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Do Charter Schools Ruin Local Public Schools in Poor Neighborhoods? Evidence from New York City

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Sarah Cordes
Institute for Education and Social Policy
NYU Wagner Doctoral Candidate
Wagner School of Public Service

NYU Steinhardt
Steinhardt School of Culture, Education, and Human Development

NYU Wagner
Robert F. Wagner Graduate School of Public Service

Direct correspondence to the first author at sarah.cordes@nyu.edu. The author would like to thank Amy Ellen Schwartz and Leanna Stiefel for their guidance, as well as the IESP Seminar participants for their invaluable feedback.

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ABSTRACT

Charter schools and school choice are popular reforms believed to improve student performance largely through market competition, increased innovation, or some combination of the two mechanisms. Opponents of school choice argue that such reforms sap needed funds and resources from the traditional public school system. Despite this claim, there has been little or no research examining the impact of charter schools on the resources of surrounding public schools. Given recent policies such as Race to the Top that encourage the proliferation of charter schools, it is important to understand the impact that charter schools have on the level and distribution of resources in traditional neighborhood public schools. Using data on New York City Public Schools for the period 1997-2010, this paper seeks to answer the question: What impact do charter schools have on neighborhood public school resources? As a supplemental analysis, I further probe my results by answering the question: What potential mechanisms explain these effects, if any?

Findings indicate that charter schools lead to average increases in financial resources including total and instructional spending per pupil, with small or insignificant changes in non-financial resources such as the percent of teachers with master's degrees, the percent of teachers with more than two years of experience in their current school, and pupil-teacher ratios. These findings are robust to several different measures of charter school competition, definitions of neighborhood, and model specifications.

Exploration of mechanisms reveals that increased per pupil expenditures may be due, in part, to decreasing enrollments of general education students and higher concentrations of both free lunch eligible and special education students in neighborhood public schools following charter school entry. On net, charter schools appear to have no significant negative effects on public school resources as measured by expenditures, although some schools that serve larger shares of lower cost (i.e. general education and immigrant) may experience decreased spending. These findings are consistent with a theory where charter schools act as profit maximizers that compete with public schools for students, particularly those students who are easiest and least costly to educate.

Introduction

Charter schools are publically funded schools of choice that are operated by non-profit or for-profit organizations. In 2007, approximately two percent of all students in the United States were enrolled in charter schools, of whom almost two-thirds (64 percent) resided in cities (Grady, Bielick, and Aud, 2010). By 2010, more than 1.5 million students, or about 3.3 percent of all public school students, attended charter schools (Snyder & Dillow, 2012). In all states where charter schools currently operate, they receive at least partial funding from public dollars, and often draw the majority of their student bodies from local public schools. One of the most prominent arguments made in favor of charter schools is that by increasing choice, such schools can increase competition and produce efficiency gains in surrounding public schools (Friedman, 1955). Another related argument is that the more lax regulations placed on charter schools allow for innovations in education that would be unlikely to occur in traditional public schools (TPS's). Opponents of charter schools, however, argue that charter schools sap needed funds and resources from the traditional public school system. Furthermore, there is evidence to suggest that among consumers of the education system, the answer to the question of whether or not charter schools affect public school resources may have important implications for public support of charter schools. A Phi Delta Kappa poll found that while 49 percent of those surveyed were in favor of charter schools, 65 percent said they would oppose charter schools in their own community if it meant reduced funding for public schools (Rose and Gallup, 2005). Despite these concerns, there has been little or no research examining the financial impact of charter schools on neighborhood public schools. Most of the charter school literature focuses on outcomes such as the performance of TPS students and questions of whether charter schools

attract the most able students from surrounding public schools, leaving the most difficult to educate students behind in the public system.

Given recent policies such as Race to the Top, that encourage the proliferation of charter schools, it is important to understand the impact of charter schools on the resources of traditional public schools within the same district, and particularly, schools within the same neighborhood. It is not clear what, if any, effect charter schools will have on public schools, as they could plausibly increase, decrease, or have no impact on public school resources. Therefore, the primary analysis in this paper seeks to answer the question: What impact do charter schools have on the resources of traditional public schools within the same neighborhood? A supplemental analysis explores the question: What mechanisms appear to explain these changes, if any?

The remainder of this paper is organized as follows. Section 1 contains a review of the most relevant charter school literature, Section 2 describes potential mechanisms through which charter schools might affect public school resources, Section 3 describes the empirical models and measures, Section 4 contains a description of the data, Section 5 provides results, and Section 6 concludes with a discussion of the results and an outline of next steps.

Section 1: Literature Review

There is little or no research directly addressing the question of how charter schools affect the level and distribution of resources among public schools. Most of the current charter school literature can be divided into four broad categories: the impacts of charter schools on public school performance, the impacts of charter schools on public school composition, the impacts of charter schools on teacher labor markets, and models of where charter schools may

locate based on financial incentives. Each of these topics will be reviewed briefly below, focusing on the research findings most pertinent for this study.

Effects of Charter Schools on Public School Student Achievement

The evidence regarding the impact of charter schools on public school performance is quite mixed, but tends to find small or insignificant effects. For example, using an instrumental variables strategy to account for nonrandom location of charter schools, Bettinger (2005) finds that charter schools have small negative effects on the performance of students in public schools in a large southwestern urban school district. Conversely, using a value-added student model, Sass (2006) finds an increase in public school performance in Florida, a finding which is supported by other research using data from Texas and Michigan (Booker et al., 2008; Hoxby, 2003). Using distance to the nearest charter school as the measure for competition from charter schools, Bifulco and Ladd (2006) find no statistically significant impact of charter schools on performance in North Carolina—a finding that is echoed in additional research by Buddin and Zimmer (2005). Finally, some more recent evidence in the Boston area find sizeable positive impacts of KIPP charter schools on student performance, but this study focuses on a school that is oversubscribed and follows a very specific model, so the results may not be generalizable to all charter schools (Angrist, et al, 2010).

Effects of Charter Schools on Composition of Public Schools

The evidence on the effects of charter schools on public school composition is also mixed, and appears to be quite context specific. For example, studies using data from North Carolina, Florida, and Texas, find that charter school students are more likely to be black, less likely to be white, more likely to have college educated parents, and tend to be lower performing

than their public school peers (Bifulco and Ladd, 2006; Booker, Zimmer and Buddin, 2005). Multiple studies examining charter schools find that compared to public schools in the same district, charter school students are less likely to be eligible for special education services or to be limited English proficient—this is particularly true when looking at more "selective" charter schools such as KIPP schools (Tuttle et al 2010; Sass, 2006; Booker, Zimmer, and Buddin, 2005). In New York state specifically, there is some evidence of under-enrollment of special education students in charter schools relative to their host districts (Lake, Gross, & Denice, 2012). All of these studies examine the characteristics of students relative to other students in the *district* rather than their assigned public school, so it is unclear whether charter schools attract the most motivated and/or easiest to educate student populations from the nearest public *school*.

Effects of Charter Schools on Composition of Public School Teacher Labor Force

Many of the studies that examine the relationship between charter schools and teacher labor markets use cross-sectional comparisons of public and charter school teacher characteristics. These studies tend to find that teachers in charter schools are more likely to be inexperienced, less likely to have tenure, less likely to be licensed, and have better academic qualifications (i.e. to have attended competitive undergraduate institutions and more course-taking in math and science) than teachers in public schools (Podgursky and Ballou, 2001; Hoxby, 2002; Baker and Dickerson, 2006). These studies do not, however, address the question of how charter schools may change the distribution of teachers among public schools. One exception is Jackson (2012) who examines the effect of charter school entry on the distribution of teachers in nearby public schools. Using a difference-in-differences strategy similar to that employed in this

paper, Jackson finds that teachers leaving the public system tend to have worse observable characteristics (such as advanced degrees and certification) and value-added than those who remain. Among those who remain in or join the traditional public school teaching force, he finds an increase in teacher compensation and a decrease in the number of newly hired teachers after charter entry.

Effects of Financial Incentives on Charter School Location

A final relevant strand of literature focuses on the effect of financial incentives on charter school location. In their model of charter school location, Bifulco and Buerger (2012) hypothesize that charter schools locate so as to maximize revenues and minimize costs. Charter schools can maximize revenues by increasing enrollments or locating in higher spending districts. Reducing costs could be achieved through locating in districts with lower teacher salaries or targeting more advantaged students. Using data on New York State, the authors find some evidence of profit maximizing behavior. Specifically, they find that that charter schools tend to locate near families with the highest demand rather than near families whose children are less costly to educate. Further, they find that certain types of charter schools tend to avoid serving the most disadvantaged students. This analysis focuses on charter school location decisions, however, and does not explicitly address how charter schools may compete for students *after* the location is determined.

Section 2: Background & Mechanisms for Changing Public School Resources

Brief Background: Charter Schools and Charter School Finance in New York City

In 1998, New York State passed a law giving parents, teachers, and communities the opportunity to own and operate charter schools. New York currently has three approved

chartering entities: the Board of Trustees at the State University of New York, the New York State Board of Regents, and local boards of education (in New York City, this authority is granted to the Chancellor). Initially, the law allowed for only 100 charter schools statewide, but in 2007 this cap was raised to 200, and at least 50 of these new charters were reserved for New York City (Charter Schools Institute, 2009). As of September 2011, there were more than 130 charter schools operating in New York City (NYC Department of Education, 2012).

In New York City, charter schools receive a per pupil allocation from the Department of Education(DOE) that is intended to cover most of their basic operating costs. Further expenses including debt service and insurance are covered by other sources of funding such as foundation grants. In addition to direct funding, charter schools can receive public funding indirectly, by operating in DOE buildings. This indirect funding is due to the subsidization of school safety, facilities, and utilities, the costs of which are paid for by the New York City DOE. Charter schools are also eligible for reimbursement for services based on the educational needs of enrolled students. Removing categorical aid and various other sources to make public school and charter school funding streams more comparable, the city's Independent Budget Office (IBO) found that in the 2008-2009 school year charter schools located in DOE buildings received approximately $700 more per general education pupil in public funding than public schools, and those located in private spaces received $2,011 less in public funding than public schools (New York City Independent Budget Office, 2011).

In addition to the funds disbursed by the New York City DOE, charter schools also receive state per pupil funding according to a formula determined by the state department of education. This formula includes weights for harder to educate student populations, deducts certain revenues, and strips out funding related to debt service, transportation, and various other

expenses. Due to the construction of this formula, per pupil funding received by charter schools is often less than the number obtained from simply taking total district funding and dividing it over the number of students.[1] Based on the IBO estimates, on average, charter schools receive at least 87 percent of the public school per pupil allotment if they operate in a private space, and more than 100 percent of the public school per pupil allotment if operating in a DOE owned building.

