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Measuring the effect of charter schools on public school student achievement in an urban environment: Evidence from New York City

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ABSTRACT

This paper uses student level data from New York City to study the relationship between a public school losing enrollment to charter school competitors and the academic achievement of students who remain enrolled in it. Geographic measures most often used to study the effect of school choice policies on public school student achievement are not well suited for densely populated urban environments. I adopt a direct approach and measure charter school exposure as the percentage of a public school's students who exited for a charter school at the end of the previous year. Depending on model specification, I find evidence that students in schools losing more students to charter schools either are unaffected by the competitive pressures of the choice option or benefit mildly in both math and English.

1. Introduction

Charter schools have recently emerged as popular alternatives to traditional public schools. Much attention has been paid in recent years to measuring whether students benefit academically when they attend charter schools. However, also of interest to researchers and policymakers is the effect that charter schools have on the performance of students who remain in the surrounding public schools. Charter school critics commonly charge that charters rob traditional public schools of their most promising and motivated students and the resources they need to provide a quality education. Whatever success charter schools achieve, it is often claimed, comes only at the expense of traditional public schools.

This paper adds to the research examining the impact of charter schools on the students who are "left behind" in traditional public schools within a large urban environment. The popular approach to measuring the systemic effect of charter schools using geographic distance as a measure of market exposure is appealing when studying the influence of charter schools across a state. However, it is a problematic proxy within diverse urban environments with densely packed populations. I utilize a more direct approach to measuring public school exposure to competition from charter schools to study the systemic effect of charter schools in New York City, which is both the nation's most populous city and home of its largest public school district.

Focusing on the impact of charter schools on achievement in urban public schools is important because cities have been particularly affected by competition from charter schools. In some urban centers, charter schools have grown so numerous that they have siphoned a considerable number of students from the traditional public school system. Since 1970, student enrollment in traditional public schools in Washington, D.C., has dropped by two-thirds—from 150,000 to about 44,000 students—while the city's charter schools now enroll about 28,000 students. Enrollment in Detroit's public schools has declined by 45

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Table 1
Summary statistics.

	Mean	Standard deviation
ELA Test Score	0.055	0.971
Math Test Score	0.046	0.988
Previous ELA Score	0.019	0.985
Previous Math Score	0.045	0.981
Special Education	0.169	0.375
English Language Learner	0.089	0.285
Indian	0.004	0.063
Asian	0.136	0.343
Hispanic	0.390	0.488
African-American	0.326	0.469
Multiple Race	0.000	0.010
White	0.144	0.351
Fourth Grade	0.193	0.395
Fifth Grade	0.198	0.399
Sixth Grade	0.197	0.398
Seventh grade	0.205	0.403
Eighth Grade	0.207	0.405
Year 2007	0.322	0.467
Year 2008	0.342	0.474
Year 2009	0.337	0.473
Proportion Moved to Charter	0.002	0.005

Note: Summary statistics using students in the ELA analysis. Summary stats in other analyses are similar, but not identical.

percent since 2004, and the city's expanding charter school sector is frequently blamed for producing a substantial part of this decline. In New York State, charter schools now educate more than 10 percent of students in both Buffalo, and Albany.

Students leaving public schools for charter alternatives could impact public school achievement in at least three important ways. Since a substantial portion of public school resources come in the form of per-pupil allocations, as students leave for charter schools the public school's finances might be reduced in such a way that harms the school's ability to educate its remaining students. On the other hand, pointing to market theory, some argue that by offering an educational alternative charter schools break up the public school's monopoly for local student enrollment, and public schools could respond to this competitive pressure for market share by improving the education they provide. Additionally, since students leave public schools for charter schools non-randomly, attrition to charter schools likely changes the peer make-up within public schools, which might itself impact the achievement of remaining students.

