positive scores above.

On average, the prior achievement levels of students transferring to charter schools differ only slightly from the citywide average and from the achievement levels of peers in their TPSs. In math, students transferring to charters had prior scores slightly below the district average and slightly above average in the TPSs they exited. In reading, students transferring to charters had scores that were marginally above the districtwide average and slightly above averages in the TPSs they exited. Overall differences between students transferring to charters and their TPS peers are statistically significant.

This story varies somewhat by race and ethnicity. Black students who move to charter schools tend to be slightly higher achieving than their peers within the same racial and ethnic group in the TPSs from which they came; the differences achieved statistical significance in both reading and math. Hispanic students show no statistically significant differences. White charter movers tend to be slightly lower achieving than their white public-school peers in reading and marginally lower achieving in math; neither difference was statistically significant.

In sum, students who transfer to charter schools have achievement levels that are generally similar to those of Chicago as a whole and of the particular TPSs from which they come. We found no evidence that charter schools are having a substantial effect on the peer composition of TPSs, as measured by student achievement.

Transfers to Charters and Racial and Ethnic Mix

Here, we compare the racial and ethnic composition of the sending (traditional public) and receiving (charter) schools of students transferring to charters. Table 3.2 compares the peer environments for charter movers before and after moving to a charter school. The top panel makes these comparisons for all charter movers, and the subsequent panels make the comparisons for students of individual racial and ethnic groups.

The top panel of Table 3.2 shows that, on average, the charter schools entered by transferring students have a citywide racial and ethnic composition that is nearly identical to the

citywide racial and ethnic composition of the TPSs they leave behind. As with achievement levels, there is no evidence that charter schools are serving a select population of students.

The information in the top panel does not tell us, however, about the peer environments of the typical transfer student of each particular racial or ethnic group. For that, we examine the second, third, and fourth panels of Table 3.2. The shaded row separating each panel compares the percentages of students of the *same* racial or ethnic group in chosen charter schools and previous TPSs. For each of the three racial and ethnic groups, the results indicate that transferring students are moving to schools with lower proportions of other students of the same race or ethnicity. Black students who transfer to charter schools remain, on average, in schools with a majority of students of the same race and ethnicity, but the majorities are smaller. Hispanics, on average, transfer from schools that have a majority of Hispanic students to charter schools that have a minority of these students. White students tend to be in the minority both before and after transferring to charter schools; they are a slightly smaller minority in the charter schools.

In sum, transfers from TPSs to charter schools in Chicago do not increase racial stratification across the schools.

Table 3.2
Traditional Public and Charter Peer Environments for Charter Movers by Racial and Ethnic Background of Student

Environment	Black (%)	Hispanic (%)	White (%)
Charter school that students attend	76.2	20.2	2.9
TPS that students previously attended	75.2	19.3	3.9
Difference, all students	1.0*	0.9*	-1.0*
Charter school that black students attend	84.3	13.2	2.1
TPS that black students previously attended	89.9	7.0	2.3
Difference, black students	-5.6*	6.2*	-0.2
Charter school that Hispanic students attend	44.0	49.3	5.3
TPS that Hispanic students previously attended	18.2	70.1	8.6
Difference, Hispanic students	25.8*	-20.8*	-3.3*
Charter school that white students attend	55.7	29.8	11.8
TPS that white students previously attended	26.3	40.6	20.1
Difference, white students	29.4*	-10.8*	-8.3*

NOTE: * indicates that the difference is significant at the 5-percent level. The values do not add up to 100 percent because the table excludes the smallest racial and ethnic categories.

Student Achievement in Charter Schools, Grades 3–8

One of the key policy questions regarding charter schools is their impact on the achievement of students who attend them. Assessing the causal impact of charter schools on their students is fraught with difficulty, however, because students who attend charter schools are a self-selected group. Students who have made active choices to attend charter schools are likely to differ in important ways (such as motivation and family support) from students who remain in TPSs. These differences can lead to selection bias in attempts to estimate the effects of charters on students. It is possible that selection bias could lead either to overestimating the achievement impact of charter schools (if charter students are unusually motivated to do well in school) or to underestimating their impact (if charter schools disproportionately serve students who have had difficulties in school).

The best way to address selection bias is through an experiment in which applicants are randomly assigned to receive or not receive places in charter schools. But the randomized experimental method is possible only in charter schools that are oversubscribed, that determine admissions by lottery, and that keep careful records of lottery winners and losers. A comprehensive, retrospective examination of the effects of all charter schools in Chicago requires a different method.

We address selection bias in the analysis of achievement in elementary and middle grades of Chicago charter schools by comparing the achievement trajectories of *the same students* when they are in charter schools and TPSs, subtracting out underlying trends for students in the rest of the district. Each student serves as his or her own control. The approach, which is known as a “student fixed-effects” or “difference-in-differences” model, does not permit causal inferences with as much confidence as a randomized experiment would but provides stronger inferences than are possible with most non-experimental designs. The “within-student” design controls for observed and unobserved constant (“fixed”) characteristics of students, including family-background influences that are not captured in observable demographic characteristics.

HSs, unfortunately, cannot be included in this analysis, because it requires testing in successive grades, and we have test data for only one grade in HS in Chicago.

There are two notable threats to the validity of the student fixed-effects approach (see Hoxby and Murarka, 2006; Ballou, Teasley, and Zeidner, 2007). First, it necessarily derives effects based only on students who have been observed (and tested) in charter schools *and* in TPSs. Students who have always attended charter schools do not contribute to the estimation of effects, because we cannot compare their charter school achievement to their achievement elsewhere. If charters affect charter-only students in ways that differ from their effects on stu-

dents who switch between charters and TPSs, estimates based only on switchers could under- or overestimate total charter effects.¹

Second, the approach does not account for the possibility that school transfers might occur when (or even because of) underlying changes in students' behavior that would cause changes in achievement independently of the school change.

Although these potential threats to validity should be kept in mind, the within-student comparison provides a stronger control for selection bias than do non-experimental methods, and the student fixed-effects method has consequently been used in several of the strongest existing studies of charter school achievement effects, including Bifulco and Ladd (2006) in North Carolina; Hanushek, Kain, and Rivkin (2002) and Booker, Gilpatric, et al. (2007) in Texas; Witte et al. (2007) in Wisconsin; Zimmer, Buddin, et al. (2003) in California; and Sass (2006) in Florida. So far, this research has found mixed results regarding the impact of charter schools on student achievement.