Mechanisms

Funding formulas for NYC public schools are ultimately determined at the district (city) and state levels. Since NYC is a single school district, changes in neighborhood public school resources cannot be explained by district or state-wide shifts in enrollment or funding. Rather, one would expect any changes in per pupil expenditures at the school or neighborhood level to occur through more isolated changes in public school enrollment, public school student composition, redistribution of instructional resources, especially teachers, and/or changes in the political capital available to public schools lobbying for additional resources.

Competition for Students: Changes in Public School Student Body

The most direct way charter schools might impact public school resources is by changing public school enrollments. For example, school budgets in NYC operate within a "corridor" of the previous fiscal year's budget and may therefore be slow to respond to dramatic changes in public school enrollment.[2] In addition, declining enrollments mean that other, more fixed

[1] This is true because if charter school composition differs from that of the average district public school—for example enrolling lower numbers of special education students—one would expect the actual charter school allocation to be lower than that obtained by dividing district funding by the total number of students in the school.
[2] For example, in academic year (AY) 2003-2004, the floor was set at -2.50 percent of the FY 2003 budget and the ceiling was established at +2.25 percent of the FY03 budget (Preliminary FY 2004 Initial School Allocation, 2004). Therefore,

resources such as categorical aid and teachers will be spread over fewer students—again resulting in higher per pupil expenditures.[3] Finally, if the introduction of charter schools leads to underutilization of public school facilities, the fixed costs of operating the building (such as utilities and security costs) will be spread over fewer students, similarly leading to increased spending per pupil. One might expect the converse should public school enrollments increase, which might occur if public school quality and the demand for public versus private school increases in response to charter school competition. Empirically, this mechanism would be evidenced by significant changes in enrollment after charter school entry into the neighborhood.

As an extension of this more general enrollment mechanism, charter schools may also affect public school resources by competing for specific types of students. If, as proposed by Bifulco and Brueger(2012), charter schools are profit maximizers, they will attempt to maximize revenues and minimize costs. One way this goal could be achieved, is by trying to attract larger numbers of more advantaged students (for example, full price lunch or general education students) and/or larger numbers of students who are low cost relative to their peers, but who are eligible for additional funds, such as reduced price lunch students and recent immigrants.[4] There is some evidence supporting this theory of profit-maximization in the literature on the types of students enrolled in charter versus public schools. For example, prior research finds that charter schools tend to attract students with more educated parents and that charter school students are less likely to be special education or Limited English Proficiency (LEP).

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if a school falls below its floor due to declining enrollments, the floor would become the current fiscal year's budget, resulting in increased per pupil expenditures.

[3] While these resources are not truly "fixed" in the traditional sense, schools *must* employ a minimum number of teachers per grade where students are enrolled and must add teachers for a given increase in enrollments for that grade because of laws mandating maximum student-teacher ratios. As an extreme case, a school would have to employ one teacher whether there were two or fifteen students enrolled in a grade. In the school with only two students per grade, this teacher's salary would then be divided over a smaller number of students, ultimately resulting in higher per pupil expenditures.

[4] Research on NYC has found that on average, recent immigrants tend to outperform their peers. See, for example, Schwartz & Stiefel, 2006.

If, consistent with this prior evidence, charter schools increase the supply of slots for lower cost or easier to educate students such as general education or immigrant students, charter school competition might increase the premium that public schools receive for educating the types of students that charter schools do not enroll. For example, charter schools may affect public school resources by changing the relative compensation that public schools receive to educate these more expensive students. Public schools that educate higher shares of these students would thus experience increases in per pupil spending, while public schools serving smaller shares of these students might experience decreases. Even if charter school competition does not affect the "price" paid to public schools for educating these students, it may very well change the mix of students remaining in neighborhood public schools, and ultimately influence the mix of funding these schools receive. Empirically, this mechanism would be evidenced by a significant change in the relationship between student characteristics and spending once charter schools are introduced into a neighborhood and by changes in student characteristics in public schools following an increase in charter school competition.

Competition for Teachers: Redistribution of Instructional Resources

Another mechanism through which charter schools might affect public school resources is through a redistribution of instructional resources. In NYC, teacher salary allocations are based on a particular school's average teacher salary in the previous year. Therefore, any changes in teacher characteristics from one year to the next (i.e. experience, advanced degrees, etc.) that are caused by charter schools may also affect the financial resources available to neighborhood schools through changes in the base teacher allocation.

Furthermore, as shown by Jackson (2012), charter school entry might also lead to increased salaries for public school teachers in response to increased competition from charter schools. Since teacher salaries and instructional expenditures account for a large portion of school spending, such changes would also be reflected in other expenditure categories including total expenditures among public schools, as well as changes in teacher quality as measured by observable characteristics. Therefore it will be worthwhile to examine whether charter school competition induces changes in instructional expenditures and teacher characteristics, as well as total expenditures per pupil.[5]

Redistribution of Political Capital

A final mechanism through which charter school entry could affect public school resources is through the redistribution of political capital. If the families who choose to enroll in charter schools are families with more political savvy or willingness to lobby for additional resources in public schools, the introduction of charter schools may lead to a decline in public school spending as the political capital available to TPS's decreases in response to charter entry. Similarly, if the introduction of charter schools focuses public attention and political will away from the needs of local public schools, one might similarly expect a decline in expenditures with the introduction of charter schools. Conversely, if the parents of children remaining in public schools or local policy-makers are concerned with the possible negative consequences of charter schools, they may lobby to obtain additional public school resources in response to increased competition. Unfortunately, this particular mechanism is difficult to isolate empirically with current data. Changes in the characteristics of TPS students may provide some indication—for

[5] Data on teacher salaries and fringe benefits are also available, but not for the most recent years of the sample period. I therefore plan to analyze these variables as they become available.

example if there is a change in the concentration of groups that are traditionally more active in politics (such as full price lunch and white students) in the public schools—but such evidence should be viewed as suggestive at best.

Section 3: Measures and Models

Measures

The two measures of interest for this analysis are neighborhood charter school competition and public schools resources. To capture charter school competition in the neighborhood, three alternative measures are used: a binary indicator of whether any charter schools are currently located in the same community district as a particular TPS in a given year, a set of indicators for whether there are one, two, or three plus charter schools located in the same community district as a TPS in a given year, and a variable measuring the distance between each public school and the nearest charter school within a half and one mile radius. As indicated by the choice of measures, in this analysis neighborhood is defined in two ways. The first of these measures, community districts (CDs), are political zones that deal with issues such as land use/zoning and identify community needs in the city's budget process. Community districts (of which there are 59 across the city) are smaller than community school districts (of which there are only 32 across the city), and are larger than census tracts, which in NYC, are quite small geographically and may therefore may not meaningfully capture "neighborhood" as it pertains to school-attendance.

In addition to defining a neighborhood as a political region, it is also measured using the distance between each public school and the nearest charter school within a half mile and one mile. According to this measure, if the nearest charter school is located further than one half or

one mile away from a particular public school, that TPS is coded as having *no* charter school in the neighborhood in that year. These two radii were chosen based on NYC policies regarding transportation reimbursement: students in grade K-2 are considered within walking distance if they reside within a half mile of their school and this distance is expanded to 1 mile for students in grades 3 through 6. Elementary school students who live more than 1 mile from their school are eligible for full fare public transportation.

Financial resources are measured in two ways: total and instructional expenditures per pupil. Total expenditures include all factors contributing to the cost of educating students (facilities, teacher salaries, etc.), while instructional expenditures will reflect those changes in spending that occur through changing teacher characteristics. Expenditures are measured both as levels and logs. In the discussion to follow, only estimates from the log models are reported, although results are robust to estimation using levels.[6] The log models have the advantage of being less susceptible to heteroskedasticity and because the coefficients on charter school entry can be interpreted as percentage changes in expenditures, they may provide a better sense of the relative magnitude of charter school effects than the level models. Future work will expand these financial measures to include teacher salaries and fringe benefits.

Non-financial resources include the percent of teachers in a school with master's degrees, the percent of teachers with more than two years of experience in their current school, and pupil teacher ratios. While the first two measures are arguably poor measures of teacher quality, these are the measures that are consistently available for all years in the sample and they are also characteristics that school districts are willing to pay for in the form of salary increases. Future work will include other teacher measures, such as total teaching experience, for the time periods during which they are available.

[6] For reference, results from the level-expenditures specifications are presented in the appendix.

Empirical Strategy

The primary obstacle to identifying the effects of charter schools on neighborhood public schools is that charter schools locate non-randomly throughout the city. This means that a simple cross-sectional comparison of resources between TPS's with any charter schools in the neighborhood and TPS's with no charter schools in the neighborhood is unlikely to provide consistent estimates of the impact of charter schools on TPS resources. For example, since charter schools tend to locate in neighborhoods with high concentrations of poor students, one might expect such cross-sectional comparisons to yield upwardly biased estimates of charter school effects. This is because the types of public schools that are located near charter schools tend to be eligible for more categorical aid and would also tend to have higher per pupil expenditures even in the absence of charter schools.

To address the potential bias that arises from non-random charter school location, I limit my sample of schools to those that were ever exposed to a charter school between Academic Year (AY) 1996-97 and AY 2009-10, and I compare changes in resources within schools after an increase in charter school presence to changes in resources within schools that face no change in charter school presence over the same period.[7] The primary model used to identify the relationship between charter schools and public school resources is as follows:

$$Y_{sct} = \alpha + \beta CS_{ct} + \gamma_s + \mu_t + \varepsilon_{sct} \qquad (1)$$

Where Y is a measure of school resources in school s, in community district c, at time t, CS is an measure of charter school competition in community district c at time t, γ are school fixed effects, μ are year fixed effects, and ε is the usual error term.

[7] While schools that face no competition from charter schools during this period (i.e. are never exposed to charter schools) may have different demographic characteristics, because they are subject to the same district policies regarding funding and the same general trends in spending and budgetary pressures, they may provide a reasonable comparison group. Therefore, as a robustness check, I also estimate models including all NYC public schools. Results are qualitatively similar to the results obtained using only the sample of ever exposed school and are available from the author upon request.

The inclusion of school fixed effects accounts for any time-invariant characteristics of schools that are correlated with both the location of a charter school in a particular neighborhood and traditional public school resources in that neighborhood. Such characteristics might include school climate and teaching practices, as well as average levels of student characteristics associated with funding including percent special education, percent free lunch eligible, school enrollment, etc. Time fixed effects control for any factors that affected the entire city in a given year that might be correlated with both the opening of charter schools and public school resources. Time effects should, therefore, control for events such as the appointment of Joel Klein as the Chancellor of the NYC DOE, the implementation of the Fair Student Funding formula in AY 2007-2008, citywide enrollment/resources responses to September 11, or any significant changes in education policies put into practice by the NYC DOE during the sample period. All models are estimated using both weighted and unweighted measures of student enrollment. In unweighted models, coefficients can be interpreted as the effect on resources experienced by the average school, whereas in the weighted models coefficients can be interpreted as the effect on resources experienced by the average student in a public school facing competition from nearby charter schools.[8] The discussion in the remainder of the analysis will focus on unweighted models, but results from weighted models are qualitatively similar and are available from the author upon request.

