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# Different Paths to College Success: The Impact of Massachusetts's Charter Schools on College Trajectories[†]

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*The charter school movement encompasses many school models. In Massachusetts in the 2010s, the site of our study, urban charter schools primarily used "No Excuses" practices, whereas nonurban charters had greater model variety. Using randomized admissions lotteries, we estimate the impact of charter schools by locality on college preparation, enrollment, and graduation. Urban charter schools boost all of these outcomes. Nonurban charter schools raise college enrollment and graduation despite reducing state test scores and AP enrollment. Notably, the nonurban charter college graduation edge is more than twice as large as that from urban charter attendance.* (*JEL* H75, I21, I23, I28)

Despite the recent decline in the college wage premium, college graduates still outearn their peers with only a high school diploma by 75 percent (Bengali et al. 2023; Autor, Dube, and McGrew 2023). With much policy and research in the United States focused on college access, we know less about how K–12 educational experiences contribute to college success (Dynarski et al. 2023). This paper uses application lotteries to show the causal effects of one K–12 educational intervention—charter schools—on college preparation, enrollment, and graduation.

Charter schools are autonomously operated public schools with administrative, curricular, budgetary, and hiring independence from traditional school districts. They are authorized by a state-empowered entity, undergo periodic review, and may be subject to closure. When oversubscribed, charter schools admit students via

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randomized admissions lotteries. Charter schools are not monolithic in character. Many urban charter schools feature longer school days and school years, a culture of high expectations, frequent teacher observations and feedback, data-driven instruction, use of tutoring, and strict discipline—practices that are often referred to as "No Excuses" (Angrist, Pathak, and Walters 2013; Dobbie and Fryer 2013). In recent years, many of these schools have moved away from this label and some of the associated practices (Torres 2022). Other charter schools operate on the basis of a greater range of educational models and include project-based learning schools, themed schools (e.g., arts, language, STEM, culture), Montessori schools, and personalized learning schools.

This paper builds on Angrist, Pathak, and Walters (2013)—henceforth, APW—which examines the effects of Massachusetts charter schools on test scores across urban and nonurban areas. APW find that urban charter schools generate large test score gains, whereas nonurban charters have null or negative effects. In our shared Massachusetts sample, at the time students were enrolled in the 2000s and 2010s, the urban charter schools mostly adhered to No Excuses practices and served a primarily minority and economically disadvantaged population. The nonurban schools did not, embracing alternative charter school models—in particular, project-based learning—and serving primarily White children. APW find that the different practices and student bodies help account for the different test scores trajectories, aligning with the existing literature on charter schools.

With a longer time horizon and more cohorts and schools, we return to APW's diverse sample of charter schools and report several novel findings. First, we replicate their test score results, finding that urban charters boost standardized test scores and nonurban charters do not. Next, we find that urban and nonurban charters both accelerate college preparation but via different means. Urban charters increase Advanced Placement (AP) and SAT test-taking and scores and completion of a college-ready curriculum, but increase time to high school graduation. Nonurban charters decrease AP test-taking but boost completion of a college-ready curriculum.

Turning to college, both urban and nonurban charter schools boost four-year college enrollment, by 7.9 and 9.8 percentage points, respectively. Regarding college graduation, we find that attending an urban charter school raises attainment of any degree by 4.6 percentage points from the comparison mean of 24 percent and BA completion by 4.2 percentage points from a comparison of 22 percent. Nonurban charter schools increase attainment of any degree by 11.2 percentage points from a comparison mean of 52 percent and BA attainment by 11.9 percentage points over a comparison rate of 47 percent. In short, both urban and nonurban charter schools lift degree attainment, but nonurban charter schools—the same schools that do not boost test scores—induce very large gains, more than twice as large as the college graduation boost from urban charters.

Our test score findings are consistent with the many lottery-based studies that have shown that attending urban charter schools increases students' test scores (see Cohodes and Roy (2025) for a summary of this research) and the more limited lottery-based evidence on nonurban charter schools, which shows mixed impacts on test scores, with findings of small positive effects (Dynarski et al. 2018) and, in other cases, null or negative effects (Gleason et al. 2010; Angrist, Pathak, and Walters 2013). Observational estimates of charter school impacts appear to confirm

the lottery-based evidence that urban charter schools boost test scores, while nonurban charters do not (see Cohodes and Parham (2021) for an overview).

The test score evidence has led some to conclude that charter schools are most successful in urban contexts when they adopt No Excuses practices (Chabrier, Cohodes, and Oreopoulos 2016; Epple, Romano, and Zimmer 2016; Cohodes and Parham 2021). This conclusion is bolstered by lottery-based evidence showing that urban charters that boost test scores also boost college preparation and enrollment and even shape non–test score outcomes such as voting and risky behavior (Angrist et al. 2016; Dobbie and Fryer 2015; Wong et al. 2014; Davis and Heller 2019; Cohodes and Feigenbaum 2021; Reber, Rünger, and Wong 2024; Demers et al. 2017). However, there is much less evidence on nonurban charter schools and non–test score outcomes. Lottery-based evidence on college graduation comes from a broad sample of charter schools in a federally funded national evaluation of charter schools (Gleason et al. 2010) extended to college outcomes (Place and Gleason 2019), which finds no impact on college enrollment or graduation and no relationship between test scores and college outcomes. This is perhaps because their sample only consists of middle schools, whereas most of the schools in our sample offer high school grades. Evidence from the mostly urban KIPP schools is consistent with the idea that high school grades are important. Demers et al. (2017) find no college enrollment or graduation boost from a lottery-based evaluation of KIPP middle schools, but when they add an instrumental variables approach to account for attendance at a KIPP high school, they find large college gains. Dobbie and Fryer (2020) use propensity score matching to show that No Excuses charter schools improve test scores and four-year college enrollment, whereas "other" charter schools decrease both.[1]

This paper makes two main contributions. First, we add to the evidence on charter schools by presenting lottery-based estimates of their impacts on college graduation from a diverse sample of schools. The findings expand our as yet limited knowledge of the impact of different charter school models on college outcomes. Second, we demonstrate that charter school test score effects do not always align with the schools' impacts on students' life trajectories. Standardized test scores provide a useful but limited measure of student learning. Jackson (2018) and Jackson et al. (2020) highlight that teacher and school effects on test scores and student behavior separably contribute to longer-term outcomes. Nevertheless, researchers often use standardized test scores as a proxy for other outcomes that we care about (Krueger 2003; Chetty et al. 2011; Hanushek 2011; Chetty, Friedman, and Rockoff 2014; Ganimian, Muralidharan, and Walters 2024), but had we done so for our sample of Massachusetts charter schools, we would have come to the wrong conclusion about the schools' impacts on attainment. Now that sufficient time has passed for APW's sample of students to have completed their education, we can measure their longer-term outcomes directly and do so in the remainder of this paper.

