Charter Schools and Labor Market Outcomes
Online Appendix - Not for Publication *

Will Dobbie
Princeton University and NBER

Roland G. Fryer
Harvard University and NBER

Original Draft: July 2016
This Version: November 2017

Contents

*We thank the Texas Education Research Center at the University of Texas at Austin's Ray Marshall Center for providing the data used in our analysis. We also thank David Card, Raj Chetty, Matt Davis, Hank Farber, Edward Glaeser, Hilary Hoynes, Lawrence Katz, Patrick Kline, Michal Kolesár, Alan Krueger, Alexandre Mas, Parag Pathak, Jesse Rothstein, Adam Sacarny, Jesse Shapiro, Doug Staiger, Chris Walters, Danny Yagan, Seth Zimmerman, and numerous seminar participants for helpful comments and suggestions. Elijah de la Campa, Tanaya Devi, Matt Farber, Adriano Fernandes, Samsun Knight, William Murdock III, Namrata Narain, Rucha Vankudre, Dan Van Deusen, Jessica Wagner, and Brecia Young provided exceptional research assistance. Correspondence can be addressed to the authors by e-mail at wdobbie@princeton.edu [Dobbie] or rfryer@fas.harvard.edu [Fryer]. The research presented here utilizes confidential data from the State of Texas supplied by the Education Research Center (ERC) at The University of Texas at Austin. The views expressed are those of the authors and should not be attributed to the ERC or any of the supporting organizations mentioned herein, including The University of Texas at Austin or the State of Texas. Any errors are attributable to the authors.

A. Supplemental Results

Appendix Table 1: Charter Schools in Estimation Sample

	District	Years Open	Grades	Cohorts	Students
Panel A: No Excuses Charters	(1)	(2)	(3)	(4)	(5)
Harmony Science Academy	Houston	2001-2014	6-12	5	349
Harmony Science Academy - Austin	Austin	2003-2014	6-12	3	105
Harmony Science Academy - Dallas	Dallas	2005-2010	8-12	1	35
IDEA College Prep	Donna	2001-2014	5-12	4	273
KIPP Academy*	Houston	1996-2014	5-12	8	431
KIPP 3D Academy	Houston	2002-2014	5-8	2	78
YES College Preparatory	Houston	1999-2014	5-12	8	659
Uplift Education - North Hills Prep	Irving	1998-2014	5-12	8	565
Panel B: Regular Charter - College Prep					
A+ Academy	Dallas	2001-2014	5-12	5	245
Arlington Classics Academy	Arlington	2000-2014	5-9	4	61
Bright Ideas Charter	Wichita Falls	1999-2014	5-12	5	93
Chaparral Star Academy	Austin	1999-2014	5-12	7	168
Girls & Boys Prep Academy	Houston	1997-2014	5-12	8	694
Heritage Champions Academy	Lewisville	2007-2014	9-12	2	43
Katherine Anne Porter	Wimberly	2000-2014	9-12	8	336
Katherine Anne Porter at Blanco	Blanco	2002-2003	6-8	1	12
Life Charter School of Oak Cliff	Lancaster	1999-2014	5-12	6	289
Pineywoods Community Academy	Lufkin	2000-2014	5-9	6	162
Richland Collegiate HS	Dallas	2007-2014	11-12	2	206
Rick Hawkins HS*	San Antonio	1999-2014	5-12	7	895
The Ehrhart School	Beaumont	2002-2014	5-11	6	149
Treetops School International	Fort Worth	1999-2014	5-12	8	251
Two Dimensions Preparatory*	Houston	1999-2014	5-6	1	10
Universal Academy*	Irving	1999-2014	5-12	6	497
Panel C: Regular Charter - Special Mission					
Burnham Wood Charter School	El Paso	1999-2001	9-11	1	10
Cedars International Academy	Austin	2002-2014	5-7	1	15
Dominion Academy	Houston	2002-2012	5-8	2	97
Eden Park Academy	Austin	1999-2014	5-8	4	64
Focus Learning Academy	Dallas	2000-2014	5-8	3	69
Gateway Charter Academy*	Dallas	2002-2014	5-12	2	72
Guardian Angel Performance Arts	San Antonio	2000-2010	6-8	6	120
Heritage Academy	Dallas	2000-2000	9-11	1	16
Houston Gateway Academy	Houston	2000-2014	5-10	3	139
Inspired Vision	Dallas	2002-2014	5-9	4	105
Kaleidoscope/Caleidoscopio	Houston	1998-2012	6-8	6	145

Northwest Preparatory	Houston	2002-2014	5-8	2	40
Nyos Charter School	Austin	1999-2014	5-12	6	135
Oak Cliff Academy	Dallas	2000-2014	5-8	4	167
Odyssey Academy	Galveston	2000-2014	5-8	5	329
Tekoa Academy	Port Arthur	2000-2014	5-11	4	92
Texas Empowerment Academy	Austin	1999-2014	5-12	6	135
The Phoenix Charter School	Greenville	2001-2014	5-12	3	79
Waxahachie Faith Family Academy	Desoto	2000-2014	5-12	7	220
West Houston Charter 2	Katy	1999-2007	6-12	8	220
XXI Century Academy	Corpus Christi	2001-2001	9-11	1	11
Panel D: Regular Charter - Misc.					
Accelerated Intermediate Charter	Houston	2002-2010	6-8	5	232
Beatrice Mayes Institute	Houston	2002-2014	5-8	3	74
Crossroad Community Charter	Houston	2001-2006	9-12	6	247
CSAS Academy of Beaumont	Beaumont	2000-2009	5-8	4	80
CSAS Academy of Houston	Houston	1999-2003	5-8	5	130
CSAS Academy of San Antonio	San Antonio	2000-2014	5-8	4	105
Emma L Harrison Charter	Waco	1999-1999	5-9	4	52
Education Center International	Rowlett	2002-2014	5-12	7	136
Fruit of Excellence School	Bastrop	2000-2010	5-12	6	96
Mainland Preparatory Academy	Texas City	1999-2014	5-8	5	105
Raul Yzaguirre School for Success*	Houston	1997-2014	5-12	8	662
Renaissance Charter HS	Irving	1998-2000	5-11	5	228

Notes: This table describes the charter schools in our estimation sample. Column 2 reports the first and last dates of the school operation in our data. Column 3 reports the largest grade span attended by students in our estimation sample. Column 4 reports the number of distinct entry cohorts in the estimation sample. Column 5 reports the total number of students in the estimation sample. * indicates schools with multiple campus IDs.

Appendix Table 2: Ever Attended Results: Test Scores

	Math Scores		Reading Scores		Pooled Scores	
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Any Charter	−0.026***	−0.025***	0.023***	0.023***	−0.001	−0.001
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
Panel B: By Charter Type						
No Excuses	0.265***	0.269***	0.211***	0.211***	0.238***	0.240***
	(0.014)	(0.014)	(0.012)	(0.012)	(0.012)	(0.012)
Regular Charter	−0.145***	−0.145***	−0.053***	−0.054***	−0.099***	−0.099***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	No	Yes	No	Yes
N Students x Years	2076898	2076898	2077867	2077867	4154765	4154765
Dep. Variable Mean	-0.017	-0.017	0.011	0.011	-0.003	-0.003

Notes: This table reports OLS estimates of the effect of charter attendance on test score outcomes. We report the coefficient and standard error on ever attending the indicated charter school type. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Even columns replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications stack 5th-11th grade test score outcomes and cluster standard errors by student. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

Appendix Table 3: Ever Attended Results: Academic Attainment

	High School Grad.		Two-Year Enrollment		Four-Year Enrollment	
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Any Charter	−0.008	−0.007	0.016***	0.015***	−0.020***	−0.019***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Panel B: By Charter Type						
No Excuses	0.064***	0.065***	−0.005	−0.006	0.059***	0.062***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Regular Charter	−0.028***	−0.028***	0.023***	0.023***	−0.044***	−0.043***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	No	Yes	No	Yes
N Students	387295	387295	387295	387295	387295	387295
Dep. Variable Mean	0.761	0.761	0.326	0.326	0.281	0.281

Notes: This table reports OLS estimates of the effect of charter attendance on academic attainment outcomes. We report the coefficient and standard error on ever attending the indicated charter school type. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Even columns replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications include one observation per student and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

Appendix Table 4: Ever Attended Results: Labor Market Outcomes at Ages 24-26

	Average Earnings					Earnings > 0	
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Any Charter	−1354.394***	−1332.899***	−1472.251***	−1114.066***	−1077.630***	−0.019***	−0.018***
	(152.671)	(153.246)	(189.727)	(133.039)	(134.191)	(0.004)	(0.004)
Panel B: By Charter Type							
No Excuses	−517.623	−473.744	59.648	−74.591	96.050	−0.020**	−0.021**
	(351.349)	(358.242)	(432.810)	(295.197)	(296.923)	(0.009)	(0.009)
Regular Charter	−1563.034***	−1549.669***	−1887.019***	−1399.458***	−1403.310***	−0.018***	−0.017***
	(163.059)	(162.914)	(203.643)	(143.243)	(144.699)	(0.005)	(0.005)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	Yes	Yes	Yes	No	Yes
Non-Zero Earnings Only	No	No	Yes	No	No	No	No
Baseline Imput.	No	No	No	Yes	No	No	No
Output Imput.	No	No	No	No	Yes	No	No
N Students	387295	387295	285304	387295	387295	387295	387295
Dep. Variable Mean	15696.69	15696.69	21307.97	19998.97	20104.60	0.675	0.675

Notes: This table reports OLS estimates of the effect of charter attendance on earnings eight years after high school graduation. We report the coefficient and standard error on ever attending the indicated charter school type. All columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Columns 2-5 and 7 replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications include one observation per student and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

Appendix Table 5: Charter School Attendance and In- and Out-of-State College Attendance

	Texas Colleges				Non-Texas Colleges			
	Any Two-Year		Any Four-Year		Any Two-Year		Any Four-Year	
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any Charter	0.001	0.001	0.005**	0.005**	0.000	0.000	0.008***	0.008***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)
Panel B: By Charter Type								
No Excuses	−0.011***	−0.012***	0.016***	0.016***	0.000	0.000	0.017***	0.017***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)
Regular Charter	0.014***	0.014***	−0.007***	−0.007***	0.000	0.000	−0.002**	−0.002**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	No	Yes	No	Yes	No	Yes
N Students	135116	135116	135116	135116	135116	135116	135116	135116
Dep. Variable Mean	0.269	0.269	0.226	0.226	0.006	0.006	0.044	0.044

