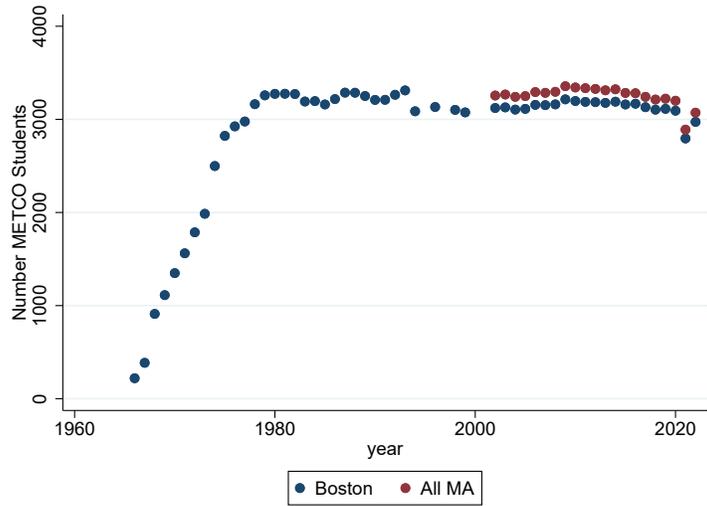# Online Appendix

Figure 1: METCO Enrollment Over Time

Notes: This figure plots the total METCO enrollment since the program started in 1966. Pre-2001 data comes from the Northeastern University Archives METCO Collection and was only available for Boston, not for Springfield. Not all years were available in the archives. The 2001 - present data come from the Massachusetts Department of Elementary and Secondary Education. All MA includes the Boston and Springfield programs.

Figure 2: Referral Rates by Age of Application
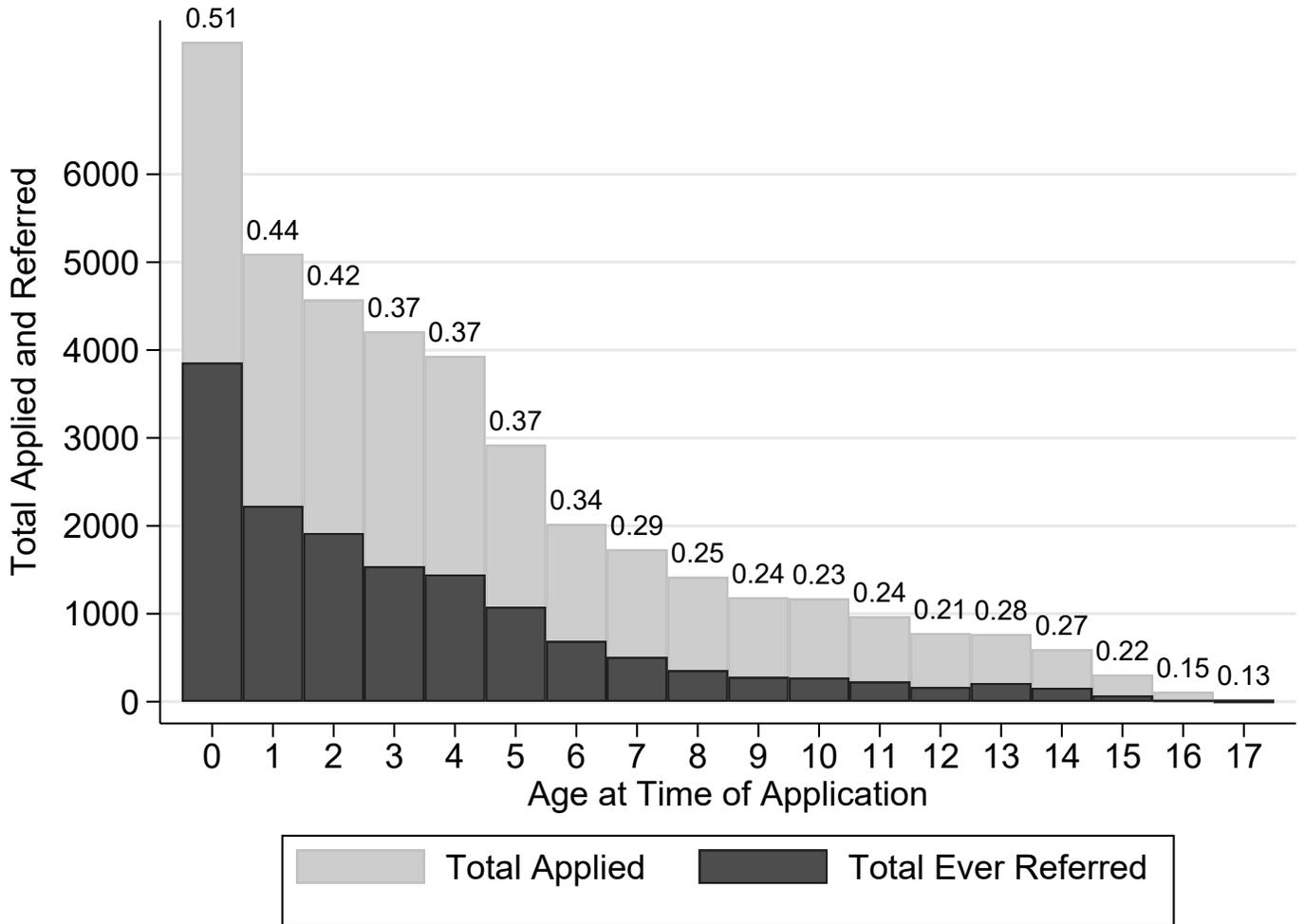
Notes: This figure plots the total METCO applications by children's ages in light gray. The number referred by age is shown in dark gray and the proportion enrolled by age appears above the bar. Data include those who start first grade in 1991 through 2020.