I intentionally do not include time-varying school characteristics such as percent of free lunch eligible and special education students, because a change in these characteristics is a mechanism through which charter schools are expected to influence public school resources. Specifically, because charter schools may affect public school spending by changing public school composition, including controls for characteristics of the student body associated with

[8] Unweighted analyses, which produce qualitatively similar results, are presented in the Appendix but not discussed.

funding such as enrollment, percent free lunch eligible, etc. may understate or obscure the effect of charter schools on public school resources. In addition, as a first order question, I am interested in the total effect of charter school competition on public school resources, which would include any changes in spending due to changing public school student composition. As a robustness check, I also estimate models including these characteristics and as expected, point estimates are generally in the same direction but of smaller magnitude.[9]

In this model, charter school effects are identified by the variation in the timing of charter entry and can reasonably be interpreted as causal effects if, conditional on school and year effects, charter school entry into the neighborhood is random. One might still be concerned, however, that the timing of charter entry into a neighborhood is correlated with pre-existing trends in TPS characteristics and/or resources. For example, charter schools may be more likely to open in districts where enrollments are already declining because of the improved chances of being able to locate within a DOE building. In this case, one might expect a spurious positive relationship between charter school entry and per pupil expenditures, as charter school entry is correlated with declining enrollments. In order to address this concern, I augment my model with a set of indicators to capture trends in public school characteristics and resources in the periods immediately prior charter school entry. Specifically, I add indicators for 1 year prior to entry, 2 years prior to entry, and 3 or more years prior to entry to my model. Including these variables in the model non-parametrically controls for any pre-existing trends occurring in schools immediately prior to charter school entry that might be correlated with both charter school entry and public school resources. In this particular model, charter schools are still identified by variation in the timing of charter entry, but can be interpreted as causal effects if

[9] Results available upon request.

charter school entry into the neighborhood is random, conditional on school effects, year effects, *and* pre-existing trends in resources.

In the case where CS is an indicator variable, β represents the change in public school resources associated with having any charter school in the same neighborhood (measured as the CD, a one half, or one mile radius). In the case where CS represents a set of indicators, β_1 is the effect of the first charter school, β_2 is the effect of the second charter school, and β_3 is the effect the third plus charter school in a given neighborhood.[10] In all models where neighborhood is defined as the community district, standard errors are clustered at the CD-year level to account for the fact that all schools in the same CD in the same year are assigned identical values for the charter school measure.

I then augment the distance model by estimating the follow:

$$Y_{st} = \alpha + \beta_1 CS_{st} + \beta_2 CSDIST_{st} + \delta_1 1YRPRE_{st} + \delta_2 2YRPRE_{st} + \delta_3 3 + YRPRE_{st}\gamma_s + \mu_t + \varepsilon_{st} \quad (2)$$

Where Y is as described in model (1). In this model, β_1 is the effect of having any charter school within a half and one mile of a public school, while β_2 is the effect of increasing the distance between a public school and the nearest charter school. A positive coefficient on β_2 indicates that public school resources *decrease* the closer the nearest charter school is to a given public school and a negative coefficient would indicate that public schools resources *increase* the closer the nearest charter school is to a given public school. This model is also estimated with quadratic of distance to allow the effect of distance to vary.

[10] A more parametric model using the count of charter schools, rather than a set of indicators was also estimated and again the results are qualitatively similar.

Section 4: Data

Data on public schools come from five sources: school based expenditure reports (SBER), school report cards (SRC), student-level data files, New York City facilities data, and the common core of data (CCD). The SBER data contain information on school resources including total and instructional expenditures per pupil, as well as data on per pupil expenditures on teachers, teacher salaries, etc. For the purpose of this analysis, SBER data are used to obtain school level information on total and instructional expenditures per pupil as well as total, general education, and special education enrollments. All financial data are converted to 2010 dollars using the consumer price index.

The SRC data contain information on school characteristics including number of teachers (which can be used to construct pupil-teach ratios), teacher characteristics, percent of school capacity utilized, etc. While SRC data also contain information about demographic characteristics of students, for the present analysis, I construct these measures from student-level data due to both the higher match rate obtained when matching SBER files to student-level files and the discontinuation of some variables in the SRC data during the sample period. The New York City facilities data are used to attach school to community districts.

Data on charter school openings, grade spans, and locations (latitude and longitude) were obtained from a combination of the SRC and CCD. Charter school information is only included for those charter schools whose first year of operation was 2009-10 or earlier, and excludes any charter schools that serve only grades 6-12. Data from the CCD was also used to attach latitude and longitude coordinates to all public and charter schools in the sample, which allowed for the calculation of distance between each public school and the nearest charter school.

Sample

The sample period covers AY 1996-97 to AY 2009-10, which is the most recent year for which SBER data were readily available at the time of analysis. Only public elementary schools are studied because most charter schools in operation during this time served primarily elementary grades and because the high school choice system in New York City would greatly complicate the analysis. In addition, middle and high school students are more likely to go to a school further from home, and so the number of charter schools located in the same CD or within one mile of a public school may be a poor measure of "neighborhood" schools as it pertains to these older students. All schools in the special education district and alternative school districts are dropped from the sample because they are not directly comparable to "regular" public schools. Finally, only those schools open for all 14 years of the sample period are included in the final analysis. This eases interpretation and also removes brand new and closing (or imminently closing) public schools from the analysis. One might expect these schools to respond differently to charter schools than the more "stable" body of public schools.[11] While the overall results are robust to the inclusion of these schools, for purposes of interpretation, the analysis and discussion presented here will focus on results from the balanced panel of schools.[12] Including only those continuously operating TPS's that were ever exposed to a charter school leaves a total sample of 225 to 359 unique schools that are ever exposed to charter schools (the exact number of schools depends on the neighborhood measure used in a given model).

Restricting the sample to continuously operating schools eliminates a total of 145 unique schools, about 30-130 of which appear in any given year. Table 1 contains descriptive statistics of schools by operating status: continuously operating, closed, opened, and opened and closed.

[11] Future work will examine whether charter school competition affects the hazard of schools closings.
[12] Results using the full sample of schools are available from the author upon request.

Only continuously operating schools are included in the analytic sample. Compared to schools that closed during the sample period, continuously operating schools have slightly higher instructional spending, lower percentages of teachers with master's degrees, higher percentages of teachers with more than two years of experience at the school, higher enrollments, and higher average test scores. Furthermore, continuously operating schools have lower shares of free lunch eligible, black, Hispanic, and LEP students and higher shares of Asian, and immigrant students. Compared to schools that were newly opened during the sample period, continuously operating schools have lower expenditures, a higher share of teachers with master's degrees, a higher percentage of teachers with more than two years of experience at the school, higher pupil-teacher ratios, and higher enrollments. They have higher shares of free lunch eligible, black, Asian, and immigrant students, but lower shares of Hispanic, special education and ESL students. Therefore, continuously operating schools appear to be slightly more advantaged than schools that closed and are slightly more disadvantaged than schools that opened.

Section 5: Results

Charter Schools and Public School Resources

Table 2 displays the baseline student characteristics of neighborhoods that never have a charter school and those that ever have a charter school during the sample period. Neighborhoods that never have a charter school are more advantaged on a number of dimensions: they have significantly higher percentages of teachers with master's degrees and teachers with more than two years of experience at the school, higher test scores, lower shares of free lunch students, lower percentages of black students, and higher shares of Asian and

immigrant students than neighborhoods that ever have a charter school.[13] This underscores the importance of accounting for the non-random location of charter schools in my analysis.

Table 3 displays the baseline characteristics of schools that are ever or never located within a half, one, and three miles of a charter school. Once again, we see that public schools that are never located within a half or one mile of a charter school are more advantaged: significantly higher percentages of teachers with master's degrees and teachers with more than two years of experience at the school, higher test scores, and lower percentages of free lunch eligible, black, Hispanic, and immigrant students and much higher percentages of Asian students. Once the distance is expanded to a 3 miles radius, over 90 percent of all schools are ever located within this distance of a charter school, and almost all differences become significant, as those schools that never have a charter school within three miles are a much more selective group.

Before turning to the regression estimates, I first present visual evidence that changes in resources occur after the introduction of charter schools. Following Jackson (2012), for each of the outcomes analyzed, I run a regression with four leads and lags of charter entry into the neighborhood, school fixed effects, and year effects, with estimates centered around the year immediately prior to charter school entry. In Figures 1-5, I plot the estimated progression of these outcomes before and after charter entry. All of these patterns highlight the importance of including controls for pre-existing trends in my model. In addition, Figures 1 and 2 show that while total and instructional spending were generally trending downward immediately prior to charter school entry, one to two years after entry, both types of expenditures exhibit and upward trend.[14] A similar story emerges when examining the progression of percentage of teachers with

[13] A similar comparison of school-level characteristics is presented in the appendix as Table A2, results are qualitatively similar.

[14] In general, the trends and results for per pupil expenditures on teachers closely mirror those for instructional expenditures per pupil, and for brevity, are not presented or discussed here.

master's degrees and percentage of teachers with more than two years of experience at the school. Both of these non-financial resources were trending downward prior to charter entry and began trending up one to two years after charter school entry. This may indicate that there is a lagged response to charter entry, as public schools do not immediately respond to increased competition. The progression of pupil-teacher-ratios, on the other hand, appears to show a continuing downward trend throughout the period.

Next, I turn to regression estimates of charter school effects. Table 4 shows estimates of the effect of having any charter school in the neighborhood on public school resources. Columns 1-2 show the effects on financial resources, while columns 4-6 show the effects on non-financial resources. These estimates show that having any charter school in the neighborhood leads to a significant increase in instructional spending per pupil, a significant decrease in the percentage of teachers with more than two years of experience in their current school, with no effect on total expenditures, percentages of teachers with master's degrees, or pupil-teacher ratios. Specifically, having a charter school in the same neighborhood increases instructional expenditures by 1.9 percent. Conversely, having a charter school in the neighborhood significantly decreases the percentage of teachers with more than two years of experience in their current school by 1.6 percentage points, although this is a small change in practical terms, as 61 percent of teachers in the average school have more than two years of experience at that school. Table 5 shows the effects of charter schools on public school resources by the number of charter schools in the neighborhood. These results indicate that total and instructional expenditures increase monotonically with the number of charter schools in the neighborhood and that the magnitude of effects on the percentage of teachers with more than two years of experience decline monotonically with the number of charter schools. Specifically, TPS's located in

neighborhoods with three or more charter schools, experience a 4 and 5.9 percent increase in total and instructional expenditures respectively, while the percentage of teachers with more than two years of experience at their current school is not significantly different than in TPS's located in neighborhoods with no charter schools.