Notes: This table reports OLS estimates of the effect of charter attendance on in- and out-of-state college attendance measured using the National Student Clearinghouse data. The sample is restricted to Texas public school students in our estimation sample who graduated high school between 2008 and 2009. We report the coefficient and standard error on the number of years spent at the indicated charter school type. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Even columns replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

Appendix Table 6: Effects of Out-of-State College Attendance on Average Earnings, NSC cohorts

	Average Earnings					
Panel A: Full NSC Sample	(1)	(2)	(3)	(4)	(5)	(6)
Out-of-State Two-Year College	−522.485	−724.385	−811.489	−554.450	−617.286	−502.093
	(652.325)	(645.341)	(658.227)	(649.580)	(652.286)	(638.583)
Out-of-State Four-Year College	3949.584***	1542.928***	2411.456***	2608.754***	1112.590***	1115.176***
	(347.476)	(316.260)	(308.981)	(311.198)	(312.884)	(315.069)
N Students	99170	99170	99170	99170	99170	99170
Dep. Variable Mean	18592.30	18592.30	18592.30	18592.30	18592.30	18592.30
Panel B: Any College						
Out-of-State Two-Year College	−3207.476***	−2421.356***	−3119.981***	−2963.786***	−2259.687***	−2219.279***
	(659.073)	(647.003)	(667.137)	(668.435)	(662.077)	(660.232)
Out-of-State Four-Year College	903.597***	−155.412	−44.477	132.276	−446.049	−428.700
	(344.102)	(316.317)	(316.184)	(319.965)	(318.878)	(324.428)
N Students	51754	51754	51754	51754	51754	51754
Dep. Variable Mean	21580.86	21580.86	21580.86	21580.86	21580.86	21580.86
Panel C: Two-Year College						
Out-of-State Two-Year College	−2437.946***	−2017.880***	−2089.248***	−1743.757**	−1627.937**	−1471.462**
	(669.470)	(661.492)	(687.111)	(709.641)	(684.502)	(702.923)
N Students	31361	31361	31361	31361	31361	31361
Dep. Variable Mean	20887.86	20887.86	20887.86	20887.86	20887.86	20887.86
Panel D: Four-Year College						
Out-of-State Four-Year College	−989.438***	−1778.526***	−2380.753***	−2310.456**	−2221.333***	−2227.298***
	(383.715)	(336.197)	(342.435)	(351.772)	(344.205)	(354.525)
N Students	29290	29290	29290	29290	29290	29290
Dep. Variable Mean	23249.03	23249.03	23249.03	23249.03	23249.03	23249.03
Baseline Controls	No	Yes	No	No	Yes	Yes
4^{th} School × Cohort FE	No	No	Yes	No	Yes	No
Matched Cell FE	No	No	No	Yes	No	Yes

Notes: This table reports OLS estimates of the effect of out-of-state college attendance on earnings eight years after high school graduation. The sample is restricted to Texas public school students in our estimation sample who graduated high school between 2008 and 2009 and with non-zero earnings. We report the coefficient and standard error on the indicator for college matriculation. Panel A includes all individuals in the above-mentioned sample. Panels B, C and D restrict the sample to individuals who have attended any college, a two-year college, and a four-year college, respectively. All specifications include one observation per student and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and sample.

Appendix Table 7: Charter School Attendance and Years of College

	Years in Two-Year College			Years in Four-Year College		
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Any Charter	0.027***	0.025***	0.000	0.007	0.009	−0.042***
	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)	(0.011)
Panel B: By Charter Type						
No Excuses	−0.017**	−0.018**	−0.047***	0.084***	0.086***	−0.008
	(0.007)	(0.007)	(0.010)	(0.011)	(0.012)	(0.013)
Regular Charter	0.064***	0.061***	0.038***	−0.056***	−0.055***	−0.114***
	(0.007)	(0.007)	(0.010)	(0.006)	(0.007)	(0.019)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	Yes	No	Yes	Yes
Positive Years	No	No	Yes	No	No	Yes
N Students	387295	387295	177554	387295	387295	119006
Dep. Variable Mean	0.940	0.940	2.588	1.053	1.053	3.694

Notes: This table reports OLS estimates of the effect of charter attendance on academic attainment. We report the coefficient and standard error on the number of years spent at the indicated charter school type. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Columns 2, 3, 5, and 6 replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications include one observation per student and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and sample.

Appendix Table 8: Charter School Attendance and Years of College

	Two Plus Years Enrolled			Four Plus Years Enrolled		
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Any Charter	0.006***	0.006***	0.003	0.001	0.001	−0.016***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Panel B: By Charter Type						
No Excuses	−0.007***	−0.007***	−0.007***	0.009***	0.009***	−0.019***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
Regular Charter	0.017***	0.017***	0.006***	−0.006***	−0.006***	−0.009*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.005)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	Yes	No	Yes	Yes
Ever Enrolled Only	No	No	Yes	No	No	Yes
N Students	387295	387295	126378	387295	387295	108646
Dep. Variable Mean	0.218	0.218	0.670	0.271	0.271	0.811

Notes: This table reports OLS estimates of the effect of charter attendance on academic attainment. We report the coefficient and standard error on the number of years spent at the indicated charter school type. *Two Plus Years Enrolled* denotes the outcome is an indicator for having enrolled for two or more years in a two-year college. *Four Plus Years Enrolled* denotes the outcome is an indicator for having enrolled for four or more years in a four-year college. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Columns 2, 3, 5, and 6 replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications include one observation per student and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and sample.

Appendix Table 9: Charter School Attendance and Labor Market Outcomes at Ages 24-26

	Max Earnings				
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)
Any Charter	−169.719**	−178.164***	−193.971**	−148.783***	−108.470*
	(66.558)	(67.310)	(77.946)	(55.620)	(55.897)
Panel B: By Charter Type					
No Excuses	71.482	62.315	215.768*	145.446*	203.679**
	(105.717)	(107.648)	(126.721)	(87.393)	(87.959)
Regular Charter	−370.163***	−377.347***	−523.993***	−392.485***	−367.012***
	(84.581)	(85.459)	(96.286)	(69.258)	(69.937)
Baseline Controls	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	Yes	Yes	Yes
Non-Zero Earnings Only	No	No	Yes	No	No
Baseline Imput.	No	No	No	Yes	No
Output Imput.	No	No	No	No	Yes
N Students	387295	387295	285304	387295	387295
Dep. Variable Mean	20890.05	20890.05	28357.86	26969.84	27082.14

Notes: This table reports OLS estimates of the effect of charter attendance on earnings eight years after high school graduation. We report the coefficient and standard error on the number of years spent at the indicated charter school type. All columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Columns 2-5 replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications include one observation per student and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and sample. See the text for additional details on the imputation procedures.

Appendix Table 10: Correlations Between Outcomes in Adulthood and Test Scores

	HS Grad	Two-Year College	2+ Years College	Four-Year College	4+ Years College	Average Earnings	Earnings>0
Panel A: Reading	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reading No Controls	0.172***	0.094***	0.065***	0.198***	0.179***	3433.014***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(30.347)	(0.001)
Reading With Controls	0.148***	0.061***	0.045***	0.114***	0.103***	1525.604***	−0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(42.294)	(0.001)
Panel B: Math							
Math No Controls	0.170***	0.085***	0.058***	0.194***	0.175***	4025.582***	0.017***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(30.272)	(0.001)
Math With Controls	0.154***	0.053***	0.038***	0.125***	0.111***	2423.660***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(41.717)	(0.001)
Dep. Variable Mean	0.761	0.326	0.218	0.281	0.271	15696.69	0.675
Observations	387295	387295	387295	387295	387295	387295	387295

Notes: This table reports results from OLS regressions of academic attainment and labor market outcomes on average test scores for grades 5-11 for our estimation sample. The control specifications include the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort x race x gender effects. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level.

Appendix Table 11A: Results by Student Gender

	Pooled Scores	HS Grad	2-Year College	4-Year College	Average Earnings	Earnings>0
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Male x Any Charter	0.025***	0.015***	0.007***	0.009***	−190.974**	-0.001
	(0.004)	(0.002)	(0.003)	(0.002)	(84.508)	(0.002)
Female x Any Charter	0.022***	0.013***	0.010***	0.005**	−86.296	-0.002
	(0.004)	(0.002)	(0.002)	(0.002)	(71.991)	(0.002)
p-value	0.641	0.441	0.352	0.290	0.355	0.735
Panel B: By Charter Type						
Male x No Excuses	0.097***	0.027***	−0.003	0.033***	−112.309	-0.006*
	(0.006)	(0.002)	(0.004)	(0.004)	(137.317)	(0.003)
Female x No Excuses	0.089***	0.019***	−0.004	0.023***	208.647*	0.001
	(0.006)	(0.002)	(0.003)	(0.004)	(109.775)	(0.003)
p-value	0.313	0.008	0.862	0.072	0.076	0.108
Male x Regular Charter	−0.033***	0.006**	0.014***	−0.010***	−251.574**	0.003
	(0.005)	(0.003)	(0.003)	(0.002)	(105.157)	(0.003)
Female x Regular Charter	−0.035***	0.008***	0.022***	−0.010***	−348.206***	-0.004
	(0.005)	(0.003)	(0.003)	(0.003)	(92.160)	(0.003)
p-value	0.685	0.656	0.078	0.896	0.496	0.057
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
N Students	4154765	387295	387295	387295	387295	387295

Notes: This table reports our main results separately for male and female students. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and Tables 3-5 notes for details on the estimation framework.

Appendix Table 11B: Results by Student Baseline Test Score

	Pooled Scores	HS Grad	2-Year College	4-Year College	Average Earnings	Earnings>0
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
High Scores x Any Charter	−0.003	0.007**	0.007**	0.003	−162.084	0.000
	(0.004)	(0.002)	(0.003)	(0.003)	(106.355)	(0.002)
Low Scores x Any Charter	0.023***	0.018***	0.015***	0.012***	33.696	0.004*
	(0.004)	(0.002)	(0.003)	(0.003)	(80.876)	(0.002)
p-value	0.000	0.000	0.038	0.027	0.145	0.209
Panel B: By Charter Type						
High Scores x No Excuses	0.038***	0.012***	−0.012***	0.022***	147.900	0.003
	(0.005)	(0.002)	(0.004)	(0.004)	(143.678)	(0.003)
Low Scores x No Excuses	0.105***	0.034***	0.016***	0.048***	427.021***	0.007**
	(0.007)	(0.003)	(0.005)	(0.004)	(161.173)	(0.003)
p-value	0.000	0.000	0.000	0.000	0.214	0.373
High Scores x Regular Charter	−0.058***	0.000	0.033***	−0.022***	−581.868***	-0.004
	(0.006)	(0.003)	(0.004)	(0.004)	(145.475)	(0.003)
Low Scores x Regular Charter	−0.019***	0.010***	0.015***	−0.006**	−159.875*	0.002
	(0.005)	(0.003)	(0.003)	(0.003)	(96.484)	(0.003)
p-value	0.000	0.017	0.001	0.001	0.013	0.127
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
N Students	3552725	316791	316791	316791	316791	316791

Notes: This table reports our main results separately for students with below and above median baseline test scores (average of math and reading scores). The above specifications exclude students missing either math or reading baseline scores. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and Tables 3-5 notes for details on the estimation framework.