In addition to estimating the overall achievement effect of charter schools, we also look for differential achievement effects by student race and ethnicity, the number of years the student has attended a charter school, and the number of years the charter school has been in operation. Previous literature on charter school effects (e.g., Sass, 2006) has shown that all of these factors can lead to significant differences in estimated charter-achievement effects.

Table 4.1 shows the characteristics for Chicago students in TPSs and in charter schools in grades 3–8, for the period included in the achievement analysis, 1997–98 through 2006–07, as well as separately for the 2006–07 school year. Charter schools have a higher percentage of black students and lower percentages of white and Hispanic students than do TPSs. Charter schools also have fewer free-lunch–eligible students and fewer special-education students. Charter school students have higher mean ITBS and ISAT math and reading test scores, with average math scores 0.10 standard deviations above the district average and average reading scores 0.07 standard deviations above the district average. Table A.1 in the appendix provides additional information specifically on the students included in the analysis used to estimate achievement effects.

The estimation equation for our value-added achievement model is

$$\Delta A_{jt} = \alpha C_{jt} + \beta X_{jt} + \theta_{gt} + \mu_j + v_{jt}, \quad (4.1)$$

where ΔA_{jt} is a measure of the achievement growth of the j th student in the t th year, C_{jt} is an indicator for attending a charter school, X_{jt} is a vector of time-varying student characteristics (such as an indicator for the student switching schools or being held back or skipping a grade), θ_{gt} captures grade-by-year effects, μ_j captures individual student fixed effects, and v is the random disturbance term.

Equation 4.1 gives an estimated overall charter school effect, but we are also interested in effects over time and by student race and ethnicity. We therefore modified Equation 4.1 to perform these additional analyses. One variation is to interact the charter school indicator with indicators for the students' race and ethnicity. A second variation is to

¹ In fact, students in Chicago who transfer from TPSs into charter schools have lower average test-score gains while in charter schools than do students who are observed only in charters (details in Table A.1 in the appendix). But the transferring students also have lower average gains while in TPSs than do students who are observed only in TPSs, so there is no strong reason to believe that estimates based on transferring students would systematically underestimate charter effects.

Table 4.1
Characteristics of Charter and Traditional Public-School Students in Grades 3–8

Characteristic	Students 1997–98 Through 2006–07		Students 2006–07 only	
	TPS	Charter	TPS	Charter
Students	1,832,933	34,544	192,196	6,278
Female (%)	49.4	53.0	49.0	52.0
White (%)	9.5	3.0	8.6	2.1
Black (%)	51.9	72.8	49.3	68.7
Hispanic (%)	35.4	23.5	38.9	28.1
Asian (%)	3.0	0.6	3.0	1.1
Free-lunch eligible (%)	85.1	75.0	84.6	76.7
Special education (%)	14.7	9.4	14.2	9.7
Normalized ITBS or ISAT math score	0.01	0.10	0.00	0.14
Normalized ITBS or ISAT reading score	0.01	0.07	0.00	0.03

estimate separate effects for students attending a charter school for their first year, their second year, or their third year or beyond. A third variation allows separate charter effects by the number of years the charter school has been in operation, and a fourth variation allows interaction effects between the number of years the student has been in a charter and the number of years the charter has been in operation. Previous literature on charter schools has found that charters in their first year or two of operation are less effective than are more-established charter schools (Bifulco and Ladd, 2006; Booker, Gilpatric, et al., 2007; Sass, 2006).

Table 4.2 reports the estimated coefficients on the charter school indicator in our value-added model. For simplicity, only the charter-related coefficients are presented here; more-complete results can be found in Table A.2 in the appendix. Thirty-two Chicago charter schools are included in the analysis. Overall, we found no significant average effect of these on math achievement growth, with a small but statistically significant negative effect on reading achievement growth. On average, charters are doing about as well as district-operated CPS schools in raising student achievement.²

Estimated achievement effects vary for students with different racial and ethnic backgrounds. The lone significantly positive result is for black students in math. Hispanic students, in contrast, see significantly negative results in reading. The results suggest significantly negative effects for Asian students in both math and reading, but these results are based on only 78 students. The remaining math and reading estimates are not statistically significant.

Table 4.3 examines how the charter school–achievement effect varies depending on how long the student attends charter schools and how many years the charter school has been in operation.³ We found a significant negative effect of -0.07 of the student’s first year in a

² These results differ from those of Hoxby and Rockoff (2004), who found significantly positive achievement effects of a sample of oversubscribed charter schools in Chicago, taking advantage of the lottery admissions in a handful of charter schools to conduct a randomized experimental study. Their analysis, however, included only three Chicago charter schools.

³ Table A.3 in the appendix has a more complete set of coefficients corresponding to Table 4.3.

Table 4.2
Effects of Charter Schools on Student Achievement, Overall and Separately by Student Race and Ethnicity

Characteristic	Math	Reading
Attended a charter, overall effect	0.02 (0.02)	-0.04* (0.01)
Attended a charter, black student	0.05* (0.02)	-0.01 (0.01)
Attended a charter, Hispanic student	-0.07 (0.04)	-0.09* (0.02)
Attended a charter, white student	-0.04 (0.07)	-0.04 (0.05)
Attended a charter, Asian student	-0.26* (0.05)	-0.16* (0.05)
Observations	1,195,914	1,199,767

NOTE: * indicates statistical significance at the 5-percent level. Standard errors, in parentheses, are adjusted for the clustering of students within schools.

charter school on reading achievement growth. This effect is consistent with what other charter-achievement studies have found (Booker, Gilpatric, et al., 2007; Bifulco and Ladd, 2006). After the first year, point estimates for the effects improve, but only the positive result for math in a student's second year is statistically significant.