[1] Observational work from Florida shows that charter schools initially decrease scores (Sass 2006) but increase college persistence (Sass et al. 2016), but it does not differentiate by location type or model.

## I. Data and Descriptive Statistics

### A. *Data and Sample*

Massachusetts charter school records from randomized admissions lotteries in 2002–2014, corresponding to cohorts projected to graduate high school in 2006–2018, form the basis of our investigation into charter school impacts (Massachusetts Charter School Lottery Records 2002–2014). We include schools with admission in the middle school grades or later, as students admitted for elementary school are too young to observe longer-term outcomes. Our sample, based on APW's but augmented by a few additional schools, includes 15 urban charter schools and 9 nonurban charter schools. We define schools as urban if they are in towns where the school district participated in the Massachusetts Urban Superintendents Network and as nonurban otherwise. The sample covers all Massachusetts charter schools that offered admission for middle or high school grades at the time of the initial lottery record collection (2009–2011) and for which there are records of lotteries with more applicants than seats available (Supplemental Appendix Table A.1). All students in the sample are old enough to be observed five years after their projected high school graduation, with one fewer cohorts available at six years after projected high school graduation.

The lottery records include students' names and dates of birth alongside lottery information (application grade, sibling status, town of residence, admissions offers, and waitlist status). We use the lotteries for entry grades, as these have the greatest number of open seats and a standard open admission process, and exclude guaranteed-admission siblings and nonrandomized late and out-of-area applicants. We create indicators both for admission on the day of the lottery (initial offers) and offers extended from the randomized waitlist (waitlist offers). The sample includes students present in the Massachusetts data at baseline, excluding students who applied to charter schools from private schools.

We use name, date of birth, town of residence, and application cohort to match the lottery records to state administrative data from the Massachusetts Department of Elementary and Secondary Education (Massachusetts DESE 2002–2023). These records include student information such as school enrollment, gender, race, special education status, English learner status, subsidized lunch status, days of attendance, suspensions, and high school graduation status from the Student Information Management System (SIMS), course enrollment from the Student Course System (SCS), and achievement scores from the Massachusetts Comprehensive Assessment System (MCAS). DESE also provided information on AP and SAT exams from the College Board and college records from the National Student Clearinghouse (NSC).

Key outcomes include MCAS scores two years after the lottery, AP's and SAT's, MassCore curriculum completion, high school graduation, college enrollment, and degree attainment. We standardize MCAS scores by subject, grade, and year to have mean zero and standard deviation one for the entire state.[2] AP and SAT outcomes are available for the class of 2007 and later. SAT and AP test participation indicators

[2] MCAS scores exclude middle school scores from 2015 and 2016, when districts could select the MCAS or PARCC exam.

are marked as zeroes for students who were present in eleventh or twelfth grade but did not take each exam, and missing if not present. MassCore completion is an indicator that the student has completed college-ready high school curriculum, as defined by the state for the 2008 cohort and forward.[3] High school graduation and MassCore completion is measured for students that appear in ninth grade. Indicators for International Baccalaureate (IB) and calculus course–taking come from the SCS but are only available for the 2015 and later cohorts. We report college outcomes within time frames of expected high school graduation, where the expected high school graduation year is based on the year and grade of the application lottery. Thus, an outcome such as bachelor's attainment within six years indicates that a student obtained a bachelor's within six years of her expected high school graduation based on when she applied to a charter school. We mark college indicators as zeroes if student information was sent to the NSC but no college records were returned; otherwise, they are marked as missing.

### B. *Schools*

In addition to diverging from their traditional public school counterparts, urban and nonurban charter schools diverge in their characteristics and practices from each other. Table 1 compares school characteristics for the charter schools in the lottery sample and other public schools. We measure school characteristics in the early 2010s, the point at which most students in our sample matriculated. Urban charter schools have the lowest share of teachers with formal credentials (59 percent licensed in their subject), followed by nonurban charters (71 percent), in contrast to public schools, where almost all teachers are licensed in their subject. All urban charter schools receive federal Title I funds for serving a high-poverty student body, as do about two-thirds of nonurban charters. Among traditional schools, 77 percent of urban schools and 41 percent of nonurban schools receive Title I. The student-to-teacher ratio is lower in charter schools (12:1 or 11:1 in charters and 14:1 or 13:1 in other public schools). Charter schools are small schools, with approximately 430 students per school. This compares to 663 students at urban traditional schools and 2,271 students per school in nonurban areas, which often have large comprehensive high schools. Per-pupil expenditures (in 2014 dollars) are slightly higher in urban charters ($16,250) than in urban traditional schools ($15,661) and lower in nonurban charters ($11,982) than in nonurban traditional schools ($14,411). Urban areas have higher disciplinary rates. However, relative to traditional public schools, urban charters use discipline more, whereas nonurban charters have fewer disciplinary incidents.

For the charter schools only, we have responses to a survey on school practices (Table 1, panel B). Urban charters have longer school days and school years, use tutoring, frequent teacher observations, and frequent checks for student understanding, and have a culture of high expectations. Two of the urban schools are affiliated with multistate charter management organizations associated with No Excuses practices

[3] The MassCore curriculum entails completing four years of math coursework, four years of English language arts (ELA), three years of science, three years of history, two years of a world language, one year of arts, and five additional units of core courses. The indicator is reported by school districts to the state.

