THE EFFECTS OF CHARTER HIGH SCHOOLS ON EDUCATIONAL ATTAINMENT

Kevin Booker Mathematica Policy Research, Inc. kbooker@mathematica-mpr.com

> Tim R. Sass Florida State University tsass@fsu.edu

Brian Gill Mathematica Policy Research, Inc. bgill@mathematica-mpr.com

Ron Zimmer Vanderbilt University ronald.w.zimmer@vanderbilt.edu

Abstract

We analyze the relationship between charter high school attendance and educational attainment in Florida and in Chicago. Controlling for observed student characteristics and test scores, we estimate that among students who attended a charter middle school, those who went on to attend a charter high school were 7 to 15 percentage points more likely to earn a standard diploma than students who transitioned to a traditional public high school. Similarly, those attending a charter high school were 8 to 10 percentage points more likely to attend college. We find even larger effects when we treat high school choice as endogenous.

This research was funded by generous grants from the Bill and Melinda Gates Foundation and the Joyce Foundation. We also wish to thank Phil Gleason, Elaine Allensworth, David Figlio, Dan Goldhaber, Eric Isenberg, and John Witte for valuable comments. John Gibson provided excellent research assistance. The authors are solely responsible for the analysis and conclusions in the paper, however.

I. Introduction

Charter schools have become one of the most widely used alternatives to traditional public schools and have received considerable attention among education researchers as a result. Most of the extant analyses focus on the achievement effects of charter attendance, using either student-level panel data sets (Ballou, Teasley and Zeider 2006; Bifulco and Ladd 2006; Booker et al. 2007; Hanushek, et al. 2007; Sass 2006; Soloman, Paark and Garcia 2001; Zimmer and Buddin 2006) or random assignment via lotteries (Hoxby and Murarka 2007; Hoxby and Rockoff 2004) to control for selection into charter schools. Beyond achievement effects, however, there has been only limited analysis of the impacts of charters on the students who attend them. Solmon and Goldschmidt (2004) study the relationship between charter attendance and student retention/mobility while Imberman (2007) considers the effect of charter schools on student behavior.

In this paper we seek to determine the effects of charter high school attendance on educational attainment. In particular, do charter high schools increase the likelihood a student will complete high school and attend college? Given the positive association between educational attainment and a variety of economic and social outcomes, an affirmative answer could have significant implications for the value of school choice.

Determining the influence of charter school attendance on educational attainment is not easy, however, due to the inherent selection problem associated with students who attend charter high schools rather than traditional public high schools. Students who select into charter high schools may be different in ways that are not readily observable from those who choose to attend traditional public high schools. The fact that the charter students and their parents actively sought out an alternative to traditional public schools suggests the students may be more

motivated or their parents may be more involved in their child's education than are the families of traditional public school attendees. Since these traits are not readily observable, they would be falsely attributed to the charter high school and thus bias the estimated impact of charter high schools on educational attainment.

The two methods of dealing with selection bias in achievement studies, student "fixed effects," and random assignment via lotteries, are not practical in the high school context. The fixed effects approach is applicable to situations where there are repeated outcome measures over time for a single student. Assuming that student/family characteristics are constant over time, the variation in test scores for students who move between traditional public schools and charters can be used to infer the differential impacts of the two types of schools on student achievement while holding student/family characteristics constant. However, since only a single outcome is observed in the present context (e.g. a student receives a high school diploma or not), the fixed effects approach cannot be used. Application of the lottery method is problematic in the high school context as well. In the student achievement literature, oversubscribed charter schools that accept students based on a lottery system provide a venue for a classic random assignment experiment. Students who apply and are accepted for admission ("lotteried-in students") can be compared to students who apply but lose out and must attend a traditional public school (ie. "lotteried-out" students). Unfortunately, there is little or no reliable information available on oversubscribed charter high schools which use lotteries to determine admission, making this approach infeasible in the present context.

We employ three methods to deal with the selection bias problem. The first strategy is to control for any observable differences in charter and non-charter high school students prior to high school entry. These include factors such as race/ethnicity, gender, disability status and

family income. Most important, however, is the use of eighth-grade test scores to capture differences in student ability and past educational inputs received prior to high school. Second, we focus on students who attended a charter school in grade eight, just prior to beginning high school. If there are unmeasured student/family characteristics that lead to the selection of charter high schools, these unmeasured characteristics ought to also lead to the choice of a charter school at the middle school level. Thus comparisons of traditional public school eighth graders and charter school eighth graders would likely be biased due to self-selection. The unobserved student/family characteristics should be relatively constant within the subgroup of charter eighth graders, however. This is the same approach that Altonji, Elder and Taber (2005) take in the context of evaluating Catholic high schools. Third, like Neal (1997) and Grogger and Neal (2000) do in their analyses of Catholic high schools, we exploit variation in the proximity to charters and other types of high schools to construct instruments for the choice of attending a charter high school. For many charter middle school students, attending a charter high school may be infeasible due to the unavailability of a charter high school within a reasonable distance.

We find that charter high schools in Florida and in Chicago have substantial positive effects on both high school completion and college attendance. Controlling for observed student characteristics and test scores, univariate probit estimates indicate that among students who attended a charter middle school, those who went on to attend a charter high school were 7 to 15 percentage points more likely to earn a standard diploma than students who transitioned to a traditional public high school. Similarly, those attending a charter high school were 8 to 10 percentage points more likely to attend college. The estimated effects from bivariate probit

¹ Restricting our analysis to students who attended charter middle schools strengthens the internal validity of our findings, but it may also limit the external validity of our results if charter high schools have differential effects on the types of students who attend traditional public middle schools. We discuss possible heterogeneity in charter school effects below.

models of charter high school attendance and educational attainment are even larger in Florida. While large, our estimates are in line with previous studies which find that Catholic high school attendance boosts high school graduate probabilities and college attendance rates by 10 to 18 percent and recent evidence that vouchers which allow students to attend private schools increase the likelihood of high school graduation by 12 to 13 percentage points.²

II. Data

The data required to analyze the impact of charter high schools on educational attainment are substantial. One must have data on school type and educational outcomes of individual students prior to high school, individual-level high school attendance and exit information as well as data on high school degree completion and college attendance after high school. On top of this, the jurisdiction studied must have a sufficient enrollment of students in charter high schools to provide reliable results. The areas we analyze, the state of Florida and the city of Chicago, are two of perhaps a handful of places where all of the necessary data elements are

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² Sander and Krautmann (1995), using data from 1980 High School and Beyond surveys, find Catholic high school attendance is associated with a 10 percentage point reduction in the high school dropout rate. Evans and Schwab, who also used the 1980 High School and Beyond data, estimate Catholic high school attendance raises the probability of high school graduation 12-13 percentage points and increases the likelihood of college attendance by 11-13 percentage points. Based on NLSY79 data, Neal (1997) finds Catholic high school attendance boosts the probability of graduating from high school 16 percentage points for urban minorities and 10 percentage points for whites in urban areas. Grogger and Neal, using NELS data from 1988-1994, find even larger effects. They estimate that Catholic high school attendance is associated with an 18 percentage point increase in expected graduation rates for urban minorities and a 17 percentage point increase in the likelihood of college attendance for all minority students. Based on experimental evidence from the DC Opportunity Scholarship Program, Wolf, et al. (2010) find that voucher participants are 12 percentage points more likely to complete high school than students in the control group. The differential was somewhat higher, at 13 percentage points, for students from schools designated as "in need of improvement." Winning the lottery and receiving a voucher was not associated with higher test scores, however. As a further check on the reasonableness of our results, we estimated the impact of charter high school attendance on 10th grade achievement test scores. The results, reported in Appendix Tables A10 and A11, yield generally insignificant achievement effects in Florida and small positive effects on the order of 0.15 standard deviations in Chicago.

currently in place.³ The two jurisdictions are obviously different on a number of margins, including region of the country, degree of urbanicity and the racial/ethnic mix of students. We view this diversity in the jurisdictions studied as an advantage. Obtaining qualitatively similar results for two such disparate jurisdictions provides evidence that our findings are not simply an artifact of the student mix or institutional structure and suggests our findings may be applicable to a wide variety of jurisdictions.

