Targeted vs. General Education Investments

Evidence from Special Education and English Language Learners in Boston Charter Schools

Elizabeth Setren

ABSTRACT

Using novel variation in special education and English language learner classification from admissions lotteries, I find that students can achieve large academic gains without specialized services. Enrolling in a Boston charter doubles the likelihood that students lose their special education or English language learner status, but exposes students to a high-performing general education program. Effects extend to college—charters nearly double the likelihood that English language learners enroll in four-year colleges and quadruple two-year college graduation rates for special education students. Results suggest that high-quality general education practices drive the gains and find no detrimental effect from reduced classification.

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I. Introduction

How to allocate educational resources to serve students with large achievement gaps remains a pressing concern. The largest sources of federal funding for K–12 education, Title I for low-income students and IDEA for special education students,[1] pay for targeted services that affect only those students. State spending policies often follow this categorical spending model by targeting additional investment in low-income, special education, and English language learner (ELL) students towards specialized services as opposed to broader investments in school quality that would affect all students. The additional funds go towards specially trained teachers, counselors, therapists, curriculum consultants, and paraprofessionals that focus on the specialized populations as opposed to general investments, like increased instructional time, higher performing teachers, or tutoring programs. This funding allocation comes from a strong assumption that marginal education spending aimed to help low-performing groups of students should be focused on specialized supports instead of a balance between specialized supports and general school quality.

Policies to improve the educational and career outcomes for special education and ELL students are increasingly important as their prevalence in urban districts grows: 50 percent of Boston Public School (BPS) students have either a special education or ELL status.[2] Schools invest two to four times more per pupil for special education students and ELL students (Hayes et al. 2013; Chambers, Parrish, and Harr 2004). Even with this additional investment, the special education and ELL achievement gaps are at least double the size of the low-income and Black–white achievement gaps.[3] Despite special education and ELL students' increasing prevalence, higher costs, and low academic achievement, little causal evidence exists for how to improve their educational trajectories.

1. The federal government allocated 15.5 billion dollars for Title I and 12 billion dollars for IDEA in fiscal year 2019.
2. Author's calculations using the Massachusetts Department of Elementary and Secondary Education Student Information Management System data for Boston Public Schools for the 2013–2014 school year.
3. Author's calculations using the Massachusetts Department of Elementary and Secondary Education Student Information Management System data based on high school graduation.

maintained student confidentiality before the author submitted it to this journal, and she exercised that right. The author obtained IRB approval with "exempt" research status for this project by MIT and NBER. The data for this project are confidential, but may be obtained with data use agreements with the Massachusetts Department of Elementary and Secondary Education (DESE) and Boston area charter schools. Researchers interested in access to the data may contact research@doe.mass.edu and www.doe.mass.edu/research/contact.html; see also www.doe.mass.edu/research/agenda.html "Office of Planning and Research: Research Agenda") for access to the enrollment, student characteristic, test score, and teacher data. Access to charter school lottery records comes from collecting lottery records from individual charter schools over many years. See Table A1 for the list of participating charter schools. Contact information for individual charter schools is available through the Massachusetts DESE website (http://www.doe.mass.edu/charter/ "Charter School List"). Interested researchers will need to negotiate data use agreements to gain access to the data. Elizabeth Setren (Elizabeth.Setren@tufts.edu) will maintain an archive of the data until 12 months after publication of the article at the National Bureau of Economic Research, at which time they are required to destroy the data per the NBER agreements with DESE, but researchers may contact the author for access to the archive of programs and documentation, which will not be destroyed.

To understand the trade-offs between investments in targeted special education and ELL supports versus general school quality, we either need exogeneity in access to specialized supports or in the allocation of funds to specialized supports and general school investments. However, schools endogenously designate students as special education and ELL based on student needs and ability. Additionally, families endogenously sort into schools, making it difficult to conduct this analysis.

Boston charter schools and their randomized admissions lotteries offer a unique opportunity to look at both types of variation. First, I find that charter enrollment at least doubles the likelihood that a student in special education or ELL at the time of the lottery loses this classification and subsequently access to specialized services. The classification changes occur for students with a wide range of special education and ELL needs. This enables the first analysis of the impact of specialized services for students far from the qualification margin for services. Past work on ELL and special education focuses on the impact of services for marginally qualified students. Research on ELL classification for marginally qualified students finds mixed effects (Pope 2016; Robinson-Cimpian and Thompson 2015). Hanushek, Kain, and Rivkin (2002) analyze students who move in and out of special education programs and find that special education classification boosts math outcomes, but these movements are not exogenous. This is also the first study to use exogenous variation in special education classification.

Second, the Boston charter school lotteries create variation in access to high-performing schools (Boston charters) versus lower performing schools that spend more on specialized supports (BPS).[4] Boston charter schools spend 44 percent less on special education instruction compared to BPS (see Online Appendix Table A11).[5] At the same time, Boston charters implement a set of education practices that affect all students, including increased instructional time, high academic and behavioral expectations, high-intensity tutoring, data-driven instruction, and frequent teacher feedback. These practices have a strong positive relationship with school effectiveness in charters and yield positive effects when implemented in traditional public schools or schools converted to a charter model (Angrist, Pathak, and Walters 2013; Dobbie and Fryer 2013; Fryer 2014; Abdulkadiroğlu et al. 2016). However, little is known about the effect of these practices or charter schools on special education and ELL students specifically.

Critics argue that charter schools underserve special education and ELL students because charters enroll lower rates of these students compared to district schools. Charters also lack the economies of scale of traditional public school districts, which may make it difficult to provide separate classrooms and other intensive resources (Government Accountability Office 2012; Boston Globe Editorial Board 2015; Massachusetts Teachers Association 2015).[6] These criticisms hold true in Boston; however, the lower special needs enrollment and reduced spending on intensive services stem

4. Lottery-based evidence shows that Boston charters generate large academic gains relative to applicants' traditional public school options (Angrist, Pathak, and Walters 2013; Angrist et al. 2016; Abdulkadiroğlu et al. 2011).

5. Districts do not report ELL specific school expenditures. See Online Appendix Table A11 for detailed BPS and charter school expenditure and grant information.

6. I will refer to students with special education and ELL classifications at the time of the charter lottery as special needs students.

from charters moving students to more inclusive, general education settings. As such, this study speaks to policy debates about the trade-offs of targeted services versus inclusion in general education classrooms.

My lottery-based estimates find large, positive effects of Boston charter enrollments for students with special education or ELL classifications at the time of the lottery. For special needs students, the Boston charter treatment includes reduced access to specialized services and exposure to high-quality general education practices. One year of charter attendance results in 0.261 standard deviation gains in math scores for special education applicants and by 0.326 standard deviations for ELL applicants. The gains for these special needs students are similar to those made by non-special-needs students in charter schools.

Charters also significantly increase the likelihood that special needs students meet a key high school graduation requirement, become eligible for a state merit scholarship, and take an AP exam. Special education students in charters are more than twice as likely to score 1200 or higher on the SAT than their traditional public school counterparts. Charters nearly double the likelihood that ELL students enroll in four-year colleges and quadruple the likelihood of two-year college graduation for special education students.

Charters generate academic gains even for the most disadvantaged charter applicants. Special needs students who scored in the bottom third on their state exams in the year of the lottery experience gains of more than 0.24 standard deviations in math. English language learners with the lowest baseline scores have the largest English exam gains. Students with the most severe needs at the time of the lottery—special education students who spent the majority of their time in substantially separate classrooms and ELLs with beginning English proficiency—perform significantly better in charters than in traditional public schools.

Lastly, I use a multiple instrument strategy that harnesses school-specific variation in reclassification rates and pre-lottery characteristics of charter applicants to separately estimate the academic effects of general education practices and specialized services. I find suggestive evidence that special education and ELL classification removal have weak positive effects on test scores. The weak positive correlation between individual charter schools' classification removal effects and special education and ELL achievement gains supports this finding. At the same time, school practices that predict gains for general education students also predict gains for special needs students. Together, this suggests that the achievement gains stem mostly from the general education practices and point to a weak positive effect from reduced specialized services.

Combined, the findings show that it is feasible for special needs students to make large academic gains without special needs services in a high-quality general education program. The effects extend throughout the ability distribution and level of need. This suggests that increased focus on general school quality investments can improve special education and ELL student outcomes.

The next section provides background on Boston charter schools, discusses the special needs classification process, and describes the data analyzed here. Section III details my empirical strategy and reports the effect of charter enrollment on special needs classification. Section IV reports the academic effects of charter enrollment, and Section V investigates mechanisms. The final section concludes.

II. Background and Data

A. Special Needs Classification Processes

The special education classification process begins when a parent, teacher, or school staff requests an evaluation for a student. This can happen at any grade or age. After a request, the district or a private psychologist conducts an evaluation. The school holds a meeting with the parent(s) to decide the student's classification. If the student is classified, the school develops an individualized education program (IEP) that details the supports the student will receive. Students are designated to full inclusion, partial inclusion, or substantial separate classrooms. Students in full inclusion spend less than 21 percent of their time outside of the general education classroom. Partial inclusion students spend between 21 percent and 60 percent of their time in a separate setting. Substantially separate students spend more than 60 percent of their time receiving special education services. Schools are required to reevaluate students' classification and level of services every three years.[7]

To classify students as English language learners, Massachusetts public schools survey the parent(s) of all new students, including those coming from within the same district.[8] Students whose primary home language is not English take an English Proficiency exam. A licensed ELL teacher or administrator interprets the test to decide whether the student will be classified as ELL and to determine the set of services they will receive. Every spring, ELL students take a state standardized English proficiency exam. Teachers and ELL specialists evaluate these results to reconsider students' ELL status and services. State guidelines suggest how to decide the level of services students receive on the basis of their English proficiency exam scores, but schools have discretion.

Schools aim to improve English language ability of ELL students so that they no longer need the ELL classification and services. This goal of removing classification does not exist for special education students; rather, schools aim to provide the proper set of supports to enable the child to succeed academically.

B. Classification Incentives

The financial and accountability incentives for special needs classification go in opposite directions and impact charters more than traditional public school districts. The state and local school funding formula in Massachusetts does not include special education enrollment to discourage overclassification. For the same reason, the federal Individuals with Disabilities Act (IDEA) Grant, which provides funding to the states for special education costs, does not consider the number of classified students in its funding formula. As a result, school funding formulas disincentivize special education classification due to higher costs for special education services.[9]

7. Cullen (2003) and Kubik (1999) analyze how financial incentives affect special education classification. Cullen and Rivkin (2003) overviews the classification incentives and stratification in school choice programs.
8. The survey is offered in 28 languages and administered by specially trained professionals (including teachers, principals, and guidance counselors). The training teaches the professionals to detect whether families falsely report English proficiency.
9. Districts in Massachusetts can also receive reimbursement for individual students' special education costs above a high threshold. In addition, districts can apply for Medicaid reimbursement for qualifying medical services.

