Title: Factors Associated with Charter School Impacts

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Background:

Charter schools are a central component of current efforts to reform the public education system in the United States. These schools are publicly financed, but are freed from many of the regulations that govern traditional public schools, such as those involving staffing, curriculum, and budget decisions. As of fall 2010, more than 5,400 charter schools served about 1.7 million students—about 3.5 percent of all public school students—in forty states and the District of Columbia. Prior research on the effectiveness of charter schools in boosting student achievement has been mixed. A number of studies have found that across a broad set of charter schools, average impacts are either negative or statistically insignificant (Sass 2006; Bifulco and Ladd 2006; Booker et al. 2007; Hanushek et al. 2007; Zimmer et al. 2009; CREDO 2009; Gleason et al. 2010). On the other hand, several recent lottery-based studies have found positive impact estimates for oversubscribed urban charter schools (Hoxby and Rockoff 2005; Abdulkadiroglu et al. 2009; Hoxby et al. 2009; Dobbie and Fryer 2010). This pattern of findings suggests that variation in estimated impacts across studies is being driven by the sample of schools studied—positive impacts among urban charter schools, negative or no impacts among charter schools elsewhere.

One finding from the research that seems quite clear is that there is a great deal of variation in effectiveness across individual charter schools (CREDO 2009; Hoxby et al. 2009; Gleason et al. 2010; Angrist et al. 2011). Some schools have positive impacts on student achievement; others have negative impacts. Since charter schools have greater autonomy in their design and operations than the typical traditional public school, and are viewed by their supporters as being laboratories for innovative educational ideas, this variation is perhaps not too surprising. However, we know very little about what factors are associated with charter school effectiveness. In particular, what characteristics or factors seem to be associated with more effective versus less effective charter schools? Better understanding the root causes of variation in charter school effectiveness will help policy makers translate the most successful practices within and outside of the charter school sector.

Purpose:

In this paper, we explore variation in charter school effectiveness, measure the factors related to the schools’ impacts on student achievement, and examine one policy lever that may affect the performance of charter schools. To do this, we use impact estimates for a set of oversubscribed charter schools generated as part of the National Charter School Study, conducted by Mathematica Policy Research for the U.S. Department of Education. We measure the variation in impacts across these schools and measure the correlation of various factors to these impacts, in both a bivariate and multivariate framework. The factors we examine include general policy parameters (such as the school’s levels of funding and autonomy), characteristics of the school like the student-teacher ratio, and characteristics of students enrolled in the school. Subsequent sections describe in greater detail the role of authorizers as well as our data, research approach, results, and conclusions.
Setting:

Our analysis is conducted on a set of 36 charter schools across 15 states, and includes data on a control group of students attending other schools in nearby districts.

Population:

We examine a population of students who applied to enter one of the participating charter schools in the 2005-2006 or 2006-2007 school years.

Intervention:

Our study examines the relationship between various characteristics of charter schools and their impacts on student achievement.

Research Design:

The design for our analysis used as a starting point the impact estimates from the experimental study. These estimates were based on a comparison of outcomes among a treatment group of students who applied to participating charter schools, participated in the admission lottery, received a favorable lottery draw, and were offered admission to the school versus a control group of applicants who participated in the same admissions lotteries but were not offered admission. We focus on estimated impacts for each participating school on student achievement in reading and math two years after the admission lottery. To ensure the integrity of this experimental design, we observed the admissions lotteries, monitored the overall admissions process, and used sample weights to account for idiosyncrasies of individual schools’ admissions. The details of our approach to ensuring the integrity of the design are presented in Tuttle et al. (2011).

We then examined correlations between these estimated impacts and characteristics of the charter schools and their environments. In particular, we focused on three sets of characteristics, or factors that could be related to charter school effectiveness: (1) aspects of the policy environment in which the schools operated; (2) policies and practices of the schools themselves; and (3) characteristics of the students attending these schools. We examined these relationships in both a bivariate and multivariate framework. It should be noted that the design for examining these relationships, unlike the main design for estimating impacts, was non-experimental and exploratory.