Table 4.3 also includes results by the number of years that the charter has been in operation. In their first year of operation, charter schools appear to have statistically significant negative effects on student-achievement growth in both math and reading. As in charter schools elsewhere, however, the performance of Chicago's charter schools improves following their first year of operation. In schools' second year in operation, the effects are no longer distinguishable from those of TPSs. Charter schools in their third year of operation or beyond demonstrate math gains that are significantly positive (but small), while the estimated reading effect remains indistinguishable from that of TPSs.⁴

The story is similar when we allow for interaction effects between how long the student attends charter schools and how long the charter has been in operation. For charter schools that have been in operation at least three years, there is still a statistically significant negative effect on reading for first-year charter students, while the effect for math on students in their second year or more in a charter is positive and statistically significant.

As previously noted, one potential concern with the student fixed-effects method is that transferring into charter schools may occur concurrently with (or subsequent to) other changes in a child's life. In particular, if students who switch to a charter school experience a dip in performance prior to moving, either due to a real disruption or to noise in the test score, this could cause us to overestimate charter school effects due to students reverting to their mean performance level.

To address this issue, we added an indicator for the student being in a TPS the year prior to attending a charter school and ran the achievement model (results in Table 4.3) with this

⁴ Ten schools contribute to the first-year charter estimates, 17 contribute to the second-year charter estimates, and 24 contribute to the estimate for three or more years of operation.

Table 4.3
Effects of Charter School Attendance on Student Achievement, Separately by Years Student Has Been in a Charter and Years Charter Has Been in Operation

Characteristic	Math	Reading
Attended a charter, student's first year in a charter	-0.03 (0.04)	-0.07* (0.02)
Attended a charter, student's second year in a charter	0.04* (0.02)	-0.01 (0.02)
Attended a charter, student's third year or beyond in a charter	0.05 (0.03)	-0.04 (0.02)
Attended a charter, charter's first year in operation	-0.24* (0.06)	-0.11* (0.02)
Attended a charter, charter's second year in operation	-0.04 (0.05)	-0.04 (0.03)
Attended a charter, charter's third year or beyond in operation	0.06* (0.01)	-0.03 (0.01)
Attended a charter, charter's first year in operation, student's first year in charter	-0.23* (0.06)	-0.12* (0.02)
Attended a charter, charter's second year in operation, student's first year in charter	-0.08 (0.09)	-0.03 (0.04)
Attended a charter, charter's second year in operation, student's second year in charter	0.01 (0.04)	-0.03 (0.04)
Attended a charter, charter's third year or beyond in operation, student's first year in charter	0.04 (0.02)	-0.07* (0.02)
Attended a charter, charter's third year or beyond in operation, student's second year in charter	0.06* (0.02)	0.00 (0.02)
Attended a charter, charter's third year or beyond in operation, student's third year or beyond in charter	0.07* (0.03)	-0.03 (0.02)
Observations	1,195,923	1,199,776

NOTE: * indicates statistical significance at the 5-percent level. Standard errors, in parentheses, are adjusted for the clustering of students within schools.

indicator included. The coefficient on this indicator gives us a measure of students' average achievement growth in the year prior to switching to a charter school, relative to the achievement growth of the same students in their other years in a TPS. The coefficient on the indicator for the year prior to switching was -0.02 for math and 0.00 for reading and, in both cases, was statistically insignificant. Moreover, estimates of the charter effect are essentially unchanged when we add an indicator for the year prior to switching. In short, there is no evidence of a statistically significant change in students' math- or reading-achievement growth in the year prior to transferring to a charter.

Effects of Chicago Charter High Schools on Graduation, College Entry, and ACT Scores

This study—which includes a parallel statewide analysis of attainment outcomes in Florida (see Booker et al., 2008)—is the first to rigorously estimate the effects of charter schools on HS graduation and college entry. The absence of such research has been due partly to the absence of data and partly to the difficulty of controlling for selection bias in examining a one-time student outcome. Unlike achievement tests, HS graduation and college entry do not recur annually. A difference-in-differences approach is unavailable for examining such outcomes, because they occur only after the student has completed the charter school treatment. Moreover, attainment outcomes may be even more affected than achievement-test scores by unobserved factors, such as motivation and family support. We therefore require another approach to address selection bias in assessing the impact of charter schools on the probability of graduating from HS and attending college.

Altonji, Elder, and Taber (2005) faced a similar challenge in attempting to assess the impact of Catholic HSs on attainment outcomes. Their first step in addressing selection bias was to limit their analysis to students who attended Catholic schools in eighth grade, some of whom went on to Catholic HSs, while others went to public HSs. They reasoned that students who had chosen to attend Catholic schools prior to HS were more alike than they were like students who attended public school in all grades.

Here, we follow the example of Altonji, Elder, and Taber (2005) and estimate the attainment impact of attending a charter HS by comparing the attainment outcomes of charter eighth-graders who attended charter schools in grades 9–12 with those of charter eighth-graders who attended TPSs in grades 9–12. This comparison should help to neutralize differences between charter-HS students and the comparison group, because both groups chose charter schools at some point in their education; we are not comparing choosers to non-choosers. (To be sure, this also means that we are ignoring the majority of charter-HS students who were enrolled in TPSs in eighth grade—an issue we discuss later.)

Indeed, this analysis should be more effective in the charter context than in the Catholic-school context. Catholic HSs typically have substantially higher tuition costs than do Catholic K–8 schools, so the choice to attend a Catholic HS requires a larger commitment than does the choice to attend a Catholic K–8 school. This is not true in the charter school context, where no tuition is charged.

Moreover, charter schools often have unconventional grade configurations that include elementary and middle school grades alongside HS grades. Four of the 10 Chicago charter schools serving eighth-grade students during our sample frame also included HS grades; four of the eight Chicago charter HSs operating during our sample frame took in students from

their own eighth grades. As a result, for many charter school eighth-graders, attending a charter school in ninth grade is determined largely by whether their current school includes ninth grade or not, rather than by an active choice.¹ Some charter school eighth-graders happen to be enrolled in schools that also include grades 9–12, while others happen to be enrolled in schools that terminate with grade eight. The differences between these students may be related to nothing more than the accident of the grade configuration of the charter school located closest to home. In fact, as we discuss next, the observable characteristics of the two groups of students (i.e., charter eighth-graders who attended charter HSs and charter eighth-graders who attended TPS HSs) are very similar.