A. Florida

The Florida data come from a variety of sources. The primary source for student-level information is the Florida Department of Education's K-20 Education Data Warehouse (K-20 EDW), an integrated longitudinal data base covering all public school students and teachers in the state of Florida. The K-20 EDW includes detailed enrollment, demographic and program participation information for each student, as well as their reading and math achievement test scores.

As the name implies, the K-20 EDW includes student records for both K-12 public school students and students enrolled in community colleges or four-year public universities in Florida. The K-20 EDW also contains information on the Florida Resident Assistance Grant (FRAG), a grant available to Florida residents who attend private colleges and universities in Florida. This effectively allows one to track students who attend private institutions of higher education within Florida. Data from the National Student Clearinghouse, a national database that includes enrollment data on 3,300 colleges from throughout the United States, is used to

³ In fact, the only other state or major school district which we are aware of that likely has all of requisite data components is Texas.

track college attendance outside the state of Florida as well as any private college enrollment in Florida not picked up by the FRAG data.⁴

The identity and location of schools is determined by the Master School ID files (for public K-12 schools) and the Non-Public Master Files (for private schools) maintained by the Florida Department of Education. Grade offerings are determined by enrollment in the October membership survey and by the school grade configuration information in the relevant school ID file.

High school graduation is determined by withdrawal information and student award data from the K-20 EDW. Only students who receive a standard high school diploma are considered to be high school graduates. Students earning a GED or special-education diploma are counted as not graduating. Similarly, students who withdrew with no intention of returning or exited for other reasons such as non-attendance, court action, joining the military, marriage, pregnancy, and medical problems, but did not later graduate, are counted as not graduating. Students who died while in school are removed from the sample. It is not possible to directly determine the graduation status of students who leave the Florida public school system to attend a homeschooling program, to enroll in a private school or who move out of state. Similarly, some students leave the public school system for unknown reasons. In the sample, students whose graduation status is unknown are more likely to have lower eighth grade test scores and possess other characteristics associated with a reduced likelihood of graduation.⁵ They also are more likely to initially attend a traditional high school rather than a charter high school. To avoid possible bias associated with differential sample attrition, we impute the graduation status for

⁴ Information on the National Student Clearinghouse is available at www.studentclearinghouse.org.

⁵ Based on the information in Table 2, sample attrition in Florida is 22 percent for charter-to-traditional students and only 15 percent for charter-to-charter students. In Chicago the numbers are reversed: 13 percent attrition from the charter-to-traditional sample and 20 percent from the charter-to-charter sample.

those students whose graduation outcome is unknown, based on predicted values from a regression model of graduation.⁶ Since we can track college attendance both within and outside of Florida, no imputation is necessary for the college attendance variable. Any individual who does not show up as enrolled in a two-year or four-year college or university is classified as a non-attendee.

The available data cover four cohorts of eighth grade students. Statewide achievement testing for eighth grade students began in the 1997/98 school year, so the first cohort in the sample are students who attended eighth grade in 1997/98.⁷ The last available year of student data is 2004/05. Given that high school completion typically takes four years, this means the last cohort that can be tracked through high school are students who attended grade 8 in 2000/01.

B. Chicago

The Chicago data were obtained from the Chicago Public Schools Department of Postsecondary Education. The data include all students who attended charter schools in Chicago in eighth grade, whether they attended a charter high school or traditional public high school. The data cover five cohorts of 8th grade students, students who began 8th grade from the 1997/98 school year through the 2001/02 school year.

The data include student records for grades 8-12 from the Chicago Public Schools data system, with 8th grade ITBS math and reading scaled scores and information on student gender,

⁶ Imputation was done with the uvis procedure in Stata. All variables reported in Table 3, except for the charter high school attendance variable, were used to predict graduation. If students whose graduation status is unknown are removed from the sample (rather than having their graduation status imputed), we obtain similar, though somewhat larger estimated effects of charter attendance on high school graduation. If all students with an unknown graduation status are assumed to be drop outs, we obtain even larger estimated effects of charter high school attendance in Florida and comparable, though statistically insignificant effects in Chicago. See Tables 8 and 10.

⁷ Data on limited English proficiency (LEP) and special education program participation begins in 1998/99 and is thus not available for the first eighth-grade cohort. For these students we use their LEP and special education status in ninth grade.

race/ethnicity, bilingual status, free or reduced-price lunch status, and special education status. The data are also linked to the National Student Clearinghouse, which tracks college attendance for students who graduated from the Chicago Public School system.

High school graduation is determined by withdrawal information from the Chicago Public School data. Only students who receive a standard high school diploma are considered to be high school graduates. We do not have data on the exact timing of graduation for students in Chicago, just whether or not they ever graduated. Given the timing of our data, we know that at least five years have passed since high school entry for each cohort in our study. For students who leave the Chicago public school system, we impute their graduation status with a regression model as in Florida. For Chicago we only have college attendance data for students who graduated from the Chicago public school system, so we also impute college attendance for students with missing graduation data, using the same regression model as for graduation imputation.

III. Results

A. Summary Statistics by Transition Type

Table 1 provides an overview of the number of charters operating in Florida and Chicago, broken down by grade offerings and year. In Florida the number of charters operating grew rapidly, nearly tripling in number over the four years that the sample cohorts would have entered ninth grade. Traditional grade groupings dominate among Florida charter schools; roughly two-thirds of charter schools offer only elementary, middle or high school grades. Like Florida, the charter sector in Chicago experienced rapid growth; the number of charter schools expanded from 10 to 25 over the sample period. Unlike Florida, however, K-12 schools make up a much

larger share of charters in Chicago. Nearly one-quarter of all charter schools observed in Chicago offer elementary, middle and high school grades while at most three charter schools offering only high school grades existed during any one year within the period of study.

Figures 1A and 1B illustrate the geographical distribution of charters in Florida for the first and last cohorts of our sample. In addition to the overall growth in charters, the figures show the dynamic nature of the charter offerings over time. Schools enter and leave and some schools change their grade configurations over time. Further, with the exception of the panhandle region, which has relatively few high-school-only charters, there are a variety of charter schools with differing grade configurations in each area of the state.

Summary statistics on student characteristics and educational attainment are provided in Table 2. For each jurisdiction the students are broken down by transition type: charter middle school to traditional public high school and charter middle school to charter high school.⁸ The full sample includes over 5,000 students: over 4,200 students from Florida and nearly 1,000 students from Chicago.⁹

The raw data reveal substantial differences in educational attainment between charter and traditional public high school attendees. In Florida, 57 percent of students who went from a charter school in eighth grade to a traditional public school in grade 9 received a standard high school diploma within four years whereas 80 percent of students attending a charter school in grade nine earned their diploma within four years. In Chicago, 68 percent of charter middle

⁸ Throughout the analysis, exposure to a charter high school is defined by the type of school a student attends in grade 9, whether or not they subsequently stay in that type of school. As illustrated in appendix Table A7, significant numbers of students switch school types (primarily from charters back to traditional public schools) after ninth grade. Excluding these students has little effect on the results, however (see Table A8). Nonetheless, the estimates of charter school effects should be interpreted as an "attempt to treat."

