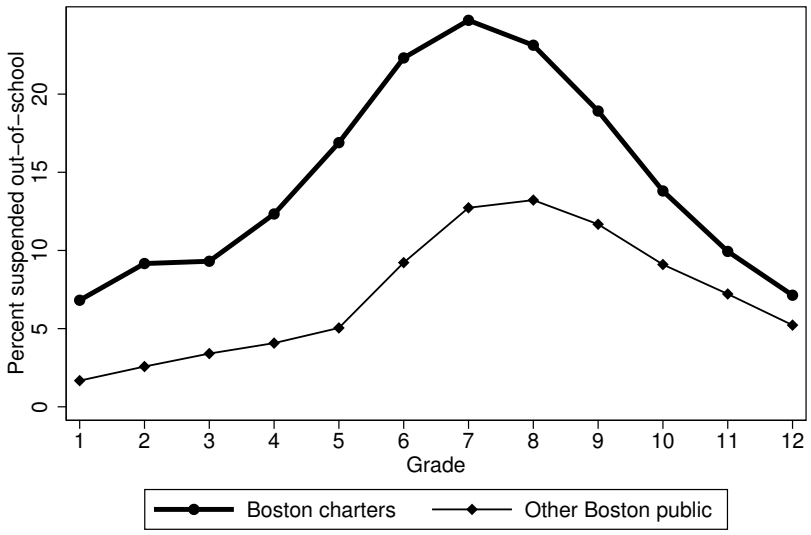
Online Appendix

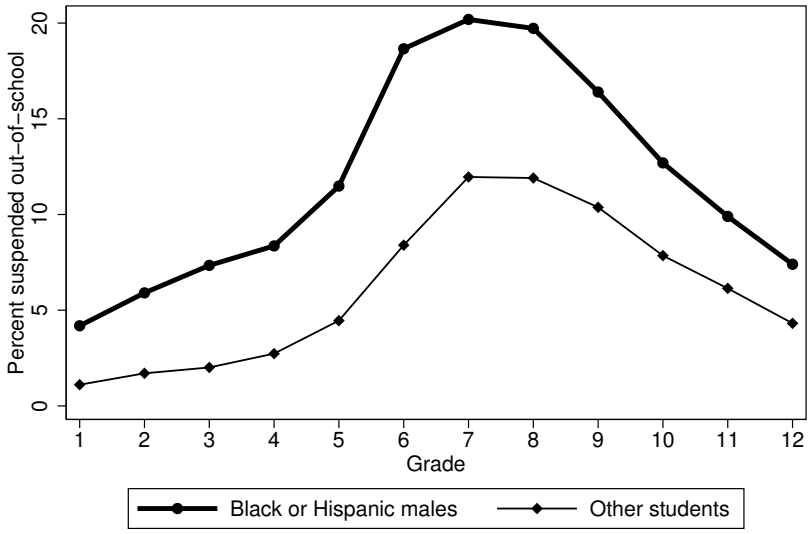
Figure A.1: Percent of Boston students suspended out-of-school

Panel A: Charters vs. Other



Note: Sample includes all 149,802 students ever attending a Boston general education public school between 2006 and 2017. Excludes exam schools.

Panel B: Black or Hispanic vs. Other

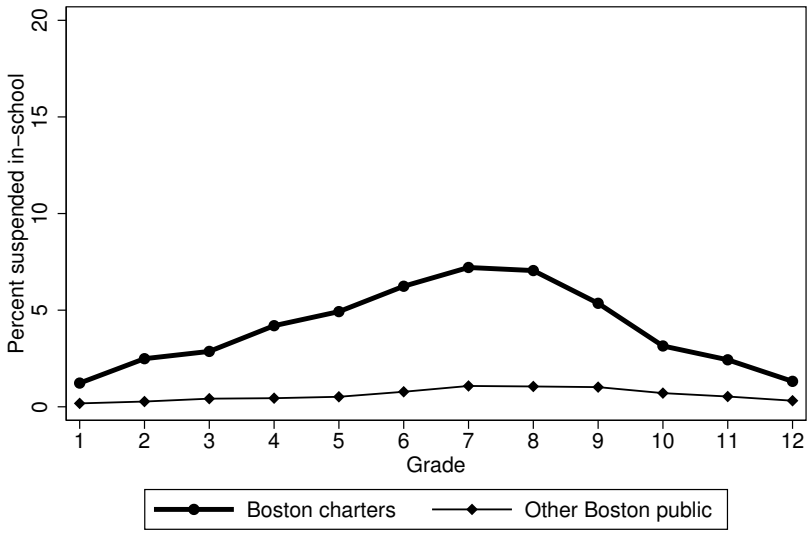


Note: Sample includes all 149,802 students ever attending a Boston general education public school between 2006 and 2017. Excludes exam schols.