However, the existence of multi-grade charter HSs creates an ambiguity in interpreting results: Any measured effects might be attributable to charter status or might be attributable to the unconventional grade configuration that eliminates the transition between middle school and HS. Transitions to new schools often have negative effects; charter schools might promote positive outcomes simply by eliminating a transition and adopting 6–12 or K–12 grade configurations. We cannot be sure about the causal *mechanism* producing any effects we measure.

Despite this interpretive ambiguity, it is nonetheless appropriate to consider this analysis as an examination of the effects of charter HSs. Four of the eight charter HSs operating in Chicago during the period examined in our data included middle school grades (and, in some cases, elementary school grades as well). Eliminating the middle school–to-HS switch is an inherent part of the educational model of these four charter schools; they have unconventional grade configurations *because* they are charter schools.

In an attempt to gain insight into the significance of the grade configuration, we conduct several sensitivity analyses to examine whether outcomes may differ in multi-grade charter HSs versus conventionally configured, 9–12 charter HSs. We also examine attainment outcomes for the population of charter-HS students who were *not* enrolled in charter schools in eighth grade, using a matched comparison group of TPS-HS students. This analysis cannot provide strong inferences about the effects of charter HSs, but it permits an exploratory examination of the substantial group of charter-HS students who cannot be included in our primary analysis.

High School Graduation and College Entry

An analysis of the effects of HSs on such outcomes as graduation and college entry requires a longer time horizon than is needed to examine year-to-year achievement effects. We need to follow students for four years from ninth-grade entry to assess the probability of graduation and for at least one more year to assess the probability of entering college. This means we can examine only the charter HSs that had opened by 2002. Eight charter HSs were operating in Chicago during the period included in our data; it is too early to examine attainment effects of

¹ Among Chicago's charter eighth-graders whose existing schools included ninth grade, 75 percent continued in a charter school in ninth grade. Meanwhile, among Chicago's charter eighth-graders whose existing schools terminated with eighth grade, only 32 percent continued in a charter school in ninth grade. The unconventional grade configurations also require caution in interpreting the meaning of *charter high school*. For the purposes of our analysis, the charter-HS treatment is defined as grades 9–12. Eighth grade is viewed as a pretreatment baseline—even though most of the students are in the same school in eighth as in ninth grade. In other words, the analysis creates a distinction between eighth grade and ninth grade even if they are in the same school. Readers should keep in mind that we are estimating the effect of attending a charter school in grades 9–12 net any effect that the school may have had in earlier grades.

charter HSs that opened more recently (including some that may be part of the city's Renaissance 2010 initiative).²

Across five cohorts (students entering HS between 1998 and 2002), 978 charter school eighth-graders in Chicago (in the 10 charter schools that served eighth grade at the time) could be observed moving to ninth grade in charter schools or TPSs and included in our analyses.³ Of these students, 469 remained in charter schools in grade nine. These 469 students constituted only 22 percent of the 2,090 charter ninth-graders in Chicago's data over the period of examination (as the rest were not enrolled in charter schools in eighth grade), but they included representation from all eight charter HSs operating in Chicago at the time. Among the charter eighth-grades, 509 switched to TPSs. The two subsets of students were remarkably similar in characteristics prior to entering HS, as Table 5.1 indicates. They are statistically indistinguishable in terms of gender, race and ethnicity, poverty, and mobility during middle school. The

Table 5.1
Baseline Descriptive Means of Treatment and Control Groups for Graduation Analysis, 1998–99 Through 2002–03

Characteristic	Treatment Group (charter 8th– charter 9th)	Comparison Group (charter 8th– TPS 9th)	All Charter 9th-Grade Students	All TPS 9th-Grade Students
School attended in grade 8	Charter	Charter	—	—
School attended in grade 9	Charter	TPS	Charter	TPS
Female (%)	57	53	57	48
White (%)	2	3	4	10
Black (%)	84	83	60	53
Hispanic (%)	14	14	34	33
Asian (%)	0	0	0.6	4
Free-lunch eligible in grade 8 (%)	89	90	93	94
Special education in grade 8 (%)	10	12	14	19
Switching schools between grades 6 and 8 (%)	27	27	15	15
Normalized 8th-grade ITBS math score	–0.24	0.03	–0.04	0.07
Normalized 8th-grade ITBS reading score	–0.15	0.05	0.01	0.06
Students	469	509	2,160	156,417

² The charter HSs included in our attainment analyses are ACT Charter School, Chicago International Charter School–Bucktown, Chicago International Charter School–Longwood, Perspectives Charter School, Young Women's Leadership Charter School, Noble Street Charter School, North Lawndale Charter High School, and Nuestra American Charter High School.

³ An additional 20 students had to be dropped from the analysis due to missing data.

only notable and statistically significant differences are in terms of prior (eighth-grade) achievement: Students who went on to attend charter HSs had lower levels of prior achievement than did students who went on to attend TPSs. (This difference could produce a bias against charter schools when measuring attainment effects, but our analysis makes an adjustment for the test scores, as described next.) The close similarity of the two groups supports the view that they are well suited to the examination of the effects of charter HSs.

The college-entry analysis includes a somewhat smaller sample than does the HS-graduation analysis, because we followed the students for five years after entering HS. The most recent cohort of students included in the HS-graduation analysis therefore drops out of the sample for the college-entry analysis. The loss of one cohort produces little change in the descriptive characteristics of the groups, which remain quite similar. We report the descriptive characteristics of the treatment and comparison groups for the college-entry analysis in Table A.4 in the appendix.

Next, we follow the two groups of students through HS, comparing differences in the probability of graduation and of enrolling in college to assess the likely impact of charter HSs.⁴ For college entry, we examine the probability of entering college within five years after initial entry to HS.⁵ In all cases, we keep students in the group defined by the school they initially entered in ninth grade; later transfers are ignored, making this an “intent-to-treat” analysis. In fact, 128 of the 474 students in the treatment group later transferred to TPSs, while seven of the 523 students in the comparison group later transferred to charter schools. Limiting our attention to the subset of students who remained in their initial groups throughout HS produces impact estimates that are larger than the ones we report here, but such estimates would probably be biased upward, because the students who leave the charter schools are likely to be those who are not doing well. We therefore report only the intent-to-treat estimates, which may, in fact, be conservative, given that the treatment group includes a substantial number of students who did not receive a full four years of charter-HS treatment.