Figure 3: District-Specific Referral and Enrollment Rates
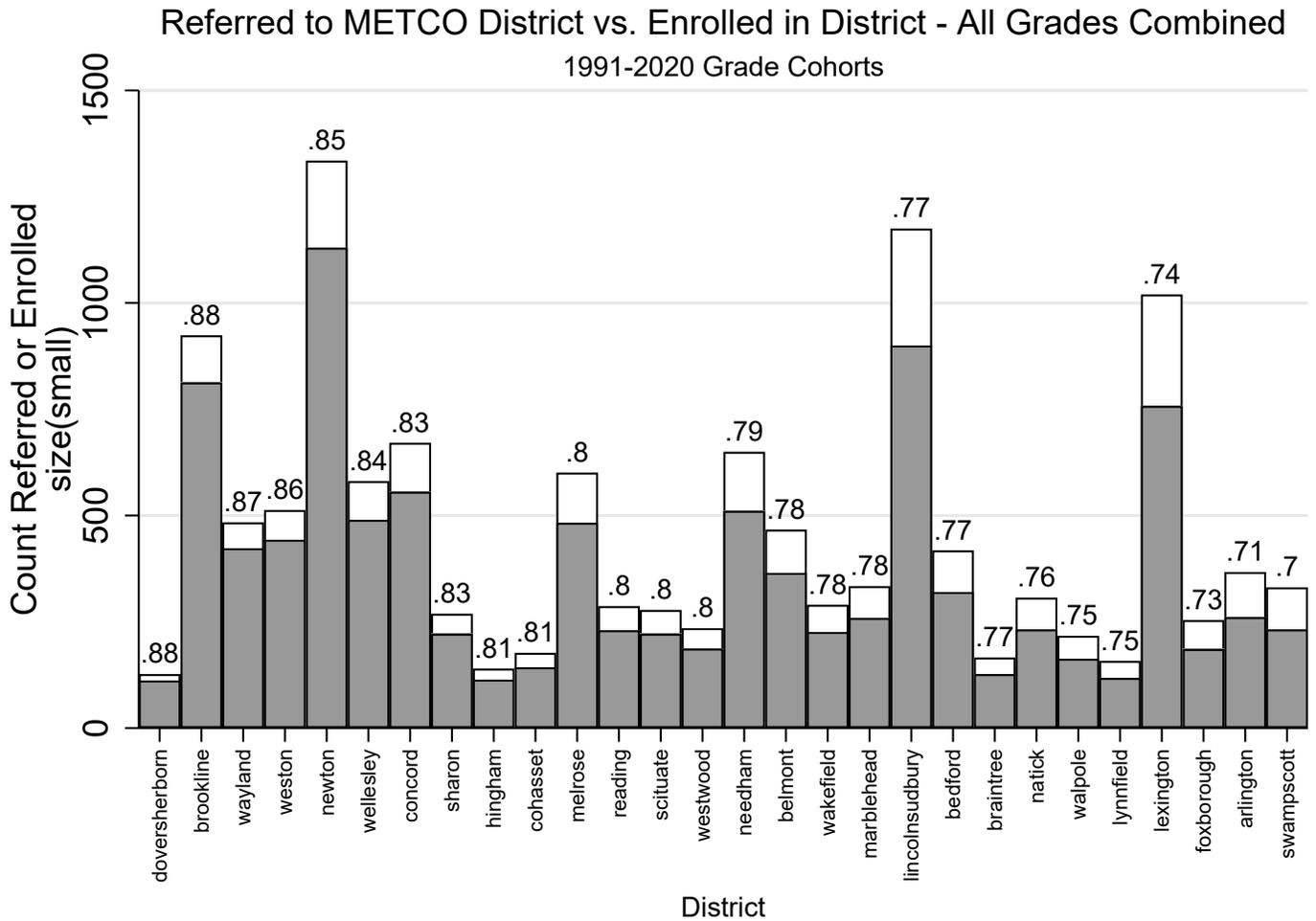
Notes: This figure plots the total METCO enrollment by suburban school district. The proportion that enroll after receiving offers is shown in gray and the label above the bars. Data include those who start first grade in 1991 through 2020.