The funding formula includes lagged ELL enrollment, but districts face financial disincentives to classify students if the costs of services exceed additional funding. Massachusetts also distributes federal funding for ELL programs through a lagged ELL enrollment formula. A 2015 Massachusetts state commission found that the state formula did not provide enough funding to meet the costs of educating ELL students and recommended an additional $2,361 for each ELL student (Chang-Diaz and Peisch 2015). This implies that schools face financial disincentives to classify both special education and ELL students. Smaller school districts, including charter school districts, face relatively larger disincentives for providing special needs services because of economies of scale.

Accountability incentives encourage schools to properly classify special needs students. The state inspects schools for proper identification of special needs and provision of services. The state accountability system considers the outcomes of special needs students in addition to overall student performance. This incentivizes districts to provide the proper set of services so that special needs students succeed academically.[10] Charter schools face higher accountability standards and the threat of deauthorization, so these incentives affect charters more acutely than traditional public schools.

C. Data and Sample

To study the effect of charter attendance for special needs students, I use the admissions lotteries of 30 Boston elementary, middle, and high school charters from the 2003–2004 to 2014–2015 school years. These schools account for 89 percent of Boston charter entry grade enrollment in 2012–2013.[11] Schools are excluded from the study if they closed,[12] declined to participate,[13] had insufficient records,[14] did not have any oversubscribed lotteries,[15] or serve alternative students.[16] Online Appendix Table A1 describes the schools and application cohorts in the sample. In having near full coverage of an entire city's charter sector, including all grade levels, this study overcomes the common criticism of lottery-based charter school studies that the set of schools electing to share data might differ from the rest of the city's charters.

I match lottery records to state administrative education data for detailed student demographics, enrollment, and outcomes. These data provide both baseline characteristics of students from the time of the lottery and post-lottery outcomes. Data include

10. This might also incentivize overclassification to increase the performance of special education students as a whole. The state inspections and financial disincentives counter this incentive.

11. The sample expands upon the 11 Boston charter schools included in Angrist, Pathak, and Walters (2013) by incorporating charter elementary schools, adding nine additional charter middle and high schools and extending the sample to include the 2011–2012 through 2014–2015 school years.

12. Uphams Corner Charter School closed in 2009. Fredrick Douglas Charter School and Roxbury Charter High School both closed in 2005.

13. Kennedy Academy for Health Careers (formerly Health Careers Academy) and Helen Davis Leadership Academy (formerly Smith Leadership Academy) declined to participate.

14. Boston Renaissance and Dudley Street Neighborhood Charter School had insufficient records.

15. UP Academy Dorchester opened in 2013–2014 and did not have an oversubscribed lottery.

16. Boston Day and Evening Academy Charter serves alternative students, including those who are over-age for high school, dropouts, and students with behavioral and attendance issues. In addition to serving a different population than the other Boston charters, Boston Day and Evening Academy uses rolling admissions instead of a lottery, making the school not appropriate for inclusion in this study's empirical strategy.

special education status, disability type, and level of classroom inclusion for special education students and ELL status, native language, and test scores on the annual English proficiency exam for ELLs. I categorize ELL students as beginning, intermediate, or advanced English proficient using their English proficiency exam scores and state guidelines for the amount of services to provide ELLs based on the exam. I study students with special needs classifications at the time of the lottery because special needs status can change over time. Throughout the paper, mentions of special education and ELL students refer to those with baseline classifications. Similarly, analysis by level of inclusion or English proficiency refers to baseline characteristics. More details about the data and matching procedure appear in the Online Appendix.

The main analysis estimates the impact of charter school attendance on academic outcomes for students by their pre-lottery special needs status. As a result, applicants who are not enrolled in Massachusetts public schools the year of the lottery are excluded because they do not have a pre-lottery special needs status. This excludes 95.4 percent of pre-K applicants and 70.7 percent of kindergarten applicants. These excluded applicants are used to investigate the effect of attending a charter school on special needs initial classification.

D. Representation of Special Needs Students

Until recently, special needs students were underrepresented among charter applicants and attendees. In 2010, the Massachusetts state legislature passed a law that required charter schools to increase efforts to recruit and retain special education and ELL students. Figure A1 in the Online Appendix shows that the special education application gap has narrowed for both middle and high school. In spring 2004, 22.1 percent of BPS students in Grades 4 and 5 had a special education status. Comparatively, only 17.0 percent of charter applicants in those grades had a special education status. By the spring 2014 lottery, the prevalence of special education students in middle school charter lotteries was similar to BPS: 22.6 and 23.1 percent, respectively. The gap also closed for high school, with 20.3 percent of applicants with a special education status in charters, compared to 19.5 percent of BPS eighth-graders. Gaps in enrollment have also narrowed. Figure A1 in the Online Appendix shows that gaps between BPS and charters remain in middle school special education entry grade enrollment, but special education students are overrepresented in ninth grade in charters.[17]

Gaps in ELL application and enrollment rates in BPS compared to charters were historically larger, but they have also narrowed. Figure A2 in the Online Appendix shows that in spring 2004, ELL students were almost three times more prevalent in BPS than in charter middle and high school lotteries. In the past decade, ELLs have become more prevalent in BPS, and the gap has closed. By spring 2014, ELLs have similar prevalence in BPS and charters: 24 percent in each for high school and 30 and 27 percent, respectively, for middle school.

Differences between the application and enrollment trends result from parental choices in response to other school options and the sibling lottery preference. Online

17. I do not display the application and enrollment trends for elementary school charters because a low proportion of pre-K and kindergarten charter applicants have a pre-lottery special needs status.

Appendix Figures A1 and A2 show that the enrollment gaps have reversed for special education students in high school. The trends are noisier for ELL students, but the middle school ELL enrollment gap has almost halved, from 18 percent at its peak in 2007 to 9 percent in 2014. Similarly, the high school ELL enrollment gap has halved, from 9.5 percent in 2009 to 4.3 percent in 2014. Because ELL students were historically underrepresented in charters, the sibling lottery preference means that ELL students have a lower likelihood of getting a charter offer compared to non-ELL students. This likely contributes to the current ELL enrollment gap.

By spring 2014, students across the pre-lottery levels of special education classroom inclusion and English language proficiency are, for the most part, similarly represented in charter lotteries and BPS, as shown in Online Appendix Figures A3 and A4. Small gaps remain for substantially separate inclusion students in middle school and high school and for beginning English speakers in high school.

III. Classification

A. Empirical Framework and Descriptive Statistics

I use charter lottery offers as instruments to estimate the causal effect of attending charter schools in a two-stage least squares setup. The second-stage equation links charter school attendance with outcomes as follows:

$$(1) \quad y_{igt} = \alpha_t + \beta_g + \sum_j \delta_j d_{ij} + X_i' \theta + \tau C_{igt} + \epsilon_{igt}$$

where y_{igt} is the outcome of interest for student i in grade g in year t. The terms α_t and β_g represent outcome year and grade effects. The d_{ij} are dummy variables for all combinations of charter school lotteries (indexed by j) present in the sample (henceforth referred to as experimental strata). These experimental strata control for the fact that the set of school applications determines the probability of receiving an offer. Baseline demographic characteristics from the year of the lottery, represented by vector X_i, include gender, race, subsidized lunch status, ELL, special education, and a female–minority interaction.

The treatment variable, C_{igt}, equals one if the student enrolled in a charter any time following the lottery and before schools reported special needs classification.[18] For models testing charter effects on college preparation measures and high school graduation, C_{igt} indicates charter enrollment between the lottery and the test or graduation date. Standard errors are clustered on the school, grade, and year of the outcome. The parameter τ captures the causal effect of charter school enrollment. I estimate the model separately for each baseline special needs status: special education, ELL, and non-special needs.

When estimating the math or English exam effects, C_{igt} represents years spent in a charter from the time of the lottery to the test date. Students take exams in Grades 3–8 and Grade 10, so elementary and middle school applicants who appear in multiple

18. Students for whom C_{igt} equals zero enroll in non-charter public schools, including traditional public schools, pilot schools, exam schools, and innovation schools. For simplicity, I refer to this group by the most common type: traditional public schools.

testing grades contribute multiple observations to the estimation. To account for this, the standard errors, ϵ_{igt}, are clustered on the unique student identifier in addition to the school, grade, and year of the test. For math and English test results, the parameter τ estimates the causal effect of a year of charter school attendance.

I use two instruments for charter attendance: whether a student receives a random offer on the day of the lottery (immediate offer) or whether a student receives an offer from the randomly ordered waitlist (waitlist offer). Z_{1i} is equal to one if the applicant received an immediate offer to attend a charter and zero otherwise. Z_{2i} designates whether the applicant received a waitlist offer. Online Appendix Table A1 details the schools and application cohorts with immediate and waitlist offers.

The first-stage equation for the instrumental variables estimation is:

$$(2) \quad C_{igt} = \lambda_t + \kappa_g + \sum_j \mu_j d_{ij} + X_i' \Gamma + \pi_1 Z_{1i} + \pi_2 Z_{2i} + \eta_{igt},$$

where π_1 and π_2 capture the effects of receiving immediate or waitlist offers on charter attendance. Like the second-stage equation, the first stage includes year and grade effects, experimental strata dummies, and baseline demographic controls.

Because they are randomly assigned, charter offers are likely to be independent of student background and ability within experimental strata. The pre-lottery demographics and test scores are similar for offered and nonoffered students, as shown in Columns 3 and 4 of Table 1. Differences in baseline characteristics by offer status are small and mostly statistically insignificant, and the *p*-values from joint tests are high. The subset of students with baseline special needs also have comparable characteristics across offer status, as seen in Columns 7 and 8 for special education and Columns 11 and 12 for ELL.

Differences between charter applicants and BPS students are documented in the first two columns of Table 1. Lottery applicants are less likely to have a special education status than BPS students. The two populations have similar rates of ELL students (though as discussed above, this is not historically true). All levels of English proficiency are more represented in charter applicants than in BPS students. Lottery applicants have slightly higher baseline test scores than BPS students (0.042 and 0.093 standard deviations in math and English, respectively).

Columns 5 and 6 of Table 1 show that BPS students and lottery applicants who have special education statuses at the time of the lottery have similar demographic characteristics. Columns 9 and 10 show that the BPS and charter applicant ELLs have similar rates of female, Latinx, and reduced-price lunch students, but different rates of Black students. Special education and ELL charter applicants have large achievement gaps relative to the general charter lottery applicant pool and have baseline test scores about one standard deviation below the state mean. However, their average test scores are 0.08 to 0.21 standard deviations higher than special education and ELL students in BPS.