Table 6 presents results controlling for pre-existing trends in public school resources. If anything, these estimates show larger effects of charter school presence on the financial resources of public schools with no accompanying impacts on non-financial resources. Here, we see that charter schools increase total per pupil expenditures by 2.9 percent and increase instructional expenditures per pupil by 3.7.

Next, I turn to estimates of charter school presence where neighborhoods are measured as a half and one mile radius around the school (presented in Table 7). These results indicate that not only does having a charter school located in the neighborhood increase public school spending, but these effects are strongest in public schools located closest to charter schools, that is, those schools facing the greatest competition. This is perhaps more evident in Figures 6 and 7, which depict the estimates from Table 7 graphically. Here, we see that it is those schools closest to charter schools that experience the greatest expenditure increases. In addition, we see that in schools located very near charter schools (0.15 miles or less), the percentage of teachers with more than two years of experience is actually greater than in public schools with no charter school located within a half mile radius.[15] The estimates of the impact of charter school competition on the percentage of teachers with more than two years of experience in their current school tend to be larger in these models where neighborhood is measured using distance, which

[15] Results from distance models excluding controls for pre-existing trends are very similar and are presented in the appendix.

may indicate that teachers are more sensitive to distance than they are to any externally imposed concepts of "neighborhoods." This would be consistent with a wider literature on labor markets.

Overall, the finding of significant increases in public school expenditures after charter school entry is robust to a number of different specifications, different samples of schools, using level versus log models, and weighting regressions by student enrollment. Next, I explore the mechanisms that could explain these expenditure increases.

Empirical Evidence for Mechanisms

Table 8 shows the effects of increased charter school competition on various public school characteristics. While there are no significant declines in total enrollment, the point estimates are in the correct direction, but imprecisely estimated. When enrollments are divided into general and special education, we do see significant declines in general education enrollments among public schools located closest to charter schools and no significant changes the number of special education students, indicating a net decrease in overall enrollments. Given that public schools operate within a corridor of the previous year's budget, these enrollment effects could certainly explain part of the increase in per pupil spending. Charter schools also appear to increase the percentage of free lunch eligible students and decrease the percentage of reduced price lunch students. Finally, there is also a decline in the percentage of both LEP students and recent immigrants in public schools. These changes in the characteristics of neighborhood public school students indicate that the mix of funding received by public schools may change once charter schools open nearby, leading to some of the observed changes in per pupil spending and potentially some of the observed changes in teacher characteristics if teachers are sensitive to school composition.

The estimates in Table 9 show that the racial composition of public schools also changes after charter school entry. These estimates indicate that with increased charter school competition, public schools experience an increase in the percentage of black students and a decrease in the percentage of white students.

Finally, to examine whether expenditure changes depend in part on the characteristics of students enrolled in TPSs, I estimate the following model:

$$Y_{sct} = \alpha + \beta_1 CS_{ct} + (CS_{ct} * \mathbf{X}_{sct})'\boldsymbol{\beta}_2 + \mathbf{X}_{sct}'\boldsymbol{\delta} + \gamma_s + \mu_t + \varepsilon_{sct} \quad (3)$$

Where CS is measured using an indicator of any charter school in the neighborhood, so that β_2 represents the relationship between school characteristics and expenditures *after* the introduction of charter schools. The vector of school characteristics included in model (3) includes: percentage of free lunch eligible, reduced price lunch eligible, special education LEP, and recent immigrant students, and reflects student classifications that are tied to additional funds. If the introduction of charter schools changes the supply of slots for different types of students, one would expect the β_2 coefficients to be significantly different from zero, indicating that the relationship between student characteristics and spending changes after charter schools entry.

The results in Table 10 show this is indeed the case for special education students. After charter school entry, there is an increase in spending associated with having higher percentages of special education students. There is also a decrease in spending associated with having higher percentages of reduced price lunch students (who are lower cost) after charter school entry. This would be consistent with charter schools increasing the relative supply of slots for general education students. Finally, Table 11 shows that the average characteristics of schools that are predicted to experience spending increases versus those predicted to experience spending

decreases after charter entry.[16] Again, consistent with the hypothesis that charter schools may be changing the supply of slots available for certain types of students, schools with predicted expenditure increases tend to be those schools that had higher numbers and percentages of higher cost students (free lunch and special education students) at baseline, whereas schools that are predicted to experience expenditure decreases are those schools that had higher percentages of the lower cost students that charter schools might compete for (general education, reduced price lunch, and recent immigrant students) at baseline.

Section 6: Discussion and Next Steps

These results indicate that if anything, the introduction of charter schools into a neighborhood leads to increase in per pupil expenditures of all types. These findings are robust to a number of different neighborhood and competition measures, different samples, and weightings. Based on these results alone, it is therefore hard to conclude that charter schools have any significant negative effects on public school spending. Instead, charter school competition increases per pupil spending in traditional public schools, a finding that may be driven by decreasing general education enrollments and changes in traditional public school student composition. Further, charter schools do not appear to have any large or consistent effect on non-financial resources such as pupil-teacher ratios, percentage of teachers with master's degrees, or percentage of teachers with two or more years of experience at a particular school—all resources that are less likely to be directly influenced by changes in TPS composition.

Future work on this project will focus on four main areas. First, I plan to further explore the theory that charter schools compete for specific kinds of students. In particular, I hope to estimate how much of the change in spending is the result of changing public school

[16] These estimates are calculated by using the estimated regression coefficients from Table 10 in conjunction with baseline public school characteristics (AY 1998-99) for schools that are ever located near a charter school.

characteristics versus how much of the change is due to a change in the price paid to public schools for educating certain types of students. Second, I plan to explore the effect of charter schools on resource distribution *within* schools. While charter schools may lead to increased spending per-pupil in the aggregate, from an equity standpoint it is important to examine whether charter schools change the level of spending available for harder to serve populations of students within traditional public schools. Thus, future work will also examine the effects of charter schools on spending per Title I eligible student, per special education student, etc. Third, if charter schools are competing for the lowest cost students, increased charter school competition may lead to changes in public school performance, particularly if the lowest performing students are left behind in the public system. I therefore plan to examine achievement outcomes at the student level. Fourth, one might imagine that public schools' responses to charter schools will change over time. For example, perhaps the simplest explanation for the increases in spending, is that public school budgets respond to enrollment changes slowly over time, so that in the years immediately after charter school openings per pupil expenditures increase (as enrollments in public schools decrease). In this case, one might expect public school budgets to converge over time as public schools reach a new steady state of enrollment. There is some evidence of this in Figures 1-5, which provide visual evidence that public schools may not respond immediately to charter school entry. Therefore, additional analysis will be conducted to determine if the impact of charter schools is different in the long versus short-run.

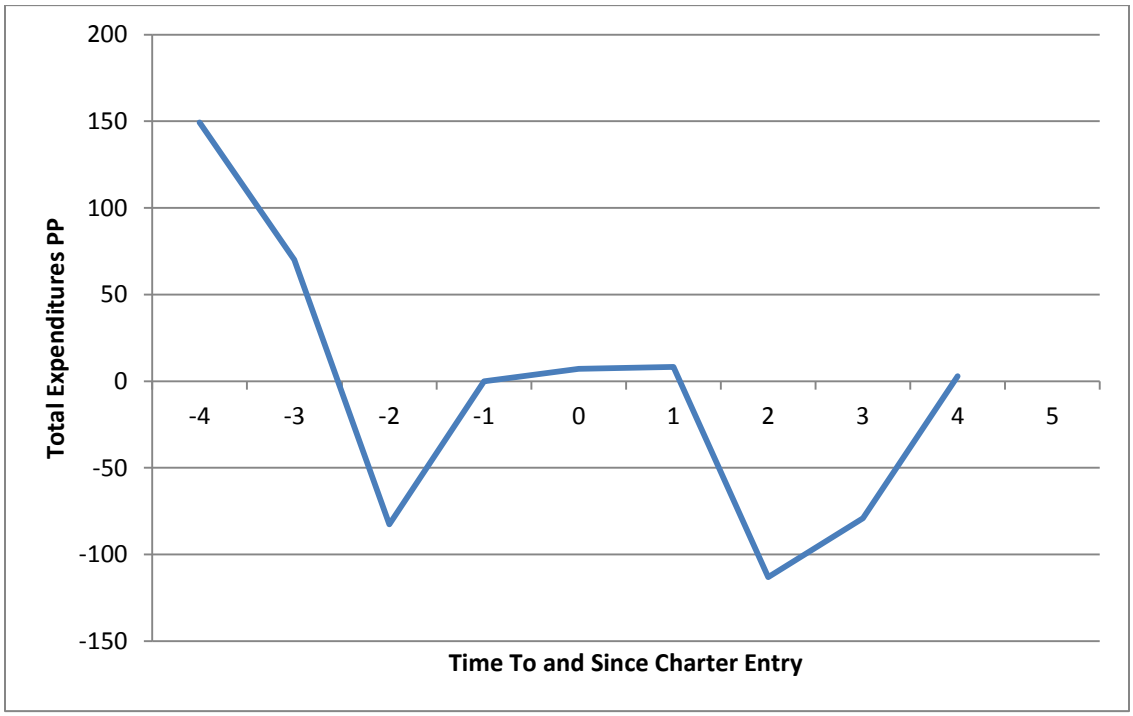
While the next steps outlined above are interesting extensions of the current empirical models, I also plan to conduct a number of additional robustness checks. For example, I plan to add census tract effects to my distance models and to check the robustness of these results to alternative measures of neighborhood (i.e. census tracts).

Conclusion

Based on the findings of this analysis, there is no evidence that charter schools negatively affect public school spending. Rather, these results provide some preliminary evidence in favor of the theory that public and charter schools compete for the least-costly to educate students. One caveat of these findings is that only a small fraction—about 5 percent—of NYC public school students in grades K-8 are actually enrolled in charter schools, so that these results will not address the impacts of charter schools on public school finance when charter schools have a larger market share. It would therefore be both interesting and beneficial for other work to examine districts such as Washington, D.C. or New Orleans where charter schools make up a much larger fraction of the market to determine if the effect of charter schools differs according to concentration.