Table 1—School and Student Characteristics

| | Charter schools | | Other public schools | |
|---|---|---|---|---|
| | Urban | Nonurban | Urban | Nonurban |
| | (1) | (2) | (3) | (4) |
| *Panel A. Schools: administrative records* | | | | |
| Percent of teachers licensed in subject | 58.867 | 70.611 | 96.608 | 96.855 |
| Percent of core classes taught by highly qualified teachers | 86.227 | 94.089 | 89.876 | 97.378 |
| Title I school | 1.000 | 0.667 | 0.767 | 0.409 |
| Student-to-teacher ratio | 11.721 | 10.511 | 13.955 | 13.165 |
| Per-pupil expenditure | 16,250 | 11,982 | 15,661 | 14,411 |
| School size | 433 | 435 | 663 | 2,271 |
| Counselors per 1,000 students | 5.204 | 2.150 | 2.793 | 3.043 |
| Disciplined students per 1,000 students | 192 | 34 | 122 | 45 |
| *Panel B. Schools: survey responses* | | | | |
| Days per school year | 192 | 182 | – | – |
| Hours per school day | 7.935 | 6.974 | – | – |
| High-quality tutoring | 0.615 | 0.111 | – | – |
| Frequent teacher observations | 0.538 | 0.375 | – | – |
| Frequent checks for student understanding | 0.846 | 0.500 | – | – |
| Differentiated instruction | 0.692 | 0.750 | – | – |
| Culture of high expectations | 0.733 | 0.111 | – | – |
| Project-based learning | 0.231 | 0.625 | – | – |
| Observations (schools) | 15 | 9 | 266 | 599 |
| *Panel C. Students: baseline characteristics* | | | | |
| Female | 0.518 | 0.519 | 0.483 | 0.491 |
| Asian | 0.030 | 0.030 | 0.076 | 0.039 |
| Black | 0.526 | 0.026 | 0.199 | 0.046 |
| Latinx | 0.284 | 0.036 | 0.316 | 0.062 |
| Other race | 0.041 | 0.028 | 0.028 | 0.017 |
| White | 0.119 | 0.880 | 0.380 | 0.836 |
| Special education | 0.194 | 0.159 | 0.187 | 0.177 |
| English learner | 0.114 | 0.011 | 0.179 | 0.028 |
| Free/reduced-price lunch | 0.740 | 0.128 | 0.644 | 0.198 |
| Baseline MCAS ELA | −0.418 | 0.417 | −0.432 | 0.155 |
| Baseline MCAS math | −0.364 | 0.331 | −0.426 | 0.153 |
| Observations | 14,191 | 3,583 | 276,401 | 643,585 |

*Notes:* This table shows characteristics for urban and nonurban charter schools in the lottery analysis sample and lottery applicants in columns 1 and 2. Information on traditional public schools that serve sixth and/or ninth grades in urban and nonurban areas and their students appears in columns 3 and 4 for comparative purposes. Data sources for panel A are DESE School District Profiles for the 2013–2014 school year. Title I eligibility is reported for the 2013–2014 school year and comes from the US Department of Education Common Core of Data. The data for panel B come from a survey of charter school leaders fielded in 2011 and 2012. The survey response rate was 87.5 percent (12 out of 15 urban schools, all 9 nonurban schools). Panel C uses the student-level data for charter school applicants enrolled in schools in the state of Massachusetts at the time of application in the projected high school classes of 2006–2018 in columns 1 and 2 and for students who attended schools in the state of Massachusetts in ninth grade in the projected high school classes of 2006–2018 in columns 3 and 4.

(KIPP and Uncommon Schools). Nonurban charters are less likely to deploy these practices, though half of them use frequent checks for student understanding and 75 percent use differentiated instruction (even higher than the 69 percent for urban charters). They are more likely to use project-based learning (63 percent versus 23 percent for urban charters). One of the nonurban schools is associated with the Coalition of Essential Schools, which focuses on individualized learning and civic contributions; another nonurban charter is associated with expeditionary learning,

which emphasizes real-world projects and active learning;[4] and another nonurban school is an IB school, following a rigorous college-preparation curriculum focused on critical thinking. Finally, one nonurban school focuses on performing arts. In all, four of nine nonurban campuses have an explicit non–No Excuses affiliation or theme.

### C. *Students*

Table 1, panel C also presents descriptive statistics for lottery applicants (columns 1 and 2) and students who attended public schools in Massachusetts in ninth grade and were projected to graduate between 2006 and 2018 (columns 3 and 4). We see important differences across urban and nonurban areas. In urban areas, Black and Latinx students comprise 20 and 32 percent of the public school student population, respectively, and 53 and 28 percent of lottery applicants. Sixty-four percent of urban students in noncharter public schools and 74 percent of lottery applicants receive free or reduced-price lunch. Urban students and lottery applicants also have low average baseline scores: 0.43 standard deviations and 0.37 standard deviations below the state average in math and 0.43 standard deviations and 0.42 standard deviations below the average in ELA. Regarding test scores, lottery applicants are representative of urban students overall.

In contrast, most students in nonurban areas are White: 84 percent of nonurban public school students and 88 percent of lottery applicants are White. Students in nonurban locations are of more affluent backgrounds and have better baseline academic outcomes. Twenty percent of public school students in nonurban areas and 13 percent of charter school applicants receive subsidized lunch. Nonurban students and lottery applicants score 0.15 standard deviations and 0.33 standard deviations above the state average in math and 0.16 standard deviations and 0.41 standard deviations above the average in ELA.

## II. Empirical Framework

To estimate the impact of urban and nonurban charter schools on educational attainment and other outcomes, we take advantage of the natural experiment created by charter school lotteries. We use randomized lottery offers as instruments for charter school attendance at each type of charter school in a two-stage least squares (2SLS) strategy with multiple endogenous variables. We link charter school attendance to outcomes with an equation of the following form:

$$y_i = \sum_j \delta_j d_{ij} + X_i'\Gamma + \rho^u C_i^u + \rho^n C_i^n + \epsilon_i, \tag{1}$$

where $y_i$ is an educational outcome for student $i$, such as degree attainment. Charter attendance is represented by type with $C_i^u$ and $C_i^n$, which are indicators for attendance prior to when $y_i$ occurs at an urban $(u)$ or nonurban $(n)$ charter school with a lottery. The effect of attending an urban or nonurban charter is captured by $\rho^u$

[4] One urban school also follows this model.

and $\rho^n$, respectively. A vector of baseline characteristics, $X_i$, increases statistical precision and includes indicators for gender, race, special education, English learner status, and subsidized lunch status, and a set of year-of-birth fixed effects. Key to our estimation strategy is the inclusion of "risk sets," indicated by $d_{ij}$, which are lottery fixed effects that account for the set of charter schools applied to by each student and include the application year and grade. The risk sets thus account for different probabilities of charter school attendance conditional on the number of schools applied to or a school's popularity. We use robust standard errors.