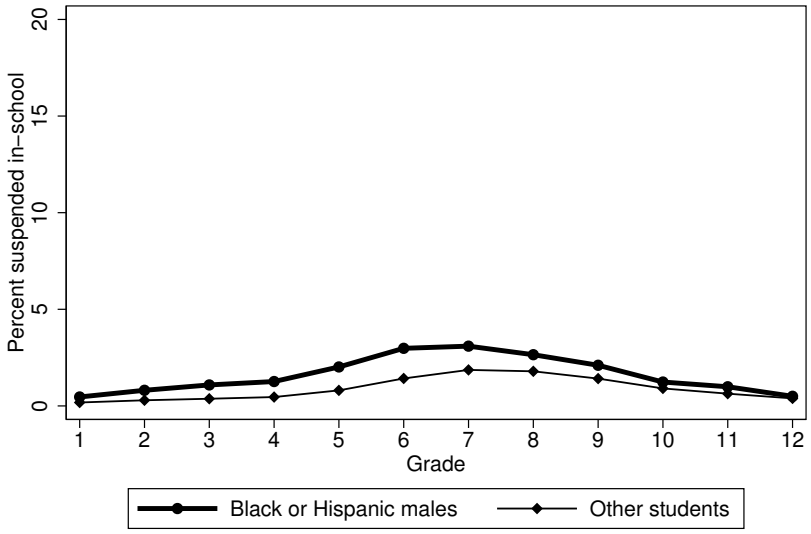
Note: The sample includes all students ever attending a Boston general education public school between 2006 and 2017, excluding exam schools.

Figure A.2: Percent of Boston students suspended in-school

Panel A: Charters vs. Other



Panel B: Black or Hispanic vs. Other



Note: The sample includes all students ever attending a Boston general education public school between 2006 and 2017, excluding exam schools.

Table A.1: IV Charter attendance effect on first year post-lottery outcomes

	Lottery losers mean (1)	Charter attendance effect (2SLS) (2)
First stage		
Instrument: any charter offer		0.501***
		(0.012)
F-statistic		1,821
Discipline outcomes		
Suspended out-of-school	0.091	0.173***
		(0.018)
Suspended in-school	0.017	0.081***
		(0.010)
Days suspended out-of-school	0.296	0.824***
		(0.113)
Days suspended in-school	0.037	0.179***
		(0.030)
Expelled	0.001	0.002
		(0.002)
MCAS test scores		
Math	-0.365	0.400***
		(0.033)
English	-0.457	0.227***
		(0.034)
N	4,054	8,206

Notes: This table displays 2SLS estimates of charter attendance for Boston charter middle school applicants. The first stage estimate is the regression coefficient of the any-charter attendance dummy on an any- charter lottery offer dummy, controlling for fully-saturated charter application risk sets, and a set of baseline covariate controls. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table A.2: Charter attendance effect for post-lottery outcomes

		Charter attendance effect			
	Lottery losers mean	1 year after lottery	2 years after lottery	3 years after lottery	4 years after lottery
	(1)	(2)	(3)	(4)	(5)
First stage					
Instrument: any charter offer		0.501***	0.353***	0.293***	0.223***
		(0.012)	(0.013)	(0.013)	(0.014)
F-statistic		1,821	762	494	246
Discipline outcomes					
Suspended out-of-school	0.091	0.173***	0.153***	0.187***	0.050
		(0.018)	(0.027)	(0.034)	(0.043)
Days suspended out-of-school	0.296	0.824***	0.957***	0.863***	-0.633
		(0.113)	(0.204)	(0.240)	(0.715)
Suspended in-school	0.017	0.081***	0.053***	0.068***	0.034
		(0.010)	(0.016)	(0.019)	(0.023)
Days suspended in-school	0.037	0.179***	0.240***	0.198***	0.068
		(0.030)	(0.060)	(0.054)	(0.061)
Expelled	0.001	0.002	-0.002	0.000	0.000
		(0.002)	(0.003)	(0.003)	(0.006)
MCAS test scores					
Math	-0.365	0.400***	0.754***	0.761***	0.814***
		(0.033)	(0.049)	(0.061)	(0.100)
English	-0.457	0.227***	0.486***	0.511***	0.716***
		(0.034)	(0.050)	(0.063)	(0.104)
N	4,054	8,206	7,886	7,548	3,657

