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Busing to Opportunity? The Impacts of the METCO Voluntary School Desegregation Program on Urban Students of Color

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Abstract

School assignment policies are a key lever to increase access to high performing schools and to promote racial and socioeconomic integration. For over 50 years, the Metropolitan Council for Educational Opportunity (METCO) has bussed students of color from Boston, Massachusetts to relatively wealthier and predominantly White suburbs. Using a combination of digitized historical records and administrative data, I analyze the short and long run effects of attending a high-performing suburban school for applicants to the METCO program. I compare those with and without offers to enroll in suburban schools. I use a two-stage least squares approach that utilizes the waitlist assignment priorities and controls for a rich set of characteristics from birth records and application data. Attending a suburban school boosts 10th grade Math and English test scores by 0.13 and 0.21 standard deviations respectively. The program reduces dropout rates by 75 percent and increases on-time high school graduation by 13 percentage points. The suburban schools increase four-year college aspirations by 17 percentage points and enrollment by 21 percentage points. Participation results in a 12 percentage point increase in four-year college graduation rates. Enrollment increases average earnings at age 35 by $16,250. Evidence of tracking to lower performing classes in the suburban schools suggests these effects could be larger with access to more advanced coursework. Effects are strongest for students whose parents did not graduate college.[1]

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De facto socioeconomic and racial segregation persist in U.S. neighborhoods and schools. School segregation has increased following Supreme Court rulings that restricted inter-district school integration and the use of race in school assignment.[2] Segregation is linked with disparities in access to advanced curriculum, resources, and outcomes. To increase equity, access to opportunity, and integration, districts utilize school assignment and school choice policies. Forty-six states and the District of Columbia have at least one intra or inter-district school choice program.

One of the longest-running school integration programs in the country, the Metropolitan Council for Educational Opportunity (METCO), has bussed students of color from Boston, Massachusetts to over 33 predominantly White and relatively wealthier suburban school districts since 1966. The program is voluntary for both urban students and suburban districts. Districts decided to accept METCO students during the first decade of the program. METCO gives students the option to enroll in high performing suburban public schools that have substantially higher graduation rates, college-going rates, advanced courses, and student test scores. The program is very popular: 50 percent of Black youth in Boston applied and 20 percent of Latinx youth in the past 20 years.

While METCO participants have access to higher performing schools and peers, they also face potential challenges that could hinder their academic outcomes. The increased travel time and distance to school could crowd out study time, make it difficult to get to school if they miss the bus, impede students' participation in after-school activities, hinder parent involvement, and make it difficult to make friends and study with classmates. Students may also face increased discrimination that could result in placement in less rigorous courses, lower teacher expectations, or disproportionate discipline. Lastly, students may face social challenges from racial isolation such as bullying or discrimination from their peers. These potential drawbacks make it unclear if students will benefit academically from enrolling in suburban schools.

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[2]See *Milliken v. Bradley (1974), Parents Involved in the Community Schools v. Seattle School District No. 1* (2007), and *Meredith v. Jefferson Co. Board of Ed* (2007).

This project identifies the causal effect of attending a suburban, high performing school on the academic outcomes of students of color in Boston, Massachusetts. Students and families who choose to apply for the METCO program may be different than the average Boston student in ways that cannot be observed in administrative school records. For example, applicant parents may be more involved with their child's schooling or may expect their child to take advanced coursework. Focusing on families that applied to the program controls for unobservable characteristics that led families to apply. To compare the outcomes of admitted applicants to non-admitted applicants, I collected and digitized 56 years of detailed application records. This lengthy digitization process resulted in a new database of the 60,000 applicants to the METCO program from its start in 1966 to present day.[3] This paper studies applicants who first enrolled in school between 1991 and 2020. Earlier applicant cohorts and the impact on suburban students in METCO receiving districts are estimated in Setren (2023*a*,*b*).

Restricting to the sample to students who applied to METCO addresses the major source of selection bias. Students should have received offers to enroll in METCO in the order in which they applied based on school districts' preferences for grade-level, gender, and race groups. However, the waitlist order was not strictly followed, in part due to file disorganization and lack of an active list of applicants ordered by application date. Deviations from the waitlist order are particularly concerning if students who are likely to have stronger academic performance are more likely to receive offers. To address this and check for selection bias, I use a rich set of baseline characteristics from the application files and birth records. I find little evidence that applicants with offers are substantially more advantaged than those without offers, after controlling for their approximate waitlist position. Applicants with offers have similar parental educational attainment, family structure, neighborhood characteristics, government healthcare receipt, and health at birth compared to those who do not receive offers. Controlling for these characteristics does not affect the point estimates. Any bias in offer status would need to be orthogonal to these traits. Following the bounding method in Altonji, Elder and Taber (2005) and Oster (2019), I find that selection on unobservables would need to be 15 times as large as selection on observables for the true treatment

[3]Application records came from the METCO, Inc. offices and the Northeastern University METCO Archives. In total, there were over 250 Bankers Boxes of paper application files that were hand-entered. Rosters of enrolled students and applicants supplemented the applicant records and were hand entered or scanned with Optical Character Recognition software, depending on the readability of the archival files.

effect to be equal to zero. Lastly, within family comparisons of siblings with and without offers find similar program effects.

After demonstrating the comparability of students with and without offers, I estimate the impact of receiving an offer to the program and the impact of participating in the program. Offers to enroll in suburban districts serve as instrumental variables and all models control for approximate waitlist position using age at the time of application, gender, and race controls. Therefore the estimates compare the outcomes of those who enroll in METCO to applicants with similar demographics, who applied at similar times, but did not enroll because they were not selected from the waitlist.

I find large positive effects on academic achievement. Students score up to 0.13 standard deviations higher in Math in grades 3 through 10 and 0.14 - 0.21 standard deviations higher in English. METCO enrollment increases school attendance by three to nine days a year despite the farther distance and fewer public transit options if students miss the school bus. The program also decreases the likelihood that students are suspended by about one-third. Participating in METCO increases SAT taking and scores, but lowers AP exam taking. The program increases the likelihood that students graduate from high school on time by 13 percentage points, and reduces the dropout rate by more than half. METCO increases four-year college aspirations by 17 percentage points, college enrollment by 21 percentage points, and college graduation by 12 percentage points. It also increases earnings in Massachusetts by $16,250 per year at age 35.

Attending suburban schools has larger effects for students whose parents did not go to college and for boys. METCO shifts students to schools with a 20 percentage point higher rate of 4-year college enrollment than applicants' counterfactual schools. This change in college-going expectations has the largest impact on students who would be the first generation in their family to go to college; METCO substantially increased their aspirations and enrollment in 4-year colleges. The finding that impacts are largest for boys is consistent with Chetty and Hendren (2015)'s finding that boys have worse outcomes from neighborhood racial isolation compared to girls. The results suggest that boys have the most to gain from reduced racial isolation.

Participation in the program changes the types of peers, teachers, courses, and school traits that

students encounter. Students with METCO offers attend schools where on average 81 percent of students plan to attend 4-year college, compared to 62 percent for those without offers. METCO students also attend schools with higher college and high school graduation rates. Their classmates score an average of 0.4 standard deviations higher on the Math and English standardized exams. METCO reduces exposure to novice teachers and it reduces class sizes by about two students on average.

METCO also leads to changes that could negatively impact student's outcomes. Participants have less exposure to teachers of color and Gershenson et al. (2022) found improved educational achievement for Black students who have at least one Black teacher. METCO participation results in changes to special education classification, which has an unclear impact on student outcomes. Students in METCO are more likely to be classified as special education and receive special education services in an inclusive setting. METCO participants are less likely to receive special education services in a separate classroom. Participants attend schools with more AP class options, but are no more likely to take advanced coursework. METCO students are more likely to be tracked to lower performing Math and English classes. It is difficult to know the exact impacts of these differences, but it is possible that the METCO impacts could be larger with increased access to advanced courses, more Black role models, and lower special education classification rates.

With newly assembled applicant data for the full length of the program, this study is uniquely poised to analyze the impact of the METCO desegregation program. A rich qualitative literature (Boardman and Brandt, 1968; Clarke, 1975; Orfield et al., 1997; Eaton, 2001; Elliott, 1998) has provided narratives of the student and parent experience in METCO. Armor (1972) compared a small number of METCO students with their non-participating siblings and did not find benefits to academic achievement or race relations. Mantil (2022) uses OLS to compare the elementary and middle school test scores of METCO applicants with and without offers from seven birth cohorts and the high school graduation and college enrollment rates for three cohorts. Angrist and Lang (2004) find no evidence of negative peer effects of urban students on suburban students in the Brookline school district. This project builds upon that work by harnessing the applicant and birth record data to analyze a broader range of outcomes, heterogeneities, and mechanisms for the full set of cohorts and districts.

This research contributes to the literature on the effects of court-ordered and voluntary desegregation by analyzing the short and long-term causal impact of a long-running, high-profile desegregation program.[4] Guryan (2004) and Reber (2010) find that the high school graduation rate of Black students increased with school desegregation. Johnson (2011, 2019) find positive effects of court-ordered school desegregation on Black students' educational, career, earnings, and health outcomes with reduced likelihood of incarceration and no effect on White students. Tuttle (2019) finds that court-ordered busing of Black students to formerly majority White schools induced them to live in higher income neighborhoods in adulthood. The results suggest that the effects stem from reductions in class size and increases in per-pupil spending. Anstreicher, Fletcher and Thompson (2022) find that the positive impacts are driven by students who were exposed to integration for the majority of their schooling years and and attended school in the South. They find null effects in other regions. Bergman (2018) studies ten cohorts of a smaller desegregation busing program in Ravenswood City, California and finds positive effects on test scores and college enrollment and increased special education classification and non-violent offense arrests. This paper adds to the literature by studying the largest and longest running voluntary integration program using a rich set of administrative data. This allows for a larger sample than previously studied in the voluntary desegregation literature: 30 cohorts across 33 suburban school districts. The paper also estimates a broader range of outcomes including college persistence, graduation, and earnings, investigates heterogeneous effects by family characteristics and district, and analyzes mechanisms including classroom tracking, teacher and peer characteristics, and school resources.

This paper relates to literature on the impact of school choice on student outcomes. Angrist et al. (2022) and Cordes, Rick and Schwartz (2022) find that students who traveled farther to get to school in Boston and New York City's within-district school choice programs did not benefit; test scores and college enrollment did not increase and their attendance rates fell. Compared to these programs, METCO students have on average longer bus rides and experience a larger increase in school performance. Other work finds that intra-district school choice can improve test scores, increase advanced course taking, increase college attainment, and reduce crime (Deming et al., 2014; Deming, 2011; Hastings and Weinstein, 2008), while

[4]See Schofield (1991) and Schofield and Hausmann (2004) for detailed reviews of the literature.

others find minimal academic effects (Cullen, Jacob and Levitt, 2006). Campos and Kearns (Forthcoming) find that within-district school choice in Los Angeles improves student achievement and college enrollment for the sector, in part through competitive effects. Bruhn (2023) finds that students earn higher test scores and take more advanced courses when they enroll in a different school district of their choice. A related literature analyzes the impact of non-traditional public schools and finds largely positive effects for urban charter schools and minimal effects for selective admissions schools (Abdulkadiroğlu, Angrist and Pathak, 2014; Abdulkadiroğlu et al., 2016; Angrist, Pathak and Walters, 2013; Dobbie and Fryer, 2011, 2014; Lucas and Mbiti, 2014; Muralidharan and Sundararaman, 2015; Angrist et al., 2016). The METCO program is distinct from these other modes of school choice because the magnitude of the change in school and peer characteristics that students experience is much larger. This study adds to this literature by identifying the impact of a dramatic shift in the school outcomes, peer traits, and demographic composition of a school. Since this project isolates the impact of enrolling in a high-performing suburban school while holding students' home neighborhood fixed, it also relates to the literature on how school and neighborhood quality impact student outcomes (Sanbonmatsu et al., 2006; Bergman et al., 2024; Laliberté, 2021; Chetty and Hendren, 2018; Chetty, Hendren and Katz, 2016; Kling, Liebman and Katz, 2007; Chyn, 2018).

The next section provides background on the METCO program. Section 2 explains the data sources, Section 3 shows the types of students who apply for the program, and Section 4 overviews the application process and selection issues. The next section overviews the identification strategy, followed by the results. Section 7 discusses the METCO treatment by detailing how it changes the school, teacher, peer, and course characteristics students experience. Section 8 presents the heterogeneity results and Section 9 concludes.

1 Background

Origin of the METCO program

METCO formed in the wake of intense opposition to integrating Boston Public Schools and improving school quality for Boston's Black students. Inadequate school facilities and resources, overcrowding, and de facto segregation led to a series of protests and school boycotts from Black parents, students, and com-

munity members. A State Board of Education commission to study school segregation in Boston concluded that the racial imbalance in Boston harmed both Black and White students, but the recommendations of the commission were denounced by the Boston School Committee, who refused to take action.