Data Collection and Analysis:

Data for the analysis come from several different sources. As noted above, we attended schools’ admissions lotteries and obtained data from the schools at that time on lottery outcomes (that is, which students were admitted to the school based on their lottery draw and which were not admitted). During a two year follow-up period (as well as for a baseline period), we obtained data on student characteristics and outcomes from administrative data collected from states and districts. The data included students’ performance on state assessments in reading and math,
which we standardized using the mean and standard deviation of the distribution of all test-takers in the state.

We obtained data on the characteristics of charter schools, their students, and the policy environment from several different sources. We administered a survey of the principals of each school attended by a sample member during the first follow-up year, including both the charter schools participating in the study and the schools attended by control students (including traditional public schools, other charter schools, and private schools). The principal survey provided a wide range of information on school characteristics and their environments. In addition to these sources of data collected by the study team, we used three sources of secondary data to provide school-level information not collected as part of the principal survey: (1) the Common Core of Data and Private School Survey; (2) the School Data Direct website; and (3) school-specific report cards on state department of education websites.

The lottery data and student data were used to estimate impacts in each of the study’s charter schools. The specific methods used to estimate these impacts are detailed in Gleason et al. (2010). We used three approaches to examine the link between study charter school characteristics and achievement impacts:

1. **Simple bivariate associations between individual factors and impacts.** We calculated simple correlation coefficients between the year 2 math and reading achievement impacts and the value of a given characteristic for charter schools in the study.

2. **Associations between individual factors and impacts while controlling for other factors.** We estimated two versions of a multivariate model in which the relationships between the charter school impacts and several charter school characteristics were examined simultaneously. This allowed us to examine whether the simple bivariate association between a given characteristic and charter school impacts persisted once we accounted for other characteristics. With so many characteristics possibly related to impacts—many highly correlated with one another—we included in the multivariate analysis only a subset of these factors, some of which we combined.* The two versions of the model differ only in the variable representing student characteristics included in the model—one includes the percentage of students eligible for free or reduced-price meals, and the other includes students’ average baseline test scores.

3. **Impacts for subgroups of schools.** We estimated impacts on test scores separately among schools with low and high values of each factor that had a statistically significant bivariate association with at least one outcome. We defined “high” and

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* We excluded the following: (1) factors that did not have a statistically significantly bivariate association with impacts on at least one of the year 2 test score outcomes and (2) factors highly correlated with other factors that we decided to include in the model. Several student characteristics were highly correlated with one another—the proportion of study charter school students who were white, the proportion eligible for free or reduced-price meals, baseline reading scores, and baseline mathematics scores all had bivariate correlations with one another that exceeded 0.75 in absolute value, with 1.00 reflecting a perfectly aligned relationship. We created a single baseline test score factor by averaging baseline reading and mathematics scores because they were also correlated with each other.
“low” values in terms of whether the value of the factor for that charter school was above or below the sample median. We then conducted a significance test to determine whether the impact of study charter schools with high values of the factor differed significantly from the impact of study charter schools with low values of the factor.

Results:

Table 1 presents summary results from the analysis. Key results from the analysis included the following:

- The only policy characteristic that is associated with impacts is revenue, which is positively correlated with impacts on math achievement, but not reading. In addition, this relationship becomes statistically insignificant in the multivariate framework.
- Total enrollment in charter schools was negatively related to impacts on achievement.
- Impacts were inconsistently related to length of the school day/year and the teacher-student ratio. These estimated relationships were not consistently statistically significant in the different specifications.
- Impacts on math (but not reading) were positively related to schools’ use of ability grouping.
- Impacts on math (but not reading) were positively related to the proportion of disadvantaged students in the school and negatively related to the mean baseline level of achievement of the students in the school.
- Impacts on math (but not reading) were more positive for schools in urban areas, although this relationship disappeared when we controlled for student characteristics.