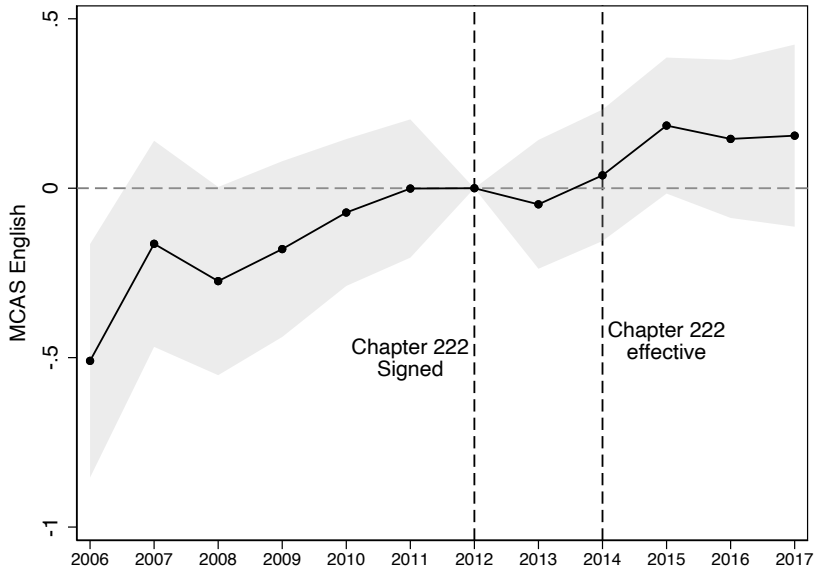
Notes: This table displays 2SLS estimates of charter attendance for Boston charter middle school applicants, separately estimated for each year since the charter lottery application. The first stage estimate is the regression coefficient of the any-charter attendance dummy on an any- charter lottery offer dummy, controlling for fully-saturated charter application risk sets, and a set of baseline covariate controls. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table A.3: Heterogeneity in charter attendance effect on first year post-lottery outcomes by baseline suspension

	Attended any charter	Attended any charter x Suspended at baseline
	(1)	(2)
Test scores		
MCAS Math	0.402***	-0.038
	(0.033)	(0.107)
MCAS English	0.226***	0.032
	(0.034)	(0.122)
First stage		
Excluded instruments		
Any charter offer	0.505***	-0.003*
	(0.012)	(0.001)
Any charter offer x	0.044	0.598***
Suspended at baseline	(0.045)	(0.043)
F-statistic	1,792	626
p-value	0.000	0.000
Degrees of freedom		
df1	1	1
df2	7,779	7,779
N	8,206	

Notes: This table displays 2SLS estimates of heterogeneity in charter attendance effects in the first year after lottery by applicant's baseline grade suspension status. All regressions control for fully-saturated charter application risk sets and non- disciplinary baseline covariate controls. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

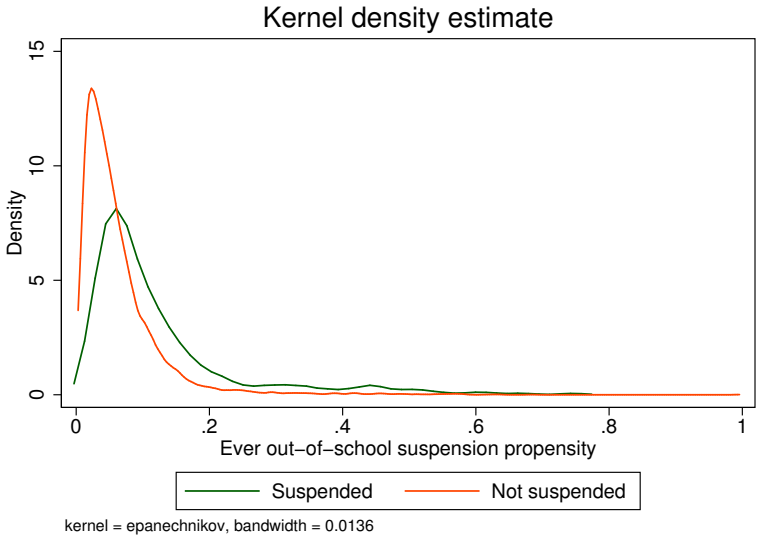
Figure A.3: Year-by-year charter attendance 2SLS treatment effects on test scores



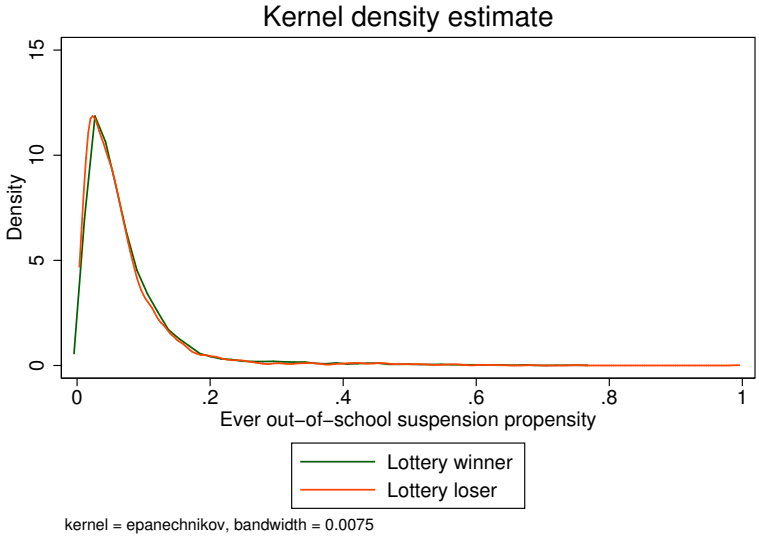
Note: See notes to Figure 1.