Randomized charter school lottery offers serve as instruments for charter school attendance, coded as mutually exclusive indicator variables: $Z_{i1}$ represents an initial offer, and $Z_{i2}$ represents a waitlist offer. In a few cases, schools reported only initial or waitlist offer information; in such situations, we include the school but only make use of the single source of offer variation. Thus, the first stage of our 2SLS framework is

$$(2) \quad C_i^k = \sum_j \mu_j d_{ij} + X_i'\beta + \pi_1^u Z_{i1}^u + \pi_2^u Z_{i2}^u + \pi_1^n Z_{i1}^n + \pi_2^n Z_{i2}^n + \eta_i;\ k \in u,n,$$

where $C_i^k$ indicates attendance at a charter school of $k$ type, where $k \in u,n$ and is estimated as a function of the risk sets described above, the same vector of student characteristics, and the randomized lottery offers. The effect of lotteries on attendance is captured by $\pi_1^k$ for the initial offer and $\pi_2^k$ for the waitlist offer.

First-stage estimates showing that charter offers boost charter attendance by 34 to 60 percentage points are presented in Supplemental Appendix Table A.2. We demonstrate in Supplemental Appendix Table A.3 that the characteristics of students offered seats in the lottery are very similar to not-offered students in both locations, offering a check on lottery randomization. Match rates to the SIMS data are above 99 percent and are very similar across lottery offers (Supplemental Appendix Table A.4). We observe a small but statistically significant amount of differential attrition between lottery winners and losers for test scores and in ninth grade (Supplemental Appendix Table A.5), prompting us to use Lee (2009) bounds for MCAS and high school outcomes (see Supplemental Appendix A for a more detailed discussion). Our analysis is concerned primarily with college outcomes. For these outcomes, there is no differential attrition, and we have almost complete sample coverage (94 percent). We thus do not present bounds for college outcomes.

The control complier mean (CCM) is our preferred indicator for the counterfactual comparison (Katz, Kling, and Liebman 2001; Abadie 2002). The CCM is the average value of the outcome for compliers without charter school offers. These are students who do not attend a charter when they do not receive an initial or waitlist offer in the first charter school lottery they apply to. We estimate the CCM for each charter type $k$ as follows (Katz, Kling, and Liebman 2001; Abadie 2002):

$$(3) \quad y_i \times \left(1 - C_i^k\right) = \sum_j \lambda_j d_{ij} + X_i'\alpha + \tau\left(1 - C_i^k\right) + \nu_i;\ k \in u,n,$$

where $\tau$ is the estimate of the CCM, and $(1\text{-}C_i^k)$ is instrumented by the initial and waitlist offers, with risk sets and demographics accounted for as in equation (2).

## III. Results

### A. *Standardized Test Scores*

MCAS math and ELA scores two years after the lottery serve as our benchmark to compare our findings to those of previous studies (Table 2). After two years, urban charters increase scores by almost half a standard deviation in math (0.48 standard deviations) and 0.32 standard deviations in ELA. These results align with the per-year effects found in APW of 0.33 standard deviations for middle school math, 0.15 standard deviations for middle school ELA, 0.34 standard deviations for high school math, and 0.26 standard deviations for high school ELA, though the comparison is inexact because of the different parameterizations. The urban results are also on par with those reported for Boston (Abdulkadiroğlu et al. 2011; Angrist et al. 2016; Walters 2018; Cohodes, Setren, and Walters 2021; Setren 2021; Cohodes and Feigenbaum 2021).

After a student spends two years in a nonurban charter school, test scores drop by 0.11 standard deviations in math and 0.14 standard deviations in ELA. The corresponding per-year middle school estimates from APW are $-0.12$ standard deviations for math and $-0.14$ standard deviations for middle school ELA, with negative but not statistically significant impacts on high school tests. Separating the sample into schools that exclusively serve middle school grades (e.g., 6–8 or 5–8) and schools that offer high school grades (e.g., 9–12 or 6–12) yields results that closely align with APW (Table 4).

We also present Lee bounds on the reduced-form estimates to address differential attrition. Findings from this exercise suggest that, even in the presence of nonrandom attrition, the overarching test score patterns remain consistent with our main results. The bounds for MCAS scores in urban areas are tight, given the minor differential attrition there. The nonurban upper bound is zero rather than negative, implying that if differential MCAS attrition is fully due to nonrandom selection into the sample, we would not find negative nonurban MCAS effects.

Notably, test score gains and losses occur at different points in the test score distribution. Comparison (traditional) urban students score approximately a third of a standard deviation below the state mean, whereas traditional nonurban students score almost half a standard deviation above the state mean. Thus, the test score gains in urban charters shift the distribution of scores rightward from below the state average to at or above the average in two years, whereas nonurban charter students, despite their performance being lower than that of traditional nonurban students, still perform above the state mean (Supplemental Appendix Figure B.1).

### B. *College Preparation*

High school students can prepare for college with several college-preparation curricula, including AP courses, IB coursework, and other rigorous classes. We show the impact of charter school attendance on those outcomes in Table 2. Both urban and nonurban charters increase college-preparation coursework but via different paths.