Appendix Table 11C: Results by Student Ethnicity

	Pooled Scores	HS Grad	2-Year College	4-Year College	Average Earnings	Earnings>0
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Black/Hispanic x Any Charter	0.042***	0.016***	0.007***	0.012**	15.723	-0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(58.673)	(0.002)
White/Asian x Any Charter	−0.039***	0.007***	0.012**	−0.005	−548.510***	-0.003
	(0.005)	(0.002)	(0.004)	(0.003)	(123.533)	(0.003)
p-value	0.000	0.000	0.192	0.000	0.000	0.405
Panel B: By Charter Type						
Black/Hispanic x No Excuses	0.122***	0.025***	−0.001	0.032***	105.463	-0.003
	(0.004)	(0.002)	(0.003)	(0.003)	(91.592)	(0.002)
White/Asian x No Excuses	−0.007	0.012***	−0.012***	0.015***	−121.496	0.001
	(0.007)	(0.003)	(0.004)	(0.005)	(203.945)	(0.004)
p-value	0.000	0.000	0.047	0.003	0.310	0.427
Black/Hispanic x Regular Charter	−0.024***	0.009***	0.014***	−0.006***	−62.688	0.002
	(0.004)	(0.002)	(0.002)	(0.002)	(75.253)	(0.002)
White/Asian x Regular Charter	−0.067***	0.003	0.029***	−0.019***	−852.058***	-0.006*
	(0.007)	(0.004)	(0.004)	(0.004)	(142.265)	(0.003)
p-value	0.000	0.170	0.003	0.003	0.000	0.052
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
N Students	4154765	387295	387295	387295	387295	387295

Notes: This table reports our main results separately for white/Asian and black/Hispanic students. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable definitions and Tables 3-5 notes for details on the estimation framework.

Appendix Table 12: Correlation of Earnings Over the Life Cycle

	Texas Data	
Age	Correlation with Age 30 Earnings Including Zeros	Correlation with Age 30 Earnings Excluding Zeros
(1)	(2)	(3)
21	0.322	0.206
22	0.394	0.291
23	0.506	0.428
24	0.585	0.524
25	0.617	0.556
26	0.675	0.620
27	0.742	0.692
28	0.819	0.771
29	0.911	0.873
30	1.000	1.000

Notes: This table reports the correlation between individual earnings at the indicated age with age 30 earnings. The sample includes students in our estimation sample graduating high school in 2002 - 2003. See the main text for additional details.

Appendix Table 13: Charter School Attendance and Realized and Predicted Earnings at Ages 28-30

	Realized Earnings		Predicted Earnings			
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Any Charter	−175.853*	−178.687*	36.085***	38.374***	2.710	3.013
	(99.381)	(100.751)	(10.388)	(10.233)	(5.186)	(5.061)
Panel B: By Charter Type						
No Excuses	160.344	130.879	102.665***	102.936***	28.784***	28.053***
	(190.070)	(193.623)	(14.715)	(15.057)	(8.271)	(8.086)
Regular Charter	−379.561***	−364.282***	−19.251	−15.108	−18.962***	−17.729***
	(109.038)	(108.934)	(14.856)	(14.417)	(6.663)	(6.596)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	No	Yes	No	Yes
Imputation with Education Outcomes	No	No	Yes	Yes	Yes	Yes
Imputation with Wage Outcomes	No	No	No	No	Yes	Yes
N Students	193481	193481	387289	387289	387289	387289
Dep. Variable Mean	16897.94	16897.94	20838.40	20838.40	8520.109	8520.109

Notes: This table reports OLS estimates of the effect of charter attendance on realized and predicted earnings at ages 28-30. The dependent variable for columns 1-2 is realized average earnings for ages 28-30 for students graduating between 2002-2006. The dependent variable for columns 3-6 is predicted earnings for ages 28-30 Texas students graduating between 2002-2006. For columns 3-4, the dependent variable is (median) predicted earnings, which is calculated in the sample of students with non-zero earnings using an OLS regression on cubic polynomials in grade 5-11 math and reading scores, 4th grade school x cohort effects, and the baseline controls used in all other specifications. For columns 5-6, the dependent variable is (median) predicted earnings where we also add cubic polynomials in earnings from ages 24-26 and cubic polynomials in median industry earnings from ages 24-26. The median of predicted earnings is taken over a cell defined by gender, race, poverty status, and educational attainment, where the latter is a categorical variable identifying the following categories: (1) less than high school, (2) high school graduate, (3) some college, and (4) over four years of college. We report the coefficient and standard error on the number of years attended at the indicated charter school type. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Even columns replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

Appendix Table 14: Charter Attendance and Industry Earnings Distributions

	25th Percentile Earnings		50th Percentile Earnings		75th Percentile Earnings	
Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Any Charter	−60.142*	−62.317*	−85.495	−87.914	−134.494	−138.740
	(33.629)	(33.837)	(56.939)	(57.114)	(92.086)	(92.283)
Panel B						
No Excuses	−14.335	−18.830	15.031	8.035	−7.523	−21.661
	(50.290)	(50.943)	(85.952)	(86.542)	(141.301)	(141.582)
Regular Charter	−98.208**	−98.337**	−169.035**	−167.386**	−240.010**	−235.714*
	(44.615)	(45.054)	(75.920)	(76.603)	(122.113)	(123.136)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	No	Yes	No	Yes	No	Yes
N Students x Years	387295	387295	387295	387295	387295	387295
Dep. Variable Mean	9363.289	9363.289	18120.15	18120.15	30346.31	30346.31

Notes: This table reports OLS estimates of the effect of charter attendance on labor market outcomes. We report the coefficient and standard error on the number of years attended at the indicated charter school type. Odd columns control for the number of years spent at charter schools not in our main sample, the baseline controls listed in Table 2, cubic polynomials in grade 4 math and reading scores, and 4th grade school x cohort effects. Even columns replace 4th grade school x cohort effects with 4th grade school x cohort x race x gender effects. All specifications include one observation per student and cluster at the fourth grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

Appendix Table 15: Results by Charter Completion

	Pooled Scores	HS Grad	2-Year College	4-Year College	Average Earnings	Earnings>0
Panel A: Pooled Results	(1)	(2)	(3)	(4)	(5)	(6)
Completed x Any Charter	0.046***	0.015***	0.007***	0.014***	−68.533	−0.002
	(0.005)	(0.002)	(0.002)	(0.002)	(64.142)	(0.002)
Not Completed x Any Charter	−0.007	0.010***	0.011***	−0.010***	−322.596***	0.000
	(0.005)	(0.003)	(0.003)	(0.003)	(104.525)	(0.003)
p-value	0.000	0.089	0.267	0.000	0.039	0.661
Panel B: By Charter Type						
Completed x No Excuses	0.111***	0.023***	−0.007**	0.037***	172.156*	−0.001
	(0.007)	(0.002)	(0.003)	(0.003)	(94.563)	(0.002)
Not Completed x No Excuses	0.059***	0.023***	0.011*	−0.003	−360.604**	−0.005
	(0.008)	(0.004)	(0.005)	(0.005)	(178.162)	(0.005)
p-value	0.000	0.989	0.004	0.000	0.007	0.482
Completed x Regular Charter	−0.022***	0.009***	0.021**	−0.008***	−298.923***	−0.002
	(0.006)	(0.002)	(0.003)	(0.002)	(85.414)	(0.002)
Not Completed x Regular Charter	−0.048***	0.003	0.011***	−0.015***	−301.054**	0.002
	(0.005)	(0.003)	(0.004)	(0.003)	(124.650)	(0.003)
p-value	0.001	0.203	0.040	0.074	0.989	0.272
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Matched Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
N Students	4154765	387295	387295	387295	387295	387295

Notes: This table reports results separately for charter students who did and did not attend until the last offered grade by the school. We report the coefficient on the number of years attended at the indicated school type. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample and Tables 3-5 notes for details on the estimation framework.

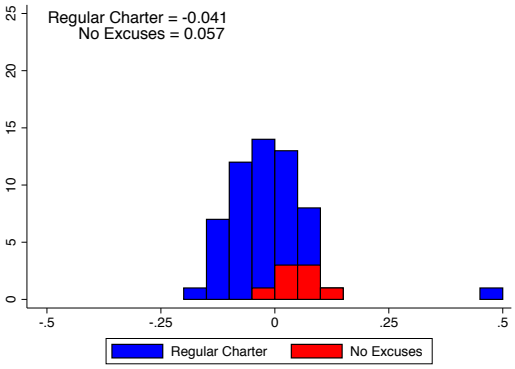
Appendix Table 16: Practices of Achievement-Increasing Versus Decreasing NYC Charters

	Negative Impacts	Postive Impacts	p-value
Panel A: Weekly Minutes in Tested Subjects	(1)	(2)	(3)
ELA	558.63	680.80	0.050
	19	25	
Math	433.00	361.36	0.010
	21	33	
Pooled Minutes	1000.89	1046.20	0.569
	19	25	
Panel B: Weekly Minutes in Non-Tested Subjects			
Art	124.76	135.59	0.566
	21	31	
Foreign Language	126.43	51.52	0.012
	21	31	
History	128.10	64.52	0.018
	21	31	
Music	100.48	145.27	0.195
	21	31	
Physical Ed	103.33	145.71	0.037
	21	33	
Science	190.71	178.94	0.468
	21	33	
Social Studies	146.75	184.79	0.148
	20	24	
Pooled Minutes	880.50	935.75	0.413
	20	20	
Panel C: Other Inputs			
Frequency of Student Assessments	2.75	3.43	0.247
	22	28	
Number of Ways Use Assessments	3.40	4.41	0.165
	15	27	
Non-Academic Summer Programs	0.27	0.22	0.669
	22	36	

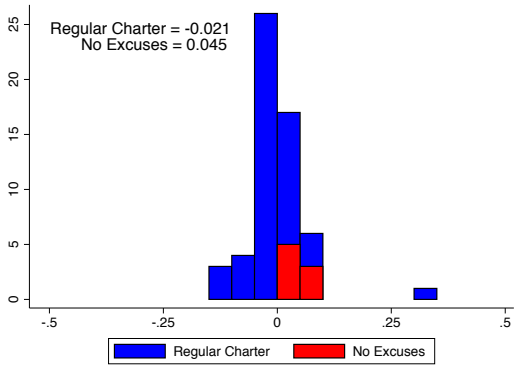
Notes: This table reports average inputs for charter schools in the NYC data used by Dobbie and Fryer (2013). Specifically, we restrict the charter sample to schools with lottery-based estimates. Column 1 (respectively, 2) reports the mean of the indicated variable for charters with negative (respectively, positive) impacts. Column 3 reports a two-sided p-value from a two-sample t-test. Below each mean, we report the number of schools with non-missing responses for the given survey question. The last rows of Panels A and B report results from summing all other non-missing variables in a panel.