I analyze the effect of exposure to charter school competition on public school student outcomes using student-level data from New York City. Depending on the level of fixed effects utilized in the model, I find that public school students are either unaffected or make mild academic improvements when their public school loses students to a charter. I find no evidence suggesting that exposure to the charter sector has a negative effect on public school student achievement. These results are generally consistent with those of prior research using geographic methods to evaluate the effect of charter school competition statewide.

The models control for peer quality and average cohort size, suggesting that that these factors do not affect the estimated relationship between attrition to charter schools and public school student achievement. However, the estimates reported in this paper are best thought of as measuring the net effect on student achievement of a public school losing enrollment to a charter school. The inability to truly disaggregate competitive, resource, and peer effects is unfortunate given that researchers have an interest in understanding the structure of the relationship between charter enrollment and public school student achievement.

2. Charter schools nationally and in New York City

Charter schools are public schools that operate outside many of the surrounding school district's rules. Freedom from the restrictions inherent in large public institutions and from collective-bargaining agreements with teachers allows charter schools to experiment with new curricula and schooling policies to an extent that traditional public schools often cannot. Charter schools are funded with taxpayer dollars on a per-pupil basis. However, unlike traditional public schools, which tend to enroll students strictly on the basis of the zones in which they reside, students apply to attend charter schools, which may be located some distance from a student's residence.

Less than two decades since the first few charter schools opened in Minnesota as a small experiment, 1.4 million students are enrolled in the nation's 4578 charter schools, which are dispersed across forty-one states and the District of Columbia.[1] Their rapid growth shows no sign of abating and has been aggressively encouraged from many influential policymakers, including President Obama.

New York State introduced charter schools with the Charter Schools Act of 1998 during the governorship of Republican George Pataki. In 2001, when the first ten New York charter schools opened their doors, state law set the cap on the number of charter schools at 100. Because of high demand, the state quickly reached this cap; in 2007, the cap was raised to 200 charter schools under Democratic governor Eliot Spitzer.

Charter schools have expanded rapidly across the state, with the greatest growth occurring in New York City. There were seventeen charter schools operating in New York City when Mayor Michael Bloomberg took office in 2002 and made expanding charter schools an important part of his aggressive education-reform platform. Today, 100 New York City charter schools educate about 24,000—or about 2 percent—of the city's students.

Charter schools in New York City receive state funds on a per-pupil basis. As of 2008–2009, charter schools received $12,205 per pupil, which is about 70 percent of what public schools receive for every student enrolled. Charter schools do not receive taxpayer funds to cover capital costs, though about two thirds of charter schools in New York City receive free space within existing public school buildings and other in-kind resources from the school system. A recent analysis by the New York City Independent Budget Office found that charter schools in the city that operated in their own

[1] The Center for Education Reform, "National Charter School & Enrollment Statistics," http://www.edreform.com/_upload/CER_charter_numbers.pdf.

Table 2
Results of estimation in math.

Percentage Moved to Charter	0.515	2.045**	0.545
	[0.856]	[2.546]	[0.416]
Observations	944,019	1,180,114	1,180,114
Schools	1125	1130	1130
Students		557,199	
Student-School Spells			707,205
School Fixed Effect	√		
Student Fixed Effect		√	
Student-School Spell Effect			√
Excludes Third Grade	√		
Student Prior Math and ELA Score	√		
Grade Level	√	√	√
Year	√	√	√
Time-Invariant Student Characteristics	√		
Prior Math and ELA Within School	√	√	√
Number of Students in Grade Within School	√	√	√
R-Squared	0.67	0.883	0.915

Dependent variable is the student's test score in mathematics. *T*-statistics based on standard errors clustered by school reported in brackets.
*Significant at 10%.
** Significant at 5%.
***Significant at 1%.

facilities received about 18 percent fewer public dollars than did surrounding public schools, but charters in public facilities received comparable funds to the public sector once the value of that in-kind contribution is taken into account (New York City Independent Budget Office, 2010). Charter schools may also seek private donations in addition to their government allocations.