Table 2—The Impact of Charter School Attendance on Tests and High School Academics

| | MCAS | | HS curriculum | | | | SAT | | HS Graduation | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Math | ELA | Took AP | Took IB | Took calc. | MassCore | Took SAT | Score | Four-year | Five-year |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *Panel A. Urban* | | | | | | | | | | |
| 2SLS | 0.475 | 0.318 | 0.164 | −0.018 | 0.052 | 0.105 | 0.042 | 39.026 | −0.066 | −0.018 |
| | (0.040) | (0.038) | (0.023) | (0.009) | (0.025) | (0.025) | (0.023) | (9.459) | (0.023) | (0.022) |
| CCM | −0.299 | −0.332 | 0.323 | 0.023 | 0.166 | 0.423 | 0.626 | 892.771 | 0.655 | 0.733 |
| Observations | 10,706 | 10,822 | 10,831 | 5,938 | 5,938 | 9,761 | 10,831 | 6,951 | 11,983 | 11,983 |
| Reduced form | 0.226 | 0.151 | 0.076 | −0.009 | 0.029 | 0.046 | 0.014 | 17.984 | −0.029 | −0.009 |
| | (0.020) | (0.019) | (0.011) | (0.005) | (0.013) | (0.012) | (0.011) | (4.512) | (0.011) | (0.010) |
| Lower bound | 0.192 | 0.114 | 0.076 | −0.009 | 0.029 | 0.046 | 0.014 | 16.577 | −0.030 | −0.011 |
| | (0.020) | (0.019) | (0.011) | (0.005) | (0.013) | (0.012) | (0.011) | (4.486) | (0.011) | (0.010) |
| Upper bound | 0.271 | 0.215 | 0.076 | −0.009 | 0.031 | 0.046 | 0.014 | 18.319 | −0.028 | −0.008 |
| | (0.019) | (0.018) | (0.011) | (0.005) | (0.013) | (0.012) | (0.011) | (4.512) | (0.011) | (0.010) |
| *Panel B. Nonurban* | | | | | | | | | | |
| 2SLS | −0.114 | −0.139 | −0.289 | 0.142 | −0.037 | 0.140 | 0.010 | 11.389 | −0.016 | −0.012 |
| | (0.059) | (0.051) | (0.035) | (0.031) | (0.047) | (0.033) | (0.032) | (15.316) | (0.026) | (0.024) |
| CCM | 0.372 | 0.481 | 0.512 | 0.066 | 0.289 | 0.737 | 0.786 | 1,121.508 | 0.815 | 0.903 |
| Observations | 3,198 | 3,164 | 3,081 | 1,729 | 1,729 | 2,942 | 3,081 | 2,376 | 3,175 | 3,175 |
| Reduced form | −0.069 | −0.082 | −0.159 | 0.078 | −0.014 | 0.083 | 0.012 | 6.982 | −0.013 | −0.011 |
| | (0.035) | (0.029) | (0.021) | (0.017) | (0.027) | (0.019) | (0.018) | (8.987) | (0.015) | (0.014) |
| Lower bound | −0.113 | −0.120 | −0.165 | 0.075 | −0.016 | 0.077 | 0.005 | −5.198 | −0.018 | −0.015 |
| | (0.035) | (0.029) | (0.020) | (0.017) | (0.027) | (0.019) | (0.018) | (8.819) | (0.015) | (0.014) |
| Upper bound | 0.012 | 0.004 | −0.153 | 0.080 | −0.012 | 0.090 | 0.017 | 18.507 | −0.009 | −0.005 |
| | (0.034) | (0.027) | (0.021) | (0.017) | (0.027) | (0.019) | (0.018) | (8.880) | (0.015) | (0.014) |

*Notes:* Each coefficient labeled "2SLS" is the instrumental variables estimate of the effect of attending an urban or nonurban charter on the outcome listed in the column heading as described in equation (1). The control complier mean is listed in the rows labeled "CCM." The estimate of the effect of winning an urban or nonurban charter lottery is reported in the rows labeled "Reduced form." For concision, the reduced-form estimates use a single offer variable, ever offer, in each locality. Estimates of the reduced form using Lee Bounds are labeled "Lower bound" and "Upper bound." The sample includes charter lottery applicants in the projected high school classes of 2006–2018. "MassCore" refers to graduating within five years with a college-preparation curriculum as defined by the state. It is available for the classes of 2008–2018. The IB and calculus indicators are available for the classes of 2015–2018. Robust standard errors in parentheses.

In terms of AP preparation, in urban areas, charter attendance increases the AP-taking rate by 16 percentage points, whereas in nonurban areas, charter attendance *decreases* AP test–taking by 29 percentage points. The decline is at least partly due to nonurban charters offering fewer AP's. AP passing rates (scoring 3 or above) align with the change in AP-taking, with urban charters boosting scores of 3 or above by 5 percentage points and nonurban charters decreasing this rate by 19 percentage points (Supplemental Appendix Table B.2). While AP courses are a popular college-readiness program, some high schools offer alternative paths. One nonurban charter school offers an IB curriculum; this results in nonurban charter attendance increasing the IB course–taking rate by 14 percentage points. We also examine enrollment in calculus regardless of AP Calculus enrollment, as it is an important college precursor. Calculus-taking rates increase for urban charter students by 5 percentage points, and they decrease by a slightly smaller amount for nonurban charter students, though this difference is not statistically significant.

AP, IB, and calculus may not encompass all college-ready curricular paths, especially in nonurban schools, many of which adhere to more individualized, project-based curricula. As a summation of college preparation, we turn to MassCore completion, which indicates a rigorous college-preparation curriculum as defined by the state. In urban areas, about 42 percent of comparison students meet the MassCore threshold; charter attendance increases this to 53 percent. In nonurban areas, the charter bump is even larger: an increase from 74 percent MassCore completion for comparison students to 88 percent. Both urban and nonurban charter schools increase college preparation, with urban charters focusing on AP courses and MassCore and nonurban charters emphasizing the MassCore college-preparation curriculum.

Taking, and scoring well on, the SAT is another milestone on the path to college. As shown in Table 2, urban charter attendance increases SAT-taking by about 4 percentage points, up from 63 percent for comparison students. Nonurban charter attendance does not change the rate of SAT-taking, with 79 percent of nonurban students in the sample taking the SAT. Urban charter attendance boosts the test scores of takers by 39 points (out of 1600), with little difference in nonurban scores.[5]

In order to matriculate to college, high school students must also progress through high school and graduate. We display treatment estimates for high school graduation in Table 2. Here, the findings diverge from those on test scores. Urban students are less likely to graduate high school on time, with a 7 percentage point decrease in high school graduation in four years. Urban charter students do catch up, with little difference in graduation rates vis-à-vis their peers at the five-year horizon. This is consistent with Angrist et al. (2016), which suggests that many Boston charter students take five years to graduate in order to complete high school requirements, and our finding that urban charter attendance increases the likelihood that students repeat ninth or tenth grade by 4 percentage points (Supplemental Appendix Table B.3). Nonurban charter students graduate at the same rates and within the same time frame as their peers.