Figure A.4: Applicant suspension propensities

Panel A: Suspended vs. Not suspended



Panel B: Charter lottery winner vs. loser



Note: This figure displays the distribution of student suspension propensity scores by suspension status and charter offer status. In Figure A4a, suspended students are those ever suspended, whether in-school or out-of-school, in the first year after the charter lottery. Applicant suspension propensities are estimated in two steps. First, a logit regression of a dummy for whether a student is ever suspended in academic year y is regressed on a rich set of predictors measured as of year y-1 on the sample of Boston students in grades 3-8 who never apply to charter schools. Table A5 displays the list of predictors along with their odds ratio coefficients. Second, the covariance structure estimated in this first step is used to predict suspension propensities in the sample of charter applicants, using each applicant's baseline grade measures as predictors for the applicant-specific suspension propensity.

Table A.4: Year-by-year 2SLS estimates of charter attendance treatment effects

	Treatment: ever attended any charter											
	Before Chapter 222 Signing							After Chapter 222 Signing				
										Chapter 222 effective		
Post-lottery calendar year:	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Discipline outcomes												
Suspended	0.344***	0.181***	0.308***	0.127**	0.207***	0.176***	0.243***	0.172***	0.158***	0.101**	0.160**	0.064
	(0.080)	(0.067)	(0.061)	(0.052)	(0.041)	(0.037)	(0.034)	(0.038)	(0.040)	(0.045)	(0.064)	(0.073)
Suspended out-of-school	0.314***	0.170**	0.244***	0.050	0.167***	0.142***	0.235***	0.171***	0.167***	0.092**	0.096	0.065
	(0.077)	(0.066)	(0.057)	(0.049)	(0.039)	(0.035)	(0.033)	(0.037)	(0.039)	(0.043)	(0.061)	(0.070)
N	549	875	1,205	1,545	1,768	1,916	3,145	3,979	4,921	4,738	3,576	2,147
Test score outcomes												
MCAS Math	0.705***	0.851***	0.607***	0.571***	0.529***	0.774***	0.566***	0.691***	0.676***	0.566***	0.665***	0.588***
	(0.157)	(0.146)	(0.136)	(0.120)	(0.095)	(0.092)	(0.083)	(0.089)	(0.099)	(0.111)	(0.159)	(0.176)
MCAS English	0.038	0.393***	0.157	0.129	0.387***	0.429***	0.450***	0.421***	0.525***	0.593***	0.430***	0.621***
	(0.149)	(0.140)	(0.136)	(0.124)	(0.093)	(0.087)	(0.081)	(0.087)	(0.099)	(0.110)	(0.159)	(0.189)
N	545	855	1,170	1,460	1,714	1,863	3,055	3,866	4,736	4,400	3,374	2,058
First stage												
Instrument: any lottery offer	0.475***	0.455***	0.426***	0.437***	0.495***	0.488***	0.419***	0.369***	0.320***	0.307***	0.257***	0.289***
	(0.039)	(0.034)	(0.030)	(0.028)	(0.024)	(0.023)	(0.018)	(0.017)	(0.017)	(0.019)	(0.024)	(0.031)
F-statistic	155	183	205	259	429	454	540	453	342	241	120	92
N	545	855	1,170	1,460	1,714	1,863	3,055	3,866	4,736	4,400	3,374	2,058

Notes: This table displays 2SLS regression coefficients displayed in Figures 2 and 3, which are estimated from year-by-year regressions of the outcomes listed on the left on an ever-attended-charter dummy. The instrument in each regression is an any-charter lottery offer. All regressions control for fully-saturated charter application risk sets and baseline grade covariates. Since charter applicants enter the sample in different years and at different grades, all regressions include outcome year, grade, and years-since-charter-lottery fixed effects. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table A.5: OLS effect of suspensions on charter applicant test scores

	Suspension OLS in BPS		Suspension OLS in Charter	
	Not suspended mean	Suspended	Not suspended mean	Suspended
	(1)	(2)	(3)	(4)
MCAS Test Scores				
Math	-0.342	-0.163***	0.040	-0.110***
		(0.035)		(0.026)
English	-0.419	-0.150***	-0.173	-0.096***
		(0.037)		(0.027)
N		4,582		3,619

Notes: This table reports OLS estimates of the effect of being suspended on a student's test score outcomes conditional on the school type that the student attends (Charter or Boston Public Schools). Regressions control for the student's propensity to be suspended and for all baseline covariates listed in Appendix Table A.6. See Table A.6 and Figure A.4 for details on the estimation of the student suspension propensity. The sample is applicants to charter schools offering seats for entry grades 5 or 6 in academic years 2004-2005 through 2014-2015. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table A.6: Predictors used in estimating charter applicant suspension propensity scores