⁹ The estimation samples are somewhat smaller, about 3,600 in Florida and 980 in Chicago, due to missing data for some explanatory variables.

school students who transitioned to a traditional public school in grade nine eventually received their high school diploma whereas 75 percent of students who transitioned to a charter high school received their diplomas. Similar differentials are found for college attendance as well. In Florida, 56 percent of students attending a charter school in grade 9 went to either a two-year or four-year post-secondary institution within five years of starting high school whereas among students who started high school in a traditional public school the college attendance rate was only 40 percent. In Chicago, the gap in college attendance is smaller but still sizable: 49 percent for charter high school attendees and 38 percent for charter middle school students who go to a traditional public high school.

B. Probit Estimates of the Determinants of Educational Attainment

Tables 3 and 4 contain marginal probabilities (evaluated at the sample means) from probit estimates of the determinants of high school graduation and college attendance, respectively. The estimated models include controls for student demographics, English language skills, special education program participation, family income (proxied by free/reduced-price lunch status) and mobility during middle school.¹⁰ Student ability and prior educational inputs are accounted for by inclusion of eighth grade test scores in math and reading.¹¹

The estimated impact of charter high school attendance on the probability of obtaining a high school diploma is positive in both Florida and Chicago. In Chicago, students who switched

¹⁰ English language skills in Florida are measured by participation in a Limited English Proficiency (LEP) program. For Chicago, English language skill is measured by participation in a Bilingual program. Student mobility is measured by an indicator for students who changed schools between grades six and seven or between grades seven and eight.

¹¹ In Florida, we use the student's scale scores on the FCAT-SSS test, a criterion-referenced test based on the state's curriculum standards. The Stanford Achievement Test is also administered to students in Florida, but administration of the Stanford test did not begin until the 1999/2000 school year. In Chicago, we use the student's scale score on the Iowa Test of Basic Skills, a criterion-referenced test used in Illinois during this period.

from a charter middle school to a charter high school were seven percentage points more likely to earn a regular high school diploma than their counterparts with similar observable characteristics who attended a traditional public high school. The graduation differential for Florida charter schools was even higher at 12 to 15 percentage points, depending on whether a four-year or five-year window for graduation is used. Graduation rates are also positively correlated with eighth grade achievement scores, with a statistically significant relationship in both Florida and Chicago. Females have higher graduation rates than males in both jurisdictions, all else equal. Further, conditional on eighth grade achievement levels as well as other demographic characteristics, blacks have higher graduation rates than whites in both Florida and Chicago. Controlling for language status and family income as well as test scores, Hispanic students are more likely to earn a high school diploma than Anglos, though the result is statistically significant only in Florida.

The findings for college attendance, presented in Table 4, are remarkably similar in Florida and Chicago. A student who attended a charter school in eighth grade and transitioned to a charter high school in grade nine is 8 to 10 percentage points more likely to attend a post-secondary institution within five years of starting high school than a similar student who attended a traditional public high school.¹⁴

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¹² The use of a five-year window for graduation lowers the number of observations significantly because we lose one cohort from the sample.

¹³ While the observed positive correlation between special education status and receipt of a standard high school diploma may appear anomalous, it is not necessarily so. Students with the most profound disabilities are exempted from testing and are thus excluded from our sample. Further, we are conditioning on eighth grade test scores. Our results indicate that *if* a student receiving special education services had the same test score in middle school as a non-disabled student they would be more likely to earn a standard high school diploma. However, on average students with disabilities tend to have lower test scores than their typical peers.

¹⁴ We also estimated the college attendance model using a six-year window. Tracking students six years past eighth grade reduces the number of cohorts and thus attenuates the sample size significantly, particularly in Chicago. Using the six-year window, the effect of charter high school attendance on college attendance remains positive and significant in the Florida sample but is positive and statistically insignificant in the Chicago sample. Using the six-

In the results presented thus far, possible selection bias is mitigated in two ways. First, by including student/family characteristics as explanatory variables we control for observable differences between students who attend charter high schools and those that go to traditional public high schools. Second, by limiting the sample to students who attended a charter school in eighth grade we indirectly control for unobserved student/family traits that may be correlated with charter school attendance.

Despite our focus on charter middle school students and the use an extensive set of controls for observable student characteristics, there still exists the possibility that our estimates of the effects of charter high school attendance are biased due to unobserved student/family traits that influence both high school choice and subsequent educational attainment. Consider the following bivariate probit model:

$$C^* = \beta_1 X_1 + u_1 \tag{1}$$

$$A^* = \beta_2 X_2 + \gamma C + u_2 \tag{2}$$

where C* and A* are latent variables and X₁ and X₂ are vectors of exogenous variables. We observe the binary choice, C, indicating charter high school attendance, where C=1 if C*>0 and C=0 if $C^* \le 0$. Likewise, we observe the binary outcome, A (either attainment of a high school diploma or college attendance, as applicable), where A=1 if $A^*>0$ and A=0 if $A^*\leq 0$. The error terms, u₁ and u₂, are distributed as bivariate normal with mean zero, unit variance and correlation coefficient ρ . Our probit estimates are based on the assumption that, conditional on X_2 and the subsample of charter middles school students, u₁ and u₂ are uncorrelated and rho is zero.

year-window sample in Chicago, but estimating the probability of attending college within five years of eighth grade

yields similar results, suggesting the differential effects between the five-year and six-year estimates are due to the reduction in sample size, rather than lengthening the window in which to observe college attendance.

However, unobserved changes which occur between eighth and ninth grade that influence both high school choice and subsequent educational attainment would yield non-zero values of rho. For example, dissatisfaction with performance in a charter middle school that is not captured by test scores (e.g. discipline issues or a poor fit between the student's interests/ability and the curriculum being offered)) could lead parents to choose to send their child to a traditional public high school and be correlated with later performance in high school. Depending on the forces behind high school choice this could impart either a negative or a positive bias on the estimated impact of charter high school attendance on educational attainment.

To allow for the possibility of unmeasured factors affecting both high school choice, C, and educational attainment, A, and develop further safeguards against selection bias we estimate a bivariate probit model as described by equations (1) and (2). This requires developing an empirical model of high school choice, which we consider next.

C. Determinants of Charter High School Attendance

As demonstrated by Neal (1997), Grogger and Neal (2000) and Altonji, et al. (2005), high school choice is determined in part by physical proximity.¹⁵ In the charter context this can play out in two ways. First, some charter schools offer both middle and high schools grades, effectively making the transition cost zero.¹⁶ Second, when a student must switch schools to

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¹⁵ While one would expect that school choice is determined in part by physical proximity, using measures of the availability of charter schools is potentially problematic if charter location is governed by unmeasured factors that are correlated with educational attainment. In appendix table A3 we show that the correlation between district-level graduation rates in Florida and the number of charter high schools in a district is quite low. Similarly, in appendix table A4 we show that controlling for unobserved differences across districts in Florida with district fixed effects has little effect on our results. These low correlations must be interpreted with caution, however, given the large geographic size of Florida's countywide school districts.

¹⁶ While most charters schools offering middle and high school classes have all grades in the same location, this is not universal. In a few instances there can be one common administration but the high school campus may be physically separate from the middle school campus.

attend high school, distance can vary greatly; the nearest charter high school may either be down the street or many miles away.