Faced with opposition from the School Committee, Black parents forged their own integration program called Operation Exodus – busing over 400 students from overcrowded schools to under-enrolled schools outside of predominantly Black neighborhoods. This evolved into the METCO program. The school committees of Boston suburbs Brookline, Lexington, Newton, and Wellesley voted to accept Black students from Boston in January 1966. Four other districts followed suit and in the Fall of 1966, 220 K-11 students from the city of Boston enrolled in suburban schools. Initially intended as a temporary program until desegregation was implemented in Boston Public Schools, METCO expanded as new districts elected to participate. Meanwhile, court-ordered integration in Boston sparked intense opposition and a series of within-city desegregation busing plans.

To join the METCO program, the town's school committee, town council, or equivalent voted to participate. Then METCO decided whether to accept the district. Several districts were turned down because there was widespread opposition to the METCO program and the town approved METCO by only a small margin.[5] METCO accepted new districts until 1975. Stakeholders in suburban districts supported the program for a range of reasons. Throughout the history of the program, METCO's mission statement and materials have highlighted that suburban districts benefit from participation by giving their students the opportunity to learn in a racially and ethnically diverse environment.[6] Potential advantages include cross-cultural knowledge, reduced racial prejudice, and increased preparedness for living and working in a multicultural setting. Suburban supporters of joining METCO emphasized the benefits of multicultural exchange and also stressed the moral imperative of participating. Op-ed pieces in newspapers highlighted the moral urgency of participating in the program and religious figures across several towns spoke out in support of the program.[7]

Except for four districts that ended their participation, after joining METCO, districts have contin-

[5]METCO rejected Beverly, Georgetown, Randolph, and Winchester in 1974 and Winchester was also rejected in 1967.
[6]See METCO (2024, 1976).
[7]Examples of this are documented in Chanoux (2011)'s analysis of the METCO archives and archival newspaper sources.

uously enrolled METCO students.[8] The city of Springfield started its own METCO program with four nearby suburbs. It currently enrolls 150 K-12 students a year. Appendix Figure 1 shows the growth in METCO enrollment as new districts joined and relatively stable enrollment of over 3,000 students since the 1980s. This study focuses on Boston's METCO program.

Once a student is accepted into a METCO suburban district, they can remain enrolled in that district until they graduate. Suburban METCO districts vary in the amount of services they provide urban students. Each district has a METCO Director who oversees the program and enrollment process. Some districts have additional services to support students academically, socially, and emotionally and to increase the inclusion of METCO students in the school district. These include late buses for after-school activity participation, tutoring, access to social workers and counselors, and social programs to foster relationships with students and families at the school. In addition, METCO urged the suburban districts include African and African-American history and culture in the curriculum and exclude racial stereotypes.[9] METCO also encouraged the districts to hire Black teachers and staff.[10] Today, METCO is working with suburban districts to help them strive to be antiracist institutions (Bleichfeld, 2023).

Funding

Districts receive $8,900 on average for each METCO student, though this amount varies by district and year.[11] Some of the funding comes from a state METCO grant which provides approximately $5,000 per student. The remaining funding comes from the general state education budget which is calculated from student enrollment.[12] Since the state aid is based off of total enrollment and is not itemized into funding for METCO and resident students, it is not transparent to districts how much funding they receive from the METCO program beyond the grant.[13]

[8] Milton, Dockland, Hamilton-Wenham, and Framingham ended their METCO programs.

[9] "Guidelines for Metropolitan Boston Communities...," 1970, METCO Archives.
"METCO Handbook," 1976, METCO Archives.

[10] "Guidelines for Metropolitan Boston Communities...," 1970, METCO Archives.

[11] Apfelbaum, Katherine and Ardon, Ken, "Expanding METCO and Closing Achievement Gaps." Pioneer Institute White Paper No. 129. March 2015.

[12] The state funding formula uses districts' prior year student enrollment and allocates more funding for certain grade levels, English Learners, and low-income students.

[13] Apfelbaum, Katherine and Ardon, Ken, "Expanding METCO and Closing Achievement Gaps." Pioneer Institute White Paper No. 129. March 2015.

Since METCO students typically fill empty classroom seats instead of causing new classrooms to be formed, the districts pay the marginal cost of a student. Under this model, it's possible that districts do not incur costs of hiring new classroom teachers. Districts cover the cost of transportation, special education services, instructional materials and costs, salaries for a METCO program director, and salaries for other program support staff, like counselors.

2 Data

Applicant data

To study the short and long run impacts of attending suburban schools through the METCO integration program, I collected application records from the start of the program in 1966 to the present. Families filled out paper applications and submitted all required paperwork to the METCO office. Each student's files were stored in their own application folder. I digitized the paper application folders into a database with a team of archivists, students, and data entry professionals.

The database includes applicants' names, date of birth, application date, race, gender, home address, and sibling names. We also noted whether the applicant had a sibling in METCO at the time they applied or received an offer. If the applicant received an offer, we collected the date of the offer and the suburban district they received an offer for. METCO staff wrote this information on the applicant file of those who received offers. We manually entered the handwritten METCO staff notes and application forms because they could not reliably be digitized by a computer software. Often the notes about offers or siblings were written in abbreviations on the folders or on top of application paperwork. These were discernible to a human eye, but would not be accurately collected by a computer.

Starting in 1991, METCO staff entered applicant information from the paper forms into an electronic database. Applicants still filled out paper applications and the selection process (described below) used this paper file-folder system. Staff did not always update the electronic database after giving a student an offer so I combine information from the electronic and paper files to determine whether and when a student received an offer.

I also collected and digitized additional information from applicant and enrollee rosters. A portion of these could be digitized through scanning and Optical Character Recognition (OCR) software. Some were not consistently legible to the OCR and were manually entered. These supplemented the applicant folders by providing another source of offers and applicant names to check the electronic database and paper files against. Files came from the Northeastern University METCO Archives and METCO, Inc's offices. In total, I digitized over 250 Bankers Boxes of application files and rosters to create a database of the 60,000 applicants to the METCO program.

State administrative education records

I match applicant names and dates of birth to the state administrative student-level data for the 2001-2002 through 2022-2023 school years. This paper focuses on applicants who entered first grade in Fall 1990 through 2019 because they have state administrative outcomes data.[14] I exclude the most recent cohorts so that I can look at test score outcomes. Eighty-nine percent of applicants match to the K-12 education data (see Appendix Table 1). Those who do not match either never attended public school in Massachusetts or I was not able to confidently match them.[15] This match rate is comparable to other matches of Boston residents to state education data.[16] METCO offers increase the likelihood that applicants appear in the K-12 administrative data by 5.8 percentage points (this differential match rate is discussed in the results section and the appendix). The analysis sample for K-12 outcomes includes the nearly 15,000 students who applied to METCO before first grade and did not have sibling preference.

Appendix Table 1 details the cohorts, match rates, and sample sizes for each set of outcomes. The sample for each outcome is restricted to the grade cohorts that have administrative data available for the year they reached that age or grade-level. Therefore, the main specifications of the paper use different grade cohorts of students based on how old they are in the available data. For example, cohorts that enter

[14] I analyze the long run social and civic outcomes of the 1966-2010 applicants and their peers in Setren (2023*b*).

[15] See Data Appendix A.1 for details about the matching process.

[16] Setren (2021) gets a 94 percent match rate among Boston charter school applicants. We would expect a lower match rate for the METCO program since students can apply years before they enroll in Kindergarten (and therefore enter the state administrative data), while charter applicants apply the year before the grade they apply for. Since there is a longer time span between application and enrollment, METCO students are more likely to move out of state before they could appear in the state education data. See Appendix A.1 for more details on the matching procedures.

the first grade in 2002-2003 through 2016-2017 appear in analysis of third grade outcomes while twelfth grade outcomes include those who enter first grade in 2002-2003 through 2010-2011. The college outcomes are available for applicants who entered first grade in 1994-1995 through 2005-2006. Earnings data at age 35 available for those who started first grade in 1990-1991 through 1993-1994. Results are robust across the different analysis samples (see Appendix Table 2 and discussion in Section 6.6

The Massachusetts Department of Elementary and Secondary Education (MA DESE) provided data on enrollment, race, ethnicity, gender, low-income status, special education status, English Learner status, standardized test scores, attendance, and suspensions. College preparation data includes SAT and AP information from 2007 - 2022 from the College Board and students' plans for after high school from a tenth grade survey.[17] Data also include high school graduation and dropout.

To understand how the program impacts the types of teachers, courses, and classroom peers that students encounter, I merge in school staffing data from the Education Personnel Information Management Systems (available from 2007-2008 through 2022-2023) and course information from the Student Course Scheduler (available from 2011-2012 through 2022-2023). This contains staff titles, years of experience, licensure status, "highly qualified" status, whether teachers have advanced degrees, race, and gender. Class data contains teacher and student linkages, which allows us to investigate peer characteristics. It also contains course titles and grades earned. I categorized the course titles to distinguish advanced coursework, core subject area, foreign languages, and the arts.

College data

The National Student Clearinghouse (NSC) database provides college enrollment, persistence, and graduation data. I received NSC data for applicants who enrolled in grades 8-12 in a Massachusetts public school from MA DESE. To include students who attended private or out of state high schools and therefore did not appear in the MA DESE college data, I pulled NSC records for any students aged 18 or older in 2022 who did not appear in the MA DESE's college data.[18] The college analysis sample includes those projected to graduate high school in 2006 through 2017 to have a balanced panel of applicants six years

[17] I use students' highest score on Math and Verbal if they take the SAT more than once.

[18] NSC matched the students using name and date of birth.

following projected high school graduation. College enrollment and persistence estimates are robust to including more recent cohorts that have not reached college graduation age yet. The college data are not biased by differential attrition because all applicants, including those who did not attend Massachusetts public schools, were matched if they had a college enrollment record in NSC.

Employment & earnings

Employment and earnings data from a partnership between Massachusetts Department of Unemployment Assistance (DUA) and MA DESE. It contains information for applicants who enrolled in Massachusetts public school when they were 14 or older between 2001 to 2023. The DUA data contains 2010 through 2023 quarterly wages and the industry (NAICS) code for workers covered under the unemployment compensation program. This excludes federal and military jobs, self-employment, and jobs outside of Massachusetts. The data also exclude those who never enrolled in a Massachusetts high school so it has a similar attrition problem as the high school results. As a result, the estimates should be interpreted as the effects on earnings in Massachusetts for those who attended a Massachusetts high school. Individuals were matched using name, date of birth, and social security number (only available for those who attended a public Massachusetts university). Over 85 percent of students in the sample who graduated a Massachusetts public high school have a DUA record. The K-12, college, and labor market outcomes have different grade cohorts in their samples due to data availability (e.g., earnings outcomes at age 25 through 35 are only available for the older cohorts). Appendix Table 1 shows the grade cohort ranges, samples sizes, and match rates across the analysis samples and Appendix Table 2 shows that results are robust across the overlapping grade cohorts in each of the samples.

Birth records

Since families can apply to METCO starting in infancy, the education records cannot serve as baseline variables. The Massachusetts Department of Public Health provided birth record data which I matched to applicants using name and date of birth. Applicants who were born outside of Massachusetts do not appear in this data. Socioeconomic baseline controls include parents' educational achievement at the time

of birth and whether prenatal or delivery healthcare were paid for by the government. Neonatal health measures, including birthweight, gestational age, and APGAR scores, are predictive of special needs Elder et al. (2021) and can help control for unobserved family income and health factors. Data also include whether the parents are married, whether there are two parents listed on the birth certificate, the number of older siblings, and parents' race. The census tract of the parents' home address can be linked to Census data to get characteristics of their neighborhood. I do the same linkages with the census tracts of their neighborhoods at the time they apply to METCO. In the K-12 sample, I have birth records for 77 percent of applicants that did not receive offers and 80 percent for those with offers (see Appendix Table 1). Match rates around 64 percent for earnings outcomes and not differential by offer status.

3 Descriptive statistics

Panel A of Table 1 describes the demographics of the applicant sample (Column 1) and their peers in Boston (Column 2) and suburban schools (Column 4). The racial demographics of METCO applicants during the study period reflect the program's original goals of promoting Black-White integration. Over 70 percent of applicants are Black: twice the rate of Boston Public Schools students that did not apply to METCO. Latinx students comprise 20 percent of the applicant pool, compared to 42 percent of the BPS non-applicants. Asian students and White students are also under-represented in the applicant pool.[19]

The METCO program substantially adds to the diversity of the suburban schools, which still predominantly enroll White students. METCO participants are bussed to suburban districts with 3.1 percent Black, 6.6 percent Latinx, and 10.3 percent Asian students. Participation in METCO exposes students to a peer group that is 77 percent White instead of 12 percent White if they remain in Boston Public Schools.

Students with disabilities that might require additional transportation assistance like a smaller bus or an aide are less likely to apply for METCO.[20] Only 2.4 percent of applicants have one of these disabilities compared to 3.4 percent of BPS students that did not apply.

[19]In recent years, METCO recruitment efforts have strove to make the pool of METCO students reflective of Boston's racial and ethnic diversity (Vaznis, 2019).

[20]These disabilities include physical, autism, emotional, intellectual, multiple disabilities, sensory (hearing or vision), neurological, and developmental delay disabilities. Disability identification may vary by the school a student enrolls in, but these are among the less variably diagnosed disabilities with the exception of autism.

Immigrant families are also underrepresented: they are over eight times less likely to apply for METCO compared to BPS non-applicants. This underrepresentation partially stems from the timing of their arrival in the Boston area: children that apply at an older age are less likely to be admitted from the waitlist and immigrant students on average apply later than non-immigrant students.