The estimates could also be biased in favor of charters as a result of missing data on graduation and college attendance for a subset of the students. Students who are reported as leaving the district are missing information about graduation and college entry. Both the treatment group of charter-HS students and the comparison group of CPS-HS students experienced some attrition from the data as a result, and the attrition rate is higher for the charter students (20 percent missing graduation information) than for the CPS students (13 percent missing graduation information). Students with missing graduation and postsecondary information had lower baseline (eighth-grade) achievement scores than did students with complete information (by 0.10 to 0.16 standard deviations), suggesting that their attainment outcomes may also have been worse. If so, the missing information could artificially inflate our estimates of charter school attainment effects.⁶ To address this possibility, we predicted the probability of graduating and entering college for students with missing information, based

⁴ For the college-entry outcome, the sample size shrinks, because the most recent cohort of students had not yet reached five years beyond HS entry in our latest data.

⁵ Like the other data in the study, college-enrollment data were provided by CPS; originally, however, they came from the National Student Clearinghouse, which collects data on postsecondary enrollment in institutions nationwide.

⁶ The differences in eighth-grade test scores between students with missing graduation information and those with complete information was virtually identical for the treatment group of charter-HS students and the comparison group of CPS-HS students. Among the treatment group, students with missing data had baseline scores that were 0.10 and 0.15 lower

on observable variables that demonstrably predict graduation for the larger group of students with complete information.⁷ Predictor variables were eighth-grade ITBS math and reading scores; indicators for student gender and race and ethnicity; indicators for eighth-grade bilingual, special-education, and free- or reduced-price-lunch status; cohort indicators; ACT math, reading, and composite scores; an indicator of whether the student transferred during HS; and indicators for the student being enrolled in grades 10, 11, and 12.⁸ We impute graduation for 159 students with missing information, and we impute college attendance for 118 students with missing information. The results of the analysis using imputed probability estimates are slightly less favorable to charters than the parallel results that ignore the students with missing data. We therefore report the (more conservative) results with the imputed graduation and college-entry estimates.⁹

The results of our analyses represent estimated effects for the average student in our data, i.e., the average eighth-grade charter student in Chicago. This is important to keep in mind, because the average charter-HS student in Chicago may differ from the average charter eighth-grade student. Because our primary analysis includes only the charter-HS students who were enrolled in charters in eighth grade, it includes a much higher proportion of enrollment in the multi-grade charter HSs than in the charter HSs that include only grades 9–12. We therefore conducted alternative analyses that weighted each school according to its total ninth-grade enrollment and analyzed attainment outcomes for charter-HS students who came from TPS middle schools—an analysis that implicitly provides greater weight to the 9–12 charter HSs. The results of these analyses are described in the sections that follow our primary results.

Table 5.2 highlights attainment differences between the two groups, descriptively (under Raw Charter-HS Advantage) and adjusting for observable characteristics (under Charter-HS Probit Marginal Effect). Control variables used in the analysis reported in the last column include eighth-grade ITBS scores in reading and math, free- or reduced-price-lunch status, special-education status, bilingual status, race and ethnicity, gender, and cohort year. Sample sizes are larger for the last column than for raw charter-HS advantage, because the former includes the students with imputed outcomes, while the latter does not.

The results in Table 5.2 consistently indicate advantages for charter HSs in terms of both HS graduation and college enrollment. Descriptive outcome differences are statistically

in math and reading, respectively. Among the comparison group, students with missing data had baseline scores that were 0.16 lower in math and 0.11 lower in reading.

⁷ Students with missing college-entry information who were known not to have graduated were assumed to have not enrolled in college.

⁸ Missing values for graduation, college entry, and ACT scores were imputed using Stata's "impute" command, which uses best-subset regression to deal with missing predictors (see Little and Rubin, 2002). For graduation and college-entry outcomes, we used a probabilistic method to convert imputed probabilities for each student to a binary prediction. For ACT outcomes, we simulated an error term for imputed scores, creating simulated errors with the same standard deviation as the observed residuals in the unimputed data.

⁹ Despite our efforts to improve accuracy by predicting the probability of graduation and college entry for students with missing data, it is possible that the predictions are inaccurate. Students with missing information may differ in unobservable ways from students with complete information, and, if so, predictions based on the observable characteristics could over- or underestimate true rates of graduation and college entry. We therefore conducted additional analyses that examined best-case and worst-case scenarios. In the best-case scenario, we assume that all students with missing data actually graduated and entered college. In the worst-case scenario, we assume that all students with missing data actually failed to graduate and enter college. Best-case estimates are 1 to 4 percentage points higher than those reported in Table 5.2; worst-case estimates are 2 to 3 percentage points lower.

Table 5.2
Charter High Schools and Attainment

Attainment	Treatment Group (charter 8th grade–charter HS) Descriptive Mean (%)	Comparison Group (charter 8th grade– TPS HS) Descriptive Mean (%)	Raw Charter-HS Advantage (%)	Charter-HS Probit Marginal Effect (%)
Graduation	75	68	8* N=837	7* N=978
College within 5 years of starting HS	49	38	11** N=594	11* N=695

NOTE: Coefficient estimates are marginal probabilities controlling for student characteristics. * indicates statistical significance at the 5-percent level. ** indicates statistical significance at the 1-percent level.

significant and favor charter schools for graduation and college entry. Multivariate regressions (controlling for eighth-grade reading and math scores, race and ethnicity, gender, bilingual status, and cohort year) produce results (under Charter-HS Probit Marginal Effect) that significantly favor charter schools for both outcomes.

In sum, these results suggest that, for the average charter school eighth-grader in Chicago, attending a charter HS rather than a district-run HS may increase the probability of graduating by 7 percentage points and increase the probability of enrolling in college by 11 percentage points.

Charter High Schools and ACT Scores

We used the same methods used in the attainment analyses to examine whether charter HSs in Chicago have positive effects on students' ACT scores. Again, the analysis compares results for charter eighth-graders who went on to charter HSs (the treatment group) with charter eighth-graders who went on to CPS HSs. Again, we imputed outcomes for students with missing ACT scores. Approximately one-third of the sample was missing ACT scores, and ignoring those students produces results substantially more significant than the ones that follow, almost certainly as a result of biased attrition.