In addition to spatial location, the match between the attributes of schools and parental/student preferences will also affect the decision to attend a charter high school or a traditional public high school. For example, in the Catholic school literature, religious affiliation is often used as an instrument for the choice to attend a Catholic school. Although we do not observe many of the attributes of schools, like curricular emphasis and course offerings, directly, we use the availability of private schools as a gauge of the similarity of charter and traditional public school alternatives. Most private schools pre-date charters in our sample and competition from privates likely had an impact on the operation of traditional public schools even before charters came on the scene. Similarly, charter school entrants would likely take into account the availability and characteristics of nearby private schools when designing their schools. In a simple product variety model of competition, private schools would initially offer a mix of attributes that differs significantly from that of traditional public schools. If charters enter an environment with significant private-school penetration, they would tend to locate "closer" to traditional public schools in product attribute space than if no private-school competitors existed.¹⁷ Thus we would expect that in areas where there is vibrant competition from private high schools, students would be less likely to choose a charter high school over a traditional high school because the charters would be more similar to the traditional public schools. 18

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¹⁷ Glomm, Harris and Lo (2005) also use a product differentiation approach and similar reasoning to empirically analyze the location decisions of charter schools.

¹⁸ Locating between traditional public schools and private schools in product attribute space, charters would also expect to draw away families who would otherwise go to private schools. Indeed, depending on the size of the private sector and the distribution of consumer preferences, charters may choose to adopt attributes similar to private schools. We would expect, however, that charters to be at least somewhat more similar to traditional public schools than are privates to traditional public schools. If traditional public schools responded to pre-existing private-school competition by making their product "closer" to the offerings of private schools, there would be less "distance"

We measure the grade configurations of charter schools by an indicator for whether or not a student's grade-8 charter school offered grade 9 in the year after they attended eighth grade. We measure the physical proximity of other charter high schools by the minimum linear distance from a student's eighth-grade charter to a different charter school offering grade 9 and by the number of other charter high schools within various radii. Similarly, in Florida we capture the time cost of a attending a traditional public school by the distance to the nearest traditional public high school. As in recent work by Barrow, Claessens and Schanzenbach (2009) on "small schools" in Chicago, we do not include a measure of traditional high-school proximity since there is not much variation in the distance to the nearest traditional high school within the City of Chicago. Because traditional public school students are usually required to attend their neighborhood school, we do not include a count of the number of nearby traditional public high schools in either Florida or Chicago.

In Table 5 we present probit estimates of the choice of attending a charter school in grade nine as a function of both the grade offerings of a student's middle school and the availability of other school alternatives. Separate results are presented for various radii from the student's middle school location. As one would expect, the availability of ninth grade in the same school a student attended in eighth grade generally has a large positive impact on the likelihood of

between traditional public schools and private schools, which would also reduce the expected enrollment in charter schools.

¹⁹ Summary statistics on the transition patterns of students by the range of grades that were offered by the charter school they attended in grade 8 are provided in appendix table A1. Consistent with expectations, in both Florida and Chicago, students whose grade 8 school also offered at least some high school grades were much more likely to attend a charter school in grade 9 than were students who had to switch schools in order to continue in a charter in grade 9.

²⁰ In Table A2 of the appendix we provide information on the number of charter school options available to Florida students within 10, 5 and 2.5 miles of the charter school they attended in grade 8. As expected, students who go on to a charter school in grade 9 have more charter schools to choose from within a given distance than do students who transition to traditional public schools.

attending a charter school in grade 9. With the exception of the 2.5-mile radius in Chicago, the availability of ninth grade in the same school raises the probability of attending a charter high school from 31 to 49 percentage points, depending on the jurisdiction and the size of the geographic area under consideration. Holding constant the number of charter schools within a given area, an increase in the distance to the nearest charter high school decreases the likelihood of attending a charter high school in Florida, as one would expect, though the estimates are imprecise and never statistically significant. Similarly, as expected, increases in the distance to the nearest traditional public high school are positively correlated with the likelihood of attending a charter school in grade 9, though once again the effects are not statistically significant. Consistent with competition on product variety, the number of private schools is negatively correlated with the probability of attending a charter school in ninth grade, though the effect is only statistically significant for the 5-mile radius in Florida.

There exists the possibility that the determinants of high school choice also affect educational attainment (i.e. the vectors X_1 and X_2 in equations (1) and (2) share some elements). For example, if combining middle and high school grades improves student learning or fosters greater school attachment, then schools that offer both grades 8 and 9 may have positive effects on both the likelihood of attending a charter school in grade 9 and the probability of graduating from high school. In Table 6 we present Wald tests of exclusion restrictions in univariate probit estimates of the attainment equations for various combinations of the explanatory variables used in the high school choice equation.²¹ For Florida, the number of charter schools and the number of private schools within five miles can be excluded from the graduation equation and those two variables plus the indicator for schools offering grade 9 can be excluded from the college

²¹ Formally, a test of exclusion restrictions requires an over-identified system where all instruments are valid. However, it is common practice in the empirical literature to conduct the sort of informal tests we utilize here.

attendance equation. Unfortunately, for Chicago, none of the determinants of high school choice can be excluded from the graduation equation and only the number of other charter and private high schools (neither of which is a significant determinant of high school choice in Chicago) can be excluded from the college attendance equation. Thus, in the case of Chicago we do not possess strong instruments and must rely primarily on the non-linearity of the bivariate probit for identification.

D. Bivariate Probit Estimates of the Determinants of Educational Attainment

Estimates of the charter high school effect from bivariate probit regressions of educational attainment are presented in Table 7. For the charter high school attendance equation we use the five-mile radius specification from Table 5 for both Florida and Chicago, since it provided the best fit. The outcome equations include all of the variables from the univariate analysis plus all non-excludable variables from the high school choice equation. In Florida we continue to find highly significant positive correlations between charter high school attendance and both receipt of a high school diploma and college attendance. The magnitudes of the estimated charter-school effects are relatively large, rising to a 19 percentage point differential in high school graduation and a 20 percentage point difference in the likelihood of college attendance. For the bivariate probit estimate of high school graduation in Chicago the estimated impact of charter high school attendance falls to less than one percent and is statistically insignificant. This is perhaps not surprising, given the lack of good instruments and reliance on non-linearities for identification in the Chicago sample. The bivariate probit estimates of the charter high school effect on college attendance in Chicago are of similar magnitude to the univariate probit estimates, but like the bivariate probit estimates for high school graduation, are statistically insignificant.

The larger estimated coefficients for Florida charters in the bivariate probit model as well as the negative estimated cross-equation correlations (rho) suggest a possible negative selection bias. To the extent there is self-selection, it is the students who are less likely to graduate (conditional on observed characteristics) who are choosing to attend charter high schools.²² We can only speculate as to why this is so. It is possible that parents whose children are at risk of dropping out are more likely to choose charter high schools in a belief that the traditional public school environment would make it more likely that their child leaves school early. However, for both Florida and Chicago the estimates of rho in the high school graduation and college attendance analyses are not statistically significant. Therefore we fail to reject the null that high school choice (conditional on attending a charter middle school and all of the controls for observables) is exogenous. Put differently, we cannot reject the null that the univariate probit estimates are unbiased.²³

Given the lack of good instruments for high school choice in Chicago and the failure to reject exogeneity of school choice, we only report univariate probit estimates for Chicago in the remainder of the paper. We do report both univariate and bivariate probit estimates for Florida. However, based on failure to reject exogeneity of the choice of high school type, we place greater confidence in the univariate probit results.

²² Interestingly, Neal (1997), as well as other papers in the Catholic high school literature he cites, also finds a negative selection effect. Neal conjectures that affluent parents with strong preferences for educational quality are more likely to live in suburban areas with elite public schools and thus Catholic high schools may not attract students with the best (unobserved) traits.

²³ As demonstrated by Monfardini and Radice (2008), under correct distributional assumptions the lack of availability of valid instruments does not preclude proper testing of the exogeneity status of charter high school choice, but the estimated correlation coefficient, rho, may be highly misleading.