Access to public pre-school is similar across applicants (26 percent) and those that do not apply for METCO (23 percent). Applicants live across the city of Boston, with 42 percent coming from Dorchester, 17 percent from Mattapan or Roslindale, and 16 percent from Roxbury. Unfortunately, I do not have neighborhood information for non-applicants. Neighborhood representation is similar for students who ultimately enroll in the program, suggesting that students are similarly likely to accept offers across neighborhoods.

Panel B of Table 1 shows that participating in the METCO program exposes students to peers with different outcomes and classifications than they would have experienced otherwise.[21] About 59 percent of METCO participants are classified as economically disadvantaged, compared to only 10 percent of their suburban peers.[22] In contrast, the rates in Boston are around 74 percent. When students participate in METCO, they attend schools with lower rates of special education classification and English Learners than they would have in Boston schools. English Learners comprise about 30 percent of Boston compared to four percent of suburban districts. About 24 percent of Boston has a special education status compared to 19 percent in the suburban METCO districts. METCO participants have classmates that rarely get suspended: under one percent of suburban peers get suspended in the fifth grade. METCO applicants who enrolled in BPS or Boston charter schools attend schools with substantially higher suspension rates. METCO participants also have peers with average attendance around 95 percent, marginally higher than rates in Boston schools. Lastly, enrolling in METCO leads to a major change in classmates' academic performance. Suburban residents score 0.45 standard deviations above the state mean on standardized

[21]Since enrollment choices, outcomes, and classifications (such as English Learners, economically disadvantaged, and special education) vary over time, Table 1 shows the sample in grade 5 to describe a grade level where testing outcomes are available and the most common charter entry grade has passed.

[22]Economically disadvantaged is a designation by the Massachusetts Department of Elementary and Secondary Education for those that qualify for free or reduced price lunch from 2000 - 2014 and who participate in at least one of the following state programs: the Supplemental Nutrition Assistance Program (SNAP), the Transitional Assistance for Families with Dependent Children (TAFDC), the Department of Children and Families' (DCF) foster care program, or MassHealth (Medicaid).

Math and English tests while Boston students score below the state mean.

Panel C of Table 1 indicates that METCO applicants come from a range of family backgrounds. There is a mix of family structures among METCO applicants at the time they were born. About 38 percent of applicants had married parents, 24 percent did not have a father listed on their birth certificate, and the rest had two unmarried parents. Fifty-three percent of applicants' parents received government assistance to pay for medical costs related to the birth. This suggests that about half of METCO applicants come from low-income families.

METCO applicants' parents have varied levels of educational achievement. Twelve percent of mothers and 8.7 percent of fathers did not complete a high school degree. Over 17 percent of parents graduated from a 4-year college and about 10 percent earned a 2-year degree and did not pursue more education. The most common education level for parents is completing a high school degree and not enrolling in college (37 percent for mothers and 43 percent for fathers). Starting a college degree but not finishing is also common (23 percent for mothers and 19 percent for fathers).

Columns (2) and (4) of Panel C of Table 1 shows that METCO participation places students with peers who have substantially higher parental education and marriage levels, lower Medicaid receipt, and lower levels absent fathers.[23] METCO participation shifts students from having peers with family structure similar to their own, to peers where 92 percent were born to married parents. In the METCO program, students' peers have higher income levels, with eight percent receiving government assistance at birth compared to more than half in Boston Public Schools. Instead of the range of peer parental educational achievement levels students would experience in Boston, METCO students have peers where only two percent didn't complete high school and 69 percent complete college.

Thirty-four percent of Boston students apply to the program and 11 percent enroll in METCO for at least one grade-level. Over half of all Black Boston students ever apply to METCO, compared to 20 percent of Latinx students. For comparison, 35 percent of Boston students applied to charter schools in 2013 (Cohodes, Setren and Walters, 2021). The high demand reflects that parents think that METCO will offer a better educational experience for their children.

[23]Defined as no father or second parent is listed on the birth certificate.

4 Application and admissions process

To apply for the METCO program, parents or guardians completed application forms and submitted proof of Boston residence. Parents could apply at any point after their child's birth through 12th grade. About 70 percent of applicants apply before first grade. When suburban districts planned for the following year's enrollment, they told the non-profit organization that administers METCO in Boston, METCO, Inc., how many spaces were available for METCO students for each grade. In addition to requesting students for certain grades, suburban districts could also request gender and race for incoming students to balance the gender ratio in the classroom or increase representation of certain racial groups (i.e., if a school had few Black students, but a substantial Latino population, they could request Black students). Then, METCO, Inc. chose students within that grade, gender, and race category to give an offer to the district.[24] Districts sent METCO, Inc. their enrollment requests from February to early Fall, whenever the district was ready.

As the districts notified METCO of available spots, METCO chose applicants and notified families. Parents were not able to express preferences over districts. For example, if Weston Public Schools notified METCO they had two seats for first grade girls and two seats for first grade boys in April, then METCO would offer Weston seats to two first grade boys and girls. The parents could choose to accept or decline the offer to that district. While parents may have preferred certain districts, the staggered timing of when districts notified METCO of availability made it too complicated for parents to game the students' application timing to get offers to a specific district.

Parents were more likely to accept offers from nearby districts. If a student declined an offer, they were supposed to lose their place on the waitlist. In some cases, the district declined to accept the student and then the student returned to the top of the waitlist. In other cases, families were kept on the waitlist if METCO mistook whether the student was ready for first grade versus kindergarten and an older sibling was already enrolled in a different district. I consider only first offer date and district in the analysis since there may be selection into getting a second offer. After receiving and accepting an offer, the parent worked with the suburban school district to enroll.

[24]Due to this aspect of the offer process, I control for gender and race indicators in all analyses, including the balance tests.

Students were supposed to receive offers under a waitlist system that gave priority to those who applied earliest, within grade, gender, and racial subgroups. The waitlist system was not followed, in part because the file cabinets that held the application folders were not organized by waitlist order. METCO staff selected students to receive admissions offers from the file cabinets, searching until they found students that met the district's grade, gender, and race request. Non-adherence from the waitlist due to file disorganization is likely unrelated to student's future academic performance. However, deviations from the waitlist due to parents checking in with admissions could result in more privileged students getting offers. The potential biases in the admissions process are addressed in the next section.

I restrict the sample to students who applied before first grade. This reduces the potential selection issues, since families have not yet interacted with the school system and the METCO office has no knowledge of the students' academic ability. Furthermore, few older applicants without sibling preference received offers so the sample size would not be adequate.

5 Identification strategy

5.1 Balance across METCO offer status

Column 2 of Table 2 shows the difference between those with Kindergarten or first grade METCO offers and those who applied but did not get offers. The comparison controls for the applicant characteristics that impact likelihood of admissions according to the waitlist policy: grade, race, gender, and linear and quadratic age of application. The sample excludes those with a higher likelihood of admissions due to an older sibling who was in the program.

Less than two percent of applicants have a disability that may affect their busing needs and those with offers are 0.6 percentage points less likely than those with offers. Only two percent of applicants are immigrants and there is no significant difference in offers by immigrant status. About 30 percent of applicants attend public pre-K in Massachusetts, which is similar across offer status.

Applicants with and without offers lived in similar neighborhoods at the time they applied: Dorchester was the most common neighborhood followed by Roxbury, Mattapan, and Roslindale. At the Census

block group level, applicants' neighborhoods have similar demographics. On average, the neighborhoods of applicants both with and without offers have similar proportions of adults with high school degrees (27 percent) and college degrees (18 percent). About 54 percent of households are run by single parents. Single parent household rates and median gross rent are also not statistically significantly different across applicants who get offers and those that do not. There are some small, statistically significant differences in homeownership rates and public assistance receipt by offer status. On average, those without offers live in neighborhoods where 36 percent of households own their homes. Neighborhood homeownership rates are 2.5 percentage points higher on average for those with offers. Those with offers live in neighborhoods where 29 percent of households receive Supplemental Nutrition Assistance Program (SNAP) or public assistance income receipt. Those with offers live in neighborhoods where the assistance take-up is less than 1 percentage points lower.

Applicants with and without offers have similar health metrics at birth and similar rates of married parents. Fathers' level of education is similar across offer status. However, there are differences for mother's education. Those with offers are 4.3 percentage points more likely to have mothers that completed college (21 percent of the non-offered mean). Those with offers are 3.4 percentage points less likely to have mothers that stopped their schooling after receiving a high school diploma (9.7 percent of the non-offered mean). Column 3 and 4 shows similar balance when I change the endogenous variable from getting an offer in Kindergarten or first grade to ever getting an offer.

While some small differences between those with and without offers remain for mother's education, father absenteeism, and Medicaid, restricting to the sample that applied to METCO reduces a large portion of selection bias. Columns 5 and 6 show comparisons of traits between METCO participants and all Boston public school students. Without restricting to who applied, we see much larger differences between METCO and non-METCO Boston residents. with statistically significant differences for all available characteristics.[25] This shows selection bias into applying for the program: immigrant students, students with absent fathers, and students on Medicaid are less likely to apply for the program while students with married parents and more educated mothers and fathers are more likely to apply. Restricting the sample

[25]Neighborhood and Census block group information is not available for the non-applicants.

to applicants removes the vast majority of these differences. For example, the imbalances in the mother having a college degree is 0.04 for the applicant sample compared to 0.15 for the full Boston sample. The imbalance for Medicaid receipt at birth fall from 0.24 to 0.07. For infant health, parent's marital status, father's education, and two year or some college for mothers there are no longer statistically significant differences.

While restricting the sample to applicants reduces selection bias, I conduct additional robustness checks (discussed in Section 6.5 below) to address concerns about the imbalances across offer status. Results are robust to controlling for parental educational attainment, family structure, neighborhood characteristics, government healthcare receipt, and health at birth. Any remaining selection bias would need to be orthogonal to these detailed traits. I also show bounding estimates following Altonji, Elder and Taber (2005) and Oster (2019) which find that selection on unobservables would need to be 15 times as large as selection on observables for the true treatment effect to be equal to zero. Lastly, within family comparisons of siblings with and without offers find similar program effects to the main results.

5.2 Empirical specification

To estimate the effect of METCO, I compare the outcomes of those who applied and received an offer to those in the same application timing, gender, and race groups that did not receive an offer. I use 2SLS analysis to adjust for the fact that not all students with METCO offers accept them. To identify the causal impact of METCO for the students that are induced to participate in METCO once they get an offer (the compliers), offers to attend METCO districts will be used as instrumental variables. Since METCO gives offers to specific school districts and the rate of participation for those with offers varies by district, using district-specific offer indicators as instruments improves the first stage (see Appendix Figure 3).

The second stage is as follows:

$$y_{igt} = \alpha_t + \gamma_g + X_i^{'}\theta + \varphi M_{igt} + \epsilon_{igt} \tag{1}$$

where M_{igt} indicates whether student i participates in METCO in grade g and year t. I include fixed

effects for their projected first grade entry year α_t and control for whether they are in the applicant pool for kindergarten and/or first grade γ_g. Baseline demographic characteristics from the time of application, represented by vector X_i', include gender, race, economic disadvantaged status, home neighborhood indicators,[26] immigrant status, and age at the time of application in months (linear and squared).[27] Controls also include whether the student has a documented disability by first grade that may require special transportation and whether the student is ever categorized as an English Learner. Since siblings of current METCO participants get priority off the waitlist, students are removed from the analysis for the year and grade combinations when they were on the waitlist, but had an older sibling already enrolled in the program. Results are robust to including control variables from birth records (parental educational achievement, parents' marital status at birth, whether a father was listed on the birth certificate, infant weight, APGAR 5 score, and whether Medicaid paid for prenatal and birth medical care).[28]

The parameter φ captures the causal effect of METCO enrollment. The first stage equation is as follows:

$$M_{igt} = \lambda_t + \delta_g + X_i'\Gamma + \pi \sum_d Z_{idgt} + \eta_{igt} \tag{2}$$

Indicators for whether the student received a METCO offer to each of the individual suburban districts d serve as instrumental variables for participation in METCO. They are noted as $\sum_d Z_{idgt}$ where Z_{idgt} equals one if applicant i receives an offer from district d by grade g and year t.

[26]Neighborhood indicators come from the address listed at the time of the application and include downtown Boston, Dorchester, Roxbury, Mattapan and Roslindale, and other neighborhoods.

[27]Results are robust to including age at time of application in months as a series of indicator variables or as a linear variable.

[28]The main specifications do not include the birth records control because they restrict the sample size too much for labor outcomes at age 35. Appendix Table 3 shows that results are similar for test scores, high school outcomes, college outcomes, and earnings at age 25 and 30.

6 Results

6.1 Test score & behavioral outcomes

Getting a METCO offer substantially increases years of METCO enrollment, indicating a strong first stage (see the first row of Appendix Table 4). Getting an offer at some point between Kindergarten and the third grade increases METCO enrollment by two years on average.[29] Other grade levels similarly have large and statistically significant relationships between METCO offers and years in the program. The first stage increases less than one to one for later grades because the instruments are defined as receiving an offer at some point between Kindergarten and the outcome grade and some students leave METCO after enrolling and some get offers in later grades. Ever receiving an offer to attend METCO (receiving an offer before 12th grade) increases the likelihood of enrolling by 79 percentage points (see Table 3) and increases the years spent in METCO by 7.2 years compared to those who never receive an offer.