Appendix Figure 1: School Test Score Effects

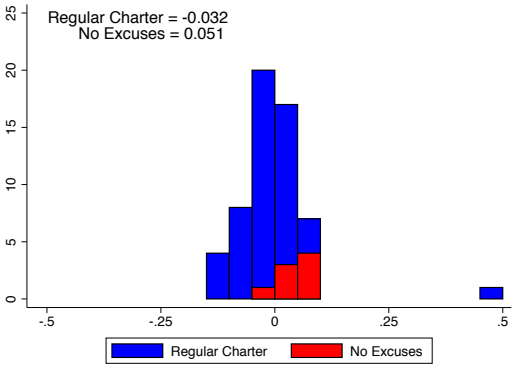
(A) Math



(B) Reading



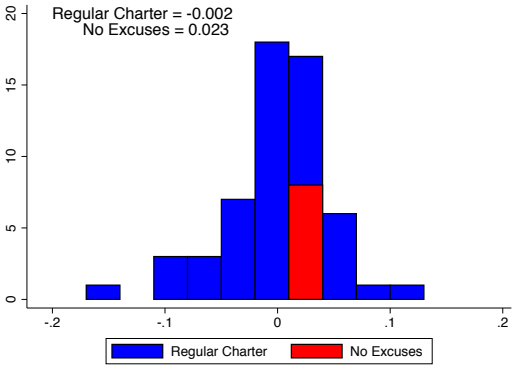
(C) Pooled



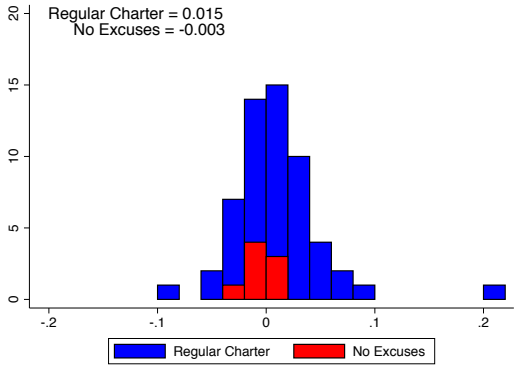
Notes: These figures plot school-level test score effects by charter school type. The reported means are weighted by the number of students at each school in the earnings effects estimation sample. See Online Appendix B for details on the sample and variable construction and Online Appendix C for details on estimation of the school effects.

Appendix Figure 2: School Academic Attainment Effects

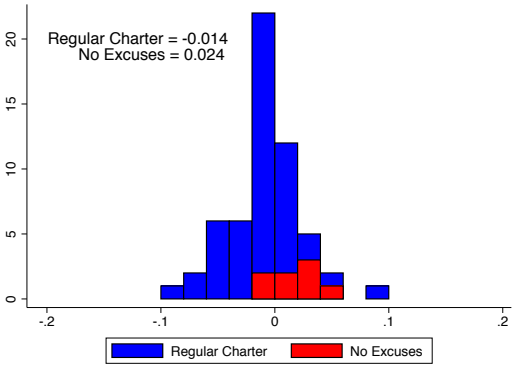
(A) High School Graduation



(B) Two-Year College Enrollment



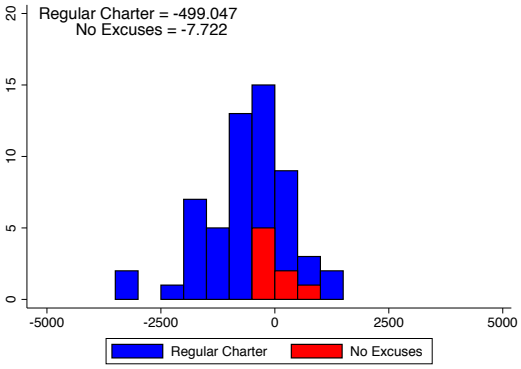
(C) Four-Year College Enrollment



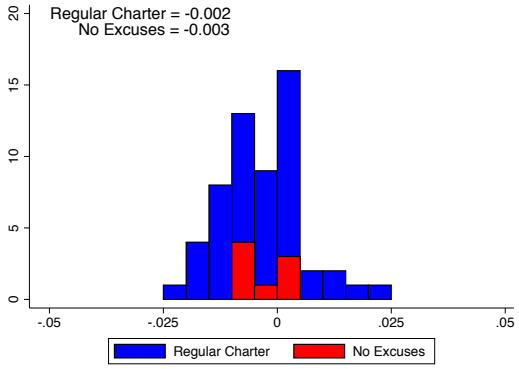
Notes: These figures plot school-level academic attainment effects by charter school type. The reported means are weighted by the number of students at each school in the earnings effects estimation sample. See Online Appendix B for details on the sample and variable construction and Online Appendix C for details on estimation of the school effects.

Appendix Figure 3: School Labor Market Effects

(A) Average Earnings 24-26

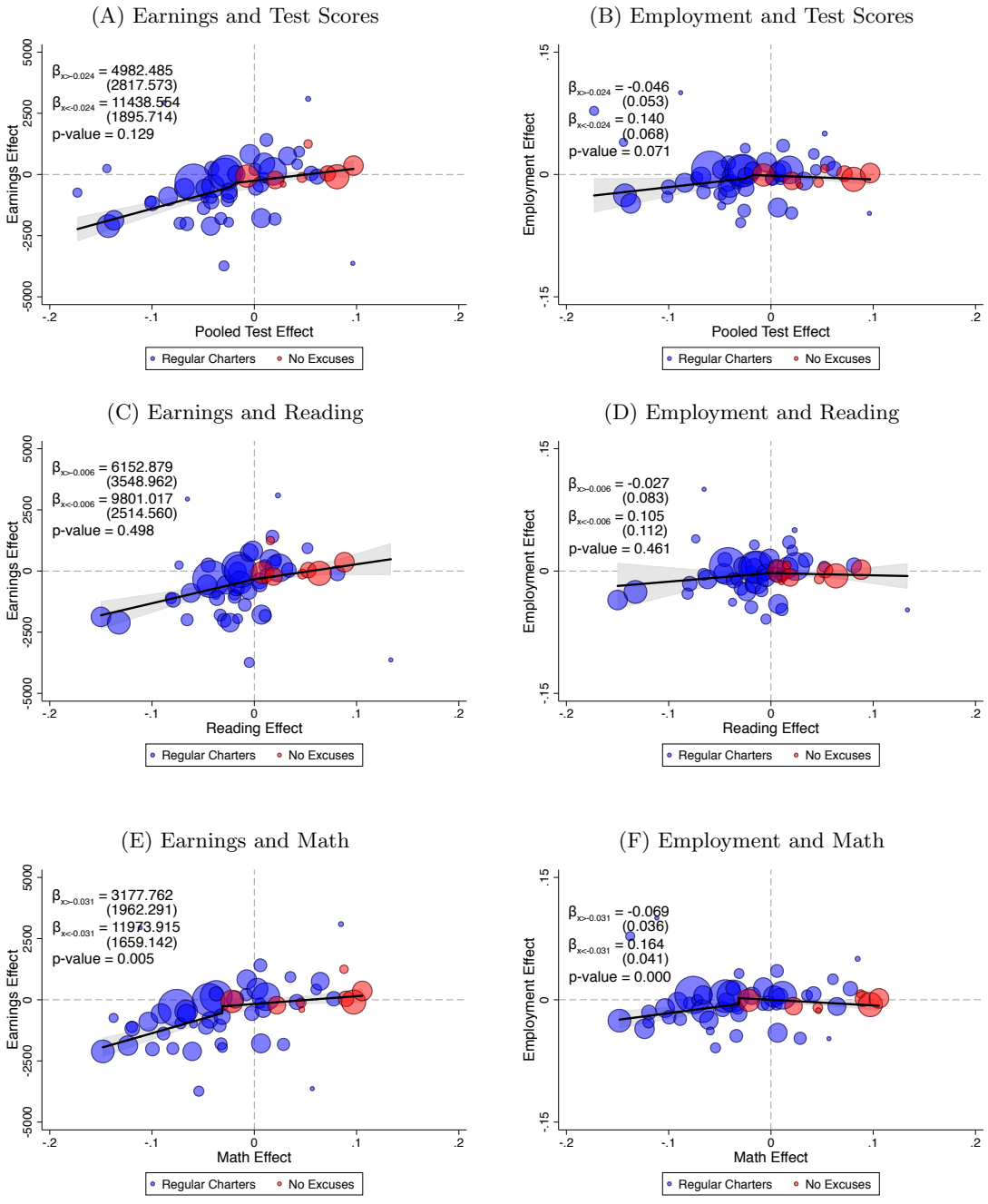


(B) Average Employment 24-26



Notes: These figures plot school-level earnings and employment effects by charter school type. Earnings and employment are measured eight years after high school graduation. The reported means are weighted by the number of students at each school in the earnings effects estimation sample. See Online Appendix B for details on the sample and variable construction and Online Appendix C for details on estimation of the school effects.

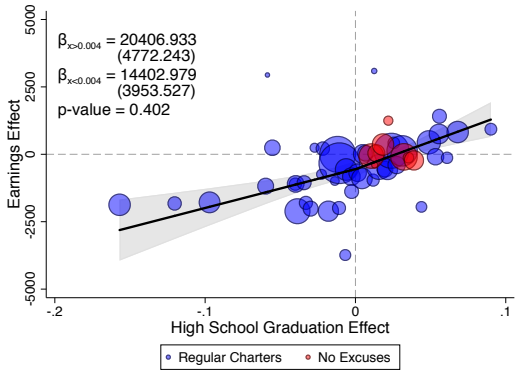
Appendix Figure 4: Correlation of Labor Market and Test Score Effects



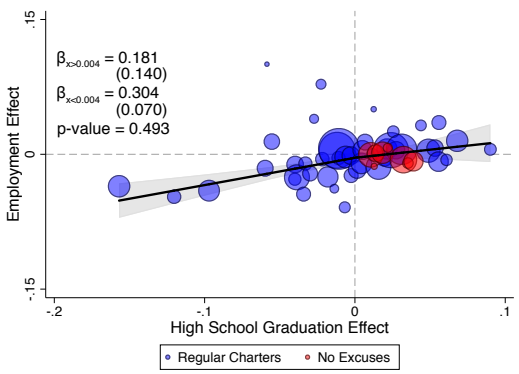
Notes: These figures plot the correlation between school-level labor market effects and school-level test score effects. We allow the correlation between effects to vary below and above the median school-level test score effect. All effects are not empirical Bayes adjusted. Observations are weighted by the number of students at each school in the earnings estimation sample. The solid line is estimated at the school x cohort level, with standard errors clustered at the school level. See Table 2 notes for details on the sample and variable construction and Online Appendix C for details on estimation of the school effects.