E. Robustness Checks

As described above, graduation indicators (and college attendance in Chicago) were imputed for students whose graduation status could not be directly determined because they left the public schools or moved out of the jurisdiction. This was done to avoid potential attrition bias. We show in Tables 8 (for Florida) and 10 (for Chicago), however, that simply dropping students whose educational attainment is unknown and not imputing any values yields qualitatively similar results. Likewise, in Florida we also demonstrate that treating all those whose status is unknown as dropouts does not change our basic findings. In Chicago, assuming students with unknown status are all dropouts has little effect on the point estimate of the impact of charter high schools on the likelihood of graduation, but the estimate is no longer significantly different from zero.

In order to determine if the higher college attendance rates associated with charter high school attendance are due solely to enhanced high school graduation, we also estimate the college attendance equation, restricting the sample to high school diploma recipients. In Florida, this makes very little difference on the estimated effect of charter high school attendance in the univariate probit estimation and reduces the point estimate by about a third in the bivariate probit model. These findings suggest that charter high schools in our sample do something that promotes college attendance beyond simply increasing the likelihood of high school graduation. For Chicago, the story is less clear; the estimated impact of charter high school attendance on the likelihood of college attendance among high school graduates is positive, but not statistically significant.

Given that charter high schools tend to be much smaller than traditional public high schools, school size and charter status may be confounded in our baseline analysis. Put

differently, what appear to be charter school effects could simply be school size effects. In order to disentangle the effects of school size and school type on educational attainment we reestimated the high school graduation and college attendance models with an additional control for the total number of students attending the school. The results, presented in Tables 9 and 10, are comparable to those from the baseline model for both Florida and for Chicago, indicating the estimated charter high school differentials are not due to differences in school size.

We attempt to distinguish between pure achievement effects and educational attainment effects of charters by including controls for tenth grade math and reading achievement scores. As indicated by the estimates reported in Tables 9 and 10, controlling for 10th grade test scores reduces the estimated charter high school effect on graduation by more than half in Florida but reduces the impact less than 20 percent in Chicago. Controlling for tenth grade test scores has an even smaller effect on the estimated impact of charter high school attendance on college enrollment, altering the estimated magnitude by only about 10 percent in both Florida and Chicago. This suggests that the differential effects of charter schools on educational attainment are not due solely to measured achievement differences in charter and traditional public high schools. One possibility is that the tenth-grade scores are picking up additional information about students, not captured by their eighth-grade scores alone.²⁴

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²⁴ We also separately estimated the relationship between charter high school attendance and student achievement. Results are reported in Tables A10 and A11 of the appendix. We find some evidence of a positive effect of charter high school attendance on achievement in Chicago, but not in Florida. This difference may simply reflect differences in the tests across the two jurisdictions. In Chicago, students take the national ACT college entrance exam while tenth graders in Florida take a Florida-specific criterion reference exam. High school effects in Florida would be muted if the exam tests concepts that many students learn in middle school. Previous work on charter school achievement effects in Chicago and Florida has focused primarily on elementary and middle schools. In Chicago, Hoxby and Rockoff (2004) find positive achievement effects for charter school students who entered in the lower elementary grades, but not for those who started charter school in the upper elementary grades. In Florida, Sass (2006), using a combined sample of elementary, middle and high-school charters finds that student achievement is lower in new charter schools than in the average traditional public school, but charters improve as they mature. By their fifth year of operation, charters are on par with traditional public schools in math ande have a small advantage in reading achievement.

In the traditional public school sector in both Chicago and Florida, high schools are almost always separate from middle schools. This is not the case for charter schools, however. As noted in Table 1, in 2001/02 18 of 82 or about 22 percent of charter schools in Florida offering middle-school grades also offered some or all high school grades. In contrast, in Chicago 6 of 15 or 40 percent of charter schools in 2001/02 offered both middle and high school grades. As a result, about 30 percent of Florida charter eighth-grade students attended schools that also offered at least some high-school grades. In Chicago, nearly half of the eighth-grade charter school students could attend at least some high school grades (grades 9-12) without changing schools. Indeed, over 70 percent of the Chicago students who attended charter schools in both grades eighth and nine were in schools offering both middle-school and high school grades. This raises the concern that the measured effects of charter high school attendance on educational attainment could simply reflect advantages of grouping middle and high school grades together rather than differences in curriculum, organization or employment practices between charters and traditional public schools.

Given the preponderance of charters offering both middle and high school grades it is not possible to clearly identify grade configuration effects in Chicago. However, we can disentangle grade configuration effects from pure charter-school effects in Florida, where there are a significant proportion of high-school-only charters. To do this, we restricted the Florida sample to those students whose eighth-grade charter school did not offer grade nine and re-estimated both the simple probit and bivariate probit models of high school graduation and college attendance.²⁵ The resulting estimates are presented in the fifth panel of Table 8. For both high school graduation and college attendance, restricting the sample produces estimates of the

²⁵ Since schools offering grade nine are removed from the sample, the first stage of the bivariate probit excludes the "Eighth Grade Charter Offers Grade 9" variable.

univariate probit model that differ from the original estimates by only about two percentage points. In the bivariate probit model of high school graduation, using the restricted sample yields estimates of the charter high school effect that are not significantly different from zero. In contrast, bivariate probit estimates of the effect of charter high school attendance on college enrollment are nearly equal to those from the original sample and are statistically significant at better than a 95 percent confidence level. These findings suggest that while combining middle and high school grades may enhance the likelihood of high school graduation (at least in the charter sector), the positive association between charter high school attendance and educational attainment is not primarily due to differences in grade configurations between charters and traditional public schools.

Even when grade configurations are taken into account, charter middle school students who go to a charter high school may experience a different transition than their classmates who go on to attend a traditional public high school. In particular, as noted in Table 2, students who stay in the charter sector have a much larger fraction of their eighth-grade schoolmates as peers in high school. We control for peer-group stability when estimating charter high school effects in the last panel of Table 9. Unfortunately, given the high degree of collinearity between charter high school attendance and peer-group stability, it is hard to disentangle the two effects. When peer-group stability is included the charter high-school effects become insignificant in all but he college-attendance bivariate probit.

Another potential concern is that a number of charter schools in Florida are former traditional public schools that converted to charter status (no charter high schools in Chicago were conversion charters). If conversion schools were better-than-average traditional public schools to begin with, they may be distorting the estimated impact of charters on educational

attainment. To account for a differential impact of conversion charters we employed two strategies. First, we simply excluded conversion charters from the sample. Second, we used the full sample, but added a conversion charter interaction term and re-estimated the graduation and college attendance equations. As shown in Table 8, removing conversions from the sample does not qualitatively change our results. We still find positive effects of charter high school attendance on the probability of graduation and college attendance. The point estimates bounce around a bit, falling in the univariate probit graduation and bivariate probit college attendance equations and rising in the graduation bivariate probit. However, all remain quantitatively substantial. Results with the full sample and a conversion charter interaction term are provided in Table 9. Conversion charters have significantly greater effects on high school graduation than do de-novo charters, though the impact of non-conversion charters is still sizable in magnitude (nearly equal to the estimate in Chicago) and statistically significant. For college attendance, we observe no significant differential impact of attending a conversion charter and the correlation between attending a de-novo charter and college attendance is still positive and statistically significant.

F. Heterogeneous Effects of Charter School Attendance

In the literature on Catholic high schools, considerable attention has been paid to differential effects of Catholic school attendance on educational attainment across student racial/ethnic groups and between urban and suburban areas. For example, Grogger and Neal (2000) find that minority students in urban settings experience the greatest gains in educational attainment from Catholic school attendance. While a detailed examination of variation in charter school effects across student race/ethnicity and location is beyond the scope of the present paper,

we present a limited analysis of possible heterogenous effects in an appendix.²⁶ Like the Catholic school literature, we find the estimated impact of charter high school attendance on educational attainment in Florida is much greater for charters located in urban areas. In contrast, we find no difference in the impact of high school charters on high school graduation by student race/ethnicity. For college attendance we find no differences by race, but the charter high school effect is larger for Hispanics than for Anglos.