METCO enrollment leads to higher test scores and attendance rates and lower suspension rates as shown in Table 3. Students who applied before first grade but never participated in METCO scored 0.40 standard deviations below the state average on the end of year third grade Math exam. The METCO program substantially moves students closer to the state average. Attending a suburban school boosts applicants' third grade test scores by 0.12 standard deviations in Math and 0.19 in English. Effects of attending suburban schools in fourth and fifth grades are similar and statistically significant. Middle school Math effects are less robust, with statistically insignificant, positive point estimates for six and seventh grade and a significant effect of 0.9 standard deviations for eighth grade. METCO participation increases 10th grade test scores by 0.13 standard deviations. Effects for English Language Arts are larger and more robust. METCO enrollment leads to 0.14 to 0.21 standard deviation gains across grades three through 10.

Using years spent in METCO instead of whether the applicant participated in METCO in a specific grade, gives the average impact of a year spent in METCO instead of the cumulative effect. For third grader applicants, each year in the METCO program increased their Math test scores by 0.04 standard

[29]For conciseness, I show the effect of any offer on METCO participation, but the main specifications use instruments for offers from each of the 33 districts and therefore have 33 separate first stages. Table 3 shows that the F-statistic for these instruments is strong and above 135.

deviations on average (see Appendix Table 4). Subsequent grade levels have comparable effect sizes, around 0.03 standard deviations for grades 3 through 5 and around 0.01 standard deviations for grades 6 through 10. While the effects in early grades are larger than those in 6 through 10, they are not statistically significantly different. Results are also larger in earlier years for English, with average effects of 0.03 to 0.06 per year in grades 3 through 5 and 0.02 in grades 6 through 10. However, these differences are not statistically significantly different. Overall, the average annual effects show consistent positive impacts of suburban enrollment throughout grade levels.

To put these results in context, by third grade, METCO participants are one-third closer to the state test score average in Math and 49 percent closer in English than those without offers. The METCO test score gains for 10th graders bring them close to the state mean in English and 50 percent closer to the state mean in Math.

Students in METCO likely have fewer back-up transportation options if they miss the school bus. Their schools are farther away and likely less connected to public transit. Because of this, we might hypothesize that METCO reduces attendance. I do not see evidence of this: students in METCO have marginally higher attendance rates. Third graders who do not get METCO offers have a 91 percent attendance rate. Participating in METCO significantly increases attendance for nine of the grade levels with effects ranging from 2.0 to 5.1 percentage points. Therefore METCO increases attendance by three to nine days a year.

About five percent of applicants without offers get suspended in the third grade. Suspension rates for this group reach over 14 percent in middle and high school. Participation in METCO lowers the likelihood of suspension substantially by 2.8 to 6.8 percentage points for grades three through nine. Effects are not statistically significant for 10th through 12th grade.

6.2 High school graduation & college preparation

Participating in METCO increases the four-year high school graduation rate by 13 percentage points. It also increases the likelihood of graduating high school in five years by six percentage points. METCO reduces the high school dropout rate by 3.3 percentages points which is a 75 percent reduction (see Table 4).

Table 4 shows mixed effects of the METCO program on outcomes related to college preparedness. METCO makes students five percentage points more likely to meet the standardized testing requirements for high school graduation in Massachusetts. These requirements are based on 10th grade Math, English, and Science test scores. Meeting this requirement also means that students continue with a college-preparatory course load instead of remedial coursework.

The Massachusetts merit-based Adams Scholarship is based on students' relative rank in their school. Since METCO students perform relatively worse than their suburban peers on the state exams, participating in METCO makes them 12.9 percentage points less likely to earn this scholarship. While this means students have reduced aid options, it could have a positive effect on their likelihood of college completion. Cohodes and Goodman (2014) find marginally winning this scholarship induces students to choose lower quality colleges and in turn lowers likelihood of college completion.

METCO participation increases the likelihood of taking the SAT by 17.5 percentage points. Thirty-six percent of applicants who do not participate in METCO score at least an 800 or higher on the SAT. Participating in METCO increases this likelihood by 16.3 percentage points. Attending the suburban schools also boosts the likelihood students earn SAT scores of at least 1,000 by 8.8 percentage points. METCO increases the likelihood that students earn 1,200 or higher on the SAT by 2.2 percentage points, a 40 percent increase compared to non-participants.

However, METCO does not increase the likelihood that students earn high SAT scores of 1,400 or more, which only 1.2 percent of applicants achieve. Attending the suburban schools reduces the likelihood students take an AP exam by five percentage points and lowers the average number of AP exams students take. It does not affect the likelihood of scoring a passing score of three or higher.

METCO shifts students' aspirations for after high school towards 4-year colleges. In a survey administered to 10th graders, METCO participants are 10.9 percentage points more likely to say that they want to go to college. In addition to increasing college-going aspirations overall, METCO shifts decreases the odds students go to 2-year colleges by 5.9 percentage points and increases the likelihood students aspire to 4-year colleges by 16.7 percentage points. Given the relatively lower completion rates in 2-year colleges in Massachusetts, students setting their sights on 4-year colleges could have a positive impact on college

completion.

6.3 College outcomes

Table 5 shows the impact of METCO participation on college enrollment, persistence, and characteristics. Increases to college enrollment from the METCO program are larger than the increases in college aspirations. About 67 percent of non-METCO applicants enroll in college. Attending a suburban school increases college enrollment by 17.7 percentage points. Students are similarly likely to enroll in 2-year colleges and 21.3 percentage points more likely to enroll in 4-year colleges. This reflects a 48 percent increase in 4-year college enrollment. Students are more likely to enroll in both public and private 4-year colleges, but the largest growth is 4-year private college enrollment.

Panel C of 5 shows the impact of METCO in the Barron's rankings of college students choose. METCO increases the likelihood students enroll in competitive colleges. Students are 17.8 percentage points more likely to enroll in schools ranked as competitive or higher. This suggests that the increases in college enrollment are met with similarly large increases in enrollment in competitive colleges. METCO students are 3.4 percentage points more likely to enroll in the next highest tier, very competitive, and 2.1 percentage points more likely to enroll in the second highest tier, highly competitive. METCO increases enrollment in the most selective category by 0.8 percentage points, a 31 percent increase relative to the applicants who didn't participate in METCO.

Panels D and E explore whether the program changes the likelihood students persist through and graduate from college. METCO increases the likelihood students persist through college with effects declining in later semesters. METCO students are 20.5 percentage points more likely to persist to the second year of college. They are 18.6 percentage points more likely to reach junior year and 16.7 percentage points more likely to reach senior year. Ultimately, they are 11.8 percentage points more likely to graduate with a 4-year degree. Therefore, METCO increases college persistence, but not all students who are induced to enroll in college persist. The increase in 4-year college graduation reflects a 51 percent increase from the 23 percent graduation rate among the comparison group. Similar to the enrollment findings, METCO does not change the likelihood of graduating from a 2-year college while also increasing the overall college

completion rate.

Attending majority White elementary and secondary schools might lead students to feel more comfortable on less diverse college campuses or increase their desire to attend more diverse colleges. On average, METCO applicants choose colleges where the student body is 52 percent non-White and 30 percent Black or Latinx. METCO participation induces students to choose colleges with marginally fewer Black and Latinx students. While METCO increases the likelihood of attending an Historically Black College or University (HBCU), but this could be driven by the fact that METCO increases college enrollment overall.

6.4 Labor market outcomes

Table 6 shows that METCO improves earnings and increases the likelihood of working in Massachusetts. At age 25, METCO increased earnings in Massachusetts positions that contribute to payroll taxes by $7,708 annually.[30] This effect size is more than double the non-METCO average of $4,819. By age 30 and 35, METCO has a larger positive effect on earnings of $14,091 and $16,250 respectively.

These estimations count the annual average salary as zero if individuals are unemployed, work out of state, or have jobs that don't contribute to payroll taxes. Column 3 shows that over seventy-five percent of applicants that never attended METCO do not appear in the Massachusetts wage data at age 25. METCO increases the likelihood that applicants appear in the data and therefore work in Massachusetts, by 23 percentage points. This pattern continues through age 30 and 35.

Since the labor data excludes those who work out of state or for non-payroll tax positions, it is difficult to disentangle how much of the earnings and employment effects are due to METCO reducing unemployment, out of state moves, or non-payroll tax positions. To make progress on this, Columns 5 through 8 restrict the sample to individuals who appear in the Massachusetts labor data at least once between the ages of 19 and 35. This removes the approximately one third of the sample who lived out of state for their 20s and early 30s and those who only had non-payroll tax positions. After this restriction, we see that METCO participants are not more likely to be employed at age 30 or 35. This means that employment effects in Column 4 are driven by an increased likelihood to live in state and/or a reduced likelihood of working

[30]Federal, military, or self-employment earnings do no contribute to payroll taxes.

in non-payroll tax positions. The income effects persist in this restricted sample (Column 6), meaning that METCO alumni who work in Massachusetts for at least one year from ages 19 to 35 earn more than applicants who did not attend METCO. This means that the differential rates of appearing in the labor data across offer status does not fully explain the income results.

Columns 9 and 10 show the earnings mean and effects for those that have non-zero earnings. The average salary among non-METCO alumni that work in Massachusetts at age 35 is $40,559 while those that participated in METCO and work in Massachusetts earn $16,000 more. The effect sizes are similar to Column 2 where annual earnings were equal zero for those missing from the labor data. This means that the earnings differentials are not fully driven by the higher rates of METCO participants in the wage data, but also stem from higher earnings among the employed.

6.5 Selection bias

Next, I run a series of robustness checks to address concerns about selection bias that stem from imbalances for mothers' education levels, absentee fathers, and Medicaid receipt across offer status and the non-adherence to the waitlist system. While those who applied at a younger age were more likely to be admitted, only 51 percent of those who applied before turning one year old were admitted (see Appendix Figure 2). The random aspect of this non-adherence which comes from file disorganization is likely unrelated to student's future academic outcomes, but deviations from the waitlist that come from parents checking on the status of their child's application could lead to more privileged students getting offers.

A key concern for selection bias is if parents increased the likelihood of their child getting offers by contacting the admissions office. If this happened, then those with offers may have more motivated parents or parents with more flexible schedules. Those parent traits could make children with offers pre-disposed to perform better in school. Age of application can proxy for parent motivation, since it is related to parent's knowledge of schooling options, how eager they are to apply to the METCO program, and their ability to navigate the application system. Controlling for this proxy for parent motivation does not alter the point estimates. This means that after controlling for who applies, there does not appear to be positive selection along application timing. Results are also stable whether the birth record and neighborhood traits are

included as controls (see Appendix Table 3 and Data Appendix A.3 for a full discussion).

The stability of the results to the inclusion of rich baseline controls means that any remaining bias from non-randomness in offers would need to stem from unobservables that are orthogonal to age of application (and the related motivation and knowledge of schooling options), neighborhood characteristics, health at birth, family structure, income status at birth, and parent's education. The identification strategy assumes that any non-randomness in the offer process is adjusted for by comparing students who applied at similar ages with a rich set of characteristics in common.

To investigate the imbalances across offer status in Medicaid receipt, absentee fathers, and parent education, I use the full set of baseline characteristics to predict college enrollment and graduation among the applicants that do not participate in METCO (see Appendix Table 5). I estimate a one percentage point difference in the predicted college enrollment and graduation of those with and without offers. This suggests that the small differences in baseline traits between the offered and non-offered groups do not generate the large college outcomes effects.[31]

Selection bias could remain if some parents are more likely to follow up with the admissions office in a way that is orthogonal to application timing, neighborhood characteristics, parent education, Medicaid receipt, race, and other baseline traits. Appendix Table 6 shows the sensitivity analysis proposed by Altonji, Elder and Taber (2005) and Oster (2019) for a range of outcomes from elementary school test scores to earnings at age 30. Column 2 shows the proportion of variation in outcomes that is explained by the full set of baseline controls. Column 3 displays the how large the selection on unobservables, δ, would need to be for the treatment effect to equal zero. I follow the suggested assumption in Oster (2019) that the maximum R-squared in a model that includes all unobserved and observed variables is 1.3 times the R-squared from the model with all observable controls. Selection on unobservables would need to be 19 times as large as selection on observables for METCO to have no impact on 10th grade English exam results. Column 4 shows the bias-adjusted intent to treat estimate, assuming that the amount of selection on unobservables equals the amount of selection on observables (δ =1). The bias adjustment yields a 10th grade English exam effect of 0.075 standard deviations similar to the unadjusted intent to treat estimate

[31]The differences in baseline traits explain at most five percent of the college enrollment effect and 8 percent of the college graduation effects.

of 0.078 (see Column 4).

If I make a more conservative assumption that the maximum R-squared in a model that includes all unobserved and observed variables is two times larger than the R-squared from the model with all observable controls, then selection on unobservables would need to be 5.8 times as large as selection on observables for there to be no METCO impact on 10th grade English scores (see Column 6). It is unlikely that the unobservables are over five times as important than parental education, parent marital status, Medicaid receipt, infant health, race, neighborhood characteristics, disability status, immigrant status, and application timing combined in explaining selection.