Appendix Figure 5: Correlation of School Labor Market and Academic Attainment Effects

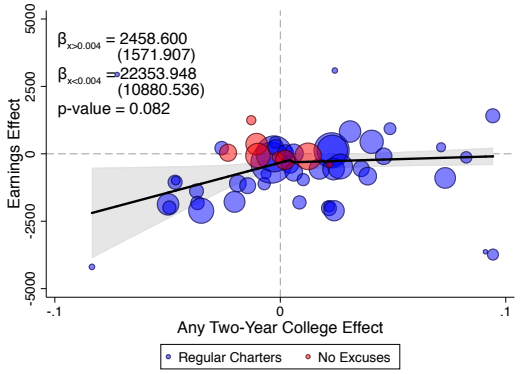
(A) Earnings and High School Graduation



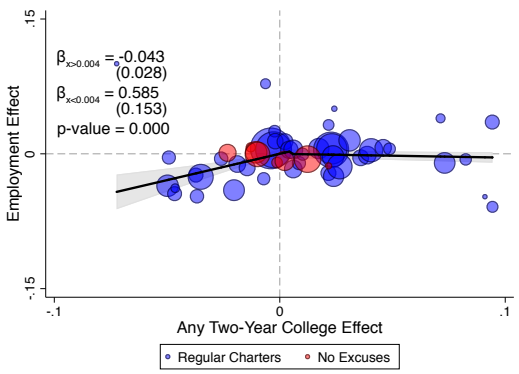
(B) Employment and High School Graduation



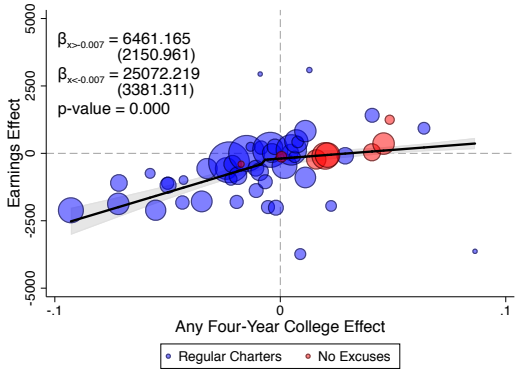
(C) Earnings and 2-Year College Enrollment



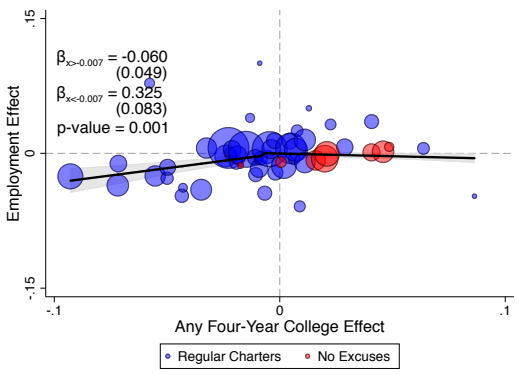
(D) Employment and 2-Year College Enrollment



(E) Earnings and 4-Year College Enrollment



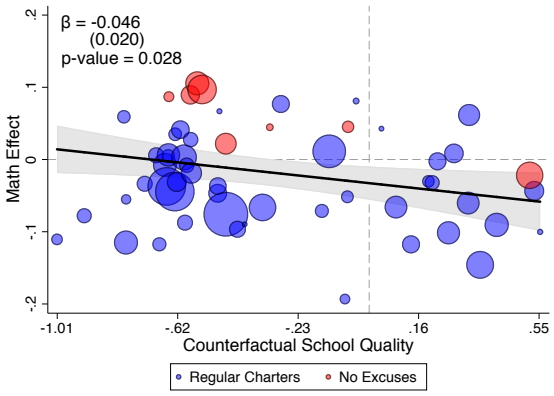
(F) Employment and 4-Year College Enrollment



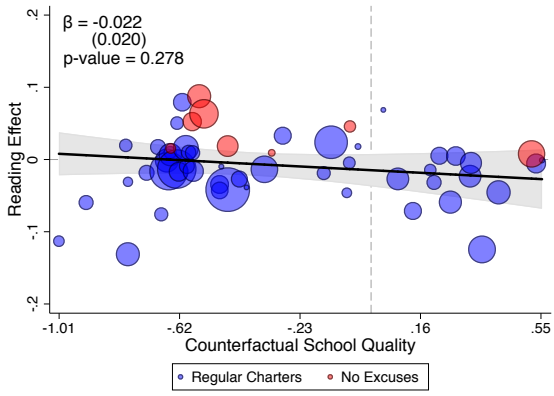
Notes: These figures plot the correlation between school labor market effects and academic attainment effects. We allow the correlation between effects to vary below and above the median school-level academic attainment effect. All effects are not empirical Bayes adjusted. Observations are weighted by the number of students at each school in the earnings estimation sample. The solid line is estimated at the school x cohort level, with standard errors clustered at the school level. The break point for the linear spines is the median academic attainment effect at the school level. See Online Appendix B for details on the sample and variable construction and Online Appendix C for details on estimation of the school effects.

Appendix Figure 6A: Charter School Effects and Quality of Counterfactual Schools

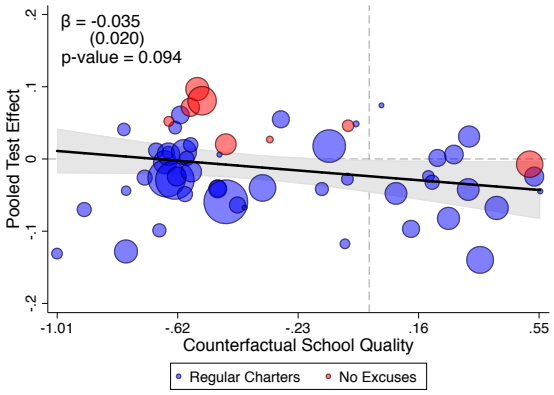
(A) Math Scores and Total Quality



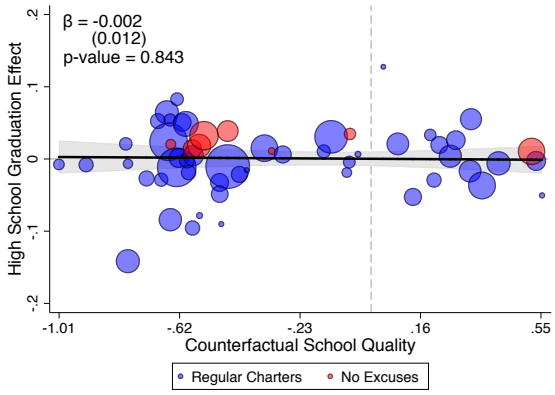
(B) Reading Scores and Total Quality



(C) Pooled Scores and Total Quality



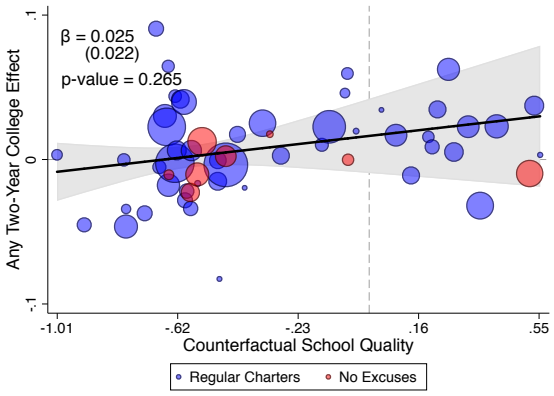
(D) High School Graduation and Total Quality



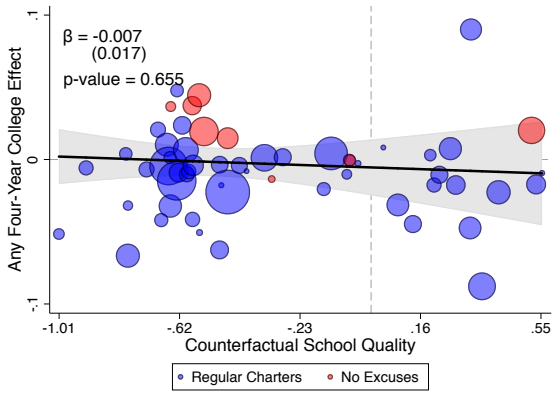
Notes: These figures plot the correlation between school-level test score effects and counterfactual school quality. The solid line is estimated at the school x cohort level. Standard errors are clustered at the school level. See Table 2 notes for details on the sample and Online Appendix B for details on the sample and variable construction. See the main text for a detailed description of the counterfactual quality measure.