Figure 4: 10th Grade Outcomes by Cohort
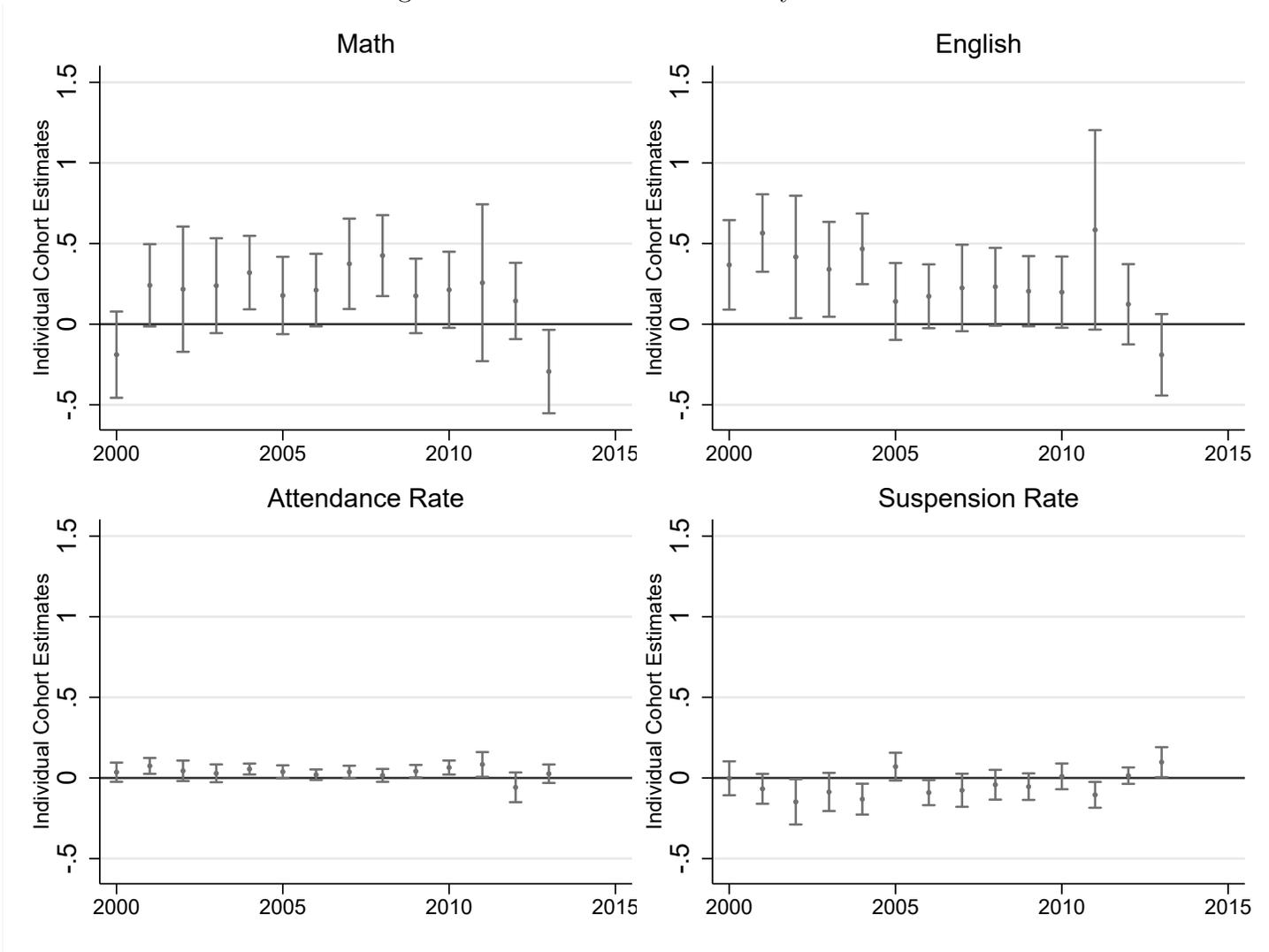
Notes: This figure plots the grade cohort-specific estimates for tenth grade outcomes.

Table 1: Match Rate of Application Data to Education Data and Birth Records

Cohort group	1st grade cohorts in sample (1)	All (2)	Applied before grade 1 (3)	Without sibling preference & applied before grade 1 (4)	Education Data Match rate (5)	Education Data Difference by referral status (6)	Birth Records Match rate (7)	Birth Records Difference by referral status (8)
K-12	2003-2020	23,065	17,831	14,924	0.89	0.058*** (0.006)	0.77	0.030*** (0.009)
High School	2003 - 2015	18,208	13,371	11,233	0.89	0.070*** (0.008)	0.76	0.034*** (0.011)
College	1995 -2011	26,005	17,479	16,889	0.85	0.089*** (0.008)	0.72	0.060*** (0.010)
Age 30 with college outcomes	1991 - 1999	13,530	8,639	8,182	0.76	0.012 (0.028)	0.64	0.001 (0.036)
Age 30 with 10th grade & college outcomes	1993 - 1999	11,297	7,151	6,812	0.79	0.045 (0.034)	0.65	-0.010 (0.042)
Age 35 with college outcomes	1991 - 1994	5,248	3,373	3,126	0.70	-0.031 (0.042)	0.59	-0.035 (0.055)
All cohorts	1991 - 2020	41,377	29,688	27,369	0.85	0.061*** (0.006)	0.72	0.044*** (0.008)

Notes: This table shows sample specifications and match rates across the analysis samples. Cohort group notes the outcomes that are available for those grade cohorts. First grade cohort year refers to the Spring of the academic year they entered first grade, so 2003 refers to the 2002-2003 school year. Columns 5 and 7 show the match rates of applicants who applied before grade 1 and did not have older siblings in METCO to the administrative K-12 education data and the Massachusetts birth records. Columns 6 and 8 show the regression estimates of whether the individual matched on whether they were referred in first grade or earlier. Controls include race, gender, age at time of application (linear and squared), and indicators for which grade and year combinations students were in the applicant pool.