The results for elementary and middle school test scores, high school graduation, college outcomes, and earnings also have large δ estimates. Selection on unobservables would need to be at least five times as large as selection on unobservables using the R-squared ratio of 1.3 and over two times as large using the R-squared ratio of two. The adjusted intent to treat estimates in Column 5 are similar to the estimates that do not adjust for selection on unobservables in Column 4. For the true impact of METCO to be null, there would need to be unobservables that are orthogonal to the rich set of baseline characteristics that explain a much larger portion of selection than the observable traits.

Lastly, I estimate a parent fixed effect model to control for any unobservable parent and household characteristics, such as parent motivation. Appendix Table 7 compares the outcomes of siblings where at least one participates in METCO and at least one applied, but did not participate (Columns 2 through 4). The OLS estimates show a large and statistically significant relationship between participating in METCO and academic outcomes after controlling for family fixed effects. Columns 5 through 7 display comparisons of siblings who received METCO offers to those that did not. These intent to treat estimates also find that siblings who are offered a seat in METCO overall are substantively more likely to graduate high school on time, aspire to a 4-year college, and graduate from a 4-year college. Combined, the sensitivity tests suggest that the findings are rather robust to selection bias concerns.

6.6 Attrition

Receiving a METCO offer makes students 5.8 percentage points more likely to enroll or remain in Massachusetts public schools and therefore have K-12 education outcomes in the state administrative data. The high match rate of applicants to K-12 education records (89 percent) lessens attrition concerns. However, the differential attrition by offer status means that not receiving an offer makes students more likely to enroll in private or out of state schools. If on average those students are pre-disposed to do better academically, then differential attrition would lower the average outcomes of the non-offered group and lead to overestimatation of the METCO program's impact on K-12 outcomes. Labor market outcomes, which are only available for former Massachusetts public high school students, also have this differential attrition problem. Appendix Table 8 shows the tests for differential attrition by METCO offer status for the various outcomes in the data and Data Appendix A.3. discusses attrition in more detail.

The college data does not have this differential attrition problem since I search for all applicants, including those who never enrolled in or left Massachusetts public schools, in the National Student Clearinghouse (NSC) data. Therefore, private school or out-of-state K-12 students are included in college outcomes. Attrition is more difficult to measure with NSC data because students do not match to the college data if they do enroll in college. Therefore, not matching reflects an outcome of interest - that the student did not enroll in college.[32] Any attrition in college results would stem from college enrollees not matching to the college data due to typos or variations in spelling. Typos and spelling differences should be similar across offer status. As a result, the college results are unlikely to be biased from differential attrition.

One approach to understanding the extent of bias is to look at two similar outcomes across the K-12 data which is subject to differential attrition concerns and the college enrollment data which does not have differential attrition. I find that METCO increases the likelihood students aspire to attend 4-year college in 10th grade by 17 percentage points which is similar to the actual 4-year college enrollment effect of 21 percentage points. The similarity of these estimates suggest that differential attrition is not leading to a large overestimation of the high school effects.

[32]Dynarski, Hemelt and Hyman (2015) find that NSC covers over 95 percent of Massachusetts colleges and universities and over 90 percent of US undergraduate institutions in 2011. Over time NSC's coverage has increased and the college outcomes for this paper start in 2013 (Dynarski, Hemelt and Hyman, 2015).

Appendix Table 9 shows the range of intent to treat effects using Lee bounds (Lee, 2009). I also use the rich baseline characteristics to predict who will not match to the state administrative education data and estimate the impact of METCO for those predicted most likely to attrit in Appendix Table 10. Both exercises find that high school graduation, dropout, SAT, and college aspirations estimates are robust to attrition concerns (see Data Appendix A.3. for a full discussion).

The earnings and employment data face similar attrition concerns as the high school outcomes because METCO offers decrease the likelihood students enroll in a public high school in Massachusetts – the sample that is matched to the earnings and employment records. Among the sample that enroll and graduate from Massachusetts public high school over 85 percent appear in the adult earnings data. Therefore, attrition concerns for earnings outcomes should be similar to those of high school graduation. Foote and Stange (2022) argue that Lee bounds are inappropriate to understand attrition for state administrative employment records because the bounds are wide and uninformative. While there is not a good bounding exercise for labor outcomes, the robustness of high school graduation to attrition concerns and the positive effect on college graduation in data that is not subject to differential attrition can increase our confidence in positive labor effects. If instead, we want to conservatively interpret the labor results, then they estimate the impact of the program on earnings and enrollment in Massachusetts among those who attended Massachusetts public high schools.

The test score estimates, particularly Math, are less robust to attrition (see Appendix Table 9 and Appendix Table 10). I cannot rule out that the true effect of METCO on test scores is null or negative. In contrast to the other Lee bounds outcomes, the test scores are noisier, continuous variables which make precise Lee bounds estimates less likely. To reduce noise, I also look at an binary variable for test performance: whether the student meets proficiency status on their high school Math or English exam. The Lee bounds estimates suggest we can rule out negative effects on passing rates. I find a lower bound of close to zero and an upper bound of a 14 percentage point increase in proficiency in Math and 9.5 percentage point increase in proficiency for English.

6.7 Robustness across cohorts

Appendix Table 2 shows that results are robust across the different grade cohorts used in the analysis. For example, the fifth grade test score estimates are similar for the cohorts used in the college outcomes sample and the fifth grade outcomes sample. Grade 10 test score results are large, positive, and statistically significant for the cohorts used in high school, college, earnings at age 30, and earnings at age 35 analysis samples. METCO increases 4-year college enrollment rates by 21.1 percentage points for the set of students who reach age 19 in the data and increases enrollment by 28.3 percentage points for those who reach age 35 (the labor outcomes sample).

7 Impact on school experience

The above analysis shows that attending a suburban school changed the trajectory of METCO applicants. The program increased 4-year college aspirations, enrollment, and graduation and resulted in higher earnings in adulthood. To describe the change in educational environment that yielded these results, this section details how the program altered the school, teacher, class, and peer traits that students experience.

7.1 School type & characteristics

To understand how attending METCO impacts students' school experience, it's important to know what types of schools students attend if they don't receive METCO offers. Panel A of Table 7 shows the types of schools students enroll in after applying to METCO for grades 4, 7, and 9 to give snapshots of elementary, middle, and high school choices. Column 2 shows the types of elementary schools for those who did not receive offers by first grade. Almost 40 percent choose Boston Public Schools, nine percent enroll in a Boston charter school, and almost 20 percent move to another district. Of that 20 percent, only four percent move to a METCO suburb to attend as a resident (instead of through METCO as a Boston resident). The remainder move to other non-METCO suburbs which are often other urban school districts. Thirty percent of students leave the state or attend private school in fourth grade. About two-thirds of those students are in private school or out of state for all of elementary school. Lastly, six percent of

students without first grade offers receive an offer to enroll in METCO by fourth grade.

In middle school, enrollment in charter schools increases while BPS enrollment declines for those who didn't receive METCO offers by first grade. Students also shift within BPS: seven percent enroll in a selective exam school which accept students starting in seventh grade. Seventeen percent of students remain in private or out of state schools up until the seventh grade, with some shifting out of Massachusetts public schools and about four percent switching in. High school has similar enrollment patterns as middle school. It is uncommon to enter METCO in middle and high school after not receiving an offer by first grade. Most METCO students that enter in later grades applied after first grade. By 9th grade, 16 percent of those without offers never enrolled in Massachusetts public schools. While I have no K-12 outcomes data for these individuals who never enrolled in Massachusetts public schools, they appear in the college outcomes analysis.

Panel B of Table 7 shows the average high school outcomes of schools applicants attend. On average, applicants who received METCO offers by first grade attend high schools with better high school graduation rates and higher 4-year college aspirations, enrollment, and graduation rates. Those with offers attend schools where 81 percent of students aspire to attend a 4-year college. This is about 20 percentage points higher than the average rate for those without offers. Similarly, average 4-year college enrollment is about 20 percentage points higher and 4-year college graduation rate is 12 percentage points higher in the schools of students with offers compared to those without. Therefore METCO offers are substantially shifting the school norms around college going that students experience.

On average, METCO students attend schools with higher average teacher salary, higher spending per pupil, and smaller class sizes. Table 8 shows that average teacher salary is about $3,000 higher in METCO compared to non-METCO. Average spending per pupil is on average $300 less. These spending and salary differences vary by METCO district and the types of schools non-offered students attend. For example, Boston Public Schools have higher per pupil spending and average teacher salaries than many METCO districts. METCO participants also experience smaller class sizes with 2.5 fewer students per class on average (see Table 9). For elementary grades, this results in a class size of 20.9 versus 23 and for high school, a class size of 18.1 versus 21.5.

7.2 Teacher characteristics

Table 8 shows that on average, METCO participation exposes students to more experienced teachers. METCO students' middle school core class teachers have on average one more year of experience. The difference is 0.97 years in elementary school and over one year in high school. Eighteen percent of non-METCO students' teachers have fewer than two years of teaching experience. Having novice teachers is over seven percentage points less likely for METCO participants.

The teachers of non-METCO students are about 80 percent White and 20 percent Black or Latinx. Participating in METCO reduces exposure to teachers of color by about five percentage points and increases the proportion of White teachers. Given evidence on the positive high school graduation and college enrollment effects of having at least one Black teacher for Black students, this may have a negative effect (Gershenson et al., 2022).

7.3 Peers

Participating in METCO results in a substantial shift on the demographics and outcomes of applicants' peers (see Table 9). It more than doubles the presence of White peers in students' classes and more than halves the presence of Black or Latinx students. Over 50 percent of non-METCO participants' classmates are low-income, which is over 35 percentage points higher than those who participate in METCO.

METCO participants have a higher proportion of special education peers in their classes, even though the suburban schools have overall lower special education rates than Boston schools. This suggests METCO students may be placed in classes with higher levels of special education need. Reflective of the lower presence of English learners in the suburban schools, METCO students have fewer English learner classmates than their non-METCO peers.

METCO participants have higher performing peers in their core classes compared to applicants without METCO offers. The lagged Math and English test scores of METCO participants are over 0.4 standard deviations higher than non-participants' peers. These differences are present in elementary, middle, and high school grades.

METCO participants have classmates in core subject-areas with slightly higher attendance rates and

substantially lower suspension rates than their non-METCO peers. Non-METCO ninth graders have classes where 13 percent of their classmates on average were suspended in 8th grade. METCO ninth graders attend districts with lower rates of suspension overall and their classmates are 6.5 percentage points less likely to have been suspended. Middle school METCO students have about 50 percent fewer peers with a prior suspension and elementary school METCO students have about 100 percent fewer peers with prior suspensions. This reflects overall lower suspension rates in METCO schools and may indicate that METCO students experience fewer classroom disruptions due to discipline.

7.4 Course offerings & taking

The program alters the types of course offerings that applicants have access to and take. METCO increases the number of foreign language classes, and arts classes that students have access to (see Panel A of Table 10). Participants take advantage of these offerings by completing 0.39 more years of a foreign language and taking more Arts, Math and Science courses (see Panel B of Table 10).

METCO participation also exposes students to a wider variety of AP courses. Despite the access to more rigorous classes, METCO students are less likely to take AP courses and are more likely to be placed in relatively lower performing classrooms. To measure the degree of tracking, I take the average lagged test scores of each core class in a given school and grade. Then I note the distance of the class average to the grade average. METCO participation increases the chance that students are in Math and English classes with relatively lower performing peers.

Panel B of Table 9 shows these tracking estimates. The average non-METCO student takes Math and English classes that have class lagged averages close to the grade mean (see Columns 1, 3, and 5). This suggests that on average, students are not tracked to lower performing classes. METCO students take Math classes where their peers score approximately 0.34 standard deviations below the grade mean on average in Math and 0.17 below the grade mean in English.

Tracking can also be measured as whether students are more likely to be in a class where the average lagged test scores are below the grade average. For non-METCO students, this happens about 43 to 48 percent of the time in English and 47 to 55 percent of the time in Math. METCO participants are 17 to 23

percentage points more likely to be in the lower performing class in Math and 14 to 17 percentage points less likely to be in the lower performing class for English. This indicates that applicants are more likely to be tracked to a relatively lower performing class within their grade and school in METCO.

The increased likelihood of tracking and negative effects for AP course taking suggests that METCO students do not have access to the most rigorous curricula within the suburban schools. It is possible that METCO could have a larger impact on college outcomes if AP course taking increased and participants were more often placed in higher performing core courses.

METCO participants also have classes with narrower skill distributions (see Panel B of Table 9). The average difference between the 90th and 10th percentile of lagged classmate scores is 2.2 standard deviations in fourth grade Math and English. The spread in prior performance is 0.035 standard deviations smaller for fourth grade math and 0.19 standard deviations smaller in English. This pattern continues in the middle and high school grades, with METCO resulting in a more narrow English class skill distribution by about 0.2 standard deviations. This means that METCO students are in English classes where students have more similar prior test scores. This may make it easier for teachers to differentiate and target the level of abilities in their classrooms.