Charter schools exist throughout New York City and now operate in all five boroughs. However, they tend to locate themselves in high-poverty areas and enroll a student body that is more minority and lower-income than the average New York City school (Hoxby & Murarka, 2007).

The type of education provided in charter schools not only differs substantially from that found in the traditional public sector; it varies within the charter sector as well. For instance, the Knowledge Is Power Program (KIPP) network of charter schools, which operates four charter schools in New York City, is well known for its academic rigor and disciplinary standards; the Equity Project charter school in Manhattan, where teachers earn $125,000 per year, emphasizes teacher quality; some schools have adopted special curricula—for instance, Core Knowledge; and others extend the school day.

Whether or not charter schools are generally effective across the nation is an open question that has received a great deal of recent attention (Abdulkadiroglu et al., 2009; Bettinger, 2005; Bifulco & Ladd, 2006; Buddin and Zimmer, 2009; CREDO, 2009; Davis & Raymond, 2012; Gleason, Clark, Tuttle, Dwoyer, & Silverberg, 2010; Greene, Forster, & Winters, 2003; Holmes, DeSimone, & Rupp, 2003; Hoxby, Murarka, & Kang, 2009; Sass, 2006; Witte, Weimer, Shober, & Schlomer, 2007; Zimmer & Buddin, 2006; Zimmer, Gill, Booker, Lavertu, & Witte, 2012). The results of prior research on charter schools seem to depend on the location under consideration. That the effectiveness of charter schools varies from place to place would not be so surprising a result given that charter schools operate under very different regulations across states (CER, 2009).

Fortunately for our purposes, some of the highest quality estimates to date of the effectiveness of charter schools comes from New York City. Hoxby et al. (2009) apply a Randomized Field Trial design to study charter schools in New York City. Their study includes information on 93 percent of charter school students who were enrolled in test-taking grades, all of which are oversubscribed. They found that students who attend charter schools in New York City made substantial gains in both math and English. These findings were largely confirmed by in another analysis of the city's charters that used a propensity match design (CREDO, 2010).

3. Potential collateral effect of charter schools

However, while we are certainly interested in the effect that charter schools have on students who attend them, there is also reason to believe that the expansive growth of charter schools might influence the achievement of students who remain in the surrounding public school system. As charter schools continue to grow, so does their influence on traditional public school systems.

Charter schools likely influence public schools directly by competing with them for scarce resources. A substantial portion of traditional public schools' budgets is allocated on a per-pupil basis. Thus, when a student enrolls in a charter school, he produces a financial loss to the traditional public school to which he would have instead been assigned. Proponents as well as opponents of charter schools believe that charter schools have a collateral effect on traditional public schools, although what they see as the implications of this competition differ.

Skeptics charge that charter schools are bound to diminish the effectiveness of traditional public schools by depriving them of the financial and human resources that they need to provide their students with a high-quality education. For instance, each student who attends a

Table 3
Results of estimation for math, by student subgroups.

	African-American	Hispanic	White	Quartile 1	Quartile 2	Quartile 3	Top quartile
Percentage Moved to Charter	1.296	2.336**	−3.63	0.224	0.394	−0.272	1.679*
	[1.564]	[2.049]	[−1.360]	[0.285]	[0.617]	[−0.455]	[1.948]
Observations	379,068	475,986	159,732	219,225	234,257	239,575	233,609
Schools	1123	1125	1066	1120	1121	1122	1120
Students	180,214	223630	75518				
School Fixed Effect				√	√	√	√
Student Fixed Effect	√	√	√				
Excludes Third Grade				√	√	√	√
Student Prior Math and ELA Score				√	√	√	√
Grade Level	√	√	√	√	√	√	√
Year	√	√	√	√	√	√	√
Time-Invariant Student Characteristics				√	√	√	√
Prior Math and ELA Within School	√	√	√	√	√	√	√
Number of Students in Grade Within School	√	√	√	√	√	√	√
R-Squared	0.865	0.863	0.864	0.501	0.536	0.522	0.462

Dependent variable is the student's test score in mathematics. *T*-statistics based on standard errors clustered by school reported in brackets.