IV. Summary and Conclusions

While a number of recent studies analyze the relationship between charter school attendance and student achievement, this is the first analysis of the impacts on educational attainment of charter school attendance. Like student achievement analysis, the study of educational attainment in charters is problematic due to the self-selection of students into charter schools. We deal with the selection problem by controlling for numerous observable student characteristics, restricting the sample to students who attended a charter middle school, and employing high school proximity measures as instruments.

Applying these methods, we find that charter schools are associated with a higher probability of successful high school completion and an increased likelihood of attending a two-year or a four-year college in two disparate jurisdictions, Florida and Chicago. The reasons for these differentials are not clear. We show that they are not driven by the smaller size of charter schools and are only partially explained by achievement differences between charters and traditional public schools. There is certainly room for future work to explore curricular differences, differences in expectations engendered by different environments and other factors

²⁶ See Tables A13-A15 in the appendix.

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that may cause charter schools to diminish the high-school dropout rate and promote postsecondary schooling.

Our findings are consistent with recent work on the efficacy of Catholic schools, which find large positive effects of Catholic high school attendance on educational attainment. They are also in line with recent experimental evidence indicating that a voucher program in the District of Columbia significantly boosts high school graduation rates. While just a first step, the results presented here, in the experimental DC voucher study, and in the Catholic school literature suggest that expanding school choice at the high school level may be a part of an effective policy to reduce high school dropout rates and to promote college attendance.

References

- Altonji, Joeseph G., Todd E. Elder and Christopher R. Taber. 2005. Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools. *Journal of Political Economy* 113, no. 1:151-184.
- Ballou, Dale, Bettie Teasley, and Tim Zeidner. 2006. A Comparison of Charter Schools and Traditional Public Schools in Idaho. Unpublished manuscript, Vanderbilt University, Nashville.
- Barrow, Lisa, Amy Claessens and Diane Whitmore Schanzenbach. 2009. The Impact of Small Schools in Chicago: Assessing the Effectiveness of Chicago's Small High School Initiative. Unpublished manuscript, University of Chicago, Chicago.
- Bifulco, Robert and Helen F. Ladd. 2006. The Impacts of Charter Schools on Student Achievement: Evidence from North Carolina. *Education Finance and Policy* 1, no. 1:50–90.
- Booker, Kevin, Scott M. Gilpatric, Timothy Gronberg and Dennis Jansen. 2007. The Impact of Charter School Attendance on Student Performance. *Journal of Public Economics* 91, no. 5-6:849-876.
- Evans, William N. and Robert M. Schwab. 1995. Finishing High School and Starting College: Do Catholic Schools Make a Difference? *Quarterly Journal of Economics* 110, no. 4: 941-974.
- Glomm, Gerhard, Douglas Harris, and Te-Fen Lo. 2005. Charter School Location. *Economics of Education Review* 24:451-457.
- Grogger, Jeffrey, and Derek Neal. 2000. Further Evidence on the Effects of Catholic Secondary Schooling. *Brookings-Wharton Papers on Urban Affairs* 2000:151-201.
- Hanushek, Eric A., John F. Kain, Steven G. Rivkin, and Gregory F. Branch. 2007. Charter School Quality and Parental Decision Making with School Choice. *Journal of Public Economics* 91, no. 5-6:823-848.
- Hoxby, Caroline M., and Sonali Murarka. 2007. The Effects of New York City's Charter Schools on Student Achievement. Unpublished manuscript, Harvard University, Cambridge.
- Hoxby, Caroline M., and Jonah E. Rockoff. 2004. The Impact of Charter Schools on Student Achievement. Unpublished manuscript, Harvard University, Cambridge.
- Imberman, Scott A. 2007. Achievement and Behavior in Charter Schools: Drawing a More Complete Picture. Unpublished manuscript, University of Houston, Houston.

- Monfardi, Chiara, and Rosalba Radice. 2008. Testing Exogeneity in the Bivariate Probit Model: A Monte Carlo Study. *Oxford Bulletin of Economics and Statistics* 70, no. 2:271-281.
- Neal, Derek. The Effects of Catholic Secondary Schooling on Educational Achievement. *Journal of Labor Economics* 15, no. 1, pt. 1:98-123.
- Sander, William, and Anthony C. Krautman. 1995. Catholic Schools, Dropout Rates and Educational Attainment. *Economic Inquiry* 33 (April):217-233.
- Sass, Tim R. 2006. Charter Schools and Student Achievement in Florida. *Education Finance and Policy* 1, no. 1:91–122.
- Solmon, Lewis C. and Pete Goldschmidt. 2004. Comparison of Traditional Public Schools and Charter Schools on Retention, School Switching, and Achievement Growth The Goldwater Institute, ," Phoenix, AZ.
- Solmon, Lewis, Kern Paark and David Garcia. 2001. Does Charter School Attendance Improve Test Scores? The Arizona Results. The Goldwater Institute, Phoenix, AZ.
- Wolf, Patrick, Babette Gutman, Michael Puma, Brian Kisida, Lou Rizzo, Nada Eissa, and Matthew Carr. 2010. Evaluation of the DC Opportunity Scholarship Program: Final Report. Washington DC: U.S. Department of Education.
- Zimmer, Ron, and Richard Buddin. 2006. Charter School Performance in Two Large Urban Districts. *Journal of Urban Economics* 60, no. 2:307-326.

Table 1

Number of Charter Schools in Operation by Grade Range and Year

	Florida				Chicago				
Grade Offerings	98/99	99/00	00/01	01/02	98/99	99/00	00/01	01/02	02/03
Elementary	25	37	52	68	2	2	11	9	7
Elementary, Middle and H.S. Grades	2	5	4	8	2	2	6	6	6
Elementary and Middle Grades	15	21	35	40	1	2	7	9	11
Middle Grades Only	12	20	23	24	1	1	0	0	0
Middle and Some H.S. Grades	2	4	1	3	1	0	0	0	0
Middle and All H.S. Grades	6	5	6	7	1	2	0	0	0
Only H.S. Grades	5	13	20	26	2	3	1	1	1
Total	67	105	141	176	10	12	25	25	25

Note: number of charter schools and grade ranges based on student membership counts.

Table 2
Descriptive Statistics by Transition Type

	Florida				Chi	cago		
	Charter in G8,					rter in G8		
	Trad	itional in G9		er in G8, ter in G9	Trac	litional in G9		ter in G8, rter in G9
	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
Any College in 5	1526	0.402	572	0.556	295	0.383	299	0.488
4 - Yr College in 5	1523	0.148	570	0.305				
HS Diploma in 4	2149	0.571	1066	0.795				
HS Diploma in 4 (with imputuation)	2762	0.567	1259	0.770				
HS Diploma in 5	1123	0.568	460	0.783				
HS Diploma in 5 (with imputation)	1445	0.566	551	0.764				
HS Diploma Ever					456	0.678	381	0.753
HS Diploma Ever (with imputation)					523	0.597	474	0.636
Math Score, G8	2831	291.258	1293	310.083	517	246.342	471	236.896
Reading Score, G8	2818	283.195	1283	300.984	515	240.309	471	232.406
Female	2914	0.467	1304	0.486	523	0.530	474	0.563
Black	2893	0.370	1295	0.178	523	0.834	474	0.835
Hispanic	2893	0.106	1295	0.189	523	0.132	474	0.143
Asian	2893	0.010	1295	0.017	523	0.002	474	0.000
LEB/Bi-Lingual in G8	2914	0.009	1304	0.023	523	0.082	474	0.093
Special Ed in G8	2914	0.152	1304	0.103	523	0.134	474	0.108
Free/R-P Lunch in G8	2914	0.411	1304	0.225	463	0.896	395	0.896
Change Schools in G7-8	2663	0.674	1175	0.716	523	0.264	474	0.272
1997 G8 Cohort	2914	0.027	1304	0.001				
1998 G8 Cohort	2914	0.115	1304	0.102	523	0.061	474	0.114
1999 G8 Cohort	2914	0.382	1304	0.336	523	0.153	474	0.190
2000 G8 Cohort	2914	0.476	1304	0.561	523	0.203	474	0.177
2001 G8 Cohort					523	0.231	474	0.306
2002 G8 Cohort					523	0.352	474	0.213
Proportion of G9 Schoolmates Who Were Schoolmates in G8	2912	0.041	1303	0.603	523	0.032	474	0.153