Despite the positive selection on test scores, the special education and ELL students who apply to charters represent a range of needs. The charter applicant pool includes students who receive high, moderate, and low levels of services, although students from substantially separate classrooms are slightly underrepresented and students from partial inclusion classrooms are slightly overrepresented in charter lotteries relative to BPS. Also, students of all levels of English proficiency are more prevalent in charter lotteries than in BPS.

Table 1
Descriptive Statistics and Covariate Balance

	Boston Public Schools (BPS) Students	All Lottery Applicants			Special Education at Baseline				English Language Learner at Baseline			
Baseline Characteristics	Mean (1)	Nonoffered Mean (2)	Immediate Offer (3)	Any Offer (4)	BPSMean (5)	Nonoffered Mean (6)	Immediate Offer (7)	Any Offer (8)	BPS Mean (9)	Nonoffered Mean (10)	Immediate Offer (11)	Any Offer (12)
Female	0.480	0.503	0.010 (0.013)	0.001 (0.013)	0.337	0.342	0.012 (0.030)	0.013 (0.030)	0.471	0.482	0.006 (0.028)	–0.012 (0.028)
Black	0.392	0.461	–0.023 (0.013)	–0.017 (0.013)	0.450	0.477	0.005 (0.031)	–0.006 (0.031)	0.191	0.269	0.009 (0.025)	–0.002 (0.024)
Latinx	0.363	0.369	0.013 (0.012)	0.005 (0.012)	0.360	0.360	–0.015 (0.029)	–0.016 (0.029)	0.627	0.624	–0.035 (0.027)	–0.004 (0.027)
Subsidized lunch	0.753	0.749	0.002 (0.011)	–0.007 (0.011)	0.797	0.757	0.031 (0.024)	0.012 (0.025)	0.847	0.844	–0.003 (0.020)	0.001 (0.018)
Baseline math test score	–0.449	–0.407	0.016 (0.027)	–0.012 (0.027)	–1.181	–1.002	–0.012 (0.066)	0.018 (0.066)	–0.820	–0.736	0.017 (0.057)	–0.047 (0.055)
Baseline English test score	–0.548	–0.455	–0.028 (0.028)	0.004 (0.028)	–1.424	–1.214	–0.036 (0.069)	0.062 (0.068)	–1.142	–0.980	–0.028 (0.062)	–0.003 (0.060)

(*continued*)

Table 1 (*continued*)

	Boston Public Schools (BPS) Students	All Lottery Applicants			Special Education at Baseline				English Language Learner at Baseline			
Baseline Characteristics	Mean (1)	Nonoffered Mean (2)	Immediate Offer (3)	Any Offer (4)	BPS Mean (5)	Nonoffered Mean (6)	Immediate Offer (7)	Any Offer (8)	BPS Mean (9)	Nonoffered Mean (10)	Immediate Offer (11)	Any Offer (12)
Special education	0.226	0.192	0.007 (0.011)	–0.002 (0.011)	1.000	1.000			0.212	0.190	–0.008 (0.022)	0.001 (0.022)
Substantially separate classroom	0.080	0.050	0.005 (0.005)	–0.004 (0.006)	0.355	0.260	0.016 (0.025)	–0.017 (0.026)	0.088	0.067	–0.021 (0.011)	–0.008 (0.012)
Partial inclusion	0.056	0.057	0.008 (0.007)	0.002 (0.007)	0.249	0.296	0.021 (0.030)	0.014 (0.030)	0.058	0.059	0.015 (0.016)	0.011 (0.015)
Full inclusion	0.093	0.082	–0.005 (0.007)	–0.001 (0.007)	0.411	0.425	–0.035 (0.030)	–0.004 (0.030)	0.076	0.061	0.000 (0.014)	–0.001 (0.013)
English language learner	0.231	0.258	–0.008 (0.011)	–0.003 (0.011)	0.217	0.254	–0.023 (0.026)	–0.010 (0.026)	1.000	1.000		
Beginning proficiency	0.017	0.025	–0.006 (0.003)	–0.007 (0.003)	0.015	0.024	–0.007 (0.006)	–0.006 (0.005)	0.073	0.098	–0.019 (0.012)	–0.028 (0.013)

(*continued*)

Table 1 (*continued*)

	Boston Public Schools (BPS) Students	All Lottery Applicants			Special Education at Baseline				English Language Learner at Baseline			
Baseline Characteristics	Mean (1)	Nonoffered Mean (2)	Immediate Offer (3)	Any Offer (4)	BPSMean (5)	Nonoffered Mean (6)	Immediate Offer (7)	Any Offer (8)	BPS Mean (9)	Nonoffered Mean (10)	Immediate Offer (11)	Any Offer (12)
Intermediate proficiency	0.071	0.121	0.002 (0.009)	0.005 (0.008)	0.094	0.144	0.008 (0.022)	−0.002 (0.022)	0.306	0.465	0.033 (0.028)	0.035 (0.027)
Advanced proficiency	0.049	0.058	0.001 (0.008)	0.004 (0.007)	0.026	0.029	−0.009 (0.015)	0.001 (0.013)	0.205	0.216	0.010 (0.027)	0.018 (0.027)
Observations with school/offer type	194,712	7,591	5,085	10,408	43,918	1,458	1,007	2,076	44,998	1,956	1,119	2,188
p-value			0.661	0.661			0.592	0.924			0.499	0.995

Notes: This table shows descriptive statistics for Boston Public School (BPS) students and charter lottery applicants. Column 1 shows means for BPS attendees in charter application grades (Pre-K, K, 1, 3, 4, 5, and 8) for 2003–2004 through 2013–2014. Column 2 shows means for charter lottery applicants who did not receive offers. Columns 3 and 4 report coefficients from regressions of observed characteristics on immediate offers and any offers, controlling for experimental strata dummies. *p*-values come from tests of whether all non-test score coefficients equal zero. Baseline test scores are only available for applicants to the fourth grade or higher. Columns 5–12 report analogous results for the subsample with special education classification and ELL classification in the lottery application year.

Ten percent of both BPS and charter applicants have a specific learning disability, the most common disability type (see Online Appendix Table A2).[19] Four percent of BPS and charter applicants have the second most common disability, communication impairment, which includes articulation, language, or voice impairments and stuttering. Health, intellectual, physical, and sensory impairments and multiple disabilities each constitute less than 1 percent of both BPS and charter applicant students and have similar rates in both populations. Autism, developmental delay, emotional impairment, and intellectual impairment each represent 1–3 percent of the BPS population and are underrepresented in charter lotteries.[20]

Immigrant students constitute about one-third of the ELL population in both BPS and charter lotteries (see Online Appendix Table A2). Elementary school–aged immigrant ELL students are more prevalent in charter lotteries than BPS, while high school–aged immigrant ELL students are underrepresented. Spanish speakers account for almost 60 percent of ELL BPS students and charter applicants and 13 percent of the full charter applicant sample. The rest of the ELL students comprise speakers of a variety of other languages, with Haitian Creole and Chinese as the next most common.

These summary statistics show that the study sample covers students with a wide range of special education and ELL characteristics, including students with low baseline test scores, high levels of special education need, and low levels of English proficiency. Given that I cannot observe student motivation and parental knowledge of students' ability, it is possible that these applicants could be positively selected in unobservable ways compared to the general BPS student body.

B. Special Needs Classification

Receiving a lottery offer increases the likelihood of enrolling in a charter and the amount of time spent in a charter school (see Online Appendix Table A3 for these first-stage estimates). Special needs applicants with an offer on the day of the lottery spend approximately one year longer in charters compared to those without offers. Those with waitlist offers spend more than 0.63 years longer in charters relative to those without offers. Immediate and waitlist offers also boost the likelihood that special needs students will enroll in charters one year after the lottery, by more than 51 and 34 percentage points, respectively.[21] Of those students who enroll in charters, they attend charters for an average of 3.0, 2.4, and 2.7 years, respectively, for elementary, middle, and high schools.

Charters remove special needs classifications and move special education students to more inclusive settings at the time of enrollment[22] at a higher rate than traditional public schools. Column 2 of Table 2 shows that applicants with a special education status at the

19. Federal laws 34 C.F.R. §300.7 and 300.541 define specific learning disability as "a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia."

20. For detailed information about disability type rates by grade-level group, see Online Appendix Table A2.

21. The first stage for charter enrollment does not equal one because some students with offers elect to go to traditional public schools and some students without offers ultimately enroll by moving off of a waitlist after our data collection.

22. Data are collected October 1. Given this short time span, schools likely do not have sufficient time to alter the initial classification given at the time of enrollment before the reporting date.

Table 2
Effect of Charter Enrollment on Special Education Classification

	Any Special Education		Substantially Separate Classroom		Partial Inclusion		Fully Inclusion		Classification Removed or Moved to More Inclusive Classroom	
Baseline Status	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Effect (6)	Trad. Public Mean (7)	Charter Effect (8)	Trad. Public Mean (9)	Charter Effect (10)
All special education	0.890	–0.118							0.151	0.271
		(0.032)								(0.035)
N		3,153								3,153
Substantially separate Classroom	0.967	–0.173	0.834	–0.660	0.049	0.028	0.051	0.274	0.114	0.380
		(0.036)		(0.065)		(0.039)		(0.052)		(0.063)
N		808								808
Partial inclusion	0.914	–0.079			0.627	–0.526	0.173	0.374	0.225	0.409
		(0.048)				(0.069)		(0.063)		(0.066)
N		1,004								1,004

(*continued*)

Table 2 (*continued*)

	Any Special Education		Substantially Separate Classroom		Partial Inclusion		Fully Inclusion		Classification Removed or Moved to More Inclusive Classroom	
Baseline Status	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Effect (6)	Trad. Public Mean (7)	Charter Effect (8)	Trad. Public Mean (9)	Charter Effect (10)
Full inclusion	0.823	–0.126					0.617	–0.029	0.117	0.080
		(0.052)						(0.062)		(0.043)
N		1,278								1,278
New students to MA	0.014	–0.011	0.001	–0.002	0.003	0.003	0.008	–0.008		
Public schools (no prior Special ed. evaluation)		(0.006)		(0.002)		(0.004)		(0.005)		
N		2,665								

Notes: This table reports two-stage least squares estimates of the effects of Boston charter enrollment on special education classification and level of classroom inclusion in the fall following the charter lottery. Traditional public means show the proportion of charter applicants who do not enroll in charter schools with a given special education status. Immediate and waitlist offer dummies instrument for enrollment in charter schools. Estimation is run separately for each baseline classroom inclusion type. Students in full inclusion spend less than 21 percent of their time outside of the general education classroom. Partial inclusion students spend between 21 and 60 percent of their time in a separate setting, and substantially separate students spend more than 60 percent of their time receiving special education services. Effects persist for up to two years following the charter application. All models control for gender, ethnicity, female × minority interaction, baseline special education, baseline ELL, baseline subsidized lunch, experimental strata, year-applied dummies, and grade-applied dummies. Standard errors are clustered by school–grade–year.

time of the lottery are 11.8 percentage points more likely to have their classification removed in charters than in traditional public schools.[23] Charters even remove special education status from students with more severe disabilities: applicants from substantially separate classrooms are 17.3 percentage points less likely to keep their special education status in a charter compared to a traditional public school. The classification removal effects appear consistent across disability type, though the point estimates are noisy due to relatively smaller sample sizes (see Online Appendix Table A4).