* Significant at 10%.

** Significant at 5%.

***Significant at 1%.

Table 4
Results of estimation in English language arts.

Percentage Moved to Charter	0.268	1.687***	0.71
	[0.549]	[3.233]	[0.935]
Observations	948,064	1,174,608	1,174,608
Schools	1126	1131	1131
Students		557,012	
Student-School Spells			705,744
School Fixed Effect	√		
Student Fixed Effect		√	
Student-School Spell Effect			√
Excludes Third Grade	√		
Student Prior Math and ELA Score	√	√	
Grade Level	√	√	√
Year	√	√	√
Time-Invariant Student Characteristics	√		
Prior Math and ELA Within School	√	√	√
Number of Students in Grade Within School	√	√	√
R-Squared	0.594	0.85	0.892

Dependent variable is the student's test score in ELA. *T*-statistics based on standard errors clustered by school reported in brackets.
*Significant at 10%.
**Significant at 5%.
*** Significant at 1%.

charter school in Detroit reportedly takes with him $7500 in state funding that would have gone to his traditional public school.[2] Further, traditional public schools might respond to competition from charter schools in a way that distracts from their goal of providing high-quality educational services. For instance, faced with substantial declines in enrollment (due in part to charter schools), the Washington, D.C., public school system spent $100,000—money that could have been spent in the classroom—on an advertising campaign intended to lure students back to the traditional public schools.[3]

On the other hand, some argue that competition from charter schools can be expected to improve traditional public schools precisely because competition threatens their budgets. They argue that the monopoly on student enrollment that public schools have under the current system has insulated them from any consequences for their failure. An infusion of charter schools creates a market for schooling alternatives that challenges the public school monopoly. Market theory suggests that traditional public schools should respond to competition for customers (i.e., students) by improving the quality of education that they offer. See, for instance, Nechyba (2003).

The financial impact that comes from losing students to charter schools might be particularly substantial in New York City, the focus of the present analysis. Beginning in 2003, the city adopted what it calls Fair Student Funding. Under this program, two-thirds of a school's budget is allocated on a per-pupil basis, where previously the majority of funding was based on school-level factors such as the number and experience of teachers in the school. The number of dollars that follow a particular student is weighted by his grade level and by factors thought to be related to the difficulty of educating him—income level, previous year's academic performance, English learning status. Thus, New York City's schools potentially stand to lose more per-pupil resources when a student leaves for a charter school than do individual schools in other districts and states.

Additionally, charter schools can influence public school student achievement by altering peer composition within schools (Epple & Romano, 1998). Students almost certainly leave for charter schools non-randomly. If more able students tend to exit for the charter sector then the achievement of those who remain in public schools could be harmed by the reduction in peer quality. Alternatively, if students tend to leave charter schools because they are underachieving, then the changes in school composition could lead to academic gains for students who remain in public schools.

Previous research provides some high quality estimates about the impact of charter schools on public school student achievement across a state. Hoxby (2002), Booker, Gilpatric, Gronberg, and Jansen (2008), and Sass (2006) find public school benefits from charter school competition, while Bettinger (2005), Buddin and Zimmer (2009), and Bifulco and Ladd (2006) find no competitive effect.

However, one possible limitation of this research is that its procedures for measuring the intensity of charter school exposure—and perhaps its results as well—may not translate directly to the urban context. Five of the seven previous studies measuring the systemic impact of charter schools use the number of charter schools within a limited geographical distance of a public school—usually 2.5 or five miles—as their measure of intensity (the above exceptions are Hoxby, 2002; Buddin & Zimmer, 2009). The idea is that public schools are more affected by charter schools when their students have a greater number of charter options nearby. Charter schools over five miles from a student's home might not pose a meaningful competitive threat because of the deterrent effect of transportation costs and other costs. The consistency, soundness, and simplicity of employing a standard radius to evaluate the systemic effect

[2] Marisa Schultz, "Charter Schools Expanding," *Detroit News*, August 29, 2009.
[3] Stephanie Simon, "Hard-Hit Schools Try Public-Relations Push," *Wall Street Journal*, August 17, 2009.