(please insert Table 1 here)

Conclusions:

Results of our analysis show that the impacts of charter schools vary greatly across charter schools, even in this set of charter schools that are oversubscribed and hold admissions lotteries. The factor that correlates most strongly with impacts appears to be characteristics of the schools’ student populations. Charter schools serving students who are disadvantaged and have low achievement levels at entry are more likely to have positive impacts on student achievement, particularly in math. Those serving less disadvantaged and higher achieving students are more likely to have negative impacts. The schools serving more disadvantaged students tend to be located in urban areas, so if we do not control for student characteristics there is a strong positive relationship between impacts on math achievement and location in urban areas. This finding is consistent with the general pattern of findings in the literature, in which the studies finding the most positive impacts of charter schools have invariably focused on charter schools in large urban areas. In addition, Angrist et al. (2011) found a similar pattern of differences in charter school impacts across urban versus non-urban areas in an analysis of charter schools in Massachusetts.
Appendices
Not included in page count.

Appendix A. References
References are to be in APA version 6 format.


### Table 1. Summary of Estimated Relationships Between Site Characteristics and Charter School Impacts Based on Bivariate Associations, Multivariate Regressions, and Subgroup Analysis

<table>
<thead>
<tr>
<th>Site Characteristic/Factor</th>
<th>Bivariate Association</th>
<th>Multivariate Regression&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Subgroup Analysis&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Bivariate Association</th>
<th>Multivariate Regression&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Subgroup Analysis&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy Environment</strong></td>
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<tr>
<td>Autonomy score</td>
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<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<td>Accountability score</td>
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<td>NS</td>
<td>NS</td>
<td>NS</td>
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<td>Revenue per student</td>
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<td>NS</td>
<td>NS</td>
<td>Positive</td>
<td>NS</td>
<td>Positive</td>
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<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<tr>
<td>Operated by private org</td>
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<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<tr>
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<tr>
<td>Total enrollment</td>
<td>Negative</td>
<td>NS</td>
<td>NS</td>
<td>Negative</td>
<td>Negative&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Negative&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>Enrollment per grade</td>
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<td>NS</td>
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<tr>
<td>Total hours in school year</td>
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<td>Positive</td>
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<td>Positive</td>
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<td>NS</td>
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<td>Proportion of teachers with experience</td>
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<tr>
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<td><strong>Student and School Characteristics</strong></td>
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<tr>
<td>Average mean baseline reading/math score</td>
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<td>NS</td>
<td>Negative</td>
<td>Negative</td>
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<td>Negative</td>
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<td>% white, non-Hispanic</td>
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<td>NS</td>
<td>Negative</td>
<td>n/a</td>
<td>NS</td>
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<tr>
<td>% eligible for free/reduced-price meals</td>
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<td>NS</td>
<td>Positive</td>
<td>Positive</td>
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<td>School in urban area</td>
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<td>NS</td>
<td>Positive</td>
<td>NS</td>
<td>Positive</td>
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</table>

Note: The full results of each of these analyses are presented in Appendix G. See Table G.2 for the bivariate analysis, Table G.3 for the multivariate regression results, and Tables G.5 through G.16 from the subgroup analysis results.

<sup>a</sup>The multivariate regression included only those site characteristics for which there was a statistically significant bivariate association with impacts on either Year 2 reading scores or Year 2 math scores. Site characteristics for which there is no entry in the above table were not included in the analysis. Because of the high degree of correlation between mean baseline test scores, the % white, non-Hispanic, and the % eligible for free/reduced-price meals, we did not include each of these three characteristics in the same multivariate regression. We focused on the mean baseline test score and % eligible for free/reduced-price meals because of their greater policy relevance, and estimated separate multivariate regression for each.

<sup>b</sup>The subgroup analysis was conducted only for those site characteristics for which there was a statistically significant bivariate association with impacts on either Year 2 reading scores or Year 2 math scores. Site characteristics for which there is no entry were not included in the analysis.

<sup>c</sup>The coefficient on enrollment in the multivariate regression analysis was negative and statistically significant in the model that included the average mean baseline reading/math score and was negative but not statistically significant in the model that included the % eligible for free/reduced-price meals.

n/a: Not applicable. We did not include % white, non-Hispanic in the multivariate analysis despite the fact that it was significant in the bivariate analysis because of its high correlation with both the % eligible for free/reduced-price meals and average baseline reading and math scores.