Charter enrollment increases the likelihood that special education applicants move to more inclusive classrooms[24] by 27.1 percentage points (see Column 10 of Table 2).[25] This means that students spend more time in a general education classroom and less time receiving services outside of the mainstream classroom. Charters move students across all ranges of need to more inclusive settings. Students from substantially separate classrooms have a 66.0 percentage point increase in inclusion from charter enrollment (see Column 4 of Table 2). Charters place these high-need students in full inclusion classrooms 27.4 percentage points more often than traditional public schools (see Column 8 of Table 2). Enrolling in charters leads to a significant increase in classroom inclusion across all disability types (see Online Appendix Table A4).

Charters remove ELL status at the time of enrollment 31.8 percentage points more often than traditional public schools (see Table 3). Students with intermediate and advanced English proficiency drive the differences in classification. Those with beginning English proficiency rarely have their ELL classification removed at the time of enrollment. The effects are not driven by a specific language. Applicants who speak Spanish, Haitian Creole, and other languages each experience significantly lower rates of keeping their ELL classification in charters (see Online Appendix Table A5).

In addition to removing classifications and increasing classroom inclusion, charters designate new Massachusetts public school students as special needs at a lower rate than traditional public schools. Traditional public schools classify 1.4 percent of new students to Massachusetts public schools as special education at the time of enrollment.[26] Attending a charter leads to an even lower special education classification rate, close to zero (see Column 2 of Table 2).[27] Traditional public schools designate 63.7 percent of non-native-English speakers, the potential candidates for ELL services, as ELL. The rate is 26.1 percentage points lower in charters (see Table 3).

The classification and inclusion effects described in this section are consistent across grade-level and persist for at least two years (see Online Appendix Tables A6–A9).

23. I consider students to have their classifications removed if they had a classification the year of the lottery, have no classification on the October 1 following the lottery, and continue to have no classification for the next two years. I follow the same practice for changes in classroom inclusion.

24. Increased inclusion includes removing classification, moving from substantially separate inclusion to partial or full inclusion, and moving from partial inclusion to full inclusion.

25. A small proportion of special education applicants move to a less inclusive classroom following the charter lottery. This occurs at a similar rate in BPS and charter schools (estimates available upon request).

26. The state actively recruits students with special education needs for early intervention pre-K that starts at age three. Therefore, a large portion of students who qualify for special education services at a young age already have a classification at the time of the lottery.

27. I find that less than 0.8 percent of charter applicants who apply from a Massachusetts public school are designated special education for the first time in the fall after the lottery. Two years after the lottery, the rate of new classifications is around 3.5 percent. There is no significant difference in the classification of latent disabilities between the charter and traditional public schools.

Table 3
Effect of Charter Enrollment on English Language Learner Classification

	Remain English Language Learner	
Baseline Status	Trad. Public Mean (1)	Charter Effect (2)
All English language learners	0.825	–0.318
		(0.044)
N		3,763
Beginning proficiency	0.996	–0.037
		(0.030)
N		287
Intermediate proficiency	0.954	–0.343
		(0.055)
N		1,810
Advanced proficiency	0.589	–0.270
		(0.076)
N		1,008
New non-native-English speaking students (No prior English language learner evaluation)	0.637	–0.261
		(0.061)
N		856

Notes: This table reports two-stage least squares estimates of the effects of Boston charter enrollment on ELL classification in the fall following the charter lottery. Immediate and waitlist offer dummies instrument for enrollment in charter schools. Estimation is run separately by baseline English proficiency level. Effects persist for up to two years following the charter application. Standard errors are clustered by school–grade–year. See Table 2 notes for detailed regression specifications.

C. Explanations for Classification Removal and Increased Inclusion Effects

Learning gains cannot justify the classification differences because the special needs status changes occur at the beginning of the school year following the lottery. At this point, schools have not had time to generate substantial learning gains.

Massachusetts law requires schools to assess the English proficiency of all incoming non-native-English-speaking students. Therefore, schools assess all incoming ELLs, but charters use their discretion when interpreting the English proficiency exam and remove ELL classification 2.8 times more often than traditional public schools. This supports the idea that charters have lower preference for ELL classification. The lower special education classification in charters for new pre-K and kindergarten students also implies that charters have a lower preference for classification compared to traditional public schools.

Unlike for English language proficiency assessment, Massachusetts does not require schools to assess all new enrolled students for special education needs. Therefore, factors other than schools' classification preferences could contribute to different special

education classification practices. Better transfer of student records between BPS schools compared to between BPS schools and charter schools plays a major role in changes to special education classification. Charters learn of special needs classifications from voluntary parental reporting before they receive school records. The initial reliance on parental reporting could contribute to fewer students keeping their special education classifications in charters. A survey conducted by the Massachusetts Department of Elementary and Secondary Education found that the most common reason for special education classification removal was parent(s) not disclosing.[28] The reasons why parents decline reporting special education status could include stigma, individual preferences, not knowing their child received special education services, assuming the school received the records, and not understanding what special education means. Additionally, parents can refuse their child's special education classification. Parental refusal of special needs status could differ in charters compared to traditional public schools.

Charters' preference for high levels of special education inclusion, which is often cited in charter schools' annual reports, likely also plays a role in higher levels of inclusion. Additionally, the relatively smaller size of charter schools makes it less likely for them to have the economies of scale to provide substantially separate and partial inclusion services to students compared to traditional public schools.

D. Special Needs Inputs and Implications of Special Needs Reclassification

Students who have their special needs status removed have substantially different educational experiences than those who remain classified. Schools are only legally obligated to provide special education or ELL services to students with special needs classifications. Therefore, the higher rate of classification removal in charter schools likely results in baseline special needs students receiving fewer special education and ELL services. Additionally, students who are moved to more inclusive classrooms spend less time receiving services. Classification differences likely contribute to the large differences in special needs educational inputs between charters and BPS.

Students who enroll in charters experience lower special education and ELL staff-to-student ratios (Columns 4 and 6 of Online Appendix Table A10). Lottery applicants who enrolled in BPS have roughly 1.9 special education and 1.5 ELL staff per 100 students. Enrolling in a charter school exposes lottery applicants to 1.1 fewer special education staff and 1.3 fewer ELL staff per 100 students. Lower counts of special needs teachers drive the lower special needs staff-to-student ratio in charters.

Despite having fewer classified special needs students, charters employ similar proportions of special needs specialists[29] and content support teachers.[30] The similar

28. The survey took place in response to the findings of this study. It investigated all cases of special education classification removal in the 2012–2013 through 2014–2015 school years. All sample charters participated. Forty-nine percent of the cases cited parent(s) not disclosing. The other reasons include unknown (12 percent), record error (12), student found ineligible for services after lottery by BPS (8), student transferred out of charter soon after enrolling (7), parent declined services (7), student determined ineligible by charter (3), and charter gave services later in the year (2).

29. Specialists include special education and ELL directors who oversee service provision, special education diagnosticians, therapists, and counselors.

30. Content support teachers coach teachers in how to better serve those with special education needs or limited English proficiency in the classroom. Alternatively, they also can teach alongside other teachers, providing

rates of specialists in charters and traditional public schools suggest that either specialists work with students who remain classified more intensively or that they also serve students without special needs classifications. Charters also spend 44 percent less on special education instruction compared to BPS (shown in Online Appendix Table A11).[31]

IV. Academic Effects

Charter enrollment leads to two changes for special needs students: higher likelihood of classification removal and exposure to the charter school environment. The charter school environment and classification removal could have complementary or opposing effects. The high academic and strict behavior standards common in Boston charter schools could leave special needs students behind or motivate them to meet higher expectations. Special needs students could thrive in a more inclusive classroom environment or fall behind without the specialized services they previously received.

Prior research suggests no effect or limited gains from ELL classification removal (Chin, Daysal, and Imberman 2013; Pope 2016), except Robinson-Cimpian and Thompson (2015), who estimate a negative effect when lower ability ELLs marginally qualify for classification removal. To the best of my knowledge, no causal evidence exists for special education classification removal.[32]

In this section, I present causal estimates of the effect of charter enrollment on special needs students' outcomes. These estimates reflect the combined effect of classification removal and the charter environment. In Section IV, I estimate the academic effects of classification removal and the charter environment separately.

A. Charter School Effects

1. Test score effects

Charter school attendance has large positive effects for math and English state exam scores for students with special education or ELL status at the time of the lottery. Table 4 documents the large and statistically significant gains for special needs applicants. A year of charter attendance increases math test scores by 0.261 standard deviations for special education applicants and by 0.326 standard deviations for ELL applicants. Charters generate English score gains of 0.205 and 0.241 standard deviations for special education and ELL applicants (shown in Table 4). Positive charter effects are statistically similar for special education and non-special-needs students. Point estimates for ELLs are statistically significantly larger than non-special-needs effects.

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additional attention and differentiation. They could more broadly help students without special education or ELL statuses who might also benefit from the additional attention or a more accessible learning environment. In particular, these interventions could help students with baseline special education and ELL statuses who had their classification removed.

31. Districts do not report ELL specific school expenditures. See Online Appendix Table A11 for detailed BPS and charter school expenditure and grant information.

32. Using nonexogenous movements of students in and out of special education programs, Hanushek, Kain and Rivkin (2002) find positive impacts on math test scores.

Table 4
Test Score Effects of Years in Charter by Baseline Special Needs Status

	Special Education		English Language Learner		Non-Special Needs	
	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Mean (6)
Math	–0.982	0.261	–0.503	0.326	–0.113	0.268
		(0.053)		(0.045)		(0.023)
N		4,824		5,404		16,643
English	–1.146	0.205	–0.728	0.241	–0.113	0.163
		(0.054)		(0.043)		(0.022)
N		4,829		5,416		16,622

Notes: This table reports the two-stage least squares estimates of the effects of years spent in charter schools on test scores. Traditional public means show the average score of charter applicants who do not enroll in charter schools. Immediate and waitlist offer dummies instrument for years spent in charter schools. Columns 1 and 2 show estimates for applicants with baseline special education status, Columns 3 and 4 for applicants with baseline English Language Learner classification, and Columns 5 and 6 for other students. All models control for gender, ethnicity, female × minority interaction, baseline special education, baseline ELL, baseline subsidized lunch, experimental strata, year-applied dummies, and grade-applied dummies. Estimates pool post-lottery outcomes for test-taking grades. Standard errors are clustered by student identifier and school–grade–year.