7.5 Special education

Attending METCO increases the likelihood that students get classified as special education by an average of two percentage points per year (see Figure 1). This difference is driven by an increased likelihood of "full inclusion" classification where students remain integrated in general education classrooms for at least 80 percent of their school day. METCO participation marginally lowers the likelihood that students get placed in a substantially separated classroom. It is difficult to know whether it is a positive or negative that students have higher rates of special education classification. The higher rates of classification could lead to stigma and lower expectations, but the additional services could improve learning outcomes.

8 Heterogeneity

Participating in the METCO program shifts students from schools where about half of students enroll in a 4-year college to schools where over three-fourths pursue a 4-year degree. This shift in college expectations appears to have the largest impact on those that are the first generation in their family to go to college. Gains from METCO participation are driven by students whose parents did not graduate college. Table 11 shows that these students experience large and significant gains in the 10th grade Math and English exams, attendance, and suspensions. Their peers with at least one college-educated parent do not have gains in 10th grade Math and English – the estimate for Math is negative and not statistically significant and the estimate for English is close to zero and noisy. Effects for suspensions and attendance are similar across the two groups.

METCO increases 4-year college aspirations by 17 percentage points and 4-year college enrollment by 20 percentage points for students whose parents did not graduate from college. Attending the suburban schools also increases enrollment in the highly competitive colleges by 3.2 percentage points. METCO increases 4-year college graduation of first-generation college students by 15 percentage points.

The effects for students with at least one college-educated parent are not as strong. The impacts on 4-year college aspirations and enrollment are over a third smaller for those who have a college-educated parent. METCO does not have a statistically significant impact on these students enrolling in very, highly, or most competitive colleges. It only increases the likelihood students enroll in competitive colleges, the lowest Barron's competitiveness level. There is no significant difference in the likelihood they graduate college within 6 years.

Columns 9 and 11 of Table 11 show that applicants with and without college-educated parents have substantially different counterfactuals. Without participating in METCO, applicants with college-educated parents aspire to college at a rate similar to suburban resident students. For applicants with college-educated parents, enrolling in METCO does not place them in peer groups with higher college expectations than they would have had otherwise. In contrast, 55 percent of applicants whose parents did not graduate college aspire to go to a 4-year college if they don't enroll in METCO. Having peers who are more likely to aspire to college as well as teachers and administrators that expect the majority of the students to go to

college may play a key role in boosting college enrollment for those who had a lower likelihood of enrolling in college otherwise.

Table 11 also shows subgroup effects by gender and race. Columns 1 and 3 show that boys that don't participate in METCO have lower academic achievement than girls. The counterfactual 10th grade test scores for boys are about 0.16 standard deviations lower in Math and 0.39 standard deviations lower in English compared to girls' counterfactual scores. Suspension rates are higher and rates of taking the SAT are lower for non-participant boys compared to girls. Girls who don't enroll in METCO are about 20 percentage points more likely to aspire to, enroll in, and graduate 4-year college than boys who do not enroll.

Columns 2 and 4 show that METCO has a larger impact on male students. Test score gains are 0.19 standard deviations in Math and 0.29 standard deviations in English for boys. Gains for girls are 0.09 standard deviations in Math and 0.17 standard deviations in English. Gains in SAT taking and scores are appear larger for male students, but are not statistically significantly different than the gains for girls. METCO increases college aspirations and 4-year college enrollment for both boys and girls, but the effects are larger for boys (though not statistically significantly different). Boys increase their college enrollment by 23 percentage points and girls increase theirs by 18 percentage points. The program also increases enrollment in the most competitive colleges for boys, while the effect is positive but not significant for girls. The finding that boys experience larger gains from enrolling in a school in a wealthier neighborhood is consistent with Chetty and Hendren (2015) which finds boys are negatively impacted the most by highly segregated neighborhoods and Autor et al. (2019) which finds that family disadvantages harm boys' outcomes more than girls.

Columns 5 through 8 of Table 11 show that Black and Latinx students have lower counterfactual outcomes and experience larger gains from enrolling in suburban schools than students of other races for test scores. College outcomes are either comparable or stronger for Black and Latinx students compared to others. Combined, the gender, race, and parental education results show that those who have relatively lower academic performance and attainment get the strongest gains from the program.

Figure 2 shows the individual district effects for SAT and AP testing. Nearly all school districts generate

a increase in SAT exam taking, but there is heterogeneity in districts' effects on scores. Over half of the districts increase the likelihood that students score 1000 or higher on the SAT while others' effects are not statistically significantly different from zero at the 90 percent confidence level. Most districts have no significant effect on the likelihood that students score 1200 or higher on the SAT, but five increase high scores and one decreases the likelihood of high scores. Districts have differing impacts on AP exam taking and scores. While overall, METCO participation does not change AP outcomes, about half of the districts decrease the likelihood students take an AP exam (at 90 percent confidence level or higher) while five districts increase the likelihood students take an AP exam and the likelihood of passing an AP exam.

Most districts increase student aspirations to attend 4-year colleges and the rest have no statistically significant impact (see Figure 3). Districts either have a significantly positive or a statistically insignificant effect for enrolling in a 4-year competitive college and meeting the standardized testing high school graduation requirements. Most districts decrease the likelihood students are in the top 10 percent of their district and qualify for the Adams scholarship. The rest have no statistically significant impact on qualifying for the scholarship. On average, METCO doesn't increase the odds of attending one of the most competitive colleges (as classified by Barron's), but three districts increase the likelihood. In all, Figures 2 and 3 show largely similar effects across districts, where the individual district estimates are in the same direction as the overall estimate or imprecise. The exceptions are that a few districts generate higher SAT scores, AP test taking and scores, and enrolling in the most competitive colleges.

The impacts of the program are similar for districts that are relatively closer and farther from Boston. This suggests that on average, effects do not vary by time spent on the bus. Effects are also similar for districts that enroll the most and the least METCO students. Districts that have relatively more supports in place for METCO students also have similar impacts as districts that have fewer integration supports. These similar impacts are consistent with the overall similarity in individual district effects and suggest that the common factors of the program drive the results.

9 Conclusion

Over 70 years following the Supreme Court's *Brown v. Board* decision, school segregation persists in the United States. The problem has grown since the late 1980s and is linked to racial and socioeconomic inequities in school resources and achievement. School choice policy is a key policy lever to address these inequities. By studying the METCO school desegregation program, we can learn about the impacts of dramatically increasing school quality while holding home neighborhood fixed. There are 12 similar voluntary inter-district school integration programs in the U.S. and 46 states and D.C. have inter-district school choice. The short and long-run impacts of large shifts in school characteristics seen in this study could be instructive to other districts and states changing school assignment to promote equity and access across racial or socioeconomic lines.

I find large, positive impacts on academic performance, college going and graduation, and labor market outcomes. However, while students attend schools with more advanced courses available, they are less likely to enroll in AP classes and are more likely to be placed in the lower performing core classes. It is possible that the impacts of the program could be larger if students had access to the more rigorous classes in the suburban schools. Even with the increased likelihood of tracking, participation in METCO results in a large shift in peer achievement. METCO participants' classes have 0.45 to 0.61 standard deviations higher lagged test score averages than their counterparts. METCO participation leads students to have on smaller class sizes on average, better paid teachers, more experienced teachers, and better guidance counselor-to-student ratios. The program also shifts students to an environment with higher high school graduation rates where aspiring 4-year college is the norm. This environmental shift has the largest effect for boys and for students whose parents did not go to college. This is consistent with findings from Chetty and Hendren (2015) that show that boys have the most to gain from reduced racial isolation.

The study finds that large shifts in school and peer characteristics can boost college going and graduation and improve earnings. This highlights the potential for access to higher performing schools without moving neighborhoods to promote economic mobility. Future work will explore the civic and social impacts of the program and the intergenerational effects.

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Table 1: Descriptive Statistics of Boston and Suburban Fifth Graders

	Applicants (1)	Non-Applicants in Boston Public Schools (2)	Participants (3)	Suburban Peers (4)	Applicants Enrolled in Boston Public Schools (5)	Applicants Enrolled in Charter Schools (6)
Panel A: Demographics						
Female	0.498	0.486	0.548	0.493	0.470	0.495
Black	0.730	0.368	0.784	0.031	0.667	0.781
Latino/a	0.203	0.415	0.163	0.066	0.258	0.202
Asian	0.038	0.086	0.035	0.103	0.042	0.007
White	0.010	0.115	0.001	0.767	0.014	0.003
Disability that may affect bus needs	0.024	0.034	0.012	0.033	0.041	0.015
Participation in pre-K	0.264	0.231	0.216	0.139	0.292	0.340
Immigrant	0.020	0.170	0.018	0.043	0.030	0.019
Panel B: Outcomes & Classifications						
Economically disadvantaged	0.587	0.742	0.479	0.100	0.708	0.613
Special education	0.282	0.244	0.316	0.194	0.290	0.208
English learner (EL)	0.065	0.305	0.037	0.038	0.105	0.081
Suspension rate	0.079	0.048	0.025	0.007	0.066	0.206
Attendance rate	0.947	0.918	0.956	0.955	0.932	0.959
Math exam	-0.323	-0.429	-0.302	0.449	-0.424	-0.192
English exam	-0.292	-0.539	-0.181	0.447	-0.461	-0.219
Students	11,059	49,203	3,661	147,227	3,344	1,795
Panel C: Characteristics at Birth						
Infant weight (grams)	3,212	3,243	3,232	3,399	3,191	3,200
Parents married	0.376	0.401	0.449	0.917	0.316	0.333
Absent father	0.243	0.267	0.172	0.019	0.309	0.246
Government paid for birth	0.525	0.635	0.409	0.082	0.604	0.559
Mother's highest level of education						
Less than high school	0.124	0.275	0.066	0.021	0.178	0.091
High school degree	0.366	0.402	0.301	0.113	0.402	0.402
Some college	0.233	0.134	0.248	0.108	0.213	0.246
2-year college degree	0.103	0.054	0.136	0.069	0.077	0.116
4-year college degree or more	0.174	0.135	0.249	0.689	0.130	0.146
Father's highest level of education						
Less than high school	0.087	0.212	0.057	0.021	0.116	0.079
High school degree	0.434	0.453	0.392	0.151	0.487	0.463
Some college	0.192	0.120	0.214	0.103	0.171	0.184
2-year college degree	0.096	0.050	0.104	0.045	0.072	0.112
4-year college degree or more	0.192	0.166	0.233	0.679	0.154	0.162
Students with birth records data	12,103	29,364	2,937	110,062	6,797	3,435

Notes: Data is unique at the individual student level and contains students who attended 5th grade from the 2005-06 school year to the 2018-19 school year. Economically disadvantaged is defined by the Massachusetts Department of Elementary and Secondary Education for those that qualify for free or reduced price lunch from 2000 – 2014. In subsequent years, it is defined as those who participate in at least one of the following state programs: the Supplemental Nutrition Assistance Program (SNAP), the Transitional Assistance for Families with Dependent Children (TAFDC), the Department of Children and Families' (DCF) foster care program, or MassHealth (Medicaid). Disabilities that may affect bussing needs include physical, autism, emotional, intellectual, multiple disabilties, sensory (hearing or vision), neurological, and developmental delay disabilities. Disability identification may vary by the school a student enrolls in. Birth record data is only for students born in Massachusetts. Test scores are centered using the state mean and standard deviation for the given grade level and year. Applicants include those who applied before 1st grade enrollment. Non-applicants in BPS include those that never applied to METCO.