Table 5
Results of estimation for math, by student subgroups.

	African-American	Hispanic	White	Quartile 1	Quartile 2	Quartile 3	Top quartile
Percentage Moved to Charter	1.324**	1.289**	2.379	1.227	0.3	−0.22	−0.0366
	[2.252]	[2.027]	[0.781]	[1.602]	[0.510]	[−0.369]	[−0.0615]
Observations	380,504	472,183	159,161	220,573	235,327	240,443	234,333
Schools	1123	1126	1068	1120	1122	1123	1120
Students	181,233	222,972	75,531				
School Fixed Effect				√	√	√	√
Student Fixed Effect	√	√	√				
Excludes Third Grade				√	√	√	√
Student Prior Math and ELA Score				√	√	√	√
Grade Level	√	√	√	√	√	√	√
Year	√	√	√	√	√	√	√
Time-Invariant Student Characteristics				√	√	√	√
Prior Math and ELA Within School	√	√	√	√	√	√	√
Number of Students in Grade Within School	√	√	√	√	√	√	√
R-Squared	0.843	0.846	0.809	0.531	0.522	0.491	0.414

Dependent variable is the student's test score in ELA. *T*-statistics based on standard errors clustered by school reported in brackets.
*Significant at 10%.
** Significant at 5%.
***Significant at 1%.

of a school-choice program statewide makes this geographical measure particularly appealing.

However, geographical measures of charter school influence are of limited value in densely populated cities, which is where the influence of charter schools is the most severe. For example, the number of charter schools within a five mile radius has a very limited meaning in an environment such as New York City's. On one hand, the wide availability of public transportation makes crossing such distances less burdensome than in some areas, at least for older students. On the other hand, the environments encompassed within five urban miles can be quite heterogeneous, thus potentially limiting the likelihood that they draw students from so far away: a five mile radius surrounding a home in midtown Manhattan could include not only Union Square, Harlem, Greenwich Village, the Upper East and Upper West Sides, and all of downtown, but would also extend into parts of both Brooklyn and the Bronx.

Thus, it is possible that methods utilized by previous research are not well suited to measuring the systemic effect of charter schools on public school achievement within cities. If the effects of charter schools in cities differ from the effects of competition in less densely populated areas, the findings of previous research may not apply to the urban systems that are facing the heaviest competition from charter schools.

I propose a more direct measure of the systemic effect from charter schools in an urban environment and use it to study the impact of charter schools on public school achievement in New York City—the nation's largest public school system and home to a rapidly growing charter sector. I use the percentage of a traditional public school's students at the end of the previous year who left for a charter school as a measure of charter school influence on a public school. By this definition, a public school is more greatly affected by charter schools than some other school if it has recently lost more of its students to charter schools. This more direct measure of charter school influence on public school enrollments was recently utilized by Buddin and Zimmer (2009) to study the competitive effect of charter schools in California.

This paper adds to the growing but still insufficient literature evaluating the impact of competition on public schooling generally. I provide estimates of the influence of charter schools on traditional public schools in the particular context of a large urban environment, which is a population of considerable policy interest. Further, I evaluate the growing influence of charter schools in the country's largest and most diverse school system—one so large that it educates about 2.2 percent of public school students in the United States.

4. Data and method

I use student-level data provided by the New York City Department of Education. The data set contains math and English Language Arts (ELA) test scores and demographic information on the universe of test-taking New York City public school students in grades three through eight from the 2005–2006 through the 2008–2009 school years. I convert test scores into standard-deviation units within grade and year, both to facilitate the interpretation of results and to account for the fact that New York's state assessment is not vertically scaled. The data set contains unique identifiers for each student and school. Descriptive statistics on students used for estimation are presented in Table 1.