One year of charter attendance narrows the ELL achievement gap by 84 percent in math and 39 percent in English.[33] The larger gap between special education and non-special-needs students also narrows substantially. With one year of charter enrollment, the special education gap decreases by 30 percent in math and 20 percent in English.

The ordinary least squares (OLS) estimates (shown in Online Appendix Table A12) have comparable estimates to the two-stage least squares. This suggests that the OLS is unbiased in the sample of lottery applicants. Therefore, there is not significant selection into complying with the results of the lottery. Accepting a charter offer if it is received and not attending a charter if the student does not receive an offer.

The reduced form or intent to treat estimates (shown in Online Appendix Table A12) also have comparable estimates to the two-stage least squares. Therefore, even without accounting for lottery compliance, randomly assigned charter offers have a strong positive relation to test scores.

The effects of charter attendance appear to accumulate in the first two years and then level off. The first year of charter attendance generates gains of 0.397 and 0.457 standard deviations in math for special education and ELL applicants, respectively (see Online Appendix Figure A5). The charter enrollment effect nearly doubles for special

33. Achievement gaps are calculated by comparing the ELL scores in charter and traditional public schools with the non-special-needs student scores in traditional public school (using Table 4 estimates).

education students and grows by 1.6 times for ELLs in the second year. After the third year, the charter effects stabilize and are comparable to the prior year. A similar pattern occurs for the English exam.[34]

The annual English proficiency exam, which schools use to reevaluate ELL students' classification and services, also suggests that charter schools improve English skills for ELLs. Attending a charter makes students 27.5 percentage points less likely to take the English proficiency exam because charters remove ELL status at higher rates than traditional public schools (see Column 2 of Online Appendix Table A13). Charters likely remove classification from the ELLs with relatively higher English proficiency, leading to negative selection. Therefore, if traditional public schools and charters have the same effect on English language proficiency, charters would have a negative effect on English proficiency scores. Instead, charter students perform similarly or significantly better than traditional public school students. This suggests positive charter effects on English proficiency (see Column 4 of Online Appendix Table A13).

2. College preparation and high school graduation

Charters also have positive effects on longer-term outcomes that likely have a strong, lasting link to human capital and future earnings through educational attainment. Panel A of Table 5 shows that charter special education and ELL students are 24.4 and 36.7 percentage points, respectively, more likely to reach a key high school graduation requirement: reaching proficiency on the tenth grade math and English exams.[35] Students who do not meet this requirement need to fulfill remedial coursework to graduate. Therefore, fulfilling this requirement keeps students on the path towards high school graduation and enables them to take more college preparation courses.

Charters also boost the likelihood that special education students and ELL students will become eligible for the Adams state merit college scholarship by 11.3 percentage points and 28.7 percentage points each. The John and Abigail Adams Scholarship awards free tuition to Massachusetts public universities based on tenth grade math and English exams and has stricter conditions than the proficiency graduation requirement.

Evidence in Panel B of Table 5 suggests that charter enrollment has weak positive effects on college preparation exams for special needs students. Special needs charter and traditional public school students take the SAT at similar rates, but charter enrollment has a positive effect on the likelihood that ELL students score above a 900 out of 1600 on the SAT.[36] Only 7 percent of ELL charter applicants score above 1000 on the SAT, and the likelihood of reaching 1000 is not statistically significantly different among charter and traditional public school students. Estimates of charter enrollment's impact on special education students' scoring above 800, 900, and 1000 on the SAT are positive, but not statistically significant.

34. This analysis focuses on middle school applicants because they take the state standardized exam in the three years following the lottery. The test schedule for elementary and high school applicants does not lend itself to this analysis.

35. This requirement is called Competency Determination.

36. The SAT score results include math and verbal sections. They exclude the writing section because it was not required in all years of the sample.

Table 5
Effects of Charter Enrollment on College-Preparedness by Special Needs Status

	Special Education		English Language Learner		Non-Special Needs	
	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Mean (6)
Panel A: High School Performance						
Meet high school proficiency Graduation requirement	0.376	0.244 (0.110)	0.561	0.367 (0.162)	0.766	0.154 (0.054)
Eligible for state merit scholarship	0.042	0.113 (0.051)	0.128	0.287 (0.129)	0.257	0.340 (0.058)
N		1,007		484		3,892
Panel B: SAT and AP Exams						
Take SAT	0.433	0.090 (0.100)	0.561	–0.005 (0.160)	0.632	0.124 (0.054)
SAT score 800 or higher	0.133	0.054 (0.077)	0.264	0.089 (0.148)	0.463	0.205 (0.057)
SAT score 900 or higher	0.070	0.067 (0.059)	0.137	0.216 (0.109)	0.302	0.194 (0.055)
SAT score 1000 or higher	0.032	0.039 (0.041)	0.071	–0.066 (0.100)	0.168	0.131 (0.045)
Take AP	0.100	0.308 (0.081)	0.325	0.284 (0.150)	0.349	0.279 (0.059)
Number of AP exams	0.188	0.526 (0.186)	0.772	–0.030 (0.586)	0.823	1.016 (0.218)
AP score 3 or higher	0.039	0.058 (0.048)	0.148	0.020 (0.143)	0.155	0.112 (0.048)
N		1,369		691		4,685

Notes: This table reports the two-stage least squares estimates of the effects of charter enrollment on college preparation outcomes. Immediate and waitlist lottery offer dummies instrument for any charter enrollment by the end of tenth grade. The tenth-grade state standardized exam score determines whether students meet the high school proficiency graduation requirement (called Massachusetts Competency Determination) and the state merit college scholarship (John and Abigail Adams Scholarship). The latter has higher standards for eligibility. SAT scores are out of 1600 and include the math and verbal sections. Students who do not take the SAT are coded as "0" for the SAT score indicator variables. The Panel A sample includes students projected to graduate in spring 2008–2016. Panel B includes students projected to graduate in spring 2008–2017. All models control for gender, ethnicity, female × minority interaction, baseline special education, baseline ELL, baseline subsidized lunch, experimental strata, year-applied dummies, and grade-applied dummies. Standard errors are clustered by tenth grade school and year.

Special education and ELL students are 30.8 and 28.4 percentage points more likely to take at least one AP exam in charters compared to in traditional public schools (see Panel B of Table 5). However, there is no significant effect of charter enrollment on scoring a three or higher, which is required to earn college credit.

Charter enrollment lowers the likelihood that special education and ELL students will graduate high school in four years by 29.9 and 18.3 percentage points, respectively, though the estimate for ELLs is not significant (see Panel A of Table 6). This is surprising given the gains in reaching the proficiency graduation requirement. Angrist et al. (2016) suggest that students could take longer to graduate from charters because they need additional time to meet charters' rigorous graduation requirements or because they choose to save money by remaining in high school for an additional year rather than taking remedial coursework in colleges.

Estimates of charters' effect on five-year graduation rates supports the theory that special needs students take longer to graduate from charter schools relative to traditional public schools: Panel B of Table 6 shows no significant difference between charter and traditional public school five-year graduation rates. However, the noisy negative estimates (0.123 and 0.093 percentage points lower likelihood of graduating in five years for special education and ELL students, respectively) warrant additional investigation. The difference in graduation rates is not driven by differences in dropout rates. Instead, those special needs students who do not graduate in five years appear to transfer to other schools (Panel B of Table 6).

Special education students with high levels of need can qualify for transition services during ages 18–22 if they remain enrolled in school. Therefore, remaining in school longer could be positive since it provides them with supports to help ease the transition to adulthood through teaching life and job skills. The students who remain enrolled after four years of high school likely qualify for these supports: they have qualifying disabilities (intellectual, communication, emotional, or learning disabilities) and high levels of need (they were enrolled in substantially separate classrooms in eighth grade). Also, more than 80 percent of special education charter applicants who do not graduate in five years transfer to schools that provide transitional services.

3. College enrollment and graduation

The Boston charter schools emphasize a college preparation curriculum. Table 7 investigates whether the focus on college, higher AP taking rates, and increased scholarship qualification translate into higher college enrollment and completion rates. Since charters have a negative effect on graduating high school on time, Panel A of Table 7 shows college enrollment within 18 months of students' projected high school graduation dates. Forty-seven percent of special education applicants and 56 percent of ELL applicants who attend traditional public schools enroll in college, compared to 64 percent of their general education peers (see Columns 1, 3, and 5 of Panel A of Table 7). Charters generate positive effects on college enrollment, though estimates are noisy for special education and marginal for ELL students.

Of special education college enrollees from traditional public schools, slightly more than half choose four-year institutions over two-year colleges. About two-thirds of college-enrolled ELL applicants who attended traditional public schools choose four-year colleges. Charters nearly double the likelihood that ELL applicants enroll in a four-year college. The estimates for special education students are positive, but inconclusive.

Table 6
Effects of Charter Enrollment on High School Completion by Special Needs Status

	Special Education		English Language Learner		Non-Special Needs	
	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Mean (6)
Panel A: High School Graduation						
Graduate in four years	0.567	–0.299	0.656	–0.183	0.701	–0.013
		(0.105)		(0.137)		(0.048)
N		1,369		691		4,685
Panel B: Status in Year after Projected Four-Year High School Graduation						
Graduate in five years	0.666	–0.123	0.726	–0.093	0.778	0.056
		(0.101)		(0.122)		(0.044)
Remain enrolled in same school	0.083	0.046	0.045	–0.009	0.036	–0.030
		(0.065)		(0.062)		(0.027)
Transfer to another school	0.090	0.090	0.109	0.108	0.078	–0.011
		(0.045)		(0.074)		(0.026)
Drop out of high school	0.151	–0.030	0.121	–0.005	0.106	–0.025
		(0.070)		(0.083)		(0.030)
N		1,185		546		4,188
Panel C: Status in Two Years after Projected Four-Year High School Graduation						
Graduate in six years	0.685	–0.037	0.727	–0.065	0.798	0.029
		(0.098)		(0.134)		(0.044)
N		961		363		3,579

Notes: This table reports the two-stage least squares estimates of the effects of charter enrollment on high school completion. Immediate and waitlist lottery offer dummies instrument for any charter enrollment by the end of tenth grade. The Panel A sample includes students projected to graduate in spring 2008–2017. Panel B is restricted to students projected to graduate in 2008–2016. Panel C is restricted to students projected to graduate in 2008–2015. All models control for gender, ethnicity, female × minority interaction, baseline special education, baseline ELL, baseline subsidized lunch, experimental strata, year-applied dummies, and grade-applied dummies. Standard errors are clustered by tenth grade school and year.