Table 2: Balance of Offer Status and Participation Status

	Grade K or Grade 1 Offers		Grade K - Grade 10 Offers		Participation in Any Grade	
	Non-offered Mean	Difference	Non-offered Mean	Difference	Non-Participant Mean	Difference from Participants
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Student Traits						
Disability that may affect	0.017	-0.006**	0.017	-0.007***	0.021	-0.012***
bus needs		(0.003)		(0.002)		(0.002)
Immigrant	0.021	-0.004	0.019	0.001	0.215	-0.184***
		(0.003)		(0.002)		(0.005)
Attended public pre-K	0.303	-0.013	0.310	0.000	0.262	0.016***
		(0.009)		(0.008)		(0.006)
	11,829	14,924	9,755	14,924	122,175	128,517
Panel B: Neighborhood & Census block group demographics						
Dorchester	0.398	-0.006	0.398	-0.013		
		(0.010)		(0.008)		
Roxbury	0.145	-0.004	0.142	0.004		
		(0.007)		(0.006)		
Mattapan & Roslindale	0.169	0.011	0.168	0.008		
		(0.008)		(0.007)		
% high school graduate	0.269	0.000	0.269	-0.001		
		(0.003)		(0.002)		
% college graduate	0.183	-0.003	0.184	-0.002		
		(0.002)		(0.002)		
% homeowner	0.357	0.025***	0.353	0.026***		
		(0.005)		(0.004)		
% single parent	0.539	0.005	0.538	0.003		
		(0.007)		(0.006)		
Median gross rent	1410.235	0.264	1407.947	11.873		
		(12.230)		(10.144)		
% receipting SNAP or	0.289	-0.008**	0.290	-0.010***		
public assistance income		(0.004)		(0.003)		
N	11,587	14,639	9,533	14,639		
Panel C: Birth Certificate Data						
Apgar 5	8.808	-0.001	8.806	0.005	8.833	0.029**
		(0.016)		(0.013)		(0.013)
Infant weight (grams)	3205.869	20.137	3211.540	-0.324	3246.392	39.477***
		(14.434)		(12.170)		(8.892)
Parents married at birth	0.383	-0.017	0.389	-0.024**	0.417	0.108***
		(0.011)		(0.009)		(0.007)
Absent father at birth	0.229	-0.027***	0.227	-0.018**	0.229	-0.128***
		(0.010)		(0.008)		(0.006)
Government paid for birth	0.520	-0.066***	0.527	-0.063***	0.609	-0.243***
or prenatal medical care		(0.012)		(0.010)		(0.007)
N	8,874	11,417	7,248	11,417	68,278	73,497
Mother's highest level of education						
High school degree	0.348	-0.033***	0.351	-0.040***	0.380	-0.116***
		(0.011)		(0.009)		(0.007)
Some college	0.230	0.006	0.226	0.012	0.147	0.067***
		(0.010)		(0.008)		(0.005)
2-year college degree	0.114	0.000	0.113	0.003	0.070	0.059***
		(0.007)		(0.006)		(0.004)
4-year college degree or mc	0.212	0.043***	0.213	0.039***	0.179	0.149***
		(0.010)		(0.008)		(0.005)
N	8,877	11,420	7,251	11,420	67,628	72,847
Father's highest level of education						
High school degree	0.321	0.004	0.322	-0.008	0.424	-0.156***
		(0.011)		(0.009)		(0.007)
Some college	0.142	0.014*	0.139	0.014**	0.125	0.017***
		(0.008)		(0.007)		(0.005)
2-year college degree	0.083	0.005	0.082	0.007	0.063	0.025***
		(0.007)		(0.006)		(0.004)
4-year college degree or	0.171	0.010	0.172	0.013*	0.207	0.066***
more		(0.009)		(0.007)		(0.006)
N	8,877	11,420	7,251	11,420	52,575	57,794
F-stat	3.319	-	5.186			
P-value	0.000		0.000			

Notes: This table shows the differences across offer and participation status. Coefficients from regressions of traits on METCO offer receipt for Kindergarten or first grade (Column 2) or any grade (Column 4) control for race indicators, gender, linear and quadratic age of application, and the years that applicants are in the offer pool. The sample for Columns 1 through 4 includes those who applied before first grade and excludes those with siblings already in the METCO program. Column 6 shows analogous results for the sample of students that ever attend BPS or participate in METCO. Controls include race and gender indicators. The sample includes those who attended primary or secondary school between 2001 and 2020. Columns 3 to 6 include students who applied in any grade and Columns 1 to 2 restricts to those who applied before grade 1.

Table 3: 2SLS Effects of METCO on Standardized Test Scores, Attendance, and Suspensions

	Non-METCO 3rd Grade Mean	Grade-level									
		3	4	5	6	7	8	9	10	11	12
Effect of any offer on participating in METCO											
Participation		0.667***	0.664***	0.656***	0.645***	0.627***	0.633***	0.603***	0.590***	0.584***	0.507***
		(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
Two-Stage Least Squares Results: Impact of METCO Enrollment											
Math	-0.403	0.118***	0.133***	0.121***	0.048	0.054	0.091**		0.132***		
	(1.059)	(0.035)	(0.033)	(0.035)	(0.033)	(0.034)	(0.035)		(0.044)		
N	7146	9008	8835	8172	8500	7858	7176		5486		
F-Stat		478	462	377	390	320	281		137		
P-Value		0.000	0.000	0.000	0.000	0.000	0.000		0.000		
English	-0.390	0.191***	0.204***	0.162***	0.135***	0.141***	0.180***		0.211***		
	(1.055)	(0.033)	(0.034)	(0.036)	(0.033)	(0.034)	(0.036)		(0.042)		
N	7612	9556	8830	8176	8517	7874	7188		5521		
F-Stat		533	457	374	389	319	280		136		
P-Value		0.000	0.000	0.000	0.000	0.000	0.000		0.000		
Attendance	0.907	0.026***	0.029***	0.024***	0.027***	0.020***	0.027***	0.051***	0.049***	0.044***	0.044***
rate	(0.176)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.007)	(0.009)	(0.009)	(0.009)
N	8868	11020	10379	9757	9609	9002	8232	7430	6474	5489	4916
F-Stat		581	499	426	424	347	302	255	151	193	178
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	-0.028***	-0.052***	-0.068***	-0.042***	-0.034***	-0.036***	-0.047***	-0.021	-0.013	-0.018
	(0.217)	(0.006)	(0.007)	(0.009)	(0.011)	(0.012)	(0.013)	(0.013)	(0.015)	(0.014)	(0.012)
N	8868	11020	10379	9757	9609	9002	8232	7430	6474	5489	4916
F-Stat		581	499	426	424	347	302	255	151	193	178
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 whether the student participates in METCO in that grade. The other rows report the 2SLS estimates of the impact of METCO participation in each grade on test score and behavioral outcomes. The endogenous variable is whether the student enrolled in METCO during that specific grade. All 2SLS models use individual school district METCO offers 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 4: 2SLS Effects of METCO on College Preparation

	Non-METCO mean (1)	2SLS Estimate (2)	Standard Error (3)	N (4)	F-Stat (5)	P-Value (6)
Panel A: High School Graduation						
Dropout	0.040	-0.033***	(0.006)	5014	487	0.000
Graduate in 4 years	0.793	0.130***	(0.013)	5014	487	0.000
Graduate in 5 years	0.912	0.059***	(0.009)	4131	485	0.000
Panel B: Testing						
Meets standardized testing high school graduation requirement	0.698	0.050***	(0.017)	4848	471	0.000
Qualify for Adams scholarship	0.216	-0.129***	(0.014)	4855	472	0.000
Take SAT	0.446	0.175***	(0.016)	6283	566	0.000
SAT 800 or higher	0.357	0.163***	(0.016)	6283	566	0.000
SAT 1000 or higher	0.178	0.088***	(0.013)	6283	566	0.000
SAT 1200 or higher	0.055	0.022***	(0.007)	6283	566	0.000
SAT 1400 or higher	0.012	0.002	(0.004)	6283	566	0.000
Took AP	0.289	-0.050***	(0.015)	6283	566	0.000
Number of APs	0.864	-0.276***	(0.054)	6283	566	0.000
AP Score Above 3	0.133	-0.002	(0.011)	6283	566	0.000
AP Score 4 or 5	0.076	0.001	(0.009)	6283	566	0.000
Panel C: Post High School Aspirations						
Any college	0.740	0.109***	(0.015)	4717	477	0.000
2-year college	0.172	-0.059***	(0.013)	4717	477	0.000
4-year college	0.569	0.167***	(0.017)	4717	477	0.000

Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on high school outcomes. All models use individual school district METCO offers as instrumental variables. See Table 3 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 3.

Table 5: 2SLS Effects on College Outcomes

	Non-METCO mean (1)	2SLS Estimate (2)	Standard Error (3)	N (4)	F-Stat (5)	P-Value (6)
Panel A: Racial Composition of College						
Percent Black or Latinx	0.303	-0.004	(0.011)	4129	99	0.000
Percent Non-White	0.527	-0.005	(0.012)	4129	99	0.000
Percent Attend historically Black college or university	0.026	0.040***	(0.009)	10476	96	0.000
Panel B: College Enrollment						
Any college	0.659	0.178***	(0.022)	12083	98	0.000
2-year college	0.256	-0.018	(0.022)	12083	98	0.000
4-year college	0.451	0.223***	(0.024)	12083	98	0.000
4-year public	0.195	0.054***	(0.020)	12083	98	0.000
4-year private	0.261	0.169***	(0.023)	12083	98	0.000
4-year public in MA	0.131	0.018	(0.017)	12083	98	0.000
Panel C: 4-year College Ranking						
Most competitive	0.027	0.030***	(0.008)	12083	98	0.000
Highly competitive	0.063	0.043***	(0.012)	12083	98	0.000
Very competitive	0.132	0.058***	(0.017)	12083	98	0.000
Competitive	0.389	0.171***	(0.024)	12083	98	0.000
Panel D: 4-year College Persistence+						
One academic semester	0.388	0.145***	(0.024)	12083	98	0.000
Three academic semesters	0.342	0.149***	(0.024)	12083	98	0.000
Five academic semesters	0.300	0.161***	(0.023)	12083	98	0.000
Seven academic semesters	0.262	0.134***	(0.022)	12083	98	0.000
Panel E: College Graduation within 6 Years+						
Any	0.262	0.137***	(0.022)	12083	98	0.000
2-year college	0.041	-0.021**	(0.010)	12083	98	0.000
4-year college	0.232	0.161***	(0.021)	12083	98	0.000

Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on college enrollment, persistence, and graduation. The balanced panel sample includes all applicants who were projected to graduate high school in 2006 through 2017. All models use individual school district METCO offers as instrumental variables. See Table 3 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 3 and to the unbalanced panel version which incorporates those who were projected to graduate high school in 2002 through 2021. Racial composition of college refers to the first college students enrolled in and is missing if the student did not enroll in college within two years of their projected high school graduation date. College competitiveness comes from Barron's rankings based on admissions rates.

Table 6: 2SLS Effects on Labor Market Outcomes

	Full Balanced Panel Sample				Ever Appears in Labor Data				Has Non-Missing Wages for Age	
	Annual Income in		Employed in MA		Annual Income in		Employed in MA		Annual Income in	
Age	Non-METCO Mean (1)	2SLS (2)	Non-METCO Mean (3)	2SLS (4)	Non-METCO Mean (5)	2SLS (6)	Non-METCO Mean (7)	2SLS (8)	Non-METCO Mean (9)	2SLS (10)
25	7,623	7,708**	0.349	0.228***	11,923	5,786**	0.546	0.119***	21,841	4,980**
		(1330)		(0.037)		(1,551)		(0.036)		(2,068)
30	16,105	14,091**	0.489	0.164***	25,190	10,001**	0.765	-0.010	32,936	12,757**
		(2304)		(0.041)		(2,639)		(0.037)		(2,792)
35	18,272	16,250**	0.450	0.164***	28,578	11,854**	0.705	0.014	40,559	16,041**
		(2827)		(0.042)		(3,281)		(0.041)		(3,738)
N	1,636	2,174	1,636	2,174	1,046	1,498	1,046	1,498	737	1,063
F-Stat		1183		1183		984		984		698
P-Value		0.000		0.000		0.000		0.000		0.000

Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on earnings and employment in Massachusetts. All models use whether the student received any METCO offer as an instrumental variable. See Table 3 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 3. The data are a balanced panel of those who reach age 35 and have matched to state administrative education data. This includes the cohorts that entered first grade in 1991 through 1994. Annual income is set to zero if someone has no earnings for each of the quarters in a year or does not appear in the Massachusetts Department of Unemployment Assistance data. Those with federal, military, or out of state jobs are not included in the data. Earnings from self-employment are also not included in the data.

Table 7: Average School Types and Outcomes by METCO Offer Status

	Grade 4		Grade 7		Grade 9	
	Has offer by 1st grade (1)	No offer by 1st grade (2)	Has offer by 1st grade (3)	No offer by 1st grade (4)	Has offer by 1st grade (5)	No offer by 1st grade (6)
Panel A: School Enrollment Type						
METCO	0.72	0.06	0.64	0.07	0.61	0.08
BPS (includes exam schools)	0.10	0.37	0.09	0.27	0.10	0.27
Boston charter	0.02	0.09	0.07	0.16	0.06	0.12
Exam school	0.00	0.00	0.04	0.06	0.04	0.08
Moved to public school out of Boston & not a METCO suburb	0.05	0.15	0.06	0.17	0.07	0.18
Moved to a METCO suburb	0.02	0.04	0.03	0.04	0.03	0.04
Out of State or Private	0.09	0.30	0.11	0.29	0.13	0.30
Always out of state or private (up to and including this grade)	0.03	0.21	0.02	0.17	0.02	0.16
N	2214	6781	2214	6781	2214	6781
Panel B: Average High School Outcomes						
Plan for 4-year college					0.81	0.62
Graduate high school in 4 years					0.92	0.82
Enroll in 4-year college					0.74	0.55
N					1903	4604
Graduate 4-year college					0.38	0.25
N					1872	4491

Notes: This table shows proportion of applicant that attend various types of schools by METCO offer status). Panel B shows the average outcomes for the schools that applicants enroll in by offer status. Grades 4, 7, and 9 show snapshots of elementary, middle, and high school traits.