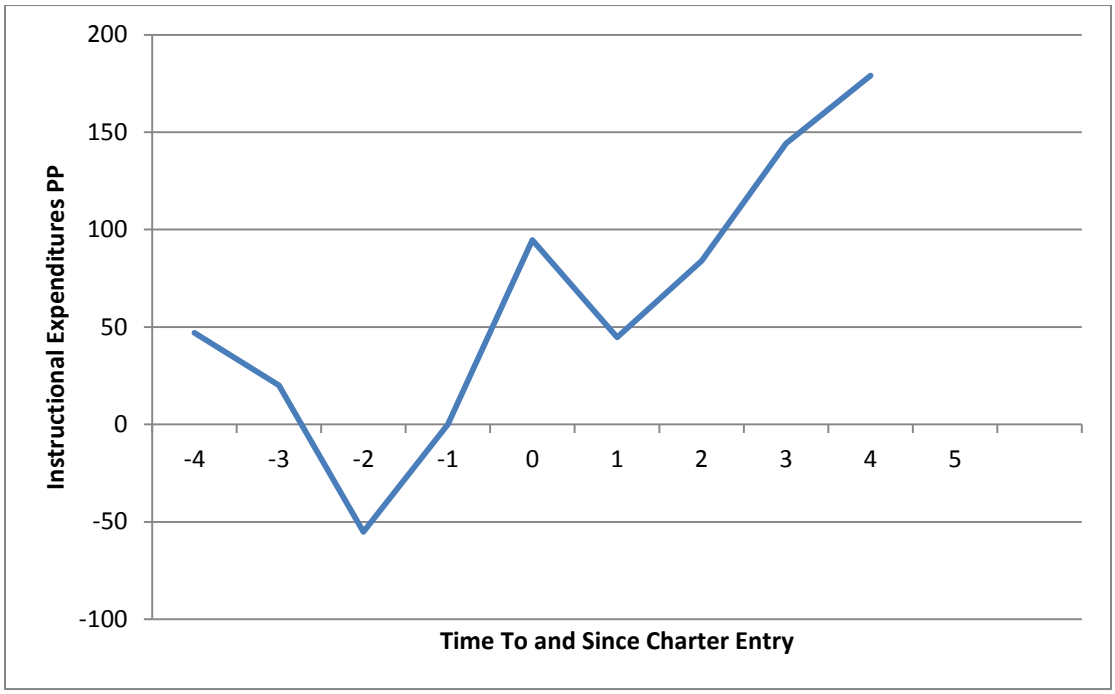
FIGURES AND TABLES

Figure 1. Predicted Trends on Total Spending PP



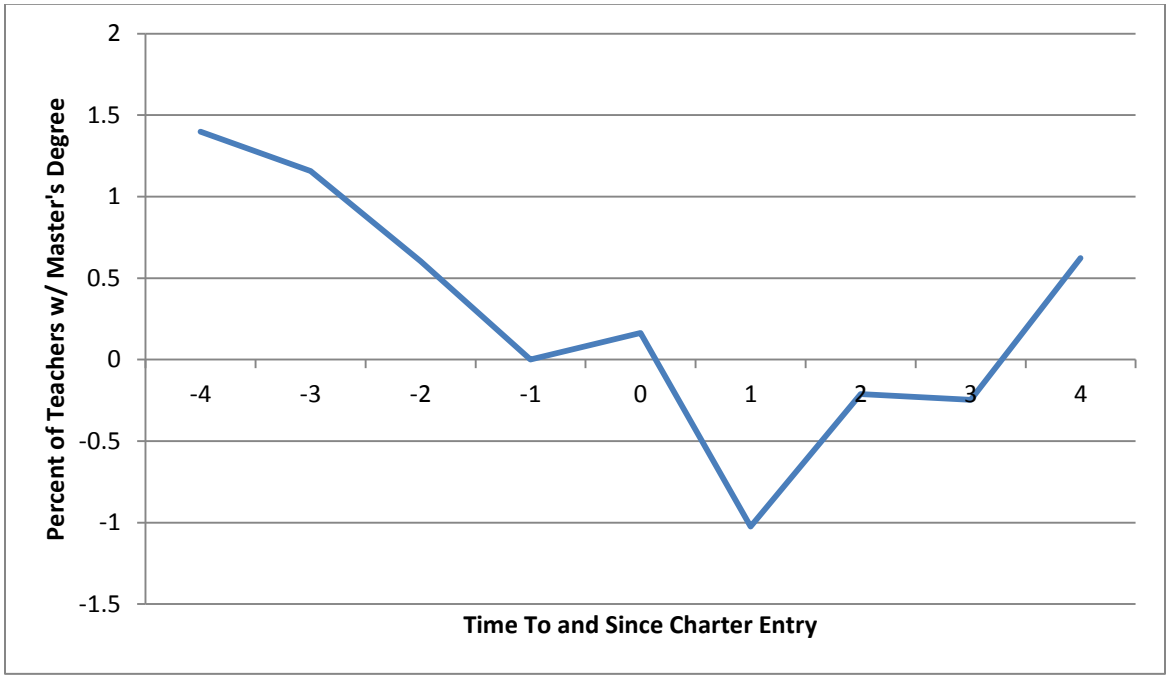
NOTES: X-axis shows time to (since) charter school entry, where 0 is the year of charter school entry. Estimates are centered around -1, i.e. the year immediately preceding charter entry.

Figure 2. Predicted Trends in Instruction Spending PP



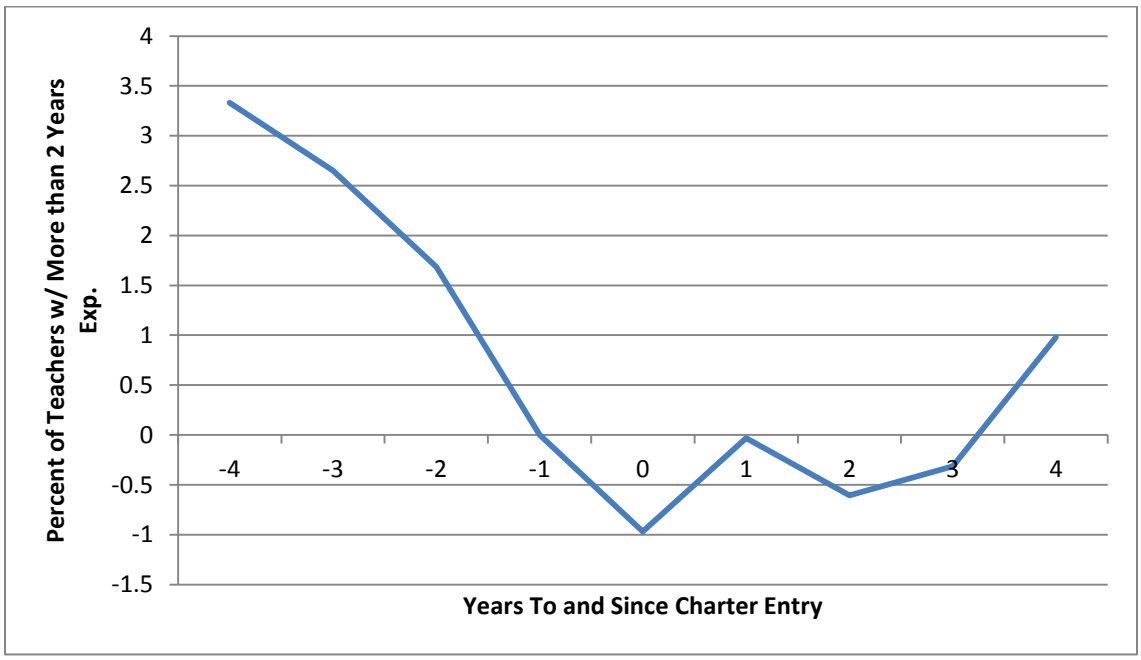
NOTES: X-axis shows time to (since) charter school entry, where 0 is the year of charter school entry. Estimates are centered around -1, i.e. the year immediately preceding charter entry.

Figure 3. Predicted Trends in Percent of Teachers with Master's Degrees



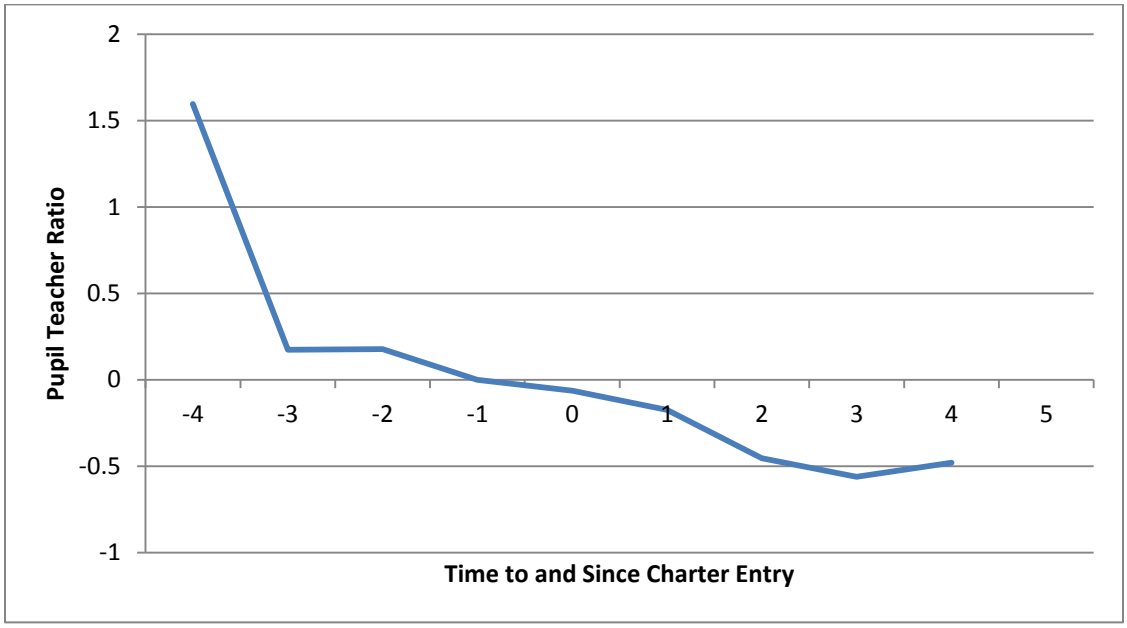
NOTES: X-axis shows time to (since) charter school entry, where 0 is the year of charter school entry. Estimates are centered around -1, i.e. the year immediately preceding charter entry.