Table 2: Estimates Across Samples

Outcomes	Has grade 5 - 12 outcomes 2003-2015 (1)	College 1995 -2006 (2)	Age 30 with college outcomes 1991 - 1999 (3)	Age 30 with 10th grade & college outcomes 1993 - 1999 (4)	Age 35 with college outcomes 1991 - 1994 (5)
Grade 5 Math	0.121***	0.156***			
	(0.035)	(0.039)			
	8172	5396			
Grade 5 English	0.162***	0.217***			
	(0.036)	(0.040)			
	8176	5396			
Grade 8 Math	0.091**	0.103***	0.269***	0.269***	
	(0.035)	(0.039)	(0.032)	(0.032)	
	7176	5314	5605	5605	
Grade 8 English	0.180***	0.230***	0.174**	0.174**	
	(0.036)	(0.039)	(0.077)	(0.077)	
	7188	5330	1307	1307	
Grade 10 Math	0.132***	0.156***	0.301***	0.294***	0.330***
	(0.044)	(0.048)	(0.033)	(0.033)	(0.057)
	5486	4416	6784	6646	1818
Grade 10 English	0.211***	0.225***	0.406***	0.400***	0.484***
	(0.042)	(0.045)	(0.033)	(0.033)	(0.063)
	5521	4454	6839	6712	1815
Plan for 4-year college	0.163***	0.163***	0.221***	0.204***	0.267***
	(0.022)	(0.022)	(0.013)	(0.014)	(0.022)
	4717	4702	7045	6025	2531
4-year high school graduate	0.076***	0.076***	0.218***	0.220***	0.227***
	(0.016)	(0.016)	(0.011)	(0.012)	(0.018)
	5014	4998	8297	7101	3087
Enroll in 4-year College	0.211***	0.211***	0.227***	0.213***	0.283***
	(0.023)	(0.023)	(0.012)	(0.013)	(0.020)
	5741	5741	11050	9598	3948
Graduate from 4-year College	0.100***	0.100***	0.122***	0.112***	0.138***
	(0.024)	(0.024)	(0.010)	(0.011)	(0.017)
	2356	2356	11050	9598	3948
Earnings at age 25	7,716	7,716	7,661***	8,187***	6,567***
	(9913)	(9913)	(631)	(673)	(1094)
	1369	1369	10231	8880	3607
Earnings at age 30			12,071***	11,718***	11,640***
			(1015)	(1061)	(1830)
			10231	8880	3607

Notes: This table shows the regression results for a range of outcomes in the different analysis samples. See Table 3 for full sample specifications and controls.

Table 3: Robustness to Inclusion of Control Variables

	(1)	(2)	(3)	(4)	(5)	(6)
5th Grade Outcomes						
Math	0.126***	0.126***	0.121***	0.121***	0.097**	0.097**
	(0.035)	(0.035)	(0.035)	(0.035)	(0.040)	(0.040)
N	8,173	8,173	8,172	8,172	5,271	5,271
R-squared	0.086	0.086	0.094	0.094	0.147	0.147
English	0.167***	0.167***	0.162***	0.162***	0.107***	0.107***
	(0.036)	(0.036)	(0.036)	(0.036)	(0.040)	(0.040)
N	8,177	8,177	8,176	8,176	5,279	5,279
R-squared	0.093	0.093	0.099	0.099	0.149	0.149
Attendance rate	0.025***	0.025***	0.024***	0.024***	0.022***	0.022***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
N	9,758	9,758	9,757	9,757	6,285	6,285
R-squared	0.511	0.511	0.512	0.512	0.550	0.550
Suspended	-0.069***	-0.069***	-0.068***	-0.068***	-0.060***	-0.060***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
N	9,758	9,758	9,757	9,757	6,285	6,285
R-squared	0.040	0.040	0.042	0.042	0.054	0.054
10th Grade Outcomes						
Math	0.134***	0.134***	0.132***	0.132***	0.079	0.079
	(0.044)	(0.044)	(0.044)	(0.044)	(0.050)	(0.050)
N	5,487	5,487	5,486	5,486	3,631	3,631
R-squared	0.104	0.104	0.112	0.112	0.163	0.163
English	0.209***	0.213***	0.211***	0.211***	0.154***	0.154***
	(0.042)	(0.043)	(0.042)	(0.042)	(0.047)	(0.047)
N	5,522	5,522	5,521	5,521	3,656	3,656
R-squared	0.122	0.122	0.128	0.128	0.179	0.179
Attendance rate	0.049***	0.049***	0.049***	0.049***	0.040***	0.040***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
N	6,475	6,475	6,474	6,474	4,208	4,208
R-squared	0.429	0.429	0.430	0.430	0.468	0.468
Suspended	-0.022	-0.021	-0.021	-0.021	-0.023	-0.023
	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)	(0.017)
N	6,475	6,475	6,474	6,474	4,208	4,208
R-squared	0.033	0.033	0.034	0.034	0.044	0.044
College Outcomes						
Enter 4-Year college	0.172***	0.167***	0.181***	0.181***	0.187***	0.166***
	(0.013)	(0.013)	(0.015)	(0.015)	(0.018)	(0.021)
N	14,635	13,130	9,316	9,316	7,118	4,417
R-squared	0.085	0.087	0.100	0.100	0.100	0.128
Graduate from 4-Year college	0.091***	0.088***	0.088***	0.088***	0.090***	0.079***
	(0.011)	(0.011)	(0.014)	(0.014)	(0.016)	(0.020)
N	14,635	13,130	9,316	9,316	7,118	4,417
R-squared	0.079	0.083	0.090	0.090	0.088	0.118
Controls						
Excludes those with enrolled siblings	X	X	X	X	X	X
Fixed effects for the years and grades in the applicant pool	X	X	X	X	X	X
Race & gender	X	X	X	X	X	X
Immigrant, English learner, disability that may affect bus need	X	X	X	X	X	X
Age at application		X	X	X	X	X
Applied before grade 1			X	X	X	X
Neighborhood at application time				X	X	X
Matched to birth records					X	X
Vital statistics controls						X

Notes: This table shows that the 2SLS estimates of the impact of participating in METCO on outcomes are robust to the controls variables that are included in the specification. Vital statistics controls include indicators for family structure, parental education, Medicaid, and health at birth. Neighborhood at application time includes indicators for neighborhood and Census block characteristics.

Table 4: Balance on Predicted College Outcomes

	Not Referred Mean of Real Outcome	Correlation of Predicted Outcome and Real Outcome	Difference Between Referred and Non-referred	Effect Size	Difference/Effect Size
	(1)	(2)	(3)	(4)	(5)
Enroll in 4-year College	0.544	0.093***	0.011***	0.223***	5%
		(0.006)	(0.004)	(0.011)	
	6,607	3,183	10,839	12,900	
Graduate 4-Year College	0.294	0.086***	0.009**	0.112***	8%
		(0.006)	(0.003)	(0.011)	
	6,607	2,261	10,839	10,392	

Notes: This table displays the difference between the predicted college enrollment and graduation for those with and without referrals. The prediction is calibrated in the sample that did not enroll in METCO using the full set of baseline characteristics (see Table 2). The sample includes applicants who entered first grade in 1995 through 2006 for college graduation and 1995 through 2010 for college enrollment. Column 4 shows the 2SLS estimates of the impact of METCO enrollment on college outcomes.