I use the student-level longitudinal data set to identify those students who were enrolled in a public school one year and in a charter school the next and use this information to calculate the percentage of a school's students who left for a charter school at the end of the previous year. Under this definition, a school can be said to be facing an increase in competition from the charter sector if a growing number of its students are leaving for a charter school.

New York City traditional public schools saw a meaningful level of migration to the charter sector in the years covered in the data set. In the 2007–2009 school years, the average school lost 0.2 percent of its students to a charter school at the end of the year preceding the one being reviewed. Some schools faced more competition from the charter sector than did others. About 8 percent of New York City schools in a given year lost over 1 percent of their student body from the year before to a charter school. Further, among schools that lost at least one student to a charter school, the average percentage of student body lost was 0.7 in a given year, and 19 percent of these schools lost over 1 percent of their enrollment, a figure probably large enough to precipitate changes in a school's policies and practices.[4]

The percentage of students who left a particular public school for a charter alternative within this data set understates the level of competition facing public schools because it does not account for a large group of students who enter a charter school earlier than the third grade. I assume that the percentage of students leaving a traditional public school for the charter sector corresponds to the percentage of students who would have been assigned to that school but go to a charter school before they reach a grade that is observed in the data set.

Accounting for unobserved difference in student ability is the second major issue to address. Not only is accounting for unobserved differences in students a nearly

[4] The calculation of the proportion of students who leave a public school for the charter sector includes students who "grade out" of the public school, which is problematic. In the case of transition grades it is the nearby middle school that would be affected by charter competition because they would not enroll the student. However, in New York, the large majority of charter middle schools begin enrolling students in the fifth grade, which is not a transition grade for most students: 45 percent of "moving" students in our sample left in the fifth grade, and only 15 percent of students left in the sixth grade. One difficulty is that students in New York have several options in middle school other than attending the zoned school, so it would be difficult if not impossible to identify the middle school affected by a student's movement into a charter in a transition grade. Further, since not all schools have the same final grades, and it would be overly burdensome to identify the transition grade for each school, we include all students who leave for the charter sector in our calculation.

universal problem when studying the influence of an education policy; measuring the level of influence of charter schools on public schools in terms of the percentage of students who leave a traditional public school exacerbates this problem. Since they also have the ability to attend (or at least apply to) a charter school, students who remain in public schools are a selected group. If students who leave for charter schools are different from those who remain in traditional public schools, then failing to account for such differences could severely bias estimation. Though the selection problem is somewhat worsened by the direct measure of attrition to charter schools, it is present in studies using geographic measures as well since we assume that being located near charter schools is related to the probably that students leave for the charter sector.

As does other recent work in this area, I account for unobserved heterogeneity by taking advantage of the panel nature of the dataset and incorporating fixed-effects at the student and/or school level. Use of fixed-effects will account for all time-invariant factors related to either the student or the school, depending on the level of fixed effect used.

I also report models that account for unobserved heterogeneity at the student and school level by incorporating a "spell" effect based on student-school matches. Use of the spell effects accounts for time-invariant student and school factors related to a student's math or ELA proficiency. Recent papers also evaluating public school responses to the influence of school choice policies that use such a spell effect include Sass (2006), Bifulco and Ladd (2006), and Booker et al. (2008).

Models that include only a fixed effect at the school level account for unobserved student heterogeneity by controlling for the student's test score in math and ELA at the end of the previous year. Since testing in New York begins in the third grade, these models only utilize observations of students in fourth through eighth grade. It is not necessary to account for prior test scores when we include a student fixed-effect because the fixed-effect itself accounts for unobserved heterogeneity. Though not reported here, results from the models that use a student fixed-effect or student-school spell effect are similar if we remove third grade students and also if we include a control for prior test scores.