Table 7
Effects of Charter Enrollment on College Enrollment and Graduation by Special Needs Status

	Special Education		English Language Learner		Non-Special Needs	
	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Mean (6)
Panel A: College Enrollment within 18 Months of Projected Four-Year High School Graduation						
Any	0.470	0.060	0.558	0.254	0.639	0.145
		(0.106)		(0.160)		(0.054)
Two-year	0.248	0.014	0.230	–0.012	0.202	–0.072
		(0.100)		(0.128)		(0.046)
Four-year	0.254	0.099	0.377	0.300	0.486	0.187
		(0.098)		(0.155)		(0.055)
Four-year public	0.098	0.128	0.185	0.337	0.219	0.128
		(0.081)		(0.159)		(0.053)
Four-year private	0.171	–0.046	0.220	–0.036	0.292	0.055
		(0.092)		(0.150)		(0.062)
Four-year public in MA	0.087	0.111	0.179	0.318	0.190	0.102
		(0.076)		(0.159)		(0.053)
N		1,207		550		4,280
Four-year private	0.171	–0.046	0.220	–0.036	0.292	0.055
		(0.092)		(0.150)		(0.062)
Four-year public in MA	0.087	0.111	0.179	0.318	0.190	0.102
		(0.076)		(0.159)		(0.053)
N		1,207		550		4,280
Panel B: College Graduation in Four Years						
Any	0.094	0.123			0.182	–0.021
		(0.095)				(0.061)
Two-year	0.039	0.117			0.057	–0.003
		(0.055)				(0.034)
Four-year	0.077	0.105			0.174	–0.024
		(0.083)				(0.061)
N		625				2,544

Notes: This table reports the two-stage least squares estimates of the effects of charter enrollment on college enrollment and graduation. Immediate and waitlist lottery offer dummies instrument for any charter enrollment by the end of tenth grade. College enrollment and graduation data come from the National Student Clearinghouse. Panel A investigates college enrollment for students projected to graduate high school in spring 2008–2016. Panel B displays estimates for college graduation for students projected to graduate high school in spring 2008–2014. All models control for gender, ethnicity, female × minority interaction, baseline special education, baseline ELL, baseline subsidized lunch, experimental strata, year-applied dummies, and grade-applied dummies. Standard errors are clustered by tenth grade school and year.

The increased four-year enrollment is driven by public, in-state college enrollment. Estimates of charter school effects on two-year enrollment are close to zero, but noisy for special needs students.

Charters have a noisy, positive effect on graduation from four-year colleges and a significant positive effect on two-year college graduation for special education applicants. The ELL applicant cohort that reaches college graduation age is too small to display college graduation findings. Despite positive effects on initial college enrollment, Column 6 of Panel B of Table 7 shows noisy zero effects of charters on college graduation for general education students.

B. Heterogeneity

Charters generate test score gains for even the most disadvantaged special needs students. Panel A of Table 8 shows gains of 0.256 standard deviations in math for special education students with the highest need. Students with less severe needs, those who apply from partial and full inclusion classrooms, also experience gains of 0.328 and 0.269 standard deviations, respectively. English exam gains for special education students are positive and of similar magnitude across levels of inclusion, but they are imprecise for substantially separate and partial inclusion students.

Those with the lowest level of English proficiency experience math and English test score gains of more than 0.400 standard deviations in charters, as seen in Panel B of Table 8. Charters also generate math and English test score gains for ELLs with intermediate and advanced English proficiency.

Baseline test scores provide an alternative approach to analyze whether charters benefit the neediest students. Column 2 of Table 9 shows that the bottom third of special education students, as measured by their combined pre-lottery math and English exams, score 0.255 standard deviations higher in math and 0.189 in English in charter schools. Column 4 shows that charters also have positive effects for the bottom third of ELLs. While the higher baseline performing students also experience charter gains, the bottom third of ELLs experience the largest gains for English.

Elementary, middle, and high school charter applicants all experience positive effects even though the characteristics of students with special education and ELL classifications vary across age groups (see Online Appendix Table A14).

Charter gains are strongest for those with specific learning disabilities, which account for 40 percent of charter special education applicants (see Online Appendix Table A15). The severity of learning disabilities varies across lottery applicants: at the time of the lottery, 37 percent of students with learning disabilities come from a full inclusion classroom, 44 percent from partial inclusion, and 19 percent from substantially separate classrooms. Charters generate significant math and English gains for ELLs who speak Spanish and Haitian Creole, the most common native languages of applicants after English (shown in Online Appendix Table A16). While the other disability types and other languages are not prevalent enough to estimate alone, students with non-learning disabilities and ELLs who speak a language other than Spanish or Haitian Creole both experience significant gains in math (see Online Appendix Tables A15 and A16).

Table 8
Test Score Effects of Years in Charter for Special Needs Subgroups

	Substantially Separate Classroom		Partial Inclusion		Full Inclusion	
	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter Effect (6)
Panel A: Baseline Special Education Level of Classroom Inclusion						
Math	−1.392	0.256	−1.148	0.328	−0.606	0.269
		(0.114)		(0.093)		(0.072)
N		1,004		1,656		2,090
English	−1.614	0.204	−1.243	0.171	−0.791	0.216
		(0.135)		(0.104)		(0.065)
N		1,004		1,658		2,092
	Beginning Proficiency		Intermediate Proficiency		Advanced Proficiency	
	Trad. Public Mean (1)	Charter Effect (2)	Trad. Public Mean (3)	Charter Effect (4)	Trad. Public Mean (5)	Charter effect (6)
Panel B: Baseline English Language Learner English Proficiency Level						
Math	−1.392	0.404	−0.652	0.370	−0.129	0.296
		(0.138)		(0.062)		(0.072)
N		289		2,710		1,799
English	−1.961	0.498	−0.904	0.315	−0.251	0.162
		(0.145)		(0.057)		(0.063)
N		292		2,719		1,801

Notes: This table reports two-stage least squares estimates of the effects of years spent in charter schools for baseline special needs subgroups: by special education level of classroom inclusion and by English proficiency level. The sample includes elementary, middle, and high school lottery applicants. Standard errors are clustered by student identifier and school–grade–year. See Table 4 notes for detailed regression specifications.

Table 9
Test Score Effects of Years in Charter by Pre-lottery Test Performance and Special Needs Status

Pre-Lottery Test Performance within Special Needs Status	Special Education		English Language Learner		Nonspecial Needs	
	Traditional Public Mean (1)	Charter Effect (2)	Traditional Public Mean (3)	Charter Effect (4)	Traditional Public Mean (5)	Charter effect (6)
Panel A: Math						
Bottom third	−1.699	0.255	−1.337	0.248	−0.905	0.357
		(0.088)		(0.090)		(0.040)
N		1,360		1,491		5,077
Middle third	−1.067	0.219	−0.539	0.334	−0.100	0.284
		(0.078)		(0.065)		(0.032)
N		1,540		1,613		5,285
Top third	−0.302	0.314	0.254	0.328	0.592	0.185
		(0.069)		(0.061)		(0.026)
N		1,597		1,706		5,123
Panel B: English						
Bottom third	−1.812	0.189	−1.474	0.400	−0.789	0.175
		(0.110)		(0.073)		(0.040)
N		1,418		1,486		5,021
Middle third	−1.187	0.114	−0.722	0.305	−0.080	0.173
		(0.077)		(0.076)		(0.028)
N		1,487		1,580		5,224
Top third	−0.443	0.131	0.009	0.140	0.451	0.106
		(0.064)		(0.056)		(0.026)
N		1,592		1,617		5,213

Notes: This table reports the two-stage least squares estimates of the effects of years spent in charter schools on test scores by baseline test performance and special needs status. Columns 1 and 2 report estimates for the baseline special education students by terciles of their baseline math and English test scores. Columns 3 and 4 report these estimates for baseline English language learners and Columns 5 and 6 for baseline non-special-needs students. The sample includes elementary, middle, and high school lottery applicants. Standard errors are clustered by student identifier and school–grade–year. See Table 4 notes for detailed regression specifications.

V. Mechanisms

A. Classification Removal and School Environment

Do the academic gains documented above stem from general charter school characteristics that affect all attendees or from classification removal and increased inclusion? Legal requirements and best practices operate under the assumption that special needs students require services and accommodations to succeed. Does charter classification removal and increased inclusion help or hinder special needs students?

The similar charter achievement effects for special needs and non-special-needs students suggest that general charter school practices have a consistent effect for both groups. However, the similar effect sizes could mask differences in the mechanisms that led to the gains. For example, positive effects of general charter school practices for special needs students could outweigh negative effects of the classification changes.

1. Classification removal

I find suggestive evidence that the general charter school environment drives the academic gains, and I find no negative effects of lower classification rates. Figure 1 plots the relationship between test score effects of each individual charter school cohort against their reclassification effects (see Online Appendix C.1 for the detailed estimation strategy). Charter school cohorts that experienced higher reclassification rates also had higher special needs student test outcomes. Test score effects have a weak positive correlation with special education increased inclusion effects and ELL classification removal effects. Test score and special education classification removal effects have a positive relationship for English and an imprecise relationship for math.[37] The weak positive correlations suggest that classification removal and increased inclusion contribute positively to student growth, but cannot fully explain the charter test score gains. Therefore, school practices other than special needs classification and services likely play an important role.

To provide additional evidence, I estimate a model with three endogenous variables: years in charter, classification removal, and the interaction of years in charter and reclassification. The coefficients on these variables show the effect of a year of charter attendance holding classification constant, the effect of classification removal, and the differential effect of classification removal between charters and BPS. This estimation requires quasi-random variation in charter enrollment and student reclassification in charters and in BPS. Unlike the lottery, which randomly offers students seats at charters, schools nonrandomly make reclassification decisions on the basis of students' needs. To address this selection issue, I harness school-specific variation in reclassification rates and pre-lottery characteristics of charter applicants. I use individual charter lottery offers

37. If schools that remove classification and increase inclusion more are effective due to other practices, then this exercise overstates the importance of reclassification. The relationship between non-special-needs test score effects and charter school reclassification effects is small and insignificant for special education and ELL classification removal, but small, positive, and marginally significant for special education increased inclusion. Therefore, there is little evidence of other school practices correlated with classification removal and increased inclusion driving the correlation between reclassification and special needs academic effects (see Online Appendix Figure A6).