Table 5: 2SLS Effects of METCO with Years in METCO as Endogenous Variable

	Non-METCO 3rd Grade Mean	Grade-level									
		3	4	5	6	7	8	9	10	11	12
Effect of any referral on years in METCO											
Years in METCO		2.028***	2.596***	3.115***	3.611***	4.132***	4.685***	5.077***	4.960***	6.477***	7.199***
		(0.017)	(0.022)	(0.028)	(0.033)	(0.039)	(0.046)	(0.055)	(0.070)	(0.077)	(0.088)
Two-Stage Least Squares Results: Average Impact of a Year in METCO											
Math	-0.403	0.038***	0.035***	0.027***	0.010*	0.011**	0.013***		0.014***		
	(1.059)	(0.011)	(0.008)	(0.007)	(0.006)	(0.005)	(0.004)		(0.004)		
N	7146	9001	8831	8168	8494	7854	7172		5482		
F-Stat		501	503	463	475	439	410		195		
P-Value		0.000	0.000	0.000	0.000	0.000	0.000		0.000		
English	-0.390	0.060***	0.050***	0.034***	0.025***	0.022***	0.023***		0.021***		
	(1.055)	(0.011)	(0.008)	(0.007)	(0.006)	(0.005)	(0.004)		(0.004)		
N	7612	9549	8826	8172	8511	7870	7184		5517		
F-Stat		544	498	460	474	438	409		194		
P-Value		0.000	0.000	0.000	0.000	0.000	0.000		0.000		
Attendance rate	0.907	0.008***	0.007***	0.005***	0.005***	0.003***	0.003***	0.006***	0.005***	0.004***	0.004***
	(0.176)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	8868	11013	10373	9751	9603	8998	8228	7426	6470	5486	4913
F-Stat		597	554	519	509	472	436	374	219	320	299
P-Value		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Suspended	0.050	-0.009***	-0.012***	-0.013***	-0.007***	-0.005***	-0.004***	-0.005***	-0.002	-0.001	-0.001
	(0.217)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
N	8868	11013	10373	9751	9603	8998	8228	7426	6470	5486	4913
F-Stat		597	554	519	509	472	436	374	219	320	299
P-Value		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: The first row shows the effect of getting an offer to any METCO district by a given grade-level on years in the METCO program to show the average years of treatment for each grade level. The other rows report the 2SLS estimates of the average effect of one year in the METCO program on test score and behavioral outcomes. The endogenous variable is years enrolled in the METCO program by that specific grade. All 2SLS models use individual school district METCO referrals as instrumental variables and control for race, gender, age at time of application (linear and squared), neighborhood indicators at the time of application, indicators for which grade and year combinations students were in the applicant pool, whether students ever had an English Learner status, immigrant status, and whether the student had a special education classification that may require specialized bussing by first grade. Effects are robust to controlling for birth record controls including parental level of education, whether the government paid for prenatal care or childbirth, parents' marital status, whether a father is on the birth certificate, and quality of prenatal care. The sample includes those who applied before the first grade and excludes those with sibling preference.

Table 6: Attrition for College Prep, College, and Career Outcomes

	Excludes Students That Never Match to Public School Data			All Applicants (including always out of state or in private school)		
	Non-treated Mean	Intent to Treat	2SLS	Non-treated Mean	Intent to Treat	2SLS
Outcome variable	(1)	(2)	(3)	(4)	(5)	(6)
Matched to education data	1.000	-	-	0.858	0.058***	0.095***
					(0.006)	(0.010)
						14910
Has any outcomes for:						
Elementary School	0.955	0.024***	0.038***	0.820	0.079***	0.128***
		(0.004)	(0.007)		(0.007)	(0.012)
			12116			13614
Middle School	0.875	0.028***	0.046***	0.748	0.087***	0.139***
		(0.008)	(0.013)		(0.010)	(0.016)
			9955			11220
High School	0.836	0.032***	0.051***	0.696	0.102***	0.149***
		(0.011)	(0.016)		(0.013)	(0.019)
			6591			7558
Has any test scores for:						
Elementary School	0.807	0.050***	0.083***	0.693	0.097***	0.160***
		(0.007)	(0.011)		(0.009)	(0.014)
			12116			13614
Middle School	0.844	0.035***	0.059***	0.721	0.095***	0.153***
		(0.009)	(0.014)		(0.010)	(0.016)
			9955			11220
High School	0.641	0.077***	0.116***	0.533	0.136***	0.201***
		(0.013)	(0.019)		(0.014)	(0.020)
			6591			7558
Has non-missing value for						
Plan for college	0.668	0.093***	0.138***	0.556	0.152***	0.223***
		(0.014)	(0.020)		(0.015)	(0.021)
			6591			7558
4-year high school graduate	0.724	0.080***	0.120***	0.603	0.140***	0.206***
		(0.014)	(0.019)		(0.014)	(0.021)
			6591			7558
5-year high school graduate	0.665	0.094***	0.136***	0.549	0.158***	0.223***
		(0.015)	(0.021)		(0.016)	(0.022)
			5812			6693

Notes: This table shows the rates of applicants that have non-missing outcomes data. Columns 1 through 3 exclude students that never appear in the administrative K-12 education data. These include students that enroll in private school or an out of state school for their whole K-12 education and students who we were unable to match. Columns 4 through 6 include these unmatched students, who by definition will not have any K-12 education outcomes data. The sample includes those who applied to METCO by grade 1 and enrolled in first grade after 2002. Applicants with sibling preference are excluded from the sample. The endogenous variable for the Intent to Treat models is an indicator for whether applicants were referred on or before grade 1. The endogenous variable for the 2SLS models is whether the student ever participated in METCO and individual district referrals are the instruments. See Table 3 for the full list of control variables. Columns 5 and 6 do not control for English Learner, immigrant, or disability status because that information is not available for those who do not match to the administrative education data.