Formally, the basic model for estimation takes the form:

$$Y_{ist} = \alpha X_{ist} + \beta S_{st} + \lambda move_{st-1} + \delta_t + \theta_i + \varepsilon_{ist} \quad (1)$$

where Y_{ist} is the test score of student i in school s at the end of year t normalized to standard-deviation units within grade and year; X is a vector of observed student characteristics; S is a vector of time variant school characteristics—the average prior math and ELA proficiency of the students within grade and school peers and the number of students in the same grade and school—which account for changes in peer composition and in class size; *move* represents the percentage of students in the school who left for a charter school at the end of the previous year; δ is a year fixed effect; θ is a student fixed effect, which is replaced in alternative specifications with either a school fixed-effect or a student-school spell effect; ε is a stochastic term clustered by school; and α and λ are parameters to be estimated.

Though the data set begins with students in 2006, the analysis begins to observe student performance only in 2007 because the previous year's observation is needed to calculate the percentage of students who moved to a charter school. Thus, in each analysis, we observe up to three years of a student's academic performance: 2007–2009.

I exclude students who are currently attending a charter school. While charter schools do compete with one another for students, students leave one charter school for another for reasons different from their reasons for leaving their local public school. Further, this measure fails to account for students who leave a charter school for what is likely their greatest competitor: the traditional school to which they may always return.

I estimate models in math and ELA. The primary models use data on all test-taking students in New York City. I also look for the presence of modifiers of charter schools' competitive effect by running models restricted to students of particular races/ethnicities and by the quartile of the student's prior achievement level within the school. Since the quartile of prior achievement can change for the student over time, models that evaluate the effect of charter competition on student achievement by prior proficiency level only incorporate a school fixed effect.

5. Results

Table 2 reports the results of the estimations in math. The models that account for only a school fixed-effect or a student-school spell effect both find an insignificant relationship between charter school competition and student math proficiency. However, the model that incorporates a student fixed-effect finds a significant positive relationship between the proportion of students in the school who left for a charter school and the math achievement of those who remain in the public school. Nonetheless, the statistically significant effect found in the student fixed-effect model is very mild: the results from the student fixed-effect model suggest that a school losing one percent of its students to charter competition (proportion of 0.01) is related to an increase of 0.02 standard deviations on student math scores.

Table 3 reports the results from math when the model is restricted to students of particular characteristics. Only Hispanic students appear to benefit significantly in math from charter competition. In fact, for white students the coefficient is substantial and negative in direction, though it fails to meet any conventional level of statistical significance. Further, it appears that only students in the top quartile of math achievement within the school the previous year benefit from competition, though, again, no prior achievement group is harmed by competition.

The results from our analysis of the influence of charter school competition on student achievement in ELA are found in Table 4. As was the case in the math analysis, only the model that utilizes a student fixed-effect shows a significant competitive effect, and it is again positive in direction. However, the positive effect of charter school competition

on student achievement found in the student fixed-effect model is statistically significant but again very mild in size.

Finally, Table 5 reports the results of our ELA estimation when we restrict the model to include certain types of students. In ELA, both African-American and Hispanic students appear to benefit from charter competition. The coefficient in the model that includes only white students is positive, but again fails to meet a conventional level of significance. There is no discernable effect of charter competition for students in particular prior quartiles of ELA achievement within the school.

6. Conclusion

In this paper, I find some evidence that increases in the attrition to charter schools from traditional New York City public schools has small but positive effects on the academic proficiency of students who remain in public schools. From a policy perspective, it is important that no model specification suggests that student achievement has been harmed by increased charter school competition. These estimates are relatively consistent with those found in previous research evaluating the effect of charter schools and other forms of school choice on student achievement at public schools.

The results of this study add to a wide body of research indicating that public school students potentially benefit somewhat, or at least are not harmed, when their school faces competition from school-choice policies. The most important contribution of this paper is its focus on measuring the influence of school choice in a large urban setting. The finding that public school students benefit, though slightly, from competition from charter schools provides some encouragement for those who would continue to expand the charter school sector in American cities.

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