Variables commonly used as covariate controls in charter lottery studies	Odds ratio coefficient (1)	*Additional predictors from disciplinary and enrollment recods*	Odds ratio coefficient (2)
Demographics		*Baseline grade suspension*	
Female	0.571***	Ever suspended out-of-school	4.049***
	(0.012)		(0.138)
Asian	0.648***	Ever suspended	2.326***
	(0.045)	in-school	(0.265)
Black	2.036***	Days suspended	1.098***
	(0.082)	out-of-school	(0.011)
Hispanic	1.434***	Days suspended	0.978***
	(0.061)	in-school	(0.052)
Other non-white	1.858***		
	(0.089)		
Baseline grade measures		*Baseline grade enrollment*	
Free or reduced price lunch	1.477***	Days attended school	0.994***
	(0.046)		(0.000)
English Language Learner	0.769***	Transferred to another school	1.164***
	(0.020)		(0.083)
English MCAS	0.803***	Repeated baseline grade	1.066***
	(0.012)		(0.058)
Math MCAS	0.781***	Immigrant	0.652***
	(0.013)		(0.036)
Special education	1.059***	Age	1.124***
	(0.024)		(0.016)

Note: This table reports odds ratio coefficients from a school or out-of-school) status on the listed variables plus grade fixed effects. The logistic regression is estimated on a sample of Boston students who never applied to charter schools. The sample contains students in grades 3-8 between between years 2004 and 2017. Suspension propensity scores are then predicted for charter applicants using applicants' baseline grade measures as predictors.

Table A.7: Suspension effect in charters vs. Charter effect on suspended: robustness to excluded instruments

	Instruments: individual charter offers					Instruments: individual charter offers plus interactions with dummy for baseline out-of-school suspension					Instruments: individual charter offers plus interactions with applicant suspension propensity score				
	Treatments					Treatments					Treatments				
	Suspended	Attended charter	Attended charter x Suspended	Suspension effect in charters (1)+(3)	Charter effect on suspended (2)+(3)	Suspended	Attended charter	Attended charter x Suspended	Suspension effect in charters (6)+(8)	Charter effect on suspended (7)+(8)	Suspended	Attended charter	Attended charter x Suspended	Suspension effect in charters (11)+(13)	Charter effect on suspended (12)+(13)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
MCAS test scores															
Math	-3.824***	0.073	3.813***	-0.011	3.886***	-1.336***	0.239***	1.318***	-0.018	1.557***	-1.096***	0.304***	0.876***	-0.219	1.181***
	(1.239)	(0.092)	(1.175)	(0.264)	(1.115)	(0.481)	(0.054)	(0.425)	(0.172)	(0.403)	(0.412)	(0.048)	(0.340)	(0.157)	(0.325)
English	-2.890***	-0.106	3.097***	0.207	2.991***	-1.506***	-0.001	1.678***	0.172	1.677***	-1.210***	0.078	1.160***	-0.050	1.238***
	(1.037)	(0.085)	(0.995)	(0.224)	(0.937)	(0.503)	(0.057)	(0.458)	(0.172)	(0.432)	(0.423)	(0.050)	(0.354)	(0.159)	(0.337)
First stage F-statistics															
F-statistic	2.497	7.846	2.754	--	--	2.548	17.929	3.076	--	--	2.867	32.648	3.557	--	--
Degrees of freedom	8	8	8	--	--	18	18	18	--	--	18	18	18	--	--
N			8,149					8,149					8,149		

Notes: This table displays robustness to the set of excluded instruments for the estimates in Table 3. Instruments in Columns (1)-(5) are individual charter offers only; whereas Columns (6)-(10) and (11)-(15) present estimates interacting individual charter offers with a dummy indicating if the applicant was suspended out-of-school in the baseline grade, or the applicant suspension propensity score, respectively.

Table A.8: Covariate balance for charter middle school lottery applicants

		Any-charter lottery losers mean (1)	Offered any charter seat (2)
Discipline baseline			
Suspended out-of-school		0.037	0.001
			(0.005)
Suspended in-school		0.003	0.000
			(0.001)
Expelled		0.000	0.000
			(0.000)
	N	9,646	
Academic achievement baseline			
MCAS Math		-0.408	-0.019
			(0.024)
MCAS English		-0.482	-0.002
			(0.025)
	N	8,906	
Time-varying demographics			
Low income		0.744	0.000
			(0.011)
Special education		0.201	-0.014
			(0.010)
Limited English Proficient		0.257	-0.003
			(0.011)
	N	9,646	
Gender and race			
Female		0.488	0.000
			(0.013)
Race			
Black		0.437	-0.013
			(0.012)
Hispanic		0.248	0.020*
			(0.011)
White		0.170	-0.005
			(0.008)
Asian		0.033	0.003
			(0.005)
	N	9,646	
Balance joint F-statistic p-value			0.456

Notes: This table displays covariate balance on baseline characteristics of charter lottery winners and losers. Column (2) displays OLS regression coefficients from regressions of each baseline characteristic on an any-charter offer dummy. All regressions control for fully-saturated charter application risk sets. Means for losers of all charter lotteries are displayed in Column (1) for reference. The joint F-statistic corresponds to the t-statistic of the any-charter offer dummy coefficient from a stacked regression of all baseline characteristics on the any-charter offer dummy. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors at the attended school level are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table A.9: Year-by-year charter attendance covariate balance