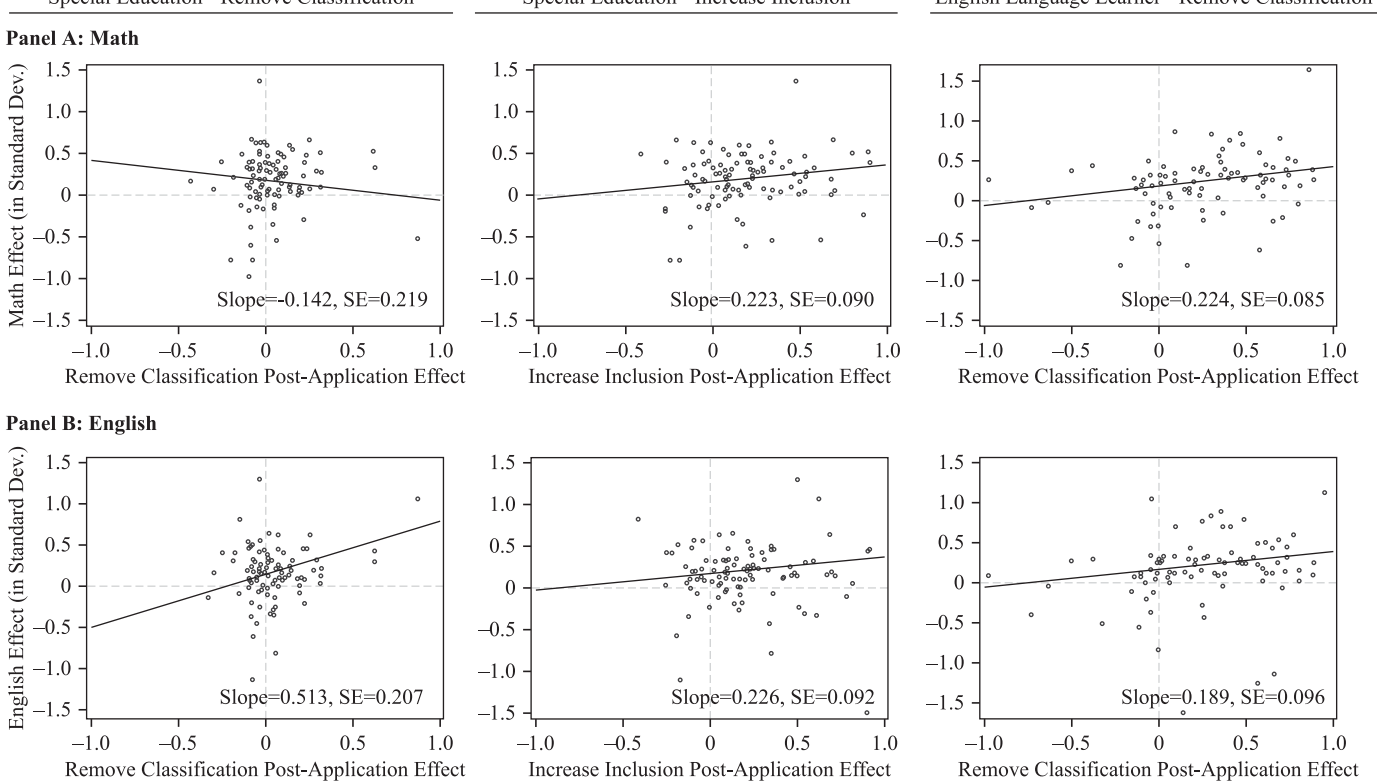

Figure 1

Correlations of Reclassification and Academic Effect Sizes by School × Cohort

Notes: This figure plots the school-specific math and English Ordinary Least Squares (OLS) effects of years in charter schools for special needs students against the school-specific post-application special needs reclassification OLS effects of charter enrollment by the fall following the lottery. The figure plots elementary, middle, and high school estimates. Each dot represents a charter school application cohort. Experimental strata with samples too small to estimate are not displayed. The fitted line is the regression of the test score effect on the reclassification effect, weighted by the inverse of the average variance of the effects.

and the interaction of these offers with students' pre-lottery classification removal likelihood as instruments (See Online Appendix C.2 for the full estimation strategy).[38]

The two-stage least squares estimation suggests weak positive effects of classification removal, similar to Figure 1 (see Online Appendix Table A17). However, the estimates are noisy for the special education sample, and the ELL sample suffers from a weak instrument problem. For increased precision, I estimate the OLS version with the same lottery applicant sample.[39] Ordinary least squares yields similar, but more precise estimates compared to the two-stage least squares estimation (see Columns 1 and 3 of Table 10). Holding classification constant, one year in a charter boosts math and English test scores of special needs lottery applicants by 0.2 to 0.3 standard deviations on average. Classification removal increases math test scores by 0.231 and 0.124 standard deviations for special education and ELL students, respectively. English test scores increase by 0.319 and 0.159 standard deviations for special education and ELL students after classification removal. Special education classification removal has a similar effect in charters and traditional public schools. For ELLs, classification removal in charters has a smaller positive effect relative to classification removal in traditional public schools.

Using these results, I calculate the upper and lower bound of the effect of charter classification removal on test scores. Then, I scale the bounds by the charter classification removal effect: the percent of applicants who lost their classification in charters, but would have kept their classification in a traditional public school. This exercise shows that classification removal is linked to 0.003 to 0.063 standard deviation test score gains, which accounts for 0.9 to 25.4 percent of the charter test score effects. Therefore, both the relationships between test scores gains and classification removal and a multiple endogenous variable estimation approach suggest that the general charter school environment, and not classification removal, drives the special needs students' academic gains in charter schools.

2. *School quality*

Charter schools that serve special needs students well also serve general education students well. Figure 2 displays the strong positive relationship between schools' special needs and non-special-needs test score effects.

To contrast the relative importance of classification practices with overall school quality, I estimate a multiple endogenous two-stage least squares using years in charter, an index of school quality, and classification removal effects. I add the math and English two-stage least squares effects for non-special-needs students for each individual charter school to create a school quality index (see Online Appendix C.1 for the estimation strategy). The multiple endogenous variables estimates yield noisy estimates for classification removal and precisely positive estimates for school quality. Enrolling in a

38. Abdulkadiroglu, Angrist, and Pathak (2014); Kling, Liebman, and Katz (2007); Kline and Walters (2016); and Cohodes (2020) also interact site-specific indicators and baseline characteristics with random or quasi-randomly assigned offers to generate new instruments to identify models with multiple endogenous variables.
39. The similarity of the OLS and two-stage least squares estimates for the effect of charter attendance on test scores and on classification removal (compare Table 4 to Online Appendix Table A12 and Tables 2 and 3 to Online Appendix Tables A18 and A19) suggests that the OLS estimates are unbiased.

Table 10
OLS Multiple Endogenous Variable Test Score Estimates

	Special Education Test Scores		English Language Learner Test Scores	
	Endogenous Variables Include:			
	Classification Removal (1)	School Quality (2)	Classification Removal (3)	School Quality (4)
Panel A: Math				
Charter enrollment	0.229	0.187	0.292	0.206
	(0.018)	(0.016)	(0.027)	(0.017)
Remove classification	0.231	0.214	0.124	0.028
	(0.071)	(0.056)	(0.043)	(0.032)
Charter × remove Classification	–0.031		–0.071	
	(0.049)		(0.033)	
School quality index		0.203		0.337
		(0.029)		(0.044)
N	3,693		3,830	
Panel B: English				
Charter enrollment	0.193	0.176	0.224	0.176
	(0.018)	(0.018)	(0.022)	(0.017)
Remove classification	0.319	0.270	0.159	0.085
	(0.065)	(0.057)	(0.043)	(0.034)
Charter × Remove Classification	–0.057		–0.051	
	(0.048)		(0.030)	
School quality index		0.071		0.187
		(0.031)		(0.037)
N	3,705		3,844	

Notes: This table displays multiple endogenous variable ordinary least squares (OLS) estimates of two separate models that investigate mechanisms behind the charter test score effects. Columns 1 and 3 display the estimates of a model with three endogenous variables: years in charter, classification removal by the fall following the lottery, and the interaction of the two. Columns 2 and 4 display the estimates of a model with the following endogenous variables: years in charter, classification removal by the fall following the lottery, and a school quality index. The school quality index is the sum of the non-special-needs math and English individual school two-stage least squares effects relative to Boston Public Schools. The sample includes middle, and high school lottery applicants with baseline test scores and special education or ELL classifications at the time of the charter application. All models control for gender, ethnicity, female × minority interaction, baseline special education, baseline ELL, baseline subsidized lunch, experimental strata, year-applied dummies, and grade-applied dummies. Estimates pool post-lottery outcomes for test- taking grades. Standard errors are clustered by student identifier and school–grade–year.

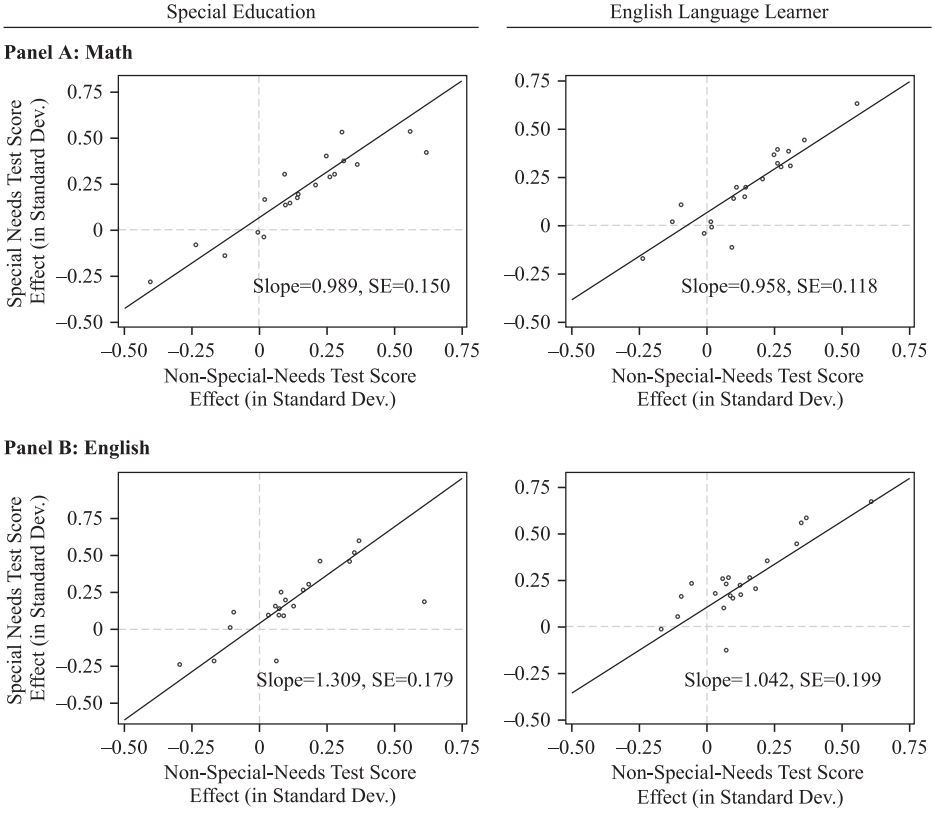

Figure 2

Correlations of Effect Sizes by School × Cohort

Notes: This figure plots the school-specific math and English ordinary least squares effects of years in charter schools for special needs students and non-special-needs students. The figure plots elementary, middle, and high school estimates. Each dot represents a charter school application cohort. Experimental strata with samples too small to estimate are not displayed. The fitted line is the regression of the special needs test score effect on the non-special-needs test score effect, weighted by the inverse of the average variance of the effects.