Appendix Figure 6B: Charter School Effects and Quality of Counterfactual Schools

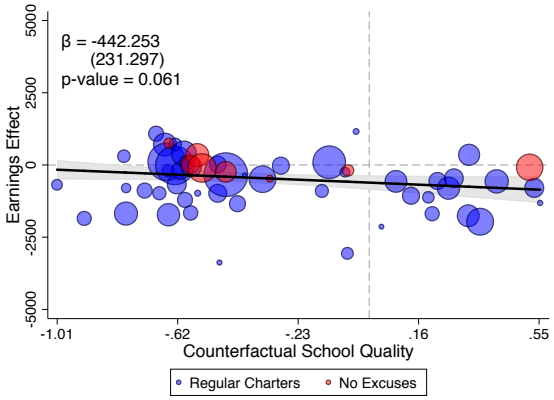
(E) 2-Year College Enrollment and Total Quality



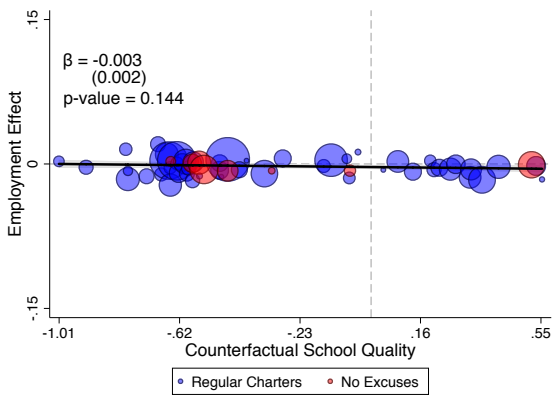
(F) 4-Year College Enrollment and Total Quality



(G) Earnings and Total Quality

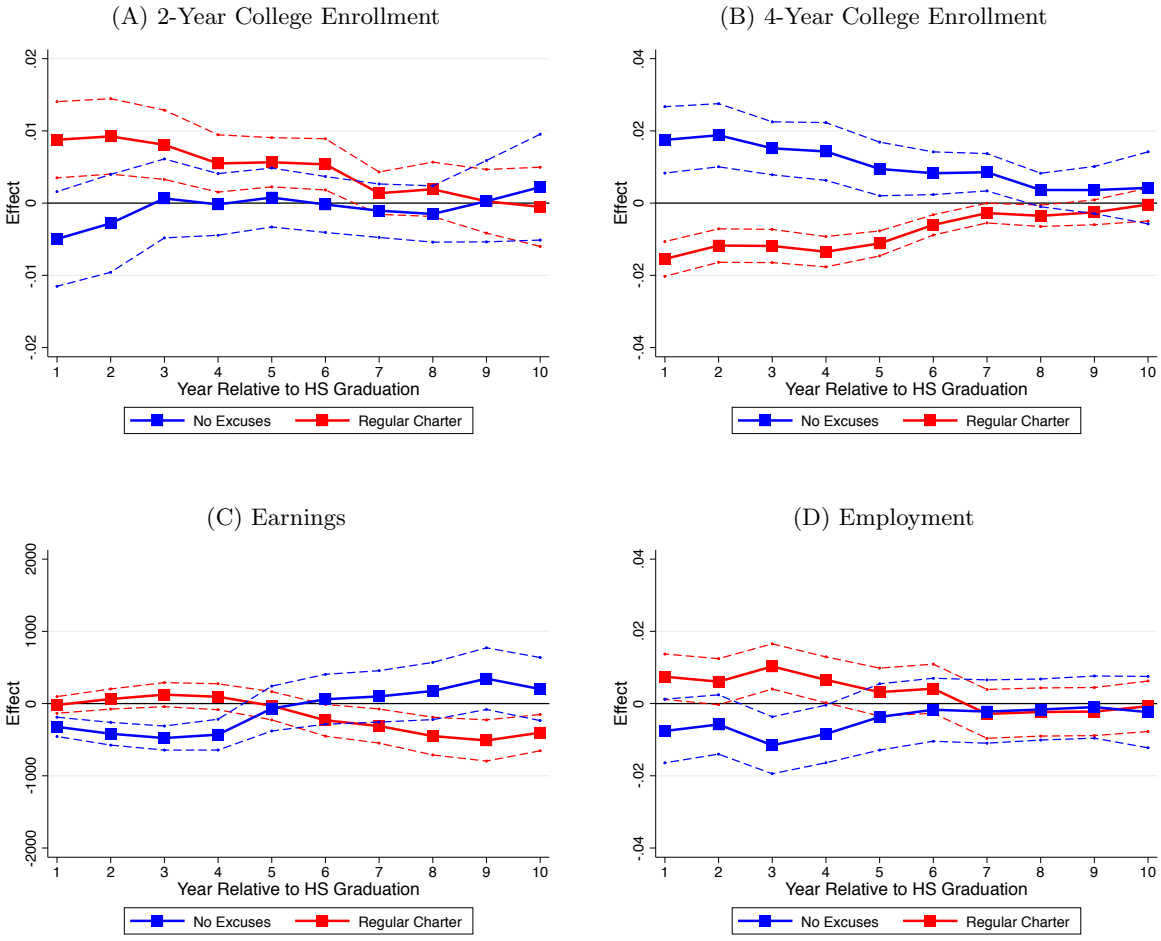


(H) Employment and Total Quality



Notes: These figures plot the correlation between school-level labor market effects and counterfactual school quality. The solid line is estimated at the school x cohort level. Standard errors are clustered at the school level. See Table 2 notes for details on the sample and Online Appendix B for details on the sample and variable construction. See the main text for a detailed description of the counterfactual quality measure.

Appendix Figure 7: Results by Year in the 2002-2006 Cohorts



Notes: These figures plot charter school effects and 95 percent confidence intervals by school type in the 2002-2006 graduating cohorts. See Tables 3-5 notes for details on the sample and estimation framework.

B. Data Appendix

We use administrative data from the Texas Education Research Center (ERC) that allows us to follow all Texas public school students from kindergarten to college to the labor market. The ERC data include information on student demographics and outcomes from the Texas Education Agency (TEA), college enrollment records from the Texas Higher Education Coordinating Board (THECB), and administrative earnings records from the Texas Workforce Commission (TWC). This appendix describes these data sets and details the procedures used to clean and match them.

Texas Education Agency

Overview: The TEA data include information on student race, gender, free and reduced-price lunch eligibility, limited English proficiency, special education status, at-risk designation, and graduation year. The TEA data also include information on each student's grade, school, and state math and reading test scores in each year. These data are available for all Texas public school students for the 1994-1995 to 2012-2013 school years.

State Assessments: Mathematics and reading assessments come from two statewide criterion-referenced achievement tests that were administered during our period of study. From 1993-2003, the Texas Assessment of Academic Skills (TAAS) was administered each spring to eligible students enrolled in grades three through eight. An exit level test was also administered in grade 10 in reading, writing, and mathematics as a requirement for graduation. In 2003, Texas introduced a new exam called the Texas Assessment of Knowledge and Skills (TAKS). TAKS expanded the number of subjects that students were required to demonstrate proficiency in and elevated the level of difficulty of the tests. TAKS was administered to grades 3-10 in reading and mathematics. An exit level test was also administered in grade 11 in English language arts, mathematics, science, and social studies as a requirement for graduation. Spanish versions of the TAKS test were offered for students with limited English proficiency in grades 3-6. TAKS assesses grade-specific content in grades 3-8. In grades 9-11, TAKS assesses content from specific courses. In our analysis, we normalize all math and reading scaled scores to have a mean of zero and a standard deviation of one in each year and grade level for the entire state of Texas. Since TAAS and TAKS are taken in different years, they are standardized separately.

High School Graduation Variables: We code a student as having graduated from high school if the Texas graduation files indicate that (1) she received a valid diploma or (2) if she enrolled in a two- or four-year college in any subsequent year. All students who are missing from both the graduation files and the college enrollment files are assumed to have not graduated from high school.

Transfer Variables: We code students as having transferred to an out-of-state school if they reenrolled outside of Texas, intended to reenroll outside of Texas, returned to their home country, or graduated from another state for the military. We also code a small number of students who are deceased as having transferred to an out-of-state school.

Demographic Variables: Demographic variables that should not vary from year to year (race, gender, immigrant status) were pulled from enrollment files, with precedence given to the most recent files. Race consisted of the following categories: white, black, Hispanic, Asian, Native American, and other race. These categories were considered mutually exclusive. Gender was coded as male, female, or missing. Demographic variables that may vary from year to year (free lunch status, English Language Learner status, at-risk status, gifted status, and special education designation) were pulled from the relevant enrollment file.[1,2]

Texas Higher Education Coordinating Board

Overview: Information on college outcomes come from the THECB. The THECB collects and centralizes data for students attending Texas public universities, private universities, community colleges, and health related institutions. The data include information on each student's enrollment, graduation, and grade in each year. The THECB data are available for the 2004-2005 to 2012-2013 school years.

Enrollment Variables: We code a student as having enrolled in college if she ever attends a school in the THECB data for an entire academic year. Two-year and four-year college results are coded similarly. All students missing from these files are assumed to have not enrolled in college.

Texas Workforce Commission

Overview: Employment and earnings outcomes are measured using data from the TWC. The TWC data record quarterly earnings for all Texas employees, with information on approximately 12 million individuals each year. The data include information on each individual's earnings, number of employers, and size of each employer. The TWC data are available from 2002 to 2016.

[1] A student is income-eligible for free lunch if her family income is below 130 percent of the federal poverty guidelines, or categorically eligible if (1) the student's household receives assistance under the Food Stamp Program, the Food Distribution Program on Indian Reservations (FDPIR), or the Temporary Assistance for Needy Families Program (TANF); (2) the student was enrolled in Head Start on the basis of meeting that program's low-income criteria; (3) the student is homeless; (4) the student is a migrant child; or (5) the student is identified by the local education liaison as a runaway child receiving assistance from a program under the Runaway and Homeless Youth Act. Determination of special education or ELL status is done by HISD Special Education Services and the HISD Language Proficiency Assessment Committee.

[2] Texas Education Code Section 29.081 defines a student as at-risk of dropping out if any of the following is true: (1) the student was held back in one grade level; (2) the student is in grades 7-12, did not maintain an average equivalent to 70 on a scale of 100 in two or more subjects in the foundation curriculum during a semester in the preceding or current school year, or is not maintaining such an average in two or more subjects in the foundation curriculum in the current semester; (3) did not perform satisfactorily on an assessment, and who has not in the previous or current school year subsequently performed on that instrument or another appropriate instrument at a level equal to at least 110 percent of the level of satisfactory performance on that instrument; (4) if the student is in PK-3 and did not perform satisfactorily on a readiness test or assessment instrument administered during the current school year; (5) is pregnant or is a parent; (6) has been placed in an alternative education program during the preceding or current school year; (7) has been expelled during the preceding or current school year; (8) is currently on parole, probation, deferred prosecution, or other conditional release; (9) was previously reported as having dropped out of school; (10) is a student of limited English proficiency; (11) is in the custody or care of the Department of Protective and Regulatory Services or has been referred to the department during the current school year; (12) is homeless; or (13) currently or in the past school year resided in a residential placement facility.

Earnings and Employment Variables: We assume that individuals with no reported earnings in a given year are unemployed. Employment is an indicator for having nonzero earnings in the relevant year. We also find that our main results are similar to dropping individuals with no reported earnings.

National Student Clearinghouse

Overview: To explore the robustness of our college results, we also use data from the National Student Clearinghouse (NSC) that contain information on student enrollment for over 90 percent of all colleges and universities in the United States. The NSC data is only available from 2008 to 2009.

Enrollment Variables: We code a student as having enrolled in college if she ever attends a school in the NSC data. Two-year and four-year college results are coded similarly. All students missing from these files are assumed to have not enrolled in any college.