	Instrument: any lottery offer											
Post-lottery calendar year:	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Baseline discipline												
Suspended out-of-school	-0.007	-0.038**	-0.009	-0.009	0.017	0.007	0.001	-0.003	-0.001	0.002	-0.004	0.006
	(0.018)	(0.017)	(0.016)	(0.014)	(0.011)	(0.009)	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.013)
Suspended in-school	--	--	--	--	0.002	0.001	-0.001	-0.003	-0.002	0.001	-0.001	0.004
	--	--	--	--	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.006)
Expelled	--	--	--	--	-0.003	-0.002	-0.001	--	--	--	--	--
	--	--	--	--	(0.002)	(0.002)	(0.001)	--	--	--	--	--
N	549	875	1,205	1,545	1,768	1,916	3,145	3,979	4,921	4,738	3,576	2,147
Baseline test scores												
MCAS Math	0.081	0.005	-0.038	-0.024	-0.052	-0.035	-0.024	0.010	0.049	0.058	0.062	0.068
	(0.135)	(0.095)	(0.069)	(0.059)	(0.052)	(0.049)	(0.038)	(0.035)	(0.034)	(0.037)	(0.044)	(0.060)
MCAS English	0.051	0.028	-0.018	-0.044	-0.008	0.006	0.012	0.025	0.040	0.066*	0.074	0.060
	(0.144)	(0.100)	(0.075)	(0.062)	(0.053)	(0.050)	(0.038)	(0.036)	(0.034)	(0.037)	(0.045)	(0.060)
Baseline demographics												
Low income	0.036	0.031	0.029	0.019	0.018	0.032	-0.033**	-0.030*	-0.015	-0.007	0.009	0.012
	(0.044)	(0.037)	(0.033)	(0.030)	(0.026)	(0.024)	(0.016)	(0.016)	(0.014)	(0.016)	(0.019)	(0.025)
Special education	0.002	-0.013	-0.009	0.006	-0.035	-0.026	-0.016	-0.006	-0.013	-0.044***	-0.025	-0.045*
	(0.038)	(0.032)	(0.028)	(0.026)	(0.022)	(0.020)	(0.016)	(0.015)	(0.014)	(0.016)	(0.019)	(0.026)
Limited English Proficient	-0.015	-0.028*	-0.005	0.020	0.009	0.036*	0.014	-0.003	-0.005	-0.031*	-0.012	-0.008
	(0.018)	(0.016)	(0.018)	(0.020)	(0.018)	(0.019)	(0.017)	(0.017)	(0.017)	(0.019)	(0.022)	(0.029)
N	549	875	1,205	1,545	1,768	1,916	3,145	3,979	4,921	4,738	3,576	2,147
Gender and race												
Female	0.083*	0.053	0.006	-0.014	-0.002	-0.002	0.001	0.010	0.002	0.014	0.025	0.025
	(0.047)	(0.040)	(0.035)	(0.032)	(0.029)	(0.027)	(0.021)	(0.019)	(0.019)	(0.020)	(0.025)	(0.033)
Race												
Black	-0.036	-0.017	-0.010	-0.029	0.012	-0.014	-0.020	-0.034*	-0.017	-0.013	-0.015	-0.027
	(0.045)	(0.038)	(0.033)	(0.030)	(0.027)	(0.025)	(0.019)	(0.018)	(0.017)	(0.019)	(0.022)	(0.028)
Hispanic	0.018	0.008	-0.008	0.013	0.013	0.030	0.035**	0.025	0.015	0.006	0.011	0.024
	(0.038)	(0.031)	(0.025)	(0.025)	(0.023)	(0.021)	(0.017)	(0.016)	(0.016)	(0.018)	(0.021)	(0.028)
White	0.023	0.015	0.022	0.033	-0.017	-0.023	-0.017	0.000	-0.006	0.009	0.007	-0.006
	(0.035)	(0.031)	(0.028)	(0.025)	(0.021)	(0.020)	(0.013)	(0.012)	(0.011)	(0.012)	(0.015)	(0.022)
Asian	-0.002	-0.005	0.001	0.004	-0.009	-0.002	0.008	0.005	0.008	0.002	0.007	0.005
	(0.016)	(0.012)	(0.009)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.011)
N	549	875	1,205	1,545	1,768	1,916	3,145	3,979	4,921	4,738	3,576	2,147
Joint F-statistic p-value	0.455	0.176	0.769	0.669	0.607	0.556	0.320	0.420	0.823	0.194	0.740	0.505

Notes: This table displays covariate balance on baseline characteristics of charter lottery winners and losers for each outcome year. Columns (1)-(12) display OLS regression coefficients from regressions of each baseline characteristic on an any-charter offer dummy. All regressions control for fully-saturated charter application risk sets, grade, and years-since-lottery fixed effects. The joint F-statistic corresponds to the t-statistic of the any-charter offer dummy coefficient from a stacked regression of all baseline characteristics on the any-charter offer dummy. Test scores are standardized by grade and year to have mean zero and unit standard deviation at the state level. Robust standard errors at the attended school level are displayed in parentheses. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table A.10: Charter lottery winners vs. losers: covariate balance