Table 3
Probit Estimates of Receiving a Standard High School Diploma

Proble Estimates of	The state of the s	lorida	Chicago
	Within 4 Years	Within 5 Years	Within 5+ Years
Attand Charter II C	0.1223**	0.1481**	0.0741*
Attend Charter H.S.	(0.0318)	(0.0375)	(0.0376)
Moth Soora Grada 9	0.0033**	0.0034**	0.0016*
Math Score, Grade 8	(0.0003)	(0.0004)	(0.0008)
Reading Score, Grade 8	0.021**	0.0018**	0.0023**
Reading Score, Grade 8	(0.0002)	(0.0003)	(0.0007)
Female	0.0678**	0.0474 +	0.0682*
remate	(0.0159)	(0.0268)	(0.0331)
Black	0.0559**	0.1062**	0.1961*
	(0.0202)	(0.0329)	(0.0928)
Hispanic	0.0912**	0.1184*	0.0875
Тизранс	(0.0275)	(0.0445)	(0.1080)
Asian	0.0993	0.1446	
Asian	(0.0864)	(0.1100)	
LEP/Bilingual, Grade 8	0.0628	0.1192	-0.007
ELI/Billigual, Glade 6	(0.0956)	(0.1345)	(0.0890)
Special Ed, Grade 8	0.0931**	0.0792*	0.0846+
Special Ed, Glade 6	(0.0309)	(0.0379)	(0.0450)
Free/Reduced-Price	-0.1718**	-0.1300**	-0.0292
Lunch, Grade 8	(0.0240)	(0.0329)	(0.0636)
Changed Schools, Grade	-0.0744**	-0.0165	-0.048
7 or Grade 8	(0.0249)	(0.0365)	(0.0380)
Observations	3642	1784	978

Note: All models include a set of cohort indicators. Coefficient estimates are marginal effects. Standard errors adjusted for clustering at the school level are in parentheses.

⁺ significant at 10%, * significant at 5%, ** significant at 1%.

Table 4
Probit Estimates of Attending a Two-Year or Four-Year College Within 5 Years

Froon Estimates of Attenuing a Two-Tear of Fo		viumi 5 i cais
	Florida	Chicago
Attend Charter H.S.	0.0823**	0.1028*
Titlella Charter His.	(0.0289)	(0.0509)
Math Score, Grade 8	0.0013**	0.0017*
Watti Score, Grade 6	(0.0005)	(0.0010)
Reading Score, Grade 8	0.0024**	0.0028**
Reading Score, Grade 6	(0.0004)	(0.0008)
Female	0.0867**	0.0696*
remate	(0.0299)	(0.0317)
Black	0.0641 +	0.1654+
	(0.0371)	(0.0801)
Hispanic	0.1804**	-0.0314
Hispanic	(0.0533)	(0.1146)
Asian	0.2895*	
Asian	(0.1044)	
LEP/Bilingual, Grade 8	-0.2880*	0.1474+
LEF/Billigual, Glade 8	(0.0855)	(0.0836)
Special Ed, Grade 8	0.042	-0.029
Special Ed, Grade 8	(0.0432)	(0.0660)
Free/Reduced-Price Lunch, Grade 8	-0.1577**	-0.013
Tree/Reduced-Frice Edition, Grade 8	(0.0259)	(0.0716)
Changed Schools, Grade 7 or Grade 8	-0.0471	-0.0705
Changed Schools, Grade / of Grade 8	(0.0314)	(0.0417)
Observations	1787	695

Note: All models include a set of chort indicators. Coefficient estimates are marginal effects. Standard errors adjusted for clustering at the school level are in parentheses.

⁺ significant at 10%, * significant at 5%, ** significant at 1%.

Table 5
Probit Estimates of Attending a Charter High School in Grade 9

	Florida			Chic	ago
	10 mi	5 mi	2.5 mi	5 mi	2.5mi
Distance to Nearest	0.0439	0.0041	0.0260		
Traditional Public School	(0.0315)	(0.0206)	(0.0258)		
Distance to Nearest Other	-0.0026	-0.0029	-0.0048	0.0149	0.1063
Charter	(0.0048)	(0.0037)	(0.0046)	(0.0444)	(0.0840)
8th Grade Charter Offers	0.4440**	0.3126*	0.4900**	0.5426**	0.1125
Grade 9	(0.1412)	(0.1589)	(0.1320)	(0.1147)	(0.3023)
Number of Other Charters	0.0468	0.049	0.0092	0.0907	0.7832**
	(0.0364)	(0.0479)	(0.0595)	(0.0687)	(0.3022)
Number of Private Schools	-0.0014	-0.0395*	-0.0405	-0.018	-0.0739
	(0.0050)	(0.0218)	(0.0493)	(0.0146)	(0.0545)
Observations	4216	4216	4216	996	996
Pseudo R-squared	0.22	0.27	0.21	0.24	0.23

Note: Estimates are based on minimum distance and number of schools of a given type in the surrounding area offering grade 9 in relevant year. Coefficient estimates are marginal effects.

Standard errors adjusted for clustering at the school level are in parentheses.

⁺ significant at 10%, * significant at 5%, ** significant at 1%

Table 6
Wald Tests of Exclusion Restrictions in Attainment Equations

	Flo	rida	Chic	ago
·	Chi-	Prob.	Chi-	Prob
Model/Exclusion	Square	Value	Squared	Value
	(d.f.)		(d.f.)	
High School Graduation	31.46	0.0000	61.57	0.0000
- All Variables	(5)		(4)	
High School Graduation	12.75	0.0017	6.65	0.0359
- Minimum Distance Variables	(2)		(1)	
High School Graduation	4.24	0.1199	11.4	0.0033
- No. Charters, No. Privates	(2)		(2)	
High School Graduation	6.38	0.0115	41.71	0.0000
- "Offer G9"	(1)		(1)	
High School Graduation	16.36	0.0010	55.4	0.0000
- No. Charters, No. Privates, "Offer G9"	(3)		(3)	
College Attendance	14.72	0.0116	30.44	0.0000
- All Variables	(5)		(4)	
College Attendance	9.04	0.0109	9.31	0.0095
- Minimum Distance Variables	(2)		(1)	
College Attendance	7.54	0.0231	0.06	0.9698
- No. Charters, No. Privates	(2)		(2)	
College Attendance	0.85	0.3554	10.95	0.0009
- "Offer G9"	(1)		(1)	
College Attendance	7.59	0.0553	21.52	0.0001
- No. Charters, No. Privates, "Offer G9"	(3)		(3)	

Note: The window for obtaining a high school diploma is 4 years from beginning high school in Florida and 5 or more years from beginning high school in Chicago. For college attendance the window is 5 years from the beginning of high school in Florida and 5 or more years from the start of high school in Chicago.