Table 7: Selection into METCO Application

	OLS Boston Students (BPS, Charter, METCO)		OLS METCO Applicants			2SLS METCO Applicants						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Math	0.063***	0.196***	0.054***	0.058***	0.044**	0.096***	0.115***	0.121***	0.121***	0.122***	0.054*	0.109***
	(0.016)	(0.016)	(0.020)	(0.021)	(0.021)	(0.027)	(0.043)	(0.035)	(0.035)	(0.037)	(0.031)	(0.040)
N	62,943	62,943	9,724	9,724	9,723	9,723	7,388	8,172	8,172	6,772	6,482	5,271
English	0.274***	0.357***	0.155***	0.155***	0.136***	0.160***	0.161***	0.162***	0.162***	0.150***	0.095***	0.119***
	(0.015)	(0.016)	(0.021)	(0.021)	(0.021)	(0.028)	(0.044)	(0.036)	(0.036)	(0.038)	(0.031)	(0.040)
N	62,186	62,186	9,734	9,734	9,733	9,733	7,391	8,176	8,176	6,778	6,494	5,279
Attendance Rate	0.030***	0.029***	0.025***	0.025***	0.025***	0.026***	0.024***	0.023***	0.023***	0.023***	0.024***	0.021***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
N	66,493	66,493	10,775	10,775	10,774	10,774	8,214	9,067	9,067	7,532	7,195	5,863
Suspended	-0.045***	-0.064***	-0.073***	-0.073***	-0.074***	-0.072***	-0.069***	-0.070***	-0.070***	-0.076***	-0.062***	-0.063***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.007)	(0.012)	(0.010)	(0.010)	(0.010)	(0.008)	(0.011)
N	66,490	66,490	10,775	10,775	10,774	10,774	8,214	9,067	9,067	7,532	7,195	5,863
Controls												
Grade Cohort FE	X	X	X	X	X	X	X	X	X	X	X	X
Race & Gender		X	X	X	X	X	X	X	X	X	X	X
Age at Application				X	X	X	X	X	X	X	X	X
Exclude Siblings							X	X	X	X	X	X
Immigrant & LEP ever					X	X	X	X	X	X	X	X
Neighborhoods					X	X	X	X	X	X	X	X
Disability Bus Need					X	X	X	X	X	X	X	X
Control for risk sets								X	X	X		X
Prenatal care adequacy											X	X
Family structure at birth											X	X
Parental education											X	X
Medicaid at birth											X	X
Applied before grade 1									X	X	X	X
Matched to birth records										X	X	X

Notes: This table displays the coefficient on METCO participation in fifth grade on individual fifth grade outcomes. Columns 1 and 2's sample includes fifth graders in Boston Public Schools, Boston charter schools, and METCO. The remaining columns include METCO applicants who applied before the first grade and attend a Massachusett public schools in fifth grade.

1 Data Appendix

1.1 Matching Process

Appendix Table 1 shows the match rate of the application records to the administrative education and birth records data. Each row reflects one of the analysis samples. For example, those that enter first grade in the 2002-2003 through 2019-2020 school years have the full set of primary and secondary school outcomes while those who enter first grade in 1990-1991 through 1993-1994 have labor market outcomes for age 35 and college outcomes. The preferred specification restricts to students who applied before first grade and did not have sibling preference. Column 4 shows this sample size. Eighty-nine percent of the K-12 preferred specification sample appears in the administrative education data. That means that they attend public school at some point between Kindergarten and 12th grade. Most of the unmatched 11 percent of the sample attended either private or out of state school for their entire primary and secondary schooling. A small portion of the unmatched may have enrolled in Massachusetts public schools, but I was unable to confidently match them. This match rate is comparable to other matches of Boston residents to state education data. Applicants match to birth records data if they were born in Massachusetts, have an official birth certificate, and could be matched with confidence using the process described below.

Applicants with offers to enroll in METCO by first grade are 5.8 percentage points more likely to match to the education data and 3 percentage points more likely to match to the Massachusetts birth records. This means that applicants with offers are slightly more likely to go to private or out of state schools. As such, the results show causal estimates for the sample of students who enroll in Massachusetts public schools.

The match rate and differences by referral status are similar for the samples that have high school and college outcomes. The samples with older cohorts have lower match rates in the education data. They enrolled in school before administrative data collection began (the 2001-2002 school year), so there are fewer grade levels where they can be matched in the data. For example, someone who attended Massachusetts public elementary schools, but then moved out of state would appear in the administrative education data if they were in first grade in 2003, but not if they were in first grade in 1993. The sample of applicants

that reach age 30 in the data and have college outcomes have a 76 percent match rate to education data and a 64 percent match rate to birth records. Match rates are not statistically significantly different across offer status for either the education or the birth records data. The estimates for both is noisier due to the small sample size, but the point estimates are small and close to zero. Restricting the age 30 sample to those that have tenth grade outcomes has similar match rates. Lastly, the sample that reach age 35 has a 70 percent match rate to education data and a 59 percent match rate for birth records. There is not statistically significantly different match rate across offer status.