Since there is modest differential attrition in presence in high school in the nonurban areas, we present Lee bounds for high school outcomes as well. The bounds for these outcomes are quite tight, and the small differences in appearance in the data do not affect our conclusions.

Overall, our findings suggest that attending an urban charter school boosts several measures of college preparation: Students increase the number of AP's taken, their completion of a college-ready high school curriculum, the likelihood that they take the SAT, and their SAT scores. There are negative impacts on high school graduation, which diminish over time. These estimates are similar to those previously reported for Boston charters (Angrist et al. 2016; Setren 2021; Cohodes and Feigenbaum 2021). For the first time, we present evidence on nonurban charter attendance on college preparation: Nonurban charter attendees take fewer AP's, given their schools' lower AP course offerings, but are much more likely to complete the rigorous MassCore curriculum. SAT and high school graduation outcomes are unchanged by nonurban charter attendance.

[5] We display SAT reasoning scores (out of 1600) since all cohorts take the relevant SAT subsections and only some take the exam scored out of 2400.

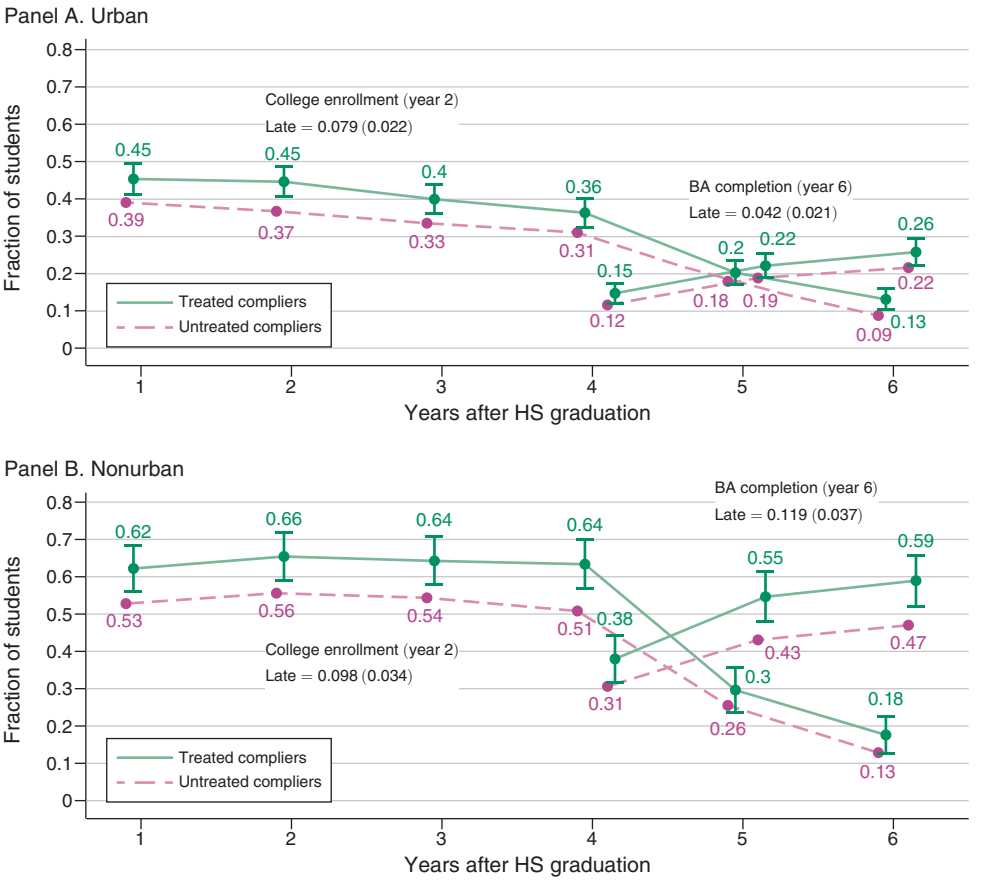


FIGURE 1. FOUR-YEAR COLLEGE PROGRESSION

*Notes:* This figure shows the treatment and CCM for four-year college enrollment and graduation for treated and untreated compliers. Treatment effects on college enrollment two years after projected high school graduation and graduation rates six years after projected high school graduation are reported under the labels. Details for the other treatment effects are in Supplemental Appendix Tables B.4 and B.5. Robust standard errors in parentheses.

## C. *College Enrollment*

College preparation in high school is an important precursor to college, but college enrollment, persistence, and graduation show whether students succeed outside secondary education. Within a year of projected high school graduation, both urban and nonurban charter students enroll in four-year college at greater rates than their peers, as shown in Figure 1 and Table 3. Additionally, both types divert enrollments from two-year institutions, such that initial enrollment in any postsecondary institution remains flat in both localities (Supplemental Appendix Table B.4). Urban charter attendance boosts immediate four-year enrollment to 45 percent from 39 percent; nonurban charter attendance boosts enrollment to 62 percent from 53 percent (Figure 1). The decline in two-year college enrollment due to urban charter attendance is 4 percentage points, and that due to nonurban charter attendance is 7 percentage points. By the second year after projected high school graduation, an

Table 3—The Impact of Charter School Attendance on College Outcomes

| | Urban | | | Nonurban | | |
|---|---|---|---|---|---|---|
| | 2SLS (1) | CCM (2) | Observations (3) | 2SLS (4) | CCM (5) | Observations (6) |
| *Panel A. College enrollment (in Y2)* | | | | | | |
| All | 0.077 (0.023) | 0.495 | 13,281 | 0.063 (0.032) | 0.684 | 3,414 |
| Graduation rate (IPEDS) | 0.043 (0.014) | 0.447 | 7,993 | 0.043 (0.019) | 0.573 | 2,728 |
| Instructional exp. per student | 809 (332) | 7,184 | 7,849 | 928 (757) | 9,259 | 2,711 |
| Student-to-faculty ratio | −0.061 (0.220) | 15.748 | 7,993 | −0.530 (0.310) | 14.921 | 2,728 |
| Two-year | −0.002 (0.016) | 0.127 | 13,281 | −0.035 (0.023) | 0.127 | 3,414 |
| Four-year | 0.079 (0.022) | 0.367 | 13,281 | 0.098 (0.034) | 0.557 | 3,414 |
| Highly competitive | 0.036 (0.016) | 0.118 | 13,281 | 0.065 (0.034) | 0.317 | 3,414 |
| Competitive | 0.044 (0.019) | 0.185 | 13,281 | 0.036 (0.031) | 0.204 | 3,414 |
| Noncompetitive | 0.001 (0.011) | 0.062 | 13,281 | −0.001 (0.015) | 0.036 | 3,414 |
| *Panel B. College degrees (by Y6)* | | | | | | |
| All | 0.046 (0.022) | 0.240 | 11,608 | 0.112 (0.037) | 0.519 | 3,158 |
| AA | 0.009 (0.011) | 0.041 | 11,608 | −0.030 (0.020) | 0.093 | 3,158 |
| BA | 0.042 (0.021) | 0.216 | 11,608 | 0.119 (0.037) | 0.472 | 3,158 |
| Highly competitive | 0.023 (0.014) | 0.082 | 11,608 | 0.078 (0.034) | 0.260 | 3,158 |
| Competitive | 0.022 (0.015) | 0.095 | 11,608 | 0.052 (0.029) | 0.161 | 3,158 |
| Noncompetitive | −0.003 (0.010) | 0.037 | 11,608 | −0.011 (0.016) | 0.049 | 3,158 |