Sample Restrictions

School Level: We employ three sample restrictions at the school level. First, we restrict our analysis to open-enrollment charter schools that target the general population of public school students. We therefore exclude both district charters that are operated by the traditional public school system, and "alternative instruction" charter schools that operate under different accountability standards and typically work with non-traditional students such as high-school dropouts. We also exclude charter schools for abused or autistic students; schools housed in shelters, residential treatment centers, or juvenile detention centers; juvenile justice alternative education programs; virtual charter schools; and sports academies. Second, we drop schools who have fewer than ten students enrolled during our sample period. In the school x cohort level analysis, we also drop cohorts with fewer than 10 students enrolled during our sample period. Third, we restrict our primary analysis sample to charter schools whose oldest cohort graduated high school in or before 2008-2009. This restriction ensures that students in our sample are approximately 25 years old or older in the most recent earnings data.

Student Level: We also make six sample restrictions to the student data with the overarching goal of having a valid comparison sample. Table 1 provides details on the number of students dropped by each sample restriction. With no restrictions, there are 2,305,979 students in regular public schools, 3,300 students in No Excuses charter schools, and 12,324 students in regular charter schools. Column 2 omits students who did not attend a public elementary school in fourth grade. This decreases the sample by 13,412 students in non-charters, but only by 178 students in No Excuses Charters and 1,586 in regular charters. Column 3 leaves out students with missing baseline covariates such as gender or race. Column 4 drops students with no middle or high school test score. Column 5 drops students who transferred to an out-of-state primary or secondary school.

Column 6 drops charter schools with a cohort size fewer than ten. In our final estimation sample – which includes all students for which there is a match cell on fourth grade school, cohort, gender, and race – there are 376,208 students in non-charters, 2,550 in No Excuses charters, and 8,537 students in regular charter schools. The majority of the non-charter sample was dropped due to not matching individuals in the charter sample, primarily because these students attend schools in districts without a charter school.

Classifying Charter Schools

We use information from the Texas Charter School Association and school websites to classify eligible charters as No Excuses schools, college preparatory schools, specialized mission schools, or regular charters. The Texas Charter School Association classifies schools as college preparatory, specialized mission, or regular/unclassified. College preparatory schools have a stated mission to prepare students for a 4-year college degree. Most college preparatory schools also have dedicated college placement offices and track students through college graduation. Specialized mission charters have distinctive focus areas such as religious study, fine arts, STEM, or classics. These schools may also have strong college readiness programs. Regular charter schools are schools that do not fall into any of the above categories.

Charter school classifications are available for 42 out of the 57 schools in our sample. For the 15 schools with missing classifications, we determined school type using mission statements from each school's website. For two schools, mission statements were unavailable. We coded both of these schools as regular charters. Results are robust to coding all schools with missing information as regular charters or coding all schools with missing information as a separate group.

College preparatory charters are further classified as either No Excuses schools or regular college preparatory charters. Compared to regular college preparatory charters, No Excuses charters have higher behavioral expectations, stricter disciplinary codes, are more likely to have uniform requirements, and are more likely to have an extended school day and year. We classify No Excuses schools using information from school mission statements, charter applications, and public statements. We verified our No Excuses categorizations with numerous school administrators in Texas. The No Excuses classification in this paper largely follows the classification system used by Dobbie and Fryer (2013) and Angrist, Pathak, and Walters (2013), but is stricter than the classification system used by Baude et al. (2014). We use this stricter definition of No Excuses to focus on exemplar schools in the category.

C. Empirical Bayes Procedure

This appendix describes the empirical Bayes (EB) procedure that we use to adjust our estimated school effects for estimation error. The EB procedure is based on Morris (1983). Jacob and Lefgren (2007), Dimick et al. (2009), and Chandra et al. (2016) provide additional examples of the EB procedure in other contexts.

The EB procedure is based on the idea that there is likely to be positive (respectively, negative) estimation error if a school's estimated effect is above (respectively, below) the mean school effect. Thus, the expected school effect is a convex combination of the estimated school effect and the mean of the underlying distribution of school effects. The relative weight on the estimated school effect is proportional to the precision of the estimate, which is based on the standard error of the coefficient estimate.

To fix ideas, suppose that we have a noisy but unbiased estimate of the effect of attending school s, $\hat{\beta}_s = \beta_s + \eta_s$, where β_s is the true effect of attending school s and η_s is a school-specific mean zero error term. We assume that the estimated school effect is independently normally distributed around the true school effect with known variance of π_s^2. In this context, π_s^2 can be thought of as the variance of the estimation error. We also assume that the true school effect β_s is independently normally distributed with an underlying mean of $\bar{\beta}$ and variance of σ^2 for the full distribution of schools. The EB adjusted estimate is equal to the expected value of the school effect conditional on the estimated effect $\hat{\beta}_s$ and the parameters π_s^2, $\bar{\beta}$, and σ^2 is:

$$E[\beta_s|\hat{\beta}_s, \pi_s^2, \bar{\beta}, \sigma^2] = \lambda_s \hat{\beta}_s + (1 - \lambda_s)\bar{\beta}$$
$$\lambda_s = \frac{\pi_s^2}{\pi_s^2 + \sigma^2}$$

As discussed above, the EB adjusted estimate attenuates the unadjusted estimated school effect $\hat{\beta}_s$ toward the underlying mean of the full distribution of school effects $\bar{\beta}$. As the variance of the estimation error π_s^2 increases, the EB adjusted estimate increasingly converges to the underlying mean of the school effects $\bar{\beta}$.

In practice, the parameters needed to construct the EB adjusted estimate are unknown and must be estimated. The estimated school effects $\hat{\beta}_s$ are the unadjusted coefficient estimates from our main student-level estimating equation described in the text. The standard errors on these unadjusted coefficient estimates are an estimate of the standard deviation of the asymptotic distribution of $\hat{\beta}_s$. We estimate π_s^2 by squaring these standard errors. We estimate the mean of the distribution of school effects $\bar{\beta}$ and the variance of the error term σ^2 using the method proposed by Morris (1983), which uses an iterative process to calculate the feasible best estimate of the appropriate shrinkage factor λ_s. This method also incorporates a degrees of freedom adjustment to account for the fact that we are estimating the mean and variance parameters. The above EB procedure yields unbiased estimates of the expected effect of attending each school in our sample for any particular outcome.

D. Tests of Identifying Assumptions

This appendix describes a series of tests of our observational research design. We first discuss selective charter enrollment, before turning to selective attrition from the Texas wage data.

Selective Charter Enrollment: The key identifying assumption of our approach is that our gender-race-cohort-school effects and baseline controls account for all observed and unobserved differences between charter and non-charter students. We therefore assume that unobserved determinants of students' labor market outcomes are orthogonal to our school value-added measures.

We partially test for selection bias on observable characteristics in our data in three ways. First, in Panel A of Appendix Table D1, we regress each baseline characteristic on the number of years at the indicated charter school type, school x cohort x race x gender effects, and all baseline controls other than the indicated dependent variable. Column 1 reports the mean and standard deviation for non-charter schools in our estimation sample. Column 2 reports results pooling all charter schools in our sample. Columns 3-4 report results for No Excuses and regular charter schools separately. Students who attend charter schools are more likely to have reached 4th grade on time – 0.9 (se=0.1) percentage points on a base of 84.7 percent. Yet, due to the precision of our estimates, this difference is statistically significant. Similarly, 4th grade LEP, reading scores and math scores all differ between students in charter and non-charter schools. As before, they are statistically significant but do not seem economically meaningful.

Second, Panel B of Appendix Table D1 conducts a number of falsification tests using outcomes that we do not directly control for: 3rd grade math and reading scores, and an indicator for having been held back before 3rd grade. On all but one outcome – 3rd grade math scores for No Excuses charters – there is no relationship between charter attendance and these baseline characteristics. Students who attend No Excuses charters have 0.014σ (se=0.005) higher math test scores. Although statistically significant, this difference is economically small.

Finally, Panel C of Appendix Table D1 conducts a similar exercise using predicted earnings and employment for ages 24-26. We predict earnings using the relationship between actual earnings and employment with the baseline controls used in Equation (1). Consistent with the previous results, we find statistically significant but economically small differences between those who attend charters and those who attend non-charters. The predicted difference in earnings between charter and non-charter students is 0.001 percent (a \$24.15 difference on a non-charter mean of \$21,205.14). It therefore appears that, because of our large sample, several coefficients are statistically significant but none of them are economically large.

To better understand how to interpret these results, we conduct an identical exercise in an environment where we believe both lottery-based and observational estimates of charter effectiveness have been shown to be highly correlated. Appendix Table D2 replicates our specifications from Appendix Table D1 using information from NYC charter schools where Dobbie and Fryer (2013) have shown that lottery-based and observational estimates are highly correlated. If anything, Appendix Table D2 reveals more selection on charter attendance in NYC than in Texas. We interpret these

results as suggesting that there is some modest selection into charter schools based on observable characteristics, but that our estimates from Equation (1) are unlikely to be significantly biased.

Selective Attrition from the Earnings Data: Another concern is that charter students may be either more or less likely to leave the state, and hence more or less likely to be missing from our earnings data. If charter students are more or less likely to migrate out of Texas, or the types of charter students that migrate out of Texas are different than the types of non-charter students who migrate, estimates of Equation (1) may be biased.

Unfortunately we are unable to directly observe out-of-state migration in our data. We therefore explore attrition from of our sample in three ways. First, Appendix Table D3 examines the characteristics of charter and non-charter students with no observed earnings outcomes. While far from an ideal test, these results help us understand the types of individuals for whom we do not observe earnings, and whether selective attrition is likely to be a serious concern in our setting. Similar to the test of selective attrition into charter schools, there are small differences in six out of seventeen variables that are statistically significant but substantively small. Female students who attend non-charter schools are about 2.6 percent less likely to be in the earnings data than male students. Among charter students this number is also about 2.6 percentage points, but the p-value of the difference is less than 0.001. There is a similar pattern among the other variables that show statistical differences.

Second, we test whether charter students are more likely to attend an out-of-state college in the two cohorts where NSC data – which include college enrollment outcomes from all states – is available. Appendix Table 5 in the main text presents these results. At the mean, charter students are no more likely to attend two-year schools in Texas or two-year colleges outside of Texas. They are, however, 0.8 (se=0.1) percentage points more likely to attend out-of-state four-year colleges. The largest coefficients in the table are from No Excuses students who attend out-of-state colleges. They are 1.7 (se=0.2) percentage points more likely to attend an out-of-state four-year college compared to a non-charter mean of 4.4 percentage points.

We also show in Section 5.D that our earnings results are robust to (1) excluding all zero earnings outcomes, (2) imputing zero earnings outcomes using baseline covariates, (3) and imputing zero earnings outcomes using both baseline covariates and observed attainment outcomes. We interpret these results as suggesting that any selective out-of-state migration is likely to be modest in our sample.