school with a one standard deviation higher non-special-needs student test score effect significantly increases special education and ELL students' math scores by 0.201 and 0.325 standard deviations), while classification removal has a noisy positive estimate (see Columns 2 and 4 of Table 10). The analogous OLS estimates show that classification removal has a similar effect to one standard deviation increase in school quality for special education math and a much smaller effect for ELL math and English. School quality has a smaller effect relative to classification removal on special education students' English outcomes. Even though the classification removal effects and the school quality effects have similar estimates for special education, school quality explains a

larger portion of the charter test score gains. This is because classification removal only affects a subset of students, but school quality affects all applicants. These findings show the importance of general education practices in explaining gains of special needs students in charters.

B. School Practices

Special needs students who apply and do not receive charter lottery offers attend schools with markedly different characteristics. Their teachers have more years of experience, higher rates of licensure, and receive higher pay. In addition, BPS spends about $1,700 more per pupil relative to the Boston charter schools (see Table 11). The BPS and charter schools also vary along other key characteristics: more than half of Boston charters have a longer school year, and more than 95 percent of Boston charters have a longer school day compared to BPS.[40] Boston charters commonly use "no excuses" practices, including high academic and behavior expectations, selective teacher hiring, frequent testing and teacher feedback, and data-driven instruction. Tutoring programs exist in all Boston charters, and about a third of charters require tutoring for all students.

The set of school practices that positively correlate with charter school effectiveness for general education students also correlate with test score gains for special needs students. Column 3 of Table 11 displays the correlation between charter school special education math effects and school practices. Columns 4 and 5 display the analogous correlations for ELL and other students. An index of "no excuses" school practices,[41] strict behavior code, longer school day, and emphasis for high expectations in academics—characteristics that Angrist, Pathak and Walters (2013) and Dobbie and Fryer (2013) find linked to overall charter gains—are also positively correlated with special education and ELL student gains.

School characteristics that do not correlate with general education student gains, including expenditure per pupil, student-to-teacher ratio, teacher licensure, teacher experience, and teacher salary, also have a null or a negative effect on special needs student outcomes. Special needs school characteristics are weakly correlated with special needs charter effects (see Panel B of Table 11).

C. Peer Composition

Charter lotteries in the bottom quartile for special needs student representation have similar academic effects as those in the top quartile (see Online Appendix Table A20). The similar point estimates counter the idea that charter special needs gains stem from having fewer special needs students in the classroom. Lotteries with an average of 41 percent of applicants with ELL status have more than 0.2 standard deviation effects. Additionally, charter cohorts with the lowest special needs representation have gains of

40. BPS has 180 school days and 6.5 hours in the day.

41. The "no excuses" index includes equal weight for discussion of the following items in the annual school report: high expectations for academics, high expectations for behavior, strict behavior code, college preparatory curriculum, core values in school culture, selective teacher hiring or incentive pay, emphasis on math and reading, uniforms, hires Teach for America teachers, Teaching Fellows, or AmeriCorps members, affiliated with Teach for America alumni, data-driven instruction, and regular teacher feedback.

Table 11
School Characteristics and Their Correlation with Individual Charter School Test Score Effects

School Practices	Boston Public Schools Mean (1)	Charter Sample Mean (2)	Correlates of School Practices and Charter Effectiveness by Special Needs Group: Special Education (3)	English Language Learner (4)	Non-Special Needs (5)
Panel A: General School Characteristics					
"No excuses" index		0.826	0.285	0.505	0.884
		(0.120)	(0.446)	(0.104)	(0.304)
Strict behavior code		0.818	0.187	0.194	0.247
		(0.395)	(0.094)	(0.042)	(0.072)
Longer school year		0.591	–0.010	0.130	–0.036
		(0.503)	(0.065)	(0.078)	(0.061)
Longer school day		0.955	0.335	0.409	0.433
		(0.213)	(0.032)	(0.051)	(0.025)
Emphasize high academic expectations		0.955	0.335	0.409	0.433
		(0.213)	(0.032)	(0.051)	(0.025)
Total per pupil expenditure	$18,766	$17,079	0.000	0.000	0.000
		($2,438)	(0.000)	(0.000)	(0.000)
Student to teacher ratio	12.678	12.126	–0.006	–0.015	–0.008
	(1.790)	(3.092)	(0.015)	(0.004)	(0.012)

(*continued*)

Table 11 (*continued*)

School Practices	Boston Public Schools Mean (1)	Charter Sample Mean (2)	Correlates of School Practices and Charter Effectiveness by Special Needs Group		
			Special Education (3)	English Language Learner (4)	Non-Special Needs (5)
Percent of teachers licensed in teaching assignment	94.974	52.265	–0.003	–0.005	–0.003
	(4.554)	(17.173)	(0.002)	(0.003)	(0.001)
Years of teaching experience in Massachusetts	12.353	2.625	–0.023	–0.085	–0.061
	(3.355)	(1.489)	(0.026)	(0.029)	(0.016)
Average teacher salary	$78,237	$65,380	0.000	0.000	0.000
		(10,774.157)	(0.000)	(0.000)	(0.000)
Panel B: Special Needs School Characteristics					
Special education compliance index	0.685	0.723	–0.323		
		(0.041)	(0.517)		
English language learner compliance index	0.511	0.696		0.335	
		(0.066)		(0.629)	
Special education remove classification effect		0.068	–0.069		
		(0.111)	(0.419)		
Special education increased inclusion effect		0.225	0.379		
		(0.229)	(0.194)		

(*continued*)

Table 11 (*continued*)

School Practices	Boston Public Schools Mean (1)	Charter Sample Mean (2)	Correlates of School Practices and Charter Effectiveness by Special Needs Group		
			Special Education (3)	English Language Learner (4)	Non-Special Needs (5)
English language learner remove classification effect		0.300		0.347	
		(0.193)		(0.260)	
Special education instructional spending per pupil	$2,299	$988	0.000		
	(2,008)	(519)	(0.000)		
Special needs staff to student ratio	0.030	0.015	−1.445	6.048	
	(0.012)	(0.011)	(4.034)	(4.894)	
N	114	22		22	

Notes: This table reports coefficients from regressions of school-specific treatment effects for each special needs subgroup on 2012–2013 school practices in Columns 3–5 (one regression for each school practice and student type combination). School-level BPS data are weighted by the proportion of lottery applicants who enrolled in the school. Only district-level data were available for total per pupil expenditure and the compliance indices. All costs are in 2015 CPI-U adjusted dollars. Column 2 displays the mean characteristics for sample charter schools with lottery cohorts with test results (those that reach Grade 3 or higher by 2013–2014). Data come from charter school annual reports, Massachusetts Department of Elementary and Secondary Education School District Profiles, Education Personnel Information Management System, School District Expenditures, and Charter School End of Year Financial Reports. Data also come from MA DESE charter inspections, including Renew Inspection Reports, site visits, Summary of Reviews, and Coordinated Program Reviews. See the Online Appendix for information on the "no excuses" index.

around 0.2 standard deviations. This suggests that economies of scale cannot fully explain the charter gains. The limited evidence that special needs economies of scale correlate with academic effects further supports the importance of general school practices in explaining special needs charter gains.

VI. Conclusion

Enrolling in a Boston charter school exposes students to a dual treatment. Lottery estimates find that Boston charter schools remove special education and English language learner classifications at a higher rate than traditional public schools and move special education students to more inclusive classrooms. Additionally, students experience the charter environment, including a set of general education practices like high intensity tutoring, increased instructional time, high expectations, and data driven instruction.

Using randomized admission lotteries, I find strong positive net effects of Boston charter schools' dual treatment for special education and ELL students. Charters generate substantial gains for special needs students in math and English standardized exams, English proficiency, and college preparation, enrollment, and completion outcomes. Even the most disadvantaged special needs students perform better in charter schools compared to traditional public schools.

Charter attendance substantially decreases the special needs achievement gap. Among students attending BPS schools, special education students and ELL students score about 0.87 and 0.39 standard deviations, respectively, below non-special-needs students in math. Since charters generate math gains of 0.261 standard deviations for special education students, one year in a charter reduces the special education achievement gap by 30 percent. ELL students score 0.326 standard deviations higher in charters, narrowing the ELL achievement gap by 84 percent.

The findings show that schools can boost special needs students' academic outcomes without the traditional set of special needs services. Frequent use of tutoring and data-driven instruction enables charters to identify and provide support to struggling students, regardless of special needs status. "No excuses" school practices, strict behavior code, longer school day, and emphasis on high academic expectations positively correlate with charter school effectiveness for special needs and general education students.

I find no evidence that classification removal or increased inclusion lowers outcomes for students. Classification removal and increased inclusion can explain between 1 and 25 percent of the special needs achievement effects. Charter schools that generate large non-special-needs student gains also generate gains for special needs students. Together, these findings imply that elements of the charter school experience that affect all students, not just those classified as having special needs, drive the positive gains for special needs students.

It is worth noting that the results apply to Boston charter lottery applicants. While special needs students are currently well represented in the charter lotteries, Boston charters could have different effects for the students who do not apply. By extension, my estimates may not reflect the effects of expanding the number of seats in Boston's charter sector or requiring charters to recruit more special needs students. Similarly, it is

unknown whether these results extend to other locations: the set of general education practices employed by Boston charter schools are common among urban charter schools, but the special education and English language learner practices of charter schools are not well documented.

This study highlights the importance of high-quality general education practices as an effective policy lever to improve special education students' and English language learners' outcomes. I cannot comment on the impact of an ideal implementation of specialized services or general education practices, only on one city's practices. The finding that special education students and English language learners can make large academic gains without specialized services in a high-quality general education program calls for greater attention to general practices, in addition to the current focus on specialized supports, to improve special needs students' outcomes.

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