*Notes:* Each coefficient in columns labeled "2SLS" is the instrumental variables estimate of the effect of attending an urban or nonurban charter on the outcome listed in the column heading as described in equation (1). The control complier mean is listed in the columns labeled "CCM." The sample includes charter lottery applicants in the projected high school classes of 2006–2018. "Highly competitive" includes Barron's categories *highly competitive*, *most competitive*, and *very competitive*; "Competitive" includes the categories *competitive* and *special*; and "Noncompetitive" includes *noncompetitive*, *unranked*, and *less competitive*. College characteristics come from IPEDS and are available for students enrolled in college: "Graduation rate" is the 150 percent graduation rate; "Instructional exp. per student" is the institution-reported expenditures on instructional staff compensation divided by the number of full-time equivalent students; and "Student-to-faculty ratio" is the number of full-time equivalent nongraduate students divided by the number of full-time equivalent instructional staff teaching nongraduate students. Robust standard errors in parentheses.

interval that allows for late high school graduation, there is little difference in enrollment at two-year institutions, and four-year college enrollment increases by 8 and 10 percentage points for urban and nonurban charters, respectively. Since two-year enrollment changes little and four-year enrollment rises, enrollment in any college increases for both charter types in the second year after projected high school graduation, as shown in Table 3. With no differential attrition in the college data, we do not present bounds for these or other college outcomes.

Following the time trend in Figure 1 into the third and fourth years after expected high school graduation, urban charters boost four-year college enrollment by 5 to 7 percentage points, with the CCM decreasing over time as students drop out. In the fifth and sixth years after high school graduation, urban charters increase enrollment, though the interpretation of this outcome is ambiguous: If it represents progress toward a degree, enrollment could be beneficial; if it represents a delay in joining the workforce, it could be detrimental. The decrease in control complier enrollment is now due in part to graduation from college. Nonurban charters boost four-year enrollment in the third and fourth years by 10 to 13 percentage points, with lower dropout among the counterfactual students. Nonurban charter students are also more likely to be enrolled in the fifth and sixth years after projected high school graduation by 4 to 5 percentage points, though only the sixth-year difference is statistically significant. Urban and nonurban charters increase both initial college enrollment and persistence through college.

### D. *Degree Attainment*

Both urban and nonurban charter school attendance increases the likelihood that a student obtains any degree, in particular a bachelor's from a four-year institution. In the fourth year after projected high school graduation, which corresponds to on-time high school progress and on-time college progress, urban charters increase BA receipt by 3 percentage points and nonurban charters by 7 percentage points (Figure 1). Urban charters boost two-year attainment by a small amount, whereas nonurban schools decrease it, meaning that both school types increase receipt of a degree of any type by 4 to 6 percentage points (Supplemental Appendix Table B.5).

As time goes on, urban charter attendance increases the BA boost to 4.2 percentage points by the sixth year after projected high school graduation and the gains in any degree attainment to 4.6 percentage points. The nonurban edge increases to an even greater extent over time, with a bump of 11.9 percentage points for BA attainment (11.2 percentage points for any degree) in the sixth year after projected high school graduation (Table 3). By the sixth year, 22 percent of urban control compliers graduate with a BA, with urban charter attendance increasing this to 26 percent, an increase of 19 percent of the comparison mean. By the sixth year, 47 percent of the nonurban control compliers graduate college, with the charter effect boosting this outcome for treated compliers to 59 percent, a 25 percent increase over the mean. Charter attendees are more likely to enroll and graduate from four-year colleges in both urban and nonurban areas. Our conclusions are robust to excluding covariates, adding baseline scores, or instrumenting using initial offers only (Supplemental Appendix Table B.6). The nonurban charter effect is even larger for college graduation outcomes than for college enrollment outcomes. Notably, six years after high school graduation, the college graduation edge from nonurban charter attendance is more than twice as large as that from urban charter attendance.

### E. *College Quality*

College quality can increase college graduation and earnings (Hoekstra 2009; DeAngelo et al. 2011; Cohodes and Goodman 2014; Zimmerman 2014; Goodman,

Hurwitz, and Smith 2017; Ge, Isaac, and Miller 2022; Black, Denning, and Rothstein 2023). Thus, we investigate the impact of charter attendance on college quality using college categories from *Barron's Guide to the Most Competitive Colleges* and college characteristics from the US Department of Education's Integrated Postsecondary Education Data System (IPEDS) in Table 3 (US Department of Education 2025). IPEDS college information is assigned to students by their first enrolled institution. We also consider the extent to which college quality accounts for the observed boost in graduation. Urban charter attendance increases both four-year college enrollment and BA attainment in fairly equal measure at highly competitive and competitive institutions. Nonurban charter attendance boosts college enrollment primarily at highly competitive institutions and graduation at highly competitive and competitive institutions. The differences in college atmospheres are reflected in increased instructional expenditures per student (compensation for instruction divided by number of students) of $809 for urban college attendees and $928 (not significant) for nonurban. Nonurban college students attend institutions with lower student-to-faculty ratios (number of nongraduate students divided by number of nongraduate instructional staff).