The results in Table 5.3 are presented in the same format as those in Table 5.2. The first three columns show descriptive means for the treatment and control groups. The fourth column indicates the coefficient associated with charter-HS status, after controlling for baseline (eighth-grade) ITBS scores, gender, race and ethnicity, English-language–learner status, special-education status, free- or reduced-price–lunch status, and cohort year. Again, sample sizes are larger in the last column because that analysis includes the students with imputed ACT scores, while raw charter-HS advantage does not. All outcomes are measured in terms of ACT scaled scores.

As with the attainment outcomes, every estimate of ACT-score effects favors charter schools, in most cases by statistically significant margins. The magnitude of the charter advantage is smaller in the regression-adjusted results than in the descriptive data, as a result of including imputed results for a substantial number of students (326) who lacked ACT scores. This implies that ignoring the students with missing data would upwardly bias the results in favor of charters. Nonetheless, even when the students with imputed scores are included, students in charter HSs show an advantage of nearly half a point on the composite ACT scale.

Table 5.3
Charter High Schools and ACT Scores

ACT Scaled Score	Treatment Group (charter 8th grade– charter HS) Descriptive Mean	Comparison Group (charter 8th grade– TPS HS) Descriptive Mean	Raw Charter-HS Advantage	Charter-HS Regression Coefficient
Math	16.5	15.6	0.9** N=662	0.19 N=981
Reading	16.8	15.8	1.0** N=662	0.45* N=981
Composite	16.7	15.8	0.9** N=662	0.43** N=981

NOTE: * indicates statistical significance at the 5-percent level. ** indicates statistical significance at the 1-percent level.

In sum, as with HS graduation and college enrollment, results suggest that, for the average charter eighth-grader, attending a charter HS may have positive effects on ACT scores.

Discussion, Interpretation, and Supplemental Analyses

As noted, it is possible that all of the estimated effects of charter HSs described here are attributable to the unconventional grade configurations of several of these schools, which eliminate the transition between middle and high school. We therefore examined whether the four multi-grade charter HSs showed different effects from those seen with the four charter HSs with conventional, 9–12 grade configurations.¹⁰ And indeed, the multi-grade HSs show stronger results. Probit analyses (analogous to those of the charter-HS regression coefficient in Tables 5.2 and 5.3) provide significantly positive estimates of effects for multi-grade charter HSs: 10 percentage points for graduation, 13 percentage points for college entry, and 0.52 points for composite ACT score.¹¹ Meanwhile, point estimates for the four 9–12 high schools—which include a much smaller number of students in our sample—are less favorable for all three outcomes and never statistically distinguishable from the outcomes for the comparison group of TPS-HS students.

The apparent difference in results for 9–12 charters versus multi-grade charters raises the possibility that the effects on the average charter-HS student in Chicago might differ from the effects estimated for the average charter-HS student *who attended a charter school in eighth grade*. The charter HSs with a conventional 9–12 grade configuration are underrepresented relative to the number of students they enroll, because ninth-graders in 6–12 or K–12 schools

¹⁰ The multi-grade charter HSs in our sample were ACT Charter School, Chicago International Charter School–Bucktown, Chicago International Charter School–Longwood, and Perspectives Charter School. The 9–12 charter HSs in our sample were Young Women’s Leadership Charter School, Noble Street Charter School, North Lawndale Charter High School, and Nuestra American Charter High School. Young Women’s Leadership Charter School now serves grades 7–12, but, in the years of HS entry included in our analysis, it was not serving eighth grade, so its ninth-graders were coming from elsewhere.

¹¹ The estimated effect for multi-grade charters on the reading ACT score is likewise statistically significant, and 0.54 points. The estimated math ACT effect is not significant for the multigrade charters, just as it is not significant for the whole group.

tend to come from eighth grade in the same school, while ninth-graders in 9–12 charter schools had to be in different schools—many of which are district-run CPS schools—in eighth grade. If each charter school has the same average effect on students coming from eighth-grade TPSs as it has on students coming from eighth-grade charters, then reweighting our analyses so that each school represents the total number of ninth-graders it enrolls (rather than the number of ninth-graders who came from eighth-grade charters) could produce a valid estimate of the effect on the average charter-HS student in Chicago. We therefore conducted an enrollment-weighted analysis.

Enrollment-based weighting reduces the precision of the results, because it places much larger weights on the small number of students in the impact sample who are enrolled in 9–12 charters. Weighted results for the probit analysis used in the charter-HS regression coefficient are notably smaller than those in Tables 5.2 and 5.3, and none is statistically distinguishable from 0, with point estimates suggesting a 4–percentage-point charter advantage in graduation, a 7–percentage-point advantage in college entry, and one-third of a point on the composite ACT scale.

The deeper problem with enrollment-based weighting, though, is that the effects of charter HSs could be different for students who have not previously attended charter schools. In light of this uncertainty, we also conducted an analysis of ACT, graduation, and college-enrollment outcomes for the population of charter-HS students who were *not* in charter schools in eighth grade. As previously noted, this group includes a majority of the students enrolled in charter HSs in Chicago during the period examined. The major challenge in estimating effects for these students is identifying an appropriate comparison group. Unlike in our primary analysis, we cannot use a comparison group that also consists of charter school choosers. The next-best option is to create a matched sample of TPS students who resembled the charter-HS students as closely as possible before the two groups entered HS. This approach cannot address the unobservable reasons that some students chose to enroll in charters while others did not and therefore permits weaker causal inferences than our primary analysis. But it is worth examining, to see whether similar results are evident in a different sample of students.

For the matched-sample analysis, the treatment group is students who were in a district-operated TPS in eighth grade then moved to a charter school for ninth grade. For each of these students, we used propensity-score matching to identify up to seven comparison students in the same cohort who attended the same TPS in eighth grade but stayed in a TPS for ninth grade. Variables included in the match equation were eighth-grade ITBS math and reading scores and indicators for student gender, ethnicity, and bilingual status. The matching procedure yielded 8,493 comparison students, matched to the 1,300 charter ninth-grade students in the treatment sample.