	Enrolled in MA Public School		Has English MCAS		Has Math MCAS	
	Any-charter lottery losers mean	Offered any charter seat	Any-charter lottery losers mean	Offered any charter seat	Any-charter lottery losers mean	Offered any charter seat
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome year 1	0.950	0.014	0.896	0.013	0.906	0.014
		(0.005)		(0.007)		(0.007)
N	9,646		9,646		9,646	
Outcome year 2	0.909	0.025	0.872	0.022	0.870	0.025
		(0.007)		(0.008)		(0.008)
N	9,646		9,646		9,646	
Outcome year 3	0.885	0.015	0.842	0.011	0.839	0.015
		(0.008)		(0.009)		(0.009)
N	9,646		9,646		9,646	
Outcome year 4	0.774	-0.003	0.732	0.005	0.732	0.009
		(0.009)		(0.013)		(0.013)
N	9,646		5,385		5,385	

Notes: This table displays differential attrition between charter lottery winners and losers. Columns (2), (4), and (6) display OLS regression coefficients from regressions of dummies indicating enrollment in a MA public school, availability of English MCAS test score, and availability of math MCAS test score, respectively, on an any-charter offer dummy. Since MCAS is not administered for grade 9, differential attrition estimates for MCAS test scores in outcome year 4 excludes 6th grade applicants, for which grade 9 is the expected grade in the 4th outcome year. All regressions control for fully-saturated charter application risk sets. Means of lottery losers' attrition indicators are displayed in Columns (1), (3), and (5) for reference.

Table A.11: Charter middle school lotteries: analysis sample applicant counts

	Application year										
Application year:	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
School	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Academy of the Pacific Rim Charter		139	166	292	116	172	145	222	420	467	
Boston Collegiate Charter	155	201	197	210	233	282	264	559	552	625	406
Boston Preparatory Charter		145	206	242	177	192	182	206	209	236	118
Codman											92
Brooke Charter School Roslindale			66	85	79	93					
Brooke Charter School Mattapan								182	103	273	241
Brooke Charter School East Boston									118	217	185
Excel Academy Charter					52	130	118	129	271	318	
Excel Academy Charter School - Boston II									172	235	
KIPP Academy Boston Charter School									104	132	209
MATCH Charter School					295	262	219	490	350	459	238
Uncommon Schools - Roxbury Prep	111	131	132	132	141	151	104	537	451	338	337
Uncommon Schools - Grove Hall								429	451	338	337
Uncommon Schools - Dorchester Prep									451	338	337
UP Academy Charter School of Boston								551	209	173	152

Note: This table displays the number of charter applicants in the analysis sample, by school lottery entered and by application year. Applications are submitted in indicated year for entry into grades 5 or 6 in the Fall semester of the following academic year.

Data Appendix

To estimate causal effects of suspensions and disciplinary environments on learning, I linked charter lotteries data collected by researchers at MIT's School Effectiveness and Inequality Initiative (SEII) to three administrative datasets provided by the Massachusetts Department of Elementary and Secondary Education (MA DESE): SIMS, SSDR, and MCAS.

SIMS

The SIMS dataset includes demographic information and student-level enrollment records for all MA public schools between school years 2002-3 and 2016-17. SIMS is used to compute three charter enrollment status by grade (charter treatment) and demographic controls.[15] These variables are coded as follows:

- *Charter treatment.* School codes and/or names are used to identify charters. To determine enrollment, since students may switch schools or grades in the same school year, some discretion is needed to determine in which school the student is enrolled. Since charter attendance is a treatment of interest, if in a given school year a student is enrolled for even one day at a charter school, the student is considered enrolled in a charter for that school year. Otherwise, I determine the school in which a student is enrolled based on the maximum number of days attended. This widely adopted definition of treatment is considered conservative because it counts towards treatment lower-achieving students who might leave charters mid-year.[16]

- *Demographic controls.* Dummy variables are created to indicate various demographic characteristics. While SIMS includes a wide number of interesting characteristics to be explored in further work – such as immigrant status and home language – the share students belonging to several of these characteristics is very low. Thus, I focus on more commonly explored demographic characteristics in the literature, such as gender, race, special education status, English language learner status, and low income status. Importantly, the last three characteristics may change over time. As a result, I define

[15] SIMS also includes total suspensions out-of-school, in-school, and an expulsion flag for school years 2003-04 and 2011-12. However, since the SIMS data is aggregated at the enrollment record level, incident dates are not available with which to compute all suspensions occurring prior to test-taking. As a result, I use SDDR as the primary source for data on disciplinary actions. Aggregating all incidents from SSDR at the student level gives similar figures to those reported in SIMS.