To measure institution graduation rate, we use the IPEDS's 150 percent completion rate, which reflects graduation within six years for four-year programs and within three years for two-year programs. Urban charter attendance improves the institutional graduation rate by 4.3 percentage points. Nonurban charter attendance also boosts this rate by 4.3 percentage points. The graduation rate shift due to urban charter attendance almost exactly matches the boost in any degree attainment (4.6 percentage points), whereas in nonurban areas, the shift in graduation rates is about 40 percent of the change in degree attainment $\left(\frac{0.043}{0.112}\right)$. The shift in college quality appears to explain the degree gains for urban charters but not for nonurban charters.

We can show this another way by considering the implicit six-year graduation rates for treated and untreated compliers at four-year colleges. In urban areas, the graduation rate for comparison students is 58.9 percent $\left(\frac{0.216}{0.367}\right)$. For treated students, the graduation rate is a similar 57.8 percent $\left(\frac{0.216+0.042}{0.367+0.079}\right)$. In nonurban areas, the graduation rate is 85 percent for counterfactual students $\left(\frac{0.472}{0.557}\right)$, whereas it is 88.9 percent for treated students $\left(\frac{0.472+0.119}{0.557+0.098}\right)$. This implies that the nonurban charter college boost operates not only through enrolling in high-quality institutions but also through how students experience and complete college.

### F. *Alternative School Groupings*

In Table 4, we present results with alternative school groupings. The college gains for both localities are concentrated among schools that offer high school grades (a majority of our sample), with no and perhaps negative effects on college for the few schools that only offer middle school grades, similar to the evidence from Place and Gleason (2019) and Demers et al. (2017). This finding indicates that continuity between the charter school environment and college transition may be a key factor behind the college boost. We also regroup schools by their practices rather than their

Table 4—The Impact of Charter School Attendance on Key Outcomes, Alternative Samples

| | Urban | | | Nonurban | | |
|---|---|---|---|---|---|---|
| | Math MCAS (1) | Four-year college enrollment (2) | Four-year college graduation (3) | Math MCAS (4) | Four-year college enrollment (5) | Four-year college graduation (6) |
| Main specification | 0.475 | 0.079 | 0.042 | −0.114 | 0.098 | 0.119 |
| | (0.040) | (0.022) | (0.021) | (0.059) | (0.034) | (0.037) |
| Observations | 10,706 | 13,281 | 11,608 | 3,198 | 3,414 | 3,158 |
| Serves HS grades | 0.418 | 0.095 | 0.062 | −0.039 | 0.125 | 0.153 |
| | (0.044) | (0.025) | (0.023) | (0.071) | (0.041) | (0.043) |
| Observations | 9,001 | 11,294 | 10,236 | 2,494 | 2,689 | 2,475 |
| Serves MS only | 0.608 | 0.011 | −0.072 | −0.346 | 0.020 | 0.010 |
| | (0.071) | (0.040) | (0.038) | (0.097) | (0.063) | (0.067) |
| Observations | 1,690 | 1,983 | 1,351 | 704 | 725 | 683 |
| | No Excuses | | | Non–No Excuses | | |
| | (7) | (8) | (9) | (10) | (11) | (12) |
| Alt. grouping | 0.494 | 0.078 | 0.043 | −0.021 | 0.070 | 0.075 |
| | (0.038) | (0.022) | (0.020) | (0.058) | (0.033) | (0.033) |
| Observations | 10,071 | 12,402 | 10,821 | 4,937 | 5,949 | 5,367 |

*Notes:* The first row of the table repeats the main specification reported in the other tables; see Tables 2 and 3 for details. "Four-year college enrollment" is enrollment in two years of projected high school graduation. "Four-year college graduation" is graduation with a BA within six years of projected high school graduation. Each subsequent row shows an alternative sample definition. The row labeled "Serves HS grades" restricts the sample to schools that offer high school grade levels. The row labeled "Serves MS only" restricts the sample to schools that exclusively offer middle school grade levels and do not offer high school grade levels. The row labled "Alt. grouping" groups schools by No Excuses and non–No Excuses instead of urban and nonurban. Since students may apply to both types of schools, they may be counted in the number of observations for each type. Robust standard errors in parentheses.

localities. One nonurban school in our sample follows No Excuses practices, and two urban schools do not follow the No Excuses model. Under this categorization, the No Excuses gains are slightly larger than the urban ones, and the non–No Excuses schools generally follow the pattern for the nonurban schools. However, the test score results are null rather than negative, and the college boost is slightly smaller. This analysis reinforces the notion that multiple school models can lift college outcomes and that test score gains are not a necessary precursor to college gains.

## IV. Conclusion

We confirm previous evidence from Massachusetts that urban charters boost test scores, whereas nonurban charters do not, a pattern that aligns with results in the broader charter school literature. However, when we turn to college enrollment and graduation, we have several novel findings. First, we show that the bump in college enrollment found previously for Boston charter attendance translates into degree completion in a wider sample of urban schools, with urban charters boosting BA attainment rates by 4.2 percentage points and attainment of any degree

by 4.6 percentage points within six years. Second, we show that nonurban charter schools—the same schools that do not increase test scores—increase four-year college enrollment and BA attainment by 9.8 and 11.9 percentage points, respectively. The current analysis cannot speak to all of the mechanisms behind the college gains, but we present evidence on a few key factors. Offering high school grade levels seems to be a necessary condition for college impact, with no college gains for schools that offer only middle school grades. Charters in both locales boost college-ready curricula, via AP and MassCore in urban areas and MassCore in nonurban ones. This academic preparation may be a key factor for the persistence effects. The college institutions that students enroll in matters: The urban charter college edge exactly parallels the rise in graduation rates due to type of enrolled institution, whereas for nonurban charters, it accounts for 40 percent of gains. The remaining nonurban advantage is unexplained. In future work, we will investigate more of the mechanisms behind this pattern of results, including differences in school practices and contexts.

We draw two main conclusions from these findings. First, multiple charter school models can induce college gains. While many have focused on the No Excuses practices as key to charter school success, the nonurban schools in this sample operating on alternative models deliver a large boost to BA attainment. Second, although test scores and longer-term outcomes are typically positively correlated, we add to the evidence that shows that the relationship between test scores and college outcomes does not hold in all contexts, concluding that researchers and policymakers should be wary of evaluating programs solely on standardized test results.

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