Appendix Table D1: Charter Attendance and Baseline Characteristics

	Non-Charter Mean	Any Charter	No Excuses	Regular Charters
Panel A: Leave-Out Controls	(1)	(2)	(3)	(4)
Free Lunch	0.510	−0.002	−0.006***	0.001
		(0.001)	(0.002)	(0.002)
4th Grade On Time	0.847	0.009***	0.014***	0.005***
		(0.001)	(0.002)	(0.002)
4th Grade Spec. Ed	0.096	0.002*	0.000	0.003**
		(0.001)	(0.001)	(0.001)
4th Grade Gifted	0.106	0.000	0.005**	−0.004***
		(0.001)	(0.002)	(0.001)
4th Grade LEP	0.127	0.003**	0.005***	0.001
		(0.001)	(0.002)	(0.001)
4th Grade At Risk	0.389	0.003*	0.002	0.003
		(0.001)	(0.002)	(0.002)
4th Grade Math	-0.011	−0.009***	0.011***	−0.026***
		(0.002)	(0.003)	(0.004)
4th Grade Reading	0.013	0.005**	0.010***	0.000
		(0.002)	(0.003)	(0.003)
Panel B: Characteristics not in Controls				
3rd Grade Math	0.865	0.005	0.016***	−0.003
		(0.003)	(0.005)	(0.004)
3rd Grade Reading	0.017	0.008**	0.014***	0.004
		(0.003)	(0.005)	(0.005)
3rd Grade On Time	0.032	0.000	0.001	0.000
		(0.000)	(0.001)	(0.001)
Panel C: Predicted Outcomes				
Predicted Earnings	21205.14	−24.146***	36.027***	−73.942***
		(5.041)	(5.954)	(7.448)
Predicted Employment (×100)	67.512	−0.038***	0.019**	−0.086***
		(0.008)	(0.010)	(0.012)
N Students	387295	11087	2550	8537

Notes: This table reports OLS estimates of the correlation between charter attendance and baseline variables. Column 1 reports the mean of the indicated variable for students at non-charter schools. Column 2 reports the coefficient and standard error on the number of years at any charter school controlling for the baseline controls listed in Table 2 and 4th grade school x cohort x race x gender effects. Columns 3-4 report the coefficient and standard error on the number of years at the indicated charter school type controlling for the baseline controls listed in Table 2 and 4th grade school x cohort x race x gender effects. In Panel A, the controls do not include the indicated dependent variable. In Panels B and C all controls from Table 2 are used. Predicted earnings and employment are calculated in the full estimation sample using the baseline controls listed in Table 2 and 4th grade school x cohort x race x gender effects. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample. See the text for additional details on the specification.

Appendix Table D2: Charter Attendance and Baseline Characteristics in NYC Data

	Non-Charter Mean	Any Charter	No Excuses	Regular Charters
Panel A: Leave-Out Controls	(1)	(2)	(3)	(4)
Free Lunch	0.924	−0.001	−0.005**	0.003
		(0.001)	(0.002)	(0.002)
4th Grade On Time	0.851	0.005***	0.006***	0.003
		(0.001)	(0.002)	(0.002)
4th Grade Spec. Ed	0.132	−0.003***	−0.004***	−0.002
		(0.001)	(0.001)	(0.002)
4th Grade LEP	0.164	−0.002**	−0.000	−0.004***
		(0.001)	(0.002)	(0.002)
4th Grade Math	-0.278	0.002	0.007*	−0.002
		(0.003)	(0.004)	(0.004)
4th Grade Reading	-0.246	0.005*	0.013***	−0.003
		(0.003)	(0.003)	(0.004)
Panel B: Characteristics not in Controls				
3rd Grade On Time	0.868	0.001	−0.000	0.002
		(0.001)	(0.001)	(0.001)
3rd Grade Math	-0.225	−0.001	0.004	−0.005
		(0.003)	(0.004)	(0.004)
3rd Grade Reading	-0.223	0.000	0.007*	−0.007
		(0.003)	(0.004)	(0.004)
N Students	70898	8036	2678	5358

Notes: This table reports OLS estimates of the correlation between charter attendance and baseline variables in the NYC data used by Dobbie and Fryer (2013). Specifically, we focus on the sample of charter schools with experimental estimates in Dobbie and Fryer (2013). Column 1 reports the mean of the indicated variable for students at non-charter schools. Column 2 reports the coefficient and standard error on the number of years at any charter school in the sample controlling for free lunch status, if a student reached 4th grade on time, 4th grade special education status, 4th grade Limited English Proficiency status, 4th grade math and ELA test scores, and 4th grade school x cohort x race x gender effects. Columns 3-4 report the coefficient and standard error on the number of years at the indicated charter school type with the same controls as Column 2. In Panel A, the controls do not include the indicated dependent variable. In Panel B all controls are used. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level.

Appendix Table D3: Zero Earnings and Baseline Characteristics

	Non-Charter	Any Charter	p-value (1)-(2)	Non-Charter	No Excuses	Regular Charters	p-value (4)-(5)	p-value (4)-(6)	p-value (5)-(6)
Panel A: Baseline Vars.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	−0.026***	−0.026***	0.000	−0.026***	−0.023	−0.027**	0.912	0.760	0.948
	(0.002)	(0.009)		(0.002)	(0.018)	(0.011)			
Black	0.009	−0.019	0.902	0.009	0.706***	−0.104	0.000	0.625	0.000
	(0.086)	(0.192)		(0.086)	(0.041)	(0.197)			
White	0.048	0.001	0.872	0.048	0.688***	−0.076	0.000	0.592	0.000
	(0.086)	(0.191)		(0.086)	(0.034)	(0.197)			
Hispanic	−0.032	−0.075	0.850	−0.032	0.619***	−0.146	0.000	0.623	0.000
	(0.086)	(0.192)		(0.086)	(0.041)	(0.197)			
Asian	0.103	0.104	0.865	0.103	0.774***	0.064	0.000	0.852	0.001
	(0.086)	(0.195)		(0.086)	(0.053)	(0.205)			
Free Lunch	0.001	−0.012	0.089	0.001	−0.045**	−0.002	0.036	0.779	0.087
	(0.002)	(0.010)		(0.002)	(0.022)	(0.012)			
4th Grade On Time	−0.030***	−0.017	0.220	−0.030***	−0.018	−0.019	0.685	0.442	0.971
	(0.002)	(0.012)		(0.002)	(0.028)	(0.013)			
4th Grade Spec. Ed	−0.066***	−0.096***	0.000	−0.066***	−0.046	−0.098***	0.701	0.056	0.278
	(0.003)	(0.016)		(0.003)	(0.043)	(0.017)			
4th Grade Gifted	0.029***	0.014	0.066	0.029***	0.006	0.017	0.394	0.516	0.736
	(0.003)	(0.016)		(0.003)	(0.028)	(0.019)			
4th Grade LEP	−0.066***	−0.076***	0.018	−0.066***	−0.061**	−0.088***	0.962	0.269	0.486
	(0.004)	(0.017)		(0.004)	(0.029)	(0.021)			
4th Grade At Risk	−0.019***	−0.015	0.776	−0.019***	−0.036	−0.008	0.467	0.454	0.317
	(0.002)	(0.011)		(0.002)	(0.023)	(0.012)			
4th Grade Math	−0.007***	−0.007	0.183	−0.007***	−0.002	−0.007	0.694	0.958	0.701
	(0.001)	(0.006)		(0.001)	(0.014)	(0.006)			
4th Grade Reading	−0.008***	−0.006	0.028	−0.008***	−0.024*	−0.002	0.213	0.435	0.143
	(0.001)	(0.006)		(0.001)	(0.014)	(0.007)			
Missing 4th Math	0.176***	0.190***	0.312	0.176***	0.216**	0.182***	0.621	0.830	0.693
	(0.006)	(0.027)		(0.006)	(0.086)	(0.029)			
Missing 4th Reading	0.109***	0.163***	0.003	0.109***	0.202**	0.148***	0.237	0.153	0.524
	(0.005)	(0.027)		(0.005)	(0.083)	(0.029)			
Panel B: Predicted Outcomes									
Predicted Earnings	−0.004***	−0.004***	0.231	−0.004***	−0.010***	−0.002**	0.012	0.374	0.009
	(0.000)	(0.001)		(0.000)	(0.003)	(0.001)			
Predicted Employment	−0.011***	−0.013***	0.000	−0.011***	−0.016***	−0.013***	0.000	0.004	0.000
	(0.000)	(0.001)		(0.000)	(0.001)	(0.001)			
N Students	376208	11087		376208	2550	8537			

Notes: This table reports OLS estimates of the correlation between zero observed earnings between ages 24-26 and baseline variables. Columns 1-2 and 4-6 reports the coefficient and standard error on the indicated variable in the indicated school type. Columns 3 and 7-9 report the p-value on the F-test that the indicated coefficients are equal. Predicted earnings and employment are calculated using the baseline controls listed in Table 2 and 4th grade school x cohort x race x gender effects. All specifications control for 4th grade school x cohort effects and cluster standard errors at the 4th grade school x cohort level. *** = significant at 1 percent level, ** = significant at 5 percent level, * = significant at 10 percent level. See Online Appendix B for additional details on the variable construction and sample.

References

[1] Angrist, Joshua D., Parag A. Pathak and Christopher R. Walters. 2013. "Explaining Charter School Effectiveness." American Economic Journal: Applied Economics, 5(4): 1-27.

[2] Baude, Patrick L., Marcus Casey, Eric A. Hanushek, and Steven G. Rivkin. 2014. "The Evolution of Charter School Quality." NBER Working Paper No. 20645.

[3] Chandra, Amitabh, Amy Finkelstein, Adam Sacarny, and Chad Syverson. 2016. "Healthcare Exceptionalism? Performance and Allocation in the U.S. Healthcare Sector." American Economic Review, 106(8); 2110-2144.

[4] Dimick, Justin B., Douglas O. Staiger, Onur Baser, and John D. Birkmeyer. 2009. "Composite Measures for Predicting Surgical Mortality in the Hospital." Health Affairs 28(4): 1189-1198.

[5] Dobbie, Will, and Roland G. Fryer. 2013. "Getting Beneath the Veil of Effective Schools: Evidence from New York City." American Economic Journal: Applied Economics, 5(4): 28-60.

[6] Jacob, Brian A., and Lars Lefgren. 2007. "What Do Parents Value in Education? An Empirical Investigation of Parents' Revealed Preferences for Teachers." Quarterly Journal of Economics, 122(4): 1603–1637.

[7] Morris, Carl N. 1983. "Parametric Empirical Bayes Inference: Theory and Applications." Journal of the American Statistical Association, 78(381): 47-55.