Applicants were matched to administrative data using full name and date of birth. Names were stripped of special characters, spaces, and surnames. The match considered all variants of applicants' names and date of birth that appeared in the applicant data. After exact matches on full name and date of birth, the remaining observations were matched with a series of rules. Since middle name sometimes appeared just as a middle initial, exact matches on first and last name, date of birth, and middle initial were accepted. Other variants included matching without a middle name or initial and swapping the middle and last names. Reclink and dtalink commands were used to suggest matches. These were reviewed for general patterns, such as strategies to deal with hyphenated last names in one dataset and only having one of the two last names in another dataset, that could be included in the code to automate the match. For the education match, all of the remaining fuzzy matches were hand reviewed. For the birth records data, only automated matching was used.

1.2 Attrition

First graders who receive offers to enroll in METCO should be similar to those that do not. Table **??** showed similar baseline observable attributes across the two groups. If receiving a METCO offer makes students more likely to enroll in Massachusetts public schools and therefore appear in the administrative education data, then that can lead to selection bias. For those that enroll in Massachusetts public schools initially, not receiving a METCO offer may make them less likely to remain in state public school system if they elect to move to another state or enroll in private school. Appendix Table 6 shows the tests for differential attrition by METCO offer status for the various outcomes in the data.

The first three columns focus on students who appear at least once in the administrative education data to show whether there is differential attrition among those that ever enroll in Massachusetts public schools. The last three columns investigate attrition for the full sample of applicants. Column 1 shows that 95.5 percent of those those without first grade offers have at least one year of outcomes for elementary school. Those with offers have a 2.4 percentage point higher likelihood of having elementary school data (Column 2) and receiving a METCO offer leads to a 3.8 percentage point higher likelihood of having elementary school outcomes. The match rates for middle (87.5 percent) and high school (83.6 percent) outcomes are lower, but have comparable differential match rates across offer status. Labor market outcomes are only available for former Massachusetts public high school students. As such, they have the same attrition statistics for having high school outcomes.

Students may appear in the administrative education data, but may be absent on the day(s) of testing or may not attend a Massachusetts public school during a testing grade (tests are administered in grades 3 through 8 and grade 10). In these cases, students would have attendance, suspension, class taking, and class peer data for the years they are enrolled, but not test score outcomes. The next rows in Appendix Table 6 show that 80.1 percent of applicants who enroll at least one year in Massachusetts public schools have at least one exam outcome (i.e., for third, fourth, or fifth grade Math or English). Those with METCO offers are 5 percentage points more likely to have an elementary school exam outcome and getting a METCO offer makes someone 8.3 percentage points more likely to have an elementary test score. Middle school has a slightly higher test-taking rate of 84.4 percent and less differential attrition (though the differences between elementary and middle school point estimates are not statistically significantly different. Unlike in elementary and middle school where there are three test-taking grades, high school only has one exam year. This contributes to the lower rates of test-taking outcomes for high school. Sixty-four percent of applicants without offers have a high school exam outcome. Those with offers are 7.7 percentage points more likely to have a high school test score and enrolling in METCO makes students 11.6 percentage points more likely to have one.

The survey that asks students' plans for after high school is administered in the same year as the high school exam, and therefore has similar attrition and differential attrition. By the end of high school, a

portion of students move out of state or to private school, so we cannot see their graduation outcomes. Over 72 percent of applicants without offers have 4-year high school graduation outcomes and those with offers are 8 percentage points more likely to have that information. In all, Column 3 shows that not enrolling in METCO makes Massachusetts public school students more likely to leave the state public school system and not have outcomes at a rate ranging from 3.8 to 13.8 percentage points.

Columns 4 through 6 show analogous results for the full sample, including the 11 percent of applicants who never enroll in Massachusetts public schools. Participating in METCO makes applicants 9.5 percentage points more likely to contribute any outcomes data to the analysis. For elementary and middle school outcomes this effect ranges from 12.8 percentage points to 16.0 percentage points. Participating in METCO increases the likelihood of having high school graduation outcomes by 20.6 percentage points. Therefore, participating in METCO reduces attrition from K-12 outcomes data since applicants are both more likely to enroll in and remain enrolled in Massachusetts public schools.

To address this differential attrition, I searched for all students, including those who never enrolled in or left Massachusetts public schools, to the National Student Clearinghouse college outcomes data. Any attrition in college results would stem from college enrollees not matching to the college data due to typos or different spelling in the name. This should be similar across offer status. As a result, the college results do not have a differential attrition problem. The fact that the college aspirations results (subject to differential attrition concerns) are very similar in magnitude to the college enrollment results (not subject to differential attrition) provides suggestive evidence that the differential attrition is not changing the magnitude of the key high school outcomes findings.

1.3 Consistent Results Across Cohorts

Appendix Table 2 shows that key results are consistent across different grade cohorts. Since college and labor market outcomes are only available for applicants who are old enough, this shows that the effects of the program are similar across analysis samples (e.g., age cohort groups). For example, those who are old enough to have attended college have similar effects for Math and English standardized exams when compared to the full set of applicants that have fifth grade outcomes (including younger students

who haven't reached college-going age). effect sizes are similar across test score, high school graduation, college, and earnings outcomes for each of the samples. Appendix Figure 4 shows similar estimates for 10th grade outcomes across individual grade cohorts.

Results are also consistent to restricting to various application ages. We might be concerned that students who submit applications very early or very late might have different unobservable characteristics or experience different impacts of the program. Findings are robust to removing those who apply at the youngest and oldest ages. This includes combinations of removing those who applied before turning one, two, or three and those who applied after turning five or six.