The match-based results for students from TPS middle schools show associations that favor charters, but less strongly and consistently than do the results from the primary analysis for charter eighth-graders. The matched analysis indicates a statistically significant (at 0.01) charter school advantage of 10 percentage points in the probability of graduating from HS. Estimates for college entry and ACT scores likewise favor charters, but results are less substantial than those in our primary analysis and do not achieve statistical significance. Interestingly, for the matched analysis, point estimates slightly (but not significantly) favor the 9–12 charter schools over the multi-grade charter schools for all outcomes (graduation, college entry, and ACT scores). For 9–12 charter HSs, estimated effects on TPS eighth-graders are significantly

positive (with a magnitude of 10 percentage points) for HS graduation but, for other outcomes, they are not significantly distinguishable from 0.

These various supplemental analyses do not produce any clear conclusions about the interpretation of the primary results, unfortunately. They are consistent with different interpretations. It is possible that charter HSs have positive effects on prior CPS students that are consistent with those found for prior charter students; the matched analysis may underestimate charter effects. It is also possible that the 9–12 charters are, in fact, producing positive effects but that these are not adequately measured for the small number of their students who appear in our primary analyses. Alternately, it is possible that charter HSs have smaller effects on students who have come from CPS schools than on students with prior experience in charter schools. And it is possible that the elimination of the middle school–to-HS transition in the multi-grade charters explains at least part of the effect measured in our primary estimates. We have fairly strong evidence that multi-grade charter HSs in Chicago are producing positive outcomes for their students but much weaker evidence that this effect is generalizable to all charter HSs in Chicago.

Conclusion

The examination of students who transfer between district-run schools and charter schools in Chicago provides several pieces of information about charter schools and their students. First, there is no indication that charters are “skimming the cream” of students from CPS: Prior achievement levels of students who leave CPS schools for charter schools are not substantially higher than the achievement levels of the peers they leave behind. Second, transferring students tend to move to charter schools that have similar or marginally smaller proportions of their own racial or ethnic group than do the CPS schools from which they are coming, such that transfers do not exacerbate racial and ethnic stratification in the schools. Third, students who transfer experience rates of achievement growth that do not differ substantially in CPS schools and charter schools, with the notable exception of the first year of a charter school’s operation, when students experience significantly and substantially negative achievement effects. The achievement effects found here are generally consistent with those found in most similar studies of charter schools across the country.

The analysis of the attainment effects of Chicago’s charter HSs (along with a parallel analysis in Florida, reported in Booker, Sass, et al., 2008), in contrast, breaks new ground and suggests positive effects for the average charter eighth-grader who continues in a charter HS. A quasi-experimental analysis that compares graduation rates, college-entry rates, and ACT scores of a group of charter-HS students and a group of CPS-HS students—in which both groups were enrolled in charter schools in eighth grade—estimates positive effects of charters on all three outcomes. For charter eighth-graders in Chicago, continuing into a charter HS appears to increase ACT scores, improve the probability of graduating by 7 percentage points, and improve the probability of enrolling in college by 11 percentage points. Booker, Sass, et al. (2008) estimated attainment effects in Florida that were likewise positive.

The major open questions about these positive effects are whether they are limited to multi-grade charter HSs and whether they are limited to students who were enrolled in charter schools in earlier grades. Future studies might attempt to estimate effects of district-operated HSs that include middle school grades, of which a few exist in Chicago. Understanding the causal mechanism for the apparent positive effects will be important for informing policy. Regardless of whether the estimated effect is a generalizable charter effect, a grade-configuration effect, or a specific effect of charters with this grade configuration, however, the results here demonstrate that educational program and policy evaluations would do well to examine outcomes that go beyond scores on state assessments. The attainment results found in Chicago and Florida are among the most promising results seen anywhere in the research literature on charter schools, which has largely ignored attainment outcomes. If charter schools (or other

multi-grade HSs) have positive effects on graduation and college entry, they have the potential to make a substantial, long-term difference in the life prospects of their students.

Supporting Data

Table A.1
Summary Statistics for Achievement-Estimation Sample

Variable	TPS Student-Year Observations	Charter Student-Year Observations		
		All	Student in Analysis at Both TPS and Charter (used for identification of effects)	Student in Analysis Only in Charter (not used for identification of effects)
Female (%)	50.2	53.3	54.1	52.9
White (%)	9.3	2.4	2.5	2.4
Black (%)	52.6	73.6	73.1	73.9
Hispanic (%)	35.0	23.2	23.3	23.2
Asian (%)	2.9	0.6	1.0*	0.4*
Normalized math score	0.04	0.13	0.00*	0.20*
Normalized reading score	0.04	0.06	-0.03*	0.12*
Math-score gain	-0.01	0.01	-0.01*	0.03*
Reading-score gain	-0.01	-0.03	-0.05*	-0.02*
Observations	1,171,806	24,117	8,828	15,289

NOTE: * indicates that the difference between the data in the last two columns is statistically significant at the 5-percent level.

Table A.2
Detailed Results for Table 4.2 in Chapter Four

Variable	Overall Estimate Model		Estimate by Race or Ethnicity Model	
	Math	Reading	Math	Reading
Attended a charter, overall effect	0.016 (0.023)	-0.036* (0.014)	—	—
Attended a charter, student is black	—	—	0.054* (0.016)	-0.013 (0.013)
Attended a charter, student is Hispanic	—	—	-0.068 (0.038)	-0.091* (0.018)
Attended a charter, student is white	—	—	-0.036 (0.070)	-0.038 (0.050)
Attended a charter, student is Asian	—	—	-0.256* (0.048)	-0.155* (0.052)
Transferred to a new school	-0.027* (0.006)	-0.009 (0.005)	-0.027* (0.006)	-0.008 (0.005)
Retained a grade	0.549* (0.006)	0.508* (0.007)	0.549* (0.006)	0.508* (0.007)
Skipped a grade	-0.427* (0.008)	-0.330* (0.009)	-0.427* (0.008)	-0.330* (0.009)
Constant	-0.074* (0.013)	-0.173* (0.015)	-0.074* (0.013)	-0.174* (0.015)
Observations	1,195,923	1,199,776	1,195,914	1,199,767
R-squared	0.24	0.21	0.24	0.21

NOTE: * indicates statistical significance at the 5-percent level. All models include a set of year-by-grade indicators. Standard errors, in parentheses, are adjusted for the clustering of students within schools.