[16] Other papers implementing the same or similar strategies include Setren (2017); Abdulkadiroğlu et al. (2017, 2016); Angrist et al. (2016, 2013).

time-varying demographic controls using baseline data (that is, data prior to charter attendance) when analyzing charter and suspensions treatment effects. [17]

SSDR

The SSDR dataset includes student-level information on any drug, violent or criminal-related offenses, as well as any non-drug, non-violent or non-criminal-related offenses committed by the student on school property between school years 2003-04 and 2016-17. Incident dates, offense types, and disciplinary measures taken are available. Students are identified by the same unique identifier as in SIMS. SSDR is used to compute out-of-school and in-school suspensions, and an expulsion dummy for each student. Ever suspended dummies and total days suspended are computed. Three points must be highlighted:

- *Consider all offense types.* While rich data on offense types are available, most incidents in MA public schools entail "non-drug, non-violent or non-criminal-related" offenses only. As a result, a more detailed look into suspension effects by offense type would be limited in power, and is thus deferred to future work.

- *Timing of suspensions.* When analyzing suspensions and expulsions as outcomes, I consider incidents throughout the academic year. However, when estimating the treatment effect of suspensions on test scores and grade progression outcomes, I limit the SSDR data to incidents occurring prior to April of each school year, when the MCAS math and English test season commences.

- *Missing data.* I assume that students not cited in any SSDR incidents were not suspended. For the purposes of estimating unbiased and consistent charter attendance effects on suspensions, and suspension treatment effects on outcomes, this assumption requires no differential SSDR reporting between charters and other MA public schools. If charters are on average better reporters, charter attendance effects on suspensions will be overestimated.

While a thorough investigation of schools' reporting habits is beyond the scope of this paper, it is unlikely that differential SSDR would drive the results in this paper. If anything, since

[17] Furthermore, it is important to note that a student's classification as special education status is a function of the school in which the student is enrolled, and could therefore change if the student enrolls at a charter. In fact, Setren (2017) finds large causal effects of charter enrollment on special education declassification, as charters move special education students into more inclusive classrooms. While the study of school discipline is particularly relevant for special education populations, assessing how declassification and suspensions interact in producing aggregate charter attendance effects is beyond the scope of this project.

charters are consistently under the criticism of over-suspending students, one might expect charters to under-report rather than over-report suspensions. Moreover, higher prevalence of reported suspensions among charters is consistent throughout many US public school districts with varying degrees of data quality collection and reporting standards.

MCAS

The MCAS dataset includes annual MCAS math and English test scores for MA public school students in grades 3 through 8, and 10. Since students may retake the test, I follow the literature in considering test results for the first attempt only.[18] I then standardize the test scores for each subject by grade and year to have mean zero and unit standard deviation at the state level.

Charter lotteries

I use Boston charter middle school lottery records collected by researchers at SEII for charter seats in school years 2004-05 through 2016-17. This sample includes 12 of 17 Boston charters offering middle school grades throughout the sample period.[19] Two points on sample selection are worth emphasizing:

- *Focus on Boston.* Focusing on Boston allows me to use of multiple charter lottery offers as instruments for suspensions and charter attendance in investigating the mechanisms behind Chapter 222's effect.

- *Focus on middle school.* I focus on lotteries for middle school entry (grades 5 and 6) for three reasons. First, as I show in Appendix Figures A.1-A.2, suspensions are primarily a middle school phenomenon in Massachusetts. Second, test scores are available for grades 3-8, allowing for analysis of estimation of test score treatment effects for 1 to 4 years following charter treatment, which is not possible for high school applicants. Finally, middle school applicants have 2-3 baseline grades with test score and discipline histories with which suspension propensities can be computed.

Lotteries take place in the Spring semester for entrance in the following Fall. Charters typically make initial offers and include several other students on a waitlist. When students

[18] In school years 2014 and 2015, Massachusetts experimented switching the standardized test to PARCC exams instead of MCAS. I use the MCAS-corresponding scores provided by MA DESE in the PARCC test score datasets for all PARCC scores.

[19] These figures exclude five charters that specialize in alternative and special education, for which there are no oversubscribed lotteries.

initially offered seats decline attendance, offers are made to waitlisted students. For the purposes of this paper, an applicant is considered a lottery winner if he or she receives either an initial or an off-waitlist offer. (Angrist et al., 2016) presents charter attendance effects on test scores for initially and waitlisted applicants separately.

Importantly, some lottery applicants may be guaranteed a seat at the charter if she/he either has a sibling in the school or fills any special school priorities. These applicants are excluded from analyses as they are not subject to randomization.

Linking datasets

Lottery records and administrative datasets contain identifiable information, such as names and dates of birth, and are thus stored in a restricted access facility at the National Bureau of Economic Research, in accordance with this project's Memorandum of Understanding with MA DESE. Once lottery records are matched to SIMS on names and date of birth, identifiable information are discarded from analyses files. Unique identifiers, available in all administrative datasets, are used to construct a panel dataset tracking applicants across time. This panel dataset includes demographic controls, baseline variables, treatment variables, and outcome variables.