1.4 Robustness to Controls

Appendix Table 3 shows that results are stable as control variables are added. Column 1 shows the results from a specification that excludes those with sibling preference and includes fixed effects for the year and grades students were in the applicant pool. It also includes indicator variables for race, gender, immigrant status, English learner status, and disability status. Adding linear and quadratic controls for the age in months at the time of application does not substantively change the estimates. Age at time of application does not explain a substantial amount of the variation in the outcomes – the R-squared increases by up to 0.01.

The next two columns add controls for the neighborhood students lived in at the time of application and restrict to those that applied before the first grade. This does not alter the estimates. It explains relatively more variation in the outcomes than the addition of age at the time of application for college outcomes (up to 0.015) and test scores (up to 0.022), but these improvements are relatively small.

Column 5 shows that results are stable after restricting to the subsample that has birth records data. Once adding birth records controls for family structure, parental education, Medicaid receipt, and health at birth the results are not statistically significantly different to the models with fewer controls. The birth records controls explain more variation in the data for college outcomes, increasing the R-squared by 0.03 for college graduation and entering college. This is a 28.4 percent increase in explanatory power of the model for college enrollment compared to the model without birth controls for the sample that matched

17

to birth records. It is a 34.2 percent increase in explanatory power for the college graduation model. Since the results are robust across control variables, I show results without birth records controls to keep a larger sample size.

The stability of the estimates can also speak to questions about selection bias. The results are the same with the addition of family structure, health at birth, parental education levels, and Medicaid receipt controls. The addition of these variables increases the R-squared by 28 and 34 percent for college-going and college graduation outcomes respectively.

The stability of the estimates after the addition of variables that increase the R-squared suggests that there is not substantial selection on observables for factors related to the birth control variables (**?**).

1.5 Selection into the METCO Applicant Sample

Appendix Table 7 investigates how selected participants in the METCO program are. This shows the extent of the bias in naive Ordinary Least Squares (OLS) estimates of the impact of METCO. The simplest analysis compares the overall outcomes of grade cohorts in METCO to cohorts in Boston Public Schools or Boston charter schools. This type of high-level data is typically what is available for policy reports and newspaper articles about the impact of METCO. Column 1 shows that cohorts in METCO score 0.63 standard deviations higher in Math, 0.274 standard deviations higher in English, have a 3 percentage points higher attendance rate, and are 4.5 percentage points less likely to get suspended.

Next, Column 2 adds controls for gender and race indicators. Under this specification, METCO's positive association with test scores and negative relationship with suspensions is stronger. This is because 95 percent of METCO students are Black and Latinx students, and these demographics have lower test scores and higher suspension rates than their White and Asian peers in Boston Public Schools. Therefore, simple comparisons of Boston schools and METCO student outcomes underestimates METCO students' higher achievement because it does not adjust for race.

The digitization of the METCO applicant data allows us to control for the fact that those who apply to and enroll in METCO may be advantaged in unobservable ways. This could include student or family motivation and parental resources (time, social connections, knowledge of program). Restricting the sample

to the 17 percent of Boston students that applied to METCO before 1st grade reduces the Math, English, and attendance point estimates by more than 50 percent (see Column 3). This suggests that students who were pre-disposed to do better on the exams were more likely to enroll in METCO, but a substantial positive association between enrolling in METCO and outcomes remains. The relationship between METCO enrollment and reduced suspensions becomes stronger, suggesting that the types of students who apply to METCO cannot explain the positive association between METCO and attendance and reduced suspensions.

Students who applied to METCO at a younger age may have different potential outcomes than those who apply later. Perhaps parents who signed their child up for METCO at infancy had more resources and time to engage with their child's learning and school. Column 4 adds controls for the linear and quadratic age in months in which students applied for METCO. There appears to be no positive selection for test score and behavior outcomes based on age at application - the model that includes age of application has nearly identical estimates to the model without. Therefore, while the types of students who apply for METCO accounts for about 50 percent of the differential between METCO and Boston outcomes, the timing at which students apply does not explain the stronger METCO outcomes.

Column 5 adds controls for whether the student has a disability that might require special transportation, whether they are ever an English Learner, immigrant status, and neighborhood indicators. There appears to be limited positive selection for test score and no selection for behavior outcomes based on these factors because the point estimates are very similar to the previous column.

The most accurate models use referrals to school districts as instrumental variables for enrolling in METCO. They show the impact of METCO enrollment for applicants who are pushed to enroll in METCO because they receive offers, excluding those who would enroll regardless of what happened or who would never enroll despite applying. Column 6 shows that the Math test score effects are larger than the OLS models, suggesting that the OLS estimates for Math are biased downwards. The other outcomes' estimates are comparable to the OLS estimates.

Applicants with older siblings already in METCO have a higher likelihood of being admitted. Therefore the referral instruments are not valid for children with older siblings since they are not plausibly random.

After excluding siblings from the analysis, Column 8 shows that the point estimates are higher in Math and English and similar in attendance and suspensions. Next, I properly control for which application grade and years students were eligible to be referred in Column 9, which shrinks the point estimates for English, attendance, and suspensions. Finally, I control for socioeconomic factors from the birth records: whether the child received adequate prenatal care, whether their parents were married when they were born, whether their parents were college educated, and whether they were on Medicaid at birth. The referred group is not positively selected on these socioeconomic controls.

In sum, the types of students who apply for METCO appear to positively selected, but not those who apply earlier rather than later. After using the referral and application data in a two-stage least squares model, there is not much selection on a range of socioeconomic controls. After controlling for who applies, participating in METCO is associated with better test scores, improved attendance, and reduced suspensions. Causal estimates which use referrals to school districts find that METCO boosts fifth grade test scores by about 0.1 to 0.2 standard deviations in Math and English, marginally improves attendance or does not reduce it, and reduces the likelihood of suspension by 3.0 to 7.2 percentage points.