Figure 4. Predicted Trends in Percent of Teachers with More than 2 Years of Experience at Current School



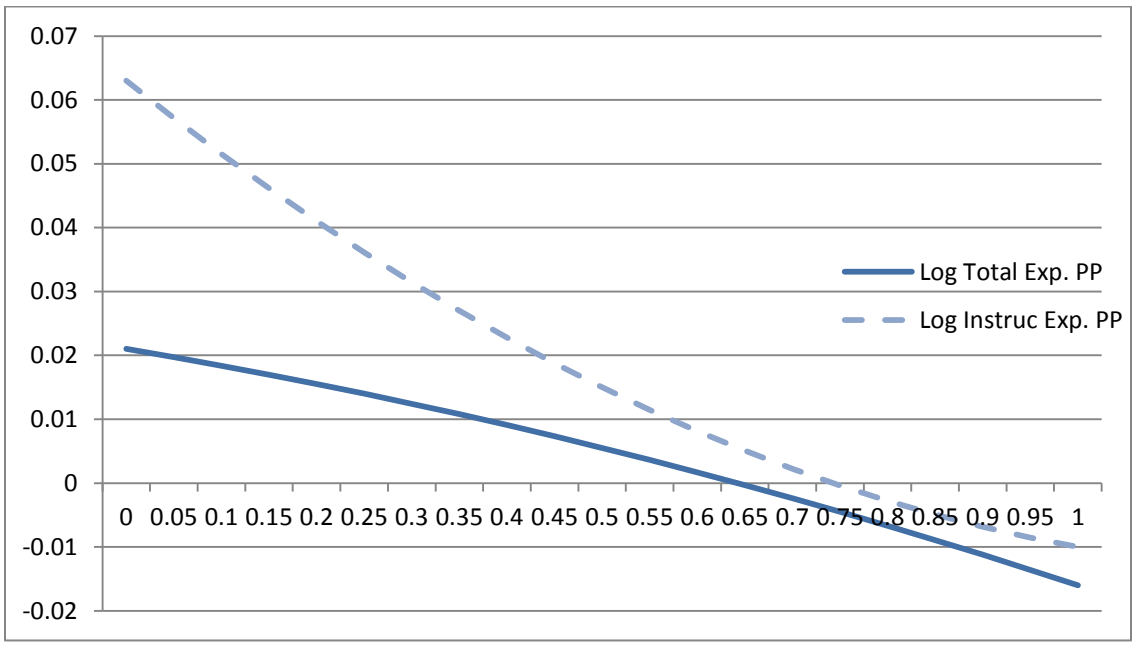
NOTES: X-axis shows time to (since) charter school entry, where 0 is the year of charter school entry. Estimates are centered around -1, i.e. the year immediately preceding charter entry.

Figure 5. Predicted Trends in Pupil-teacher Ratios



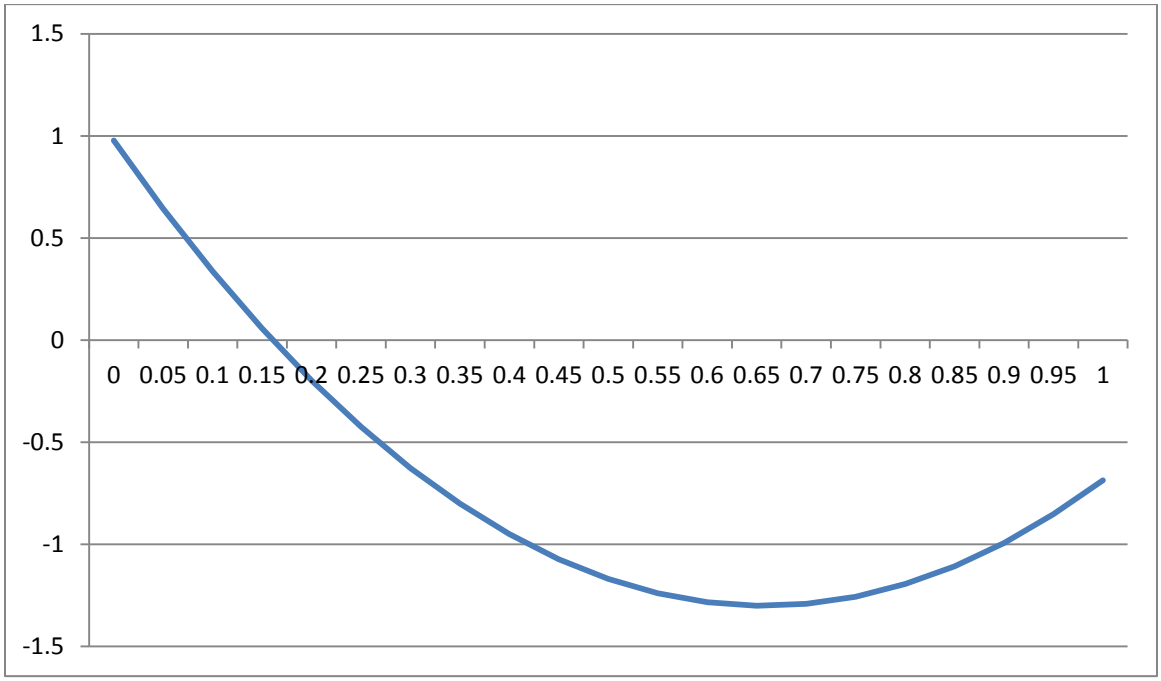
NOTES: X-axis shows time to (since) charter school entry, where 0 is the year of charter school entry. Estimates are centered around -1, i.e. the year immediately preceding charter entry.

Figure 6. Predicted Change Traditional Public School Expenditures by Distance to Nearest Charter School



NOTES: Predictions based on regression estimates in columns 4 and 5 of Table 7.

Figure 7. Predicted Change in Percent of Teachers with More than 2 Years of Experience in That School, by Distance to Nearest Charter School



NOTES: Predictions based on regression estimates in column 6 of Table 7.

Table 1. Descriptive Statistics, by School Operating Status, AY 1996-97 to 2009-10

	Continuous	Non-Continuous		
		Closed	Opened	Opened and Closed
Total spending PP	$14,930	$14,097	$16,978	$17,288
Instruc. Spending PP	$7,762	$7,152	$8,449	$8,947
% teachers with MA	64.9	68.7	46.2	67.8
% teachers w/ more than 2 years exp. in school	75.2	60.3	63.3	51.1
Pupil-teacher ratio	15.0	14.7	14.1	13.7
Enrollment	761	717	497	539
Reading Z-score	-0.04	-0.49	-0.01	-0.33
Math Z-score	0.04	-0.39	-0.06	-0.38
Percent				
Free lunch	75.0	87.0	70.3	87.4
Red. Price Lunch	5.8	3.3	6.3	3.5
Black	35.4	41.9	28.3	29.6
Hispanic	38.1	51.7	48.6	62.5
Asian	12.8	3.7	11.9	3.1
Special Ed.	11.8	10.7	13.1	12.7
ESL	14.5	18.8	17.7	15.6
LEP	11.3	14.7	14.0	11.3
Recent Immigrant	6.8	4.5	5.9	2.3
Years Operating	14.0	8.0	8.7	5.4
Total number of students served per year	442,868	10,461	38,121	$1,337
Total Number of Schools	582	22	117	6

NOTES: "Closed" schools are those schools that were operating at the beginning of the sample period (AY 1996-97) but were no longer operating at the end of the sample period (AY 2009-10). "Opened" schools are those schools that were not operating at the beginning of the sample period (AY 1996-97) but were still operating at the end of the sample period (AY 2009-10). "Opened and Closed" schools are those schools that were not operating at the beginning of the sample period (AY 1996-97) and were also no longer operating at the end of the sample period (AY 2009-10). All expenditures are reported in real 2010 dollars. "Total number of students" is the average total number of students served in schools of a given operating status per year. For example, in the average year, 442,868 students attended one of the continuously operating schools.

Table 2. Baseline Descriptive Statistics, CDs with and without Charter Schools, AY 1998-1999

	Never Charter	Ever Charter
Total Spending PP	$11,224	$11,671
Instruc. Spending PP	$5,944	$6,089
% Teachers with MA	**83.4**	**76.9**
% teachers w/ more than 2 years exp. in school	**66.3**	**61.7**
Pupil-teacher ratio	**17.7**	**17.4**
Enrollment per school	905	839
Reading z-score	**0.22**	**-0.06**
Math Z-score	**0.27**	**-0.09**
Percent		
Free lunch	**65.7**	**80.2**
Reduced lunch	**9.0**	**4.7**
Black	**16.4**	**47.2**
Hispanic	38.3	37.0
Asian	**18.7**	**6.0**
Special Ed.	6.7	6.6
ESL	16.8	12.6
LEP	12.0	9.6
Recent Immigrant	**9.9**	**6.0**
Number of CDs	25	30
Total number of students	8,189	9,793

NOTES: Bold indicates the difference between never charter CDs and ever charter CDs are significantly different at the 0.05 level. Never charter CDs are CDs where there are no charter schools open during the period from AY 1999-00 to AY 2009-10. Ever charter CDs are CDs where there is at least one charter school in operation during the period from AY 1999-00 to AY 2009-10.

Table 3. Baseline Descriptive Statistics, Schools in Schools with and without Charter Schools within ½, 1, and 3 miles, AY 1998-1999

	Within ½ Mile		Within 1 Mile		Within 3 Miles	
	Never Charter	Ever Charter	Never Charter	Ever Charter	Never Charter	Ever Charter
Total Spending PP	**$11,213**	**$12,079**	**$11,033**	**$11,868**	$10,853	$11,610
Instruc. Spending PP	**$5,938**	**$6,256**	**$5,834**	**$6,202**	**$5,758**	**$6,088**
% Teachers with MA	**81.9**	**74.5**	**84.7**	**75.6**	**87.8**	**78.3**
% teachers w/ more than 2 years exp. in school	**65.7**	**59.8**	**67.1**	**61.1**	**72.3**	**62.6**
Pupil-teacher ratio	**17.6**	**16.8**	17.8	17.0	**18.0**	**17.2**
Enrollment per school	**880**	**819**	851	860	**764**	**865**
Reading z-score	**0.15**	**-0.22**	**0.28**	**-0.16**	**0.45**	**-0.03**
Math z-score	**0.18**	**-0.24**	**0.33**	**-0.18**	**0.55**	**-0.03**
Percent						
Free lunch	**70.3**	**86.2**	**62.8**	**85.0**	**50.0**	**78.9**
Reduced lunch	**8.5**	**3.5**	**10.0**	**4.4**	**11.3**	**6.1**
Black	**29.1**	**49.8**	**23.3**	**45.7**	**12.5**	**39.3**
Hispanic	**34.1**	**42.6**	**26.9**	**43.9**	**21.7**	**38.8**
Asian	**15.7**	**3.6**	**20.4**	**5.2**	**29.0**	**9.4**
Special Ed.	6.5	6.4	**6.8**	**6.2**	6.8	6.4
ESL	14.1	14.7	**12.6**	**15.4**	**11.7**	**14.6**
LEP	10.8	11.6	**8.5**	**12.0**	**7.5**	**11.0**
Recent Immigrant	**8.8**	**5.0**	**9.8**	**5.8**	**9.3**	**7.2**
Number of Schools	357	225	223	359	48	534
Number of Students	314,306	184,202	189,851	308,657	36,691	461,817

NOTES: "Never charter" schools are schools that never have a charter school within a given radius during the sample period. "Ever charter" schools are schools that are located within a given radius for at least one year of the sample period. Bold indicates that the differences between "never" and "ever" charter schools are significantly different at the 0.05 level.