Table 7

Probit and Bivariate Probit Estimates of the Effects of Charter High School Attendance on Receiving a Standard High School Diploma and on College Attendance

	Receiving a Standard High School Diploma					
Estimateion Metheod		Florida	(Chicago		
	Rho	Marginal Effect	Rho	Marginal Effect		
Univariate Probit	0.0000	0.1223**	0.0000	0.0741*		
		(0.0318)		(0.0376)		
Bivariate Probit	-0.2375	0.1904*	-0.0907	0.0074		
	(0.1675)	(0.0877)	(0.7408)	(0.2480)		
	Attendir	ng a Two or Four Y	ear College	(within 5 years)		
	Florida		Chicago			
	Rho	Marginal Effect	Rho	Marginal Effect		
Univariate Probit	0.0000	0.0823**	0.0000	0.1028*		
		(0.0289)		(0.0509)		
Bivariate Probit	-0.2791	0.2004+	-0.3123	0.0943		
	(0.2168)	(0.1152)	(0.5078)	(0.1328)		

Note: Standard errors adjusted for clustering at the school level are in parentheses. Coefficient estimates are marginal effects. For the bivariate probit estimates, the reported standard errors equal the marginal effects divided by the bivariate probit z-scores (adjusted for clustering at the school level). The 5-mile radius equation reported in Table 5 is used to predict charter high school attendance in the bivariate probit equations. Following the exclusion-restriction tests in Table 6, only the number of proximate private schools and the number of proximate charter schools are excluded from the graduation equation for Florida and none of the school choice determinants are excluded from the graduation equation for Chicago. Given the exclusion restriction tests, the number of proximate private schools and the number of proximate charter schools are excluded from the college attendance equation for both Florida and Chicago. Whether a school offers grade 9 is also excluded from the college attendance equation for Florida

⁺ significant at 10%; * significant at 5%; ** significant at 1%.

Table 8

Probit and Bivariate Probit Estimates of the Relationship Between Charter High School Attendance and Educational Attainment in Florida from Alternative Samples

		ma Within 4 Years		ege Within 5 Years
	Probit	Bivariate Probit	Probit	Bivariate Probit
		Baseline Mode	el (Full Sample)	
Attend Charter H.S.	0.1223**	0.1904*	0.0823*	0.2004+
	(0.0318)	(0.0877)	(0.0289)	(0.1152)
	Baseline l	Model (Without Imputing	g Missing Values for	or H.S. Diploma)
Attend Charter H.S.	0.1500**	0.1895*		
	(0.0335)	(0.0898)		
	Baseline Mo	del (Missing Values for H	I.S. Diploma Assur	med to be Dropouts)
Attend Charter H.S.	0.1749**	0.2644*		
	(0.0471)	(0.1322)		
	Baseline Mode	l (Students Who Received	d a High School Di	iploma within 5 Years)
Attend Charter H.S.			0.0920**	0.1302+
	-		(0.0307)	(0.0789)
	Baseline Model	(Only Students Whose 8	th Grade Charter D	oes Not Offer Grade 9)
Attend Charter H.S.	0.0976*	0.0628	0.1074*	0.2060**
_	(0.0427)	(0.0514)	(0.0424)	(0.0718)
	Basel	ine Model (Excluding Co	onversion Charter I	High Schools
Attend Charter H.S.	0.0791*	0.2737**	0.0848*	0.1450*
	(0.0320)	(0.0688)	(0.0364)	(0.0714)

Note: All models include the explanatory variables delineated in Table 3 and a set of cohort indicators. Coefficient estimates are marginal effects. Standard errors adjusted for clustering at the school level are in parenthese

⁺ significant at 10%; * significant at 5%; ** significant at 1%.

Table 9

Probit and Bivariate Probit Estimates of the Relationship Between Charter High School Attendance and Educational Attainment in Florida from Alternative Models

	Base line Model				
	H.S. Diplom	na Within 4 Years	Attend Coll	ege Within 5 Years	
	Probit	Bivariate Probit	Probit	Bivariate Probit	
Attend Charter H.S.	0.1223**	0.1904*	0.0823*	0.2004+	
Attend Charter 11.5.	(0.0318)	(0.0877)	(0.0289)	(0.1152)	
		Model With Contr	ols for School Si	ze	
Attend Charter H.S.	0.1737**	0.2229*	0.1081**	0.2055 +	
Attend Charter 11.5.	(0.0312)	(0.0871)	(0.0334)	(0.1135)	
	M	odel With Controls fo	r 10th Grade Te	st Score	
Attend Charter H.S.	0.0466+	0.0888	0.0900*	0.1464	
Attend Charter 11.5.	(0.0226)	(0.0596)	(0.0385)	(0.0909)	
	Model Allowin	ng Differential Effect	of Conversion C	harter High Schools	
Attend Charter H.S.	0.0816*	0.1193+	0.0898*	0.2205 +	
Attend Charter 11.5.	(0.0315)	(0.0645)	(0.0358)	(0.1143)	
Attend Charter H.S. x	0.1448**	0.1677**	-0.0213	-0.0414	
Conversion Charter	(0.0321)	(0.0342)	(0.0422)	(0.0523)	
		Model With Contro	ls for Peer Stabi	lity	
Attend Charter H.S.	-0.0347	0.0610	0.1145	0.2827*	
Attend Charlet 11.5.	(0.0713)	(0.1220)	(0.0714)	(0.1321)	
Proportion of G8 and G9	0.2964*	0.1984	-0.0529	-0.1323	
School Mates	(0.1199)	(0.1256)	(0.1103)	(0.1084)	

Note: All models include the explanatory variables delineated in Table 3 and a set of cohort indicators. Coefficient estimates are marginal effects. Standard errors adjusted for clustering at the school level are in parentheses.

⁺ significant at 10%; * significant at 5%; ** significant at 1%.

Table 10

Probit Estimates of the Relationship Between Charter High School Attendance and Educational Attainment in Chicago From Alternative Samples and Models

	H.S. Diploma	Attend College Within 5 Years
	Ba	seline Model (Full Sample)
Attend Charter H.S.	0.0741*	0.1028*
	(0.0347)	(0.0509)
	Baseline Mod	lel (Without Imputing Missing Values)
Attend Charter H.S.	0.1076**	0.1302*
	(0.0384)	(0.0608)
	Baseline Model (Missing	Values for H.S. Diploma Assumed to be Dropouts)
Attend Charter H.S.	0.0510	
	(0.0380)	
	Baseline Model (Only Stud	ents Who Received a High School Diploma within 5 Years)
Attend Charter H.S.		0.0715
		(0.0585)
	Model With	Controls for School Size (Full Sample)
Attend Charter H.S.	0.0588 +	0.0699+
	(0.0334)	(0.0404)
	Model With Contro	ols for 10th Grade Test Scores (Full Sample)
Attend Charter H.S.	0.0609+	0.0924+
	(0.0338)	(0.0507)

Note: All models include the explanatory variables delineated in Table 3 and a set of cohort indicators. Coefficient estimates are marginal effects. Standard errors adjusted for clustering at the school level are in parentheses.

⁺ significant at 10%; * significant at 5%; ** significant at 1%.

Figure 1A - Location of Florida Charter Schools Offering Grade 8 in 1997 or Grade 9 in 1998

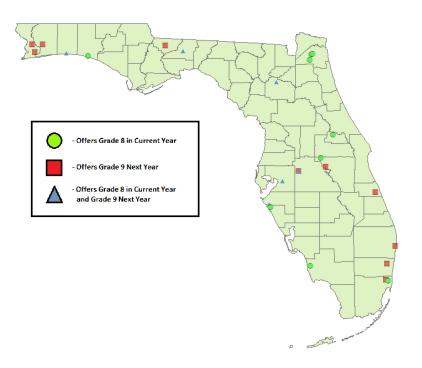


Figure 1B - Location of Florida Charter Schools Offering Grade 8 in 2000 or Grade 9 in 2001