Table A.3
Detailed Results for Table 4.3 in Chapter Four

Variable	Estimates by Student Years in Charters Model		Estimates by School Years in Operation Model		Interaction of Student and School Years Model	
	Math	Reading	Math	Reading	Math	Reading
Attended a charter, student's first year	-0.028 (0.037)	-0.072* (0.017)	—	—	—	—
Attended a charter, student's second year	0.043* (0.016)	-0.005 (0.019)	—	—	—	—
Attended a charter, student's third year or more	0.050 (0.028)	-0.039 (0.021)	—	—	—	—
Attended a charter, student first observed in charter	0.086* (0.022)	0.033 (0.023)	—	—	—	—
Attended a charter, charter's first year	—	—	-0.237* (0.060)	-0.111* (0.018)	—	—
Attended a charter, charter's second year	—	—	-0.043 (0.083)	-0.043 (0.027)	—	—
Attended a charter, charter's third year or beyond	—	—	-0.056* (0.013)	-0.026 (0.015)	—	—
Charter's first year, student's first year	—	—	—	—	-0.229* (0.060)	-0.122* (0.017)
Charter's second year, student's first year	—	—	—	—	-0.085 (0.091)	-0.031 (0.038)
Charter's second year, student's second year	—	—	—	—	0.013 (0.040)	-0.034 (0.042)
Charter's third year or beyond, student's first year	—	—	—	—	0.037 (0.024)	-0.068* (0.023)
Charter's third year or beyond, student's second year	—	—	—	—	0.057* (0.016)	0.004 (0.021)
Charter's third year or beyond, student's third year or beyond	—	—	—	—	0.073* (0.026)	-0.028 (0.021)
Transferred to a new school	-0.025* (0.006)	-0.007 (0.005)	-0.026* (0.006)	-0.008 (0.005)	-0.025* (0.006)	-0.007 (0.005)
Retained a grade	0.549* (0.006)	0.508* (0.007)	0.549* (0.006)	0.508* (0.007)	0.549* (0.006)	0.508* (0.007)
Skipped a grade	-0.427* (0.008)	-0.330* (0.009)	-0.427* (0.008)	-0.330* (0.009)	-0.427* (0.008)	-0.330* (0.007)
Constant	-0.075* (0.013)	-0.174* (0.015)	-0.075* (0.013)	-0.174* (0.015)	-0.074* (0.013)	-0.174* (0.015)
Observations	1,195,923	1,199,776	1,195,923	1,199,776	1,195,923	1,199,776
R-squared	0.24	0.21	0.24	0.21	0.24	0.21

NOTE: * indicates statistical significance at the 5-percent level. All models include a set of year-by-grade indicators. Standard errors, in parentheses, are adjusted for the clustering of students within schools.

Table A.4
Baseline Descriptive Means of Treatment and Control Groups for College-Enrollment Analysis, 1998–99 Through 2001–02

Variable	Treatment Group (charter 8th– charter 9th)	Comparison Group (charter 8th– TPS 9th)	All Charter 9th-Grade Students	All TPS 9th-Grade Students
School attended in grade 8	Charter	Charter	—	—
School attended in grade 9	Charter	TPS	Charter	TPS
Female (%)	57	51	57	48
White (%)	2	4	5	10
Black (%)	85	84	60	54
Hispanic (%)	13	12	34	32
Asian (%)	0	0	0.5	4
Free-lunch eligible in grade 8 (%)	90	89	94	94
Special education in grade 8 (%)	11	14	15	18
Switching schools between grades 6 and 8 (%)	25	27	14	13
Normalized 8th-grade ITBS math score	–0.23	–0.06	–0.05	0.07
Normalized 8th-grade ITBS reading score	–0.16	–0.07	–0.01	0.07
Students	369	326	1,690	125,669

Table A.5
Probit Estimates of Graduation and College Entry

Variable	Graduation	College Entry
Attend charter HS	0.072* (0.034)	0.105* (0.054)
Math score, grade 8	0.0016 (0.0008)	0.0015 (0.0009)
Reading score, grade 8	0.0022** (0.0008)	0.0032** (0.0008)
Female	0.075* (0.036)	0.075* (0.031)
Black	0.205* (0.098)	0.167 (0.077)
Hispanic	0.093 (0.103)	-0.031 (0.115)
Bilingual, grade 8	-0.006 (0.090)	0.149 (0.085)
Special education, grade 8	0.072 (0.044)	-0.017 (0.068)
Free-lunch eligible, grade 8	-0.037 (0.069)	0.009 (0.072)
Attended multiple schools between grades 6 and 8	-0.055 (0.041)	-0.069 (0.038)
Observations	978	695

NOTE: * indicates statistical significance at the 5-percent level. ** indicates statistical significance at the 1-percent level. Coefficient estimates are marginal effects. All models include a set of cohort indicators. Standard errors, in parentheses, are adjusted for the clustering of students within schools.

Table A.6
Full Results for ACT Regressions

Variable	Math	Reading	Composite
Attend charter HS	0.189 (0.131)	0.448* (0.202)	0.434** (0.162)
Math score, grade 8	0.071** (0.004)	0.030** (0.005)	0.053** (0.003)
Reading score, grade 8	0.013** (0.003)	0.076** (0.005)	0.045** (0.003)
Female	-0.058 (0.110)	0.870** (0.189)	0.476** (0.138)
Black	-0.516 (0.663)	-1.673* (0.657)	-0.906* (0.439)
Hispanic	-0.031 (0.680)	-0.845 (0.798)	-0.474 (0.499)
Bilingual, grade 8	-0.282 (0.269)	-1.294* (0.562)	-0.433 (0.347)
Special education, grade 8	0.596** (0.186)	-0.023 (0.273)	0.065 (0.168)
Free-lunch eligible, grade 8	-0.646** (0.230)	-0.795** (0.284)	-0.820* (0.408)
Attended multiple schools between grades 6 and 8	-0.260 (0.195)	-0.083 (0.197)	-0.210 (0.182)
Constant	-3.144** (1.083)	-8.876** (1.410)	-6.878** (1.113)
Observations	978	978	978
R-squared	0.57	0.50	0.64

NOTE: * indicates statistical significance at the 5-percent level. ** indicates statistical significance at the 1-percent level. All models include a set of cohort indicators. Standard errors, in parentheses, are adjusted for the clustering of students within schools and for the imputation of missing outcomes.

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