Table 4. Regression Estimates, Any Charter School in CD and Public School Resources, AY 1996-97 to 2009-10, Unweighted

Dependent Variable:	Log Total PP	Log Instruc. PP	% Teach w/ MA	% Teach >2 years in schl.	PTR
	(1)	(2)	(3)	(4)	(5)
Charter School in CD	0.008	0.019***	-0.625	-1.589***	0.032
	(0.005)	(0.007)	(0.442)	(0.569)	(0.438)
Year Effects	Y	Y	Y	Y	Y
School Effects	Y	Y	Y	Y	Y
Schl-year Obs	4,942	4,942	4,925	4,918	4,925
Unique Schl. Obs.	353	353	353	353	353
R-squared	0.925	0.880	0.863	0.691	0.160

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year fixed effects. Standard errors are clustered by community district-year because charter school entry measure is identical for all schools located in the same community district in the same year. The smaller number of school-year observations in columns 4 and 5 is due to missing outcome measures for some schools in some years.

Table 5. Regression Estimates, Number of Charter Schools in CD and Public School Resources, AY 1996-97 to 2009-10, Unweighted

Dependent Variable:	Log Total PP	Log Instruc. PP	% Teach w/ MA	% Teach >2 years in schl.	PTR
	(1)	(2)	(3)	(4)	(5)
1 Charter School	0.006	0.016**	-0.700	-1.713***	-0.042
	(0.005)	(0.007)	(0.472)	(0.579)	(0.426)
2 Charters schools	0.008	0.018**	-0.531	-1.521*	0.256
	(0.007)	(0.009)	(0.614)	(0.832)	(0.483)
3 plus charter schools	0.040***	0.059***	-0.007	-0.076	-0.024
	(0.010)	(0.013)	(0.694)	(0.946)	(0.732)
Year Effects	Y	Y	Y	Y	Y
School Effects	Y	Y	Y	Y	Y
Schl-year Obs	4,942	4,942	4,925	4,918	4,925
Unique Schl. Obs.	353	353	353	353	353
R-squared	0.926	0.881	0.914	0.691	0.160

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year fixed effects. Standard errors are clustered by community district-year because charter school entry measure is identical for all schools located in the same community district in the same year. The smaller number of school-year observations in columns 4 and 5 is due to missing outcome measures for some schools in some years.

Table 6. Regression Estimates, Charter Schools in CD and Public School Resources by Years Pre and Post, AY 1996-97 to 2009-10, Unweighted

Dependent Variable:	Log Total PP (1)	Log Instruc. PP (2)	% Teach w/ MA (3)	% Teach >2 years in schl. (4)	PTR (5)
Charter in CD	0.029**	0.037**	0.392	-0.622	4.019
	(0.013)	(0.015)	(1.100)	(1.123)	(3.471)
1 year pre charter	0.020	0.016	0.475	-0.624	4.427
	(0.014)	(0.016)	(1.225)	(1.363)	(3.515)
2 years pre charter	0.014	0.009	1.135	1.072	4.675
	(0.014)	(0.016)	(1.199)	(1.259)	(3.553)
3+ years pre charter	0.039**	0.038**	2.057	3.208**	4.866
	(0.015)	(0.017)	(1.301)	(1.337)	(3.861)
Year Effects	Y	Y	Y	Y	Y
School Effects	Y	Y	Y	Y	Y
Schl-year obs.	4,942	4,942	4,925	4,918	4,925
Unique Schl. Obs.	353	353	353	353	353
R-squared	0.926	0.880	0.914	0.694	0.163

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year fixed effects. Standard errors are clustered by community district-year because charter school entry measure is identical for all schools located in the same community district in the same year. The smaller number of school-year observations in columns 4 and 5 is due to missing outcome measures for some schools in some years.

Table 7. Regression Estimates, Distance to Nearest Charter School and Traditional Public School Resources, 1997-2010, Unweighted

	Within ½ mile radius			Within 1 mile radius		
	Log Total Spend.	Log Instruc. Exp.	% >2 years	Log Total Exp.	Log Instruc. Exp.	% >2 years
	(1)	(2)	(3)	(4)	(5)	(6)
Any charter within radius	0.024	0.059***	0.602	0.021*	0.063***	0.977
	(0.016)	(0.021)	(1.497)	(0.012)	(0.017)	(1.202)
Distance to nearest charter	-0.183*	-0.299**	-17.301*	-0.025	-0.119**	-6.920**
	(0.101)	(0.137)	(9.968)	(0.036)	(0.050)	(3.472)
Distance to nearest charter squared	0.418**	0.498**	28.220	-0.012	0.046	5.257*
	(0.183)	(0.240)	(17.829)	(0.033)	(0.042)	(3.146)
1 year pre charter	0.005	0.006	-3.151***	-0.020**	-0.016	-2.098**
	(0.011)	(0.012)	(0.988)	(0.010)	(0.011)	(0.944)
2 years pre charter	-0.006	-0.007	-2.119**	-0.023**	-0.021**	-1.713*
	(0.012)	(0.013)	(1.028)	(0.010)	(0.011)	(0.972)
3+ years pre charter	0.021*	0.011	-0.281	0.002	0.001	0.170
	(0.012)	(0.013)	(1.072)	(0.010)	(0.011)	(0.972)
Slope = 0	0.22	0.30	0.31	-	1.29	0.66
School effects	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y
Schl-year Obs.	3,150	3,150	3,131	5,026	5,026	4,999
Unique Schl. Obs.	225	225	225	359	359	359
R-squared	0.919	0.866	0.701	0.918	0.868	0.692

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects. In columns (1)-(3), "any charter within radius" is equal to 1 the nearest charter school is located within ½ mile of a school, and 0 otherwise. In of columns (4)-(6), "any charter within radius" is equal to 1 the nearest charter school is located within 1 mile of a school, and 0 otherwise.

Table 8. Regression Estimates, Distance to Nearest Charter School within ½ Mile Radius and Changes in Traditional Public School Composition, 1997-2010, Unweighted

Dependent variable:	Enrollment	# Gen. Ed. Stud	# Spec. Ed.	% Free lunch	% Red. Lunch	% LEP	% Rec. Immigrant
	(1)		(5)	(2)	(3)	(6)	(7)
Any charter within ½ mile	-24.928	-20.441	-4.487	5.851**	-0.052	-0.904	-0.790***
	(17.070)	(15.958)	(4.133)	(2.439)	(0.549)	(0.577)	(0.260)
Distance to nearest charter	198.743	189.982*	8.761	-26.475*	8.195**	17.181***	6.291***
	(122.061)	(114.536)	(28.382)	(15.375)	(3.553)	(3.947)	(1.957)
Distance to nearest charter sq.	-489.594**	-505.893**	16.298	43.857	-19.920***	-32.174***	-12.285***
	(230.811)	(216.850)	(53.377)	(29.268)	(6.633)	(7.833)	(3.674)
Year effects	Y	Y	Y	Y	Y	Y	Y
School effects	Y	Y	Y	Y	Y	Y	Y
School-Year Obs.	3,150	3,150	3,150	3,150	3,150	3,150	3,150
Unique Schl. Obs.	225	225	225	225	225	225	225
R-squared	0.885	0.891	0.736	0.505	0.362	0.837	0.773

Robust Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects and indicators for one, two, and three or more years pre charter entry.

Table 9. Regression Estimates, Distance to Nearest Charter School and Changes in Public School Racial Composition, 1997-2010, Unweighted

Dependent Variable:	% Black	% Hispanic	% White	% Asian
	(1)	(2)	(3)	(4)
Any charter within ½ mile	1.698**	0.531	-1.980***	-0.249
	(0.706)	(0.742)	(0.515)	(0.247)
Distance to nearest charter	-9.414**	7.782	2.024	-0.393
	(4.629)	(4.902)	(1.814)	(1.690)
1 year pre charter	1.094**	0.565	-1.735***	0.076
	(0.489)	(0.498)	(0.475)	(0.200)
2 years pre charter	1.147**	0.217	-1.571***	0.207
	(0.490)	(0.501)	(0.464)	(0.192)
3+ years pre charter	0.362	0.861	-1.616***	0.393**
	(0.488)	(0.524)	(0.457)	(0.194)
Year effects	Y	Y	Y	Y
School effects	Y	Y	Y	Y
School-year Obs.	3,150	3,150	3,150	3,150
Unique Schl. Obs.	225	225	225	225
R-squared	0.986	0.981	0.966	0.972

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects.

Table 10. Regression Estimates, Decomposing Variation in Resources, AY 1996-97 to 2007-08, Student Weighted

Dependent variable:	Log Total PP (1)	Log Instruc. PP (3)
Charter School within ½ mile	-760.671	-441.986
	(519.817)	(297.608)
Charter School * % Free Lunch	4.661	3.783
	(4.682)	(2.607)
Charter School * % Red. Lunch	-42.872**	-8.290
	(17.554)	(10.155)
Charter School* % Special Ed.	50.571***	20.288***
	(15.187)	(7.767)
Charter School * % LEP	-10.966	-1.977
	(8.118)	(4.941)
Charter School*% Immigrant	1.765	3.244
	(20.526)	(11.629)
% Free Lunch	-9.205***	-5.441***
	(2.825)	(1.682)
% Reduced Lunch	16.786*	6.797
	(9.545)	(5.412)
% Special Ed.	183.342***	75.745***
	(11.591)	(6.830)
% LEP	10.890	0.906
	(7.912)	(4.468)
% Immigrant	-37.390**	-16.795*
	(15.055)	(9.158)
Constant	9,350.689***	5,143.346***
	(390.247)	(223.293)
Year effects	X	X
School effects	X	X
Weighted Obs.	3,132	5,395,316
Unique Schl. Obs.	225	574
R-squared	0.910	0.887

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year fixed effects. Standard errors are clustered by community school district. The reference category is reduced price and full price lunch rather than simply full price lunch because some schools contain no full price lunch students.

Table 11. Characteristics of Schools by Predicted Average Increases and Decreases in Total Spending PP

	Predicted Direction of Expenditure Change	
	Increase (1)	Decrease (2)
Enrollment	723	878
General Ed. Students	650	844
Special Ed. Students	72	34
Percent		
Free Lunch	89.9	85.1
Reduced Price Lunch	3.1	4.4
Full Price Lunch	7.0	10.5
Special Ed.	10.2	7.6
LEP	12.0	16.2
Recent Immigrant	2.8	5.8
Black	55.8	45.4
Hispanic	40.7	43.7
White	1.7	6.0
Asian	1.8	4.9
N	103	122

NOTES: Predicted values are based on regression estimates in Table 10. Schools are classified as having an average increase in expenditures across all years if, on average, the predicted expenditures with a charter school located within ½ mile is greater than the predicted expenditure when no charter school is located within ½ mile. Characteristics are based on school characteristics in AY 1996-97, before any introduction of charter schools occurred.

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APPENDIX

Table A1. Baseline Descriptive Statistics, Schools in CDs with and without Charter Schools, AY 1998-1999

	Never Charter	Ever Charter
Total Spending PP	**$11,230**	**$11,754**
Instruc. Spending PP	$5,957	$6,128
% Teachers with MA	**83.4**	**76.2**
% teachers w/ more than 2 years exp. in school	**66.5**	**61.4**
Pupil-teacher ratio	**17.6**	**17.1**
Enrollment per school	894	832
Reading z-score		
Math Z-score		
Percent		
Free lunch	**65.6**	**83.5**
Reduced lunch	**9.2**	**4.8**
Black	**15.7**	**51.0**
Hispanic	**38.1**	**36.9**
Asian	**19.3**	**5.6**
Special Ed.	**6.6**	**6.4**
ESL	17.2	12.5
LEP	12.3	9.6
Recent Immigrant	**9.9**	**5.7**
Number of Schools	229	353

NOTES: Bold indicates the difference between never charter and ever charter are significantly different at the 0.05 level. Never charter schools are schools located in community districts where there are no charter schools open during this 1999-00 and 2007-08. Ever charter schools are schools located in community districts where there is at least one charter school in operation from 1999-00 to 2007-08

Table A2. Regression Estimates, Any Charter School in CD and Public School Resources, AY 1996-97 to 2009-10, Unweighted

Dependent Variable:	Total PP (1)	Instruc. PP (2)
Charter School in CD	103.354	143.131**
	(107.415)	(59.094)
Year Effects	Y	Y
School Effects	Y	Y
Schl-year Obs	4,942	4,942
Unique Schl. Obs.	353	353
R-squared	0.889	0.865

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include the school characteristics displayed in the table, as well as school and year fixed effects. Standard errors are clustered by community district-year because charter school competition measure is identical for all schools located in the same community district in the same year. The smaller number of school-year observations in columns 4 and 5 is due to missing outcome measures for some schools in some years.

Table A3. Regression Estimates, Number of Charter Schools in CD and Public School Resources, AY 1996-97 to 2009-10, Unweighted

Dependent Variable:	Total PP (1)	Instruc. PP (2)
1 Charter School	18.420	90.876
	(103.979)	(58.190)
2 Charters schools	173.537	201.233**
	(144.774)	(80.093)
3 plus charter schools	964.229***	599.254***
	(210.859)	(113.810)
Year Effects	Y	Y
School Effects	Y	Y
Schl-year Obs	4,942	4,942
Unique Schl. Obs.	353	353
R-squared	0.891	0.866

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: General education spending excludes categorical funding for special education. All models include the school characteristics displayed in the table, as well as school and year fixed effects. Standard errors are clustered by community district-year because charter school competition measure is identical for all schools located in the same community district in the same year.

Table A4. Regression Estimates, Charter Schools in CD and Public School Resources by Years Pre and Post, AY 1996-97 to 2009-10, Unweighted

Dependent Variable:	Total PP (1)	Instruc. PP (2)
Charter in CD	758.500***	468.524***
	(256.324)	(137.550)
1 year pre charter	665.375**	317.757**
	(280.199)	(150.718)
2 years pre charter	593.191**	280.994*
	(283.823)	(153.020)
3+ years pre charter	1,035.494***	541.887***
	(307.166)	(165.999)
Year Effects	Y	Y
School Effects	Y	Y
Schl-year obs.	4,942	4,942
Unique Schl. Obs.	353	353
R-squared	0.890	0.864

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: General education spending excludes categorical funding for special education. All models include school and year fixed effects. Standard errors are clustered by community district-year because charter school competition measure is identical for all schools located in the same community district in the same year.

Table A5. Regression Estimates, Distance to Nearest Charter School and Total Spending Per Pupil, Elementary Schools 1997-2010, Unweighted

Dependent variable: Log Total Spending per pupil

	Within ½ mile radius			Within 1 mile radius		
	(1)	(2)	(3)	(4)	(5)	(6)
Any charter within radius	0.010**	0.001	0.021	0.013***	0.038***	0.035***
	(0.005)	(0.010)	(0.014)	(0.004)	(0.007)	(0.010)
Distance to nearest charter		0.030	-0.186*		-0.042***	-0.029
		(0.025)	(0.101)		(0.009)	(0.036)
Distance to nearest charter squared			0.412**			-0.012
			(0.184)			(0.033)
Slope = 0			0.23 miles			-
School effects	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y
Schl-year Obs.	3,150	3,150	3,150	5,026	5,026	5,026
Unique Schl. Obs.	225	225	225	359	359	359
R-squared	0.919	0.919	0.919	0.917	0.918	0.918

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects as well. In columns (1)-(3), "any charter within radius" is equal to 1 the nearest charter school is located within ½ mile of a school, and 0 otherwise. In of columns (4)-(6), "any charter within radius" is equal to 1 the nearest charter school is located within 1 mile of a school, and 0 otherwise

Table A6. Regression Estimates, Distance to Nearest Charter School and Instructional Spending Per Pupil, Elementary Schools 1997-2010, Unweighted

Dependent variable: Log Instructional spending per pupil

	Within ½ mile radius			Within 1 mile radius		
	(1)	(2)	(3)	(4)	(5)	(6)
Any charter within radius	0.020***	0.033**	0.057***	0.023***	0.067***	0.076***
	(0.007)	(0.014)	(0.020)	(0.005)	(0.010)	(0.015)
Distance to nearest charter		-0.040	-0.300**		-0.075***	-0.123**
		(0.035)	(0.137)		(0.013)	(0.050)
Distance to nearest charter squared			0.495**			0.046
			(0.240)			(0.042)
Slope = 0			0.30			1.34
Year Effects	Y	Y	Y	Y	Y	Y
School effects	Y	Y	Y	Y	Y	Y
School-year Obs.	3,150	3,150	3,150	5,026	5,026	5,026
Unique Schl. Obs.	225	225	225	359	359	359
R-squared	0.866	0.866	0.866	0.866	0.867	0.867

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects. In columns (1)-(3), "any charter within radius" is equal to 1 the nearest charter school is located within ½ mile of a school, and 0 otherwise. In of columns (4)-(6), "any charter within radius" is equal to 1 the nearest charter school is located within 1 mile of a school, and 0 otherwise.

Table A7. Regression Estimates, Distance to Nearest Charter School and Percent of Teachers with More than 2 Years of Experience at School, 1997-2010, Unweighted

Dependent Variable: Percent of Teachers with More than 2 Years of Experience at School

	Within ½ mile radius			Within 1 mile radius		
	(1)	(2)	(3)	(4)	(5)	(6)
Any charter within radius	-0.102	0.910	2.226*	0.139	1.196*	2.259**
	(0.493)	(0.931)	(1.312)	(0.406)	(0.697)	(0.972)
Distance to nearest charter		-3.202	-17.454*		-1.797**	-7.299**
		(2.484)	(9.972)		(0.904)	(3.474)
Distance to nearest charter squared			27.124			5.307*
			(17.841)			(3.145)
Slope = 0			0.25 miles			0.69 miles
School Effects	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y
Weighted school-year observations	3,131	3,131	3,131	4,999	4,999	4,999
Unique Schl. Obs.	225	225	225	359	359	359
R-squared	0.698	0.698	0.698	0.690	0.690	0.690

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects. In columns (1)-(3), "any charter within radius" is equal to 1 the nearest charter school is located within ½ mile of a school, and 0 otherwise. In of columns (4)-(6), "any charter within radius" is equal to 1 the nearest charter school is located within 1 mile of a school, and 0 otherwise.

Table A8. Regression Estimates, Distance to Nearest Charter School and Total Spending Per Pupil, Elementary Schools 1997-2010, Unweighted

Dependent variable: Total Spending per pupil

	Within ½ mile radius			Within 1 mile radius		
	(1)	(2)	(3)	(4)	(5)	(6)
Any charter within radius	174.282*	228.563	624.449**	138.200*	927.758***	991.653***
	(103.487)	(185.565)	(265.729)	(76.721)	(133.702)	(186.654)
Distance to nearest charter		-172.398	-4,466.542**		-1,347.498***	-1,679.005**
		(511.137)	(2,049.743)		(171.983)	(693.507)
Distance to nearest charter squared			8,177.878**			320.085
			(3,733.928)			(627.471)
Slope = 0			0.27 miles			2.6 miles
School effects	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y
Schl-year Obs.	3,150	3,150	3,150	5,026	5,026	5,026
Unique Schl. Obs.	225	225	225	359	359	359
R-squared	0.886	0.886	0.886			

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects. In columns (1)-(3), "any charter within radius" is equal to 1 the nearest charter school is located within ½ mile of a school, and 0 otherwise. In of columns (4)-(6), "any charter within radius" is equal to 1 the nearest charter school is located within 1 mile of a school, and 0 otherwise

Table A9. Regression Estimates, Distance to Nearest Charter School and School Resources, Elementary Schools 1997-2010, Unweighted

	½ mile radius		1 mile radius	
	Total Spend.	Instruc.	Total Spend.	Instruc.
Any charter within radius	625.304*	501.071***	595.976**	571.854***
	(322.147)	(168.270)	(256.345)	(126.616)
Distance to nearest charter	-4,407.398**	-2,537.946**	-1,603.293**	-1,114.146***
	(2,035.467)	(1,088.056)	(690.641)	(370.165)
Distance to nearest charter squared	8,323.642**	4,194.390**	321.109	345.708
	(3,711.989)	(1,976.622)	(625.328)	(334.018)
1 year pre charter	-11.277	66.535	-555.780***	-180.534*
	(230.153)	(119.291)	(204.598)	(98.559)
2 years pre charter	-186.726	-35.733	-590.282***	-214.366**
	(232.383)	(120.393)	(209.678)	(100.642)
3+ years pre charter	349.053	156.950	-79.455	37.843
	(243.658)	(121.625)	(210.759)	(101.821)
Slope = 0	0.26	0.30	2.50	1.61
School effects	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y
Schl-year Obs.	3,150	3,150	5,026	5,026
Unique Schl. Obs.	225	225	359	359
R-squared	0.887	0.856	0.885	0.850

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

NOTES: All models include school and year effects. In columns (1)-(3), "any charter within radius" is equal to 1 the nearest charter school is located within ½ mile of a school, and 0 otherwise. In of columns (4)-(6), "any charter within radius" is equal to 1 the nearest charter school is located within 1 mile of a school, and 0 otherwise