Table 8: 2SLS Effects on Teacher Characteristics

	Grade 4		Grade 7		Grade 9	
	Mean	2SLS	Mean	2SLS	Mean	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Average teacher salary (district-level)	89,906	2,890***	88,096	2,917***	89,190	4,055***
		(163)		(190)		(225)
Average spending per pupil (district-level)	19,961	-189***	19,598	-406***	19,761	-391***
		(37)		(43)		(51)
Average students per guidance counselor	373	-109***	324	-137***	287	-162***
		(3.596)		(4.235)		(5.037)
% of teachers licensed in teaching assignment	0.959	0.038***	0.915	0.046***	0.959	0.054***
		(0.002)		(0.002)		(0.003)
% of core academic classes taught by highly qualified teachers	0.940	0.044***	0.898	0.052***	0.901	0.059***
		(0.003)		(0.004)		(0.004)
% of teachers with advanced degree	0.064	-0.017***	0.060	-0.023***	0.052	-0.025***
		(0.002)		(0.003)		(0.003)
Average years of teaching experience in MA	10.954	0.966***	9.281	1.168***	9.150	1.526***
		(0.083)		(0.097)		(0.116)
% novice teacher (<2 years)	0.180	-0.073***	0.243	-0.085***	0.194	-0.105***
		(0.004)		(0.004)		(0.005)
% new to school (<2 years in school)	0.113	-0.055***	0.180	-0.064***	0.119	-0.078***
		(0.003)		(0.004)		(0.004)
% White teachers	0.812	0.098***	0.796	0.120***	0.783	0.141***
		(0.004)		(0.004)		(0.005)
% Black or Latinx teachers	0.195	-0.117***	0.219	-0.141***	0.189	-0.166***
		(0.003)		(0.004)		(0.005)
Average Math teacher Value-Added Measure (VAM)	0.049	-0.031***	0.075	-0.038***	0.060	-0.045***
		(0.002)		(0.003)		(0.003)
Average English teacher VAM	0.239	-0.144***	0.282	-0.174***	0.245	-0.206***
		(0.004)		(0.005)		(0.005)
		86317		86317		86317

Notes: This table reports the 2SLS estimates of the impact of participating in METCO in grades 4, 7, or 9 on teacher characteristics in core classes. All models use individual school district METCO offers as instrumental variables.See Table 3 notes for the full list of control variables. Value-added measure is calculated following Chetty, Friedman, and Rockoff (2014). Results are robust to controlling for birth record variables listed in Table 3.

Table 9: 2SLS Effects on Classroom Characteristics

	Grade 4		Grade 7		Grade 9	
	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Classmate characteristics (lagged)						
Math exam	-0.267	0.455***	-0.228	0.501***	-0.347	0.559***
		(0.009)		(0.009)		(0.010)
English exam	-0.277	0.491***	-0.256	0.546***	-0.376	0.613***
		(0.008)		(0.009)		(0.010)
Attendance rate	0.938	0.021***	0.934	0.025***	0.902	0.031***
		(0.001)		(0.001)		(0.001)
Suspension rate	0.038	-0.041***	0.101	-0.052***	0.125	-0.065***
		(0.001)		(0.001)		(0.002)
% Low income	0.573	-0.347***	0.544	-0.418***	0.527	-0.499***
		(0.003)		(0.003)		(0.004)
% White	0.199	0.324***	0.233	0.398***	0.250	0.477***
		(0.003)		(0.004)		(0.004)
% Black or Latinx	0.703	-0.383***	0.672	-0.462***	0.653	-0.550***
		(0.003)		(0.004)		(0.005)
% Special Education	0.230	0.034***	0.248	0.035***	0.257	0.039***
		(0.003)		(0.003)		(0.004)
% English Language Learner	0.184	-0.067***	0.112	-0.082***	0.102	-0.096***
		(0.002)		(0.002)		(0.003)
Average class size	23.236	-2.338***	22.581	-2.806***	21.477	-3.369***
		(0.168)		(0.198)		(0.235)
N		86317		86317		86317
Panel B: Tracking						
Difference between lagged average test scores of class' and the grade's						
Math	0.000	-0.310***	-0.043	-0.343***	-0.088	-0.392***
		(0.008)		(0.009)		(0.009)
		45297		45297		45297
English	0.016	-0.162***	-0.013	-0.171***	-0.041	-0.188***
		(0.007)		(0.008)		(0.008)
		45294		45294		45294
Lagged average test scores of class are below the grade average						
Math	0.477	0.174***	0.487	0.199***	0.547	0.226***
		(0.008)		(0.008)		(0.009)
		45297		45297		45297
English	0.434	0.140***	0.442	0.155***	0.477	0.169***
		(0.008)		(0.008)		(0.009)
		45294		45294		45294
90th - 10th percentile of lagged scores						
Math	2.190	-0.034***	1.720	-0.032***	1.627	-0.033***
		(0.008)		(0.008)		(0.009)
		56921		56921		56921
English	2.191	-0.189***	1.837	-0.213***	1.782	-0.238***
		(0.008)		(0.009)		(0.010)
		56915		56915		56915

Notes: This table reports the 2SLS estimates of the impact of participating in METCO in grades 4, 7, or 9 on their core classroom characteristics. All models use individual school district METCO offers as instrumental variables. See Table 3 notes for the full list of control variables. Panel A uses the average of the classroom averages for individual applicants' core subjects. Each classroom average comes from the one-year lag of the characteristic except for average class size. The first two outcome variables in Panel B exclude classes that are smaller than five students, as well as school-grade-year-subject combinations where there is only one class (e.g., only one English class in that grade).

Table 10: 2SLS Effects on Class Options and Taking

	Non-offered mean (1)	2SLS Estimate (2)	Standard Error (3)	N (4)	F-stat (5)
Panel A: Course Offerings					
Number of AP classess offerred	15.481	8.217***	(0.403)	6061	548.319
Average number of foreign languages offered in elementary	0.452	0.180***	(0.021)	9578	555.011
in middle	1.597	1.053***	(0.046)	9130	654.441
in high school	2.938	1.820***	(0.068)	6061	548.319
Average number of arts course types offerred in elementary	2.080	-0.093***	(0.019)	9578	555.011
in middle	2.429	0.253***	(0.025)	9130	654.441
in high school	2.725	0.575***	(0.033)	6061	548.319
Panel B: Individual Student Course-Taking					
Take any AP classes	0.318	-0.047***	(0.015)	6752	560.175
Number of AP classes taken	0.864	-0.276***	(0.054)	6283	565.666
Years of HS Math	3.877	0.030**	(0.014)	4072	461.521
Years of HS Science	3.565	0.091***	(0.023)	4072	461.521
Years of HS Foreign Language	2.314	0.390***	(0.045)	4072	461.521
Years of HS Arts	1.550	0.501***	(0.050)	4072	461.521
Years of MS Arts	1.305	0.285***	(0.024)	12541	837.320

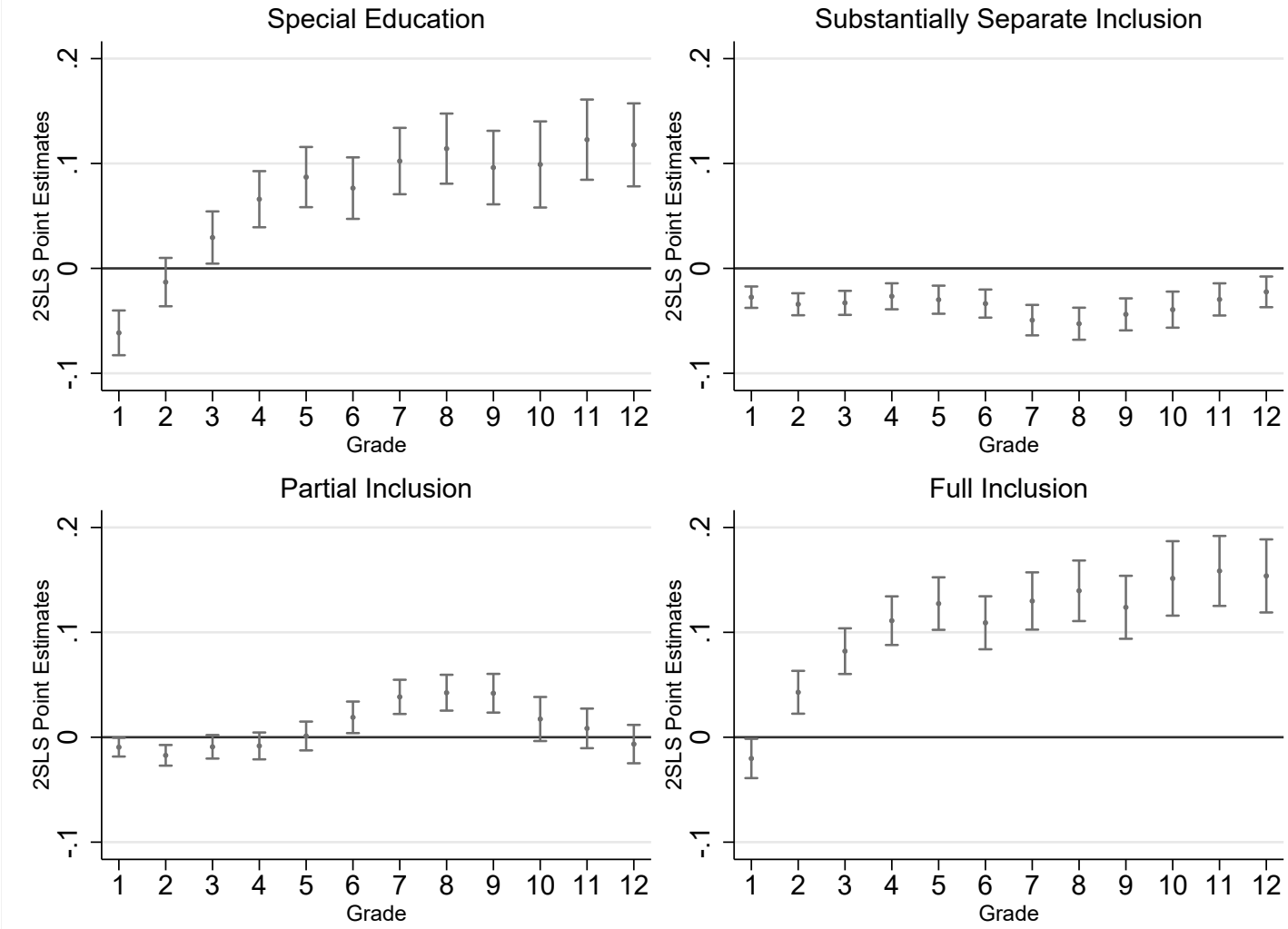
Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on the classes available in the school and the courses completed. All models use individual school district METCO offers as instrumental variables. See Table 3 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 3.

Table 11: Subgroup Analysis

	Male		Female		Black or Latinx		Asian, White, or Other Race		Neither parents went to college		At least one college-educated parent	
	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
10th grade Math exam	-0.417	0.187***	-0.260	0.092***	-0.392	0.148***	-0.059	0.093*	-0.271	0.099***	0.056	-0.057
		(0.030)		(0.026)		(0.020)		(0.049)		(0.028)		(0.045)
N	4196	5731	4108	6035	7907	11289	1692	2249	3948	5671	1317	2019
10th grade English exam	-0.484	0.287***	-0.098	0.172***	-0.331	0.240***	-0.067	0.149***	-0.227	0.155***	0.083	0.028
		(0.030)		(0.024)		(0.020)		(0.046)		(0.027)		(0.040)
N	4253	5790	4142	6069	7996	11380	1712	2268	3986	5712	1329	2031
10th grade attendance rate	0.847	0.062***	0.857	0.036***	0.849	0.050***	0.866	0.037***	0.863	0.040***	0.876	0.024***
		(0.006)		(0.005)		(0.004)		(0.009)		(0.005)		(0.008)
Suspended in 10th grade	0.182	-0.036***	0.109	-0.023**	0.152	-0.031***	0.124	-0.025	0.135	-0.034***	0.089	-0.028*
		(0.013)		(0.010)		(0.008)		(0.017)		(0.011)		(0.015)
N	4636	6093	4322	6135	8534	11728	1870	2425	4358	6045	1441	2148
Take SAT	0.338	0.178***	0.458	0.128***	0.384	0.149***	0.481	0.163***	0.455	0.146***	0.498	0.131***
		(0.014)		(0.013)		(0.010)		(0.023)		(0.014)		(0.022)
SAT 1000 or higher	0.108	0.060***	0.146	0.045***	0.110	0.050***	0.234	0.097***	0.154	0.058***	0.260	0.039*
		(0.010)		(0.010)		(0.007)		(0.020)		(0.011)		(0.021)
SAT 1200 or higher	0.031	0.009*	0.039	0.010*	0.022	0.009***	0.107	0.019	0.038	0.007	0.101	-0.001
		(0.005)		(0.005)		(0.003)		(0.014)		(0.006)		(0.014)
N	5690	7353	5157	7240	10401	14068	2091	2676	4874	6700	1597	2361
4-year high school graduate	0.647	0.205***	0.748	0.143***	0.688	0.175***	0.752	0.128***	0.722	0.150***	0.782	0.075***
N		(0.014)		(0.010)		(0.009)		(0.019)		(0.011)		(0.015)
	4838	6410	4640	6647	9057	12553	1896	2498	4492	6274	1504	2251
Aspire to 4-year college	0.433	0.208***	0.616	0.171***	0.509	0.196***	0.628	0.111***	0.551	0.172***	0.705	0.098***
		(0.017)		(0.014)		(0.011)		(0.025)		(0.016)		(0.023)
N	3571	4974	3684	5545	6896	10081	1465	1993	3481	5110	1171	1856
4-year college enrollment	0.359	0.232***	0.512	0.157***	0.423	0.197***	0.503	0.154***	0.496	0.186***	0.645	0.110***
		(0.022)		(0.020)		(0.015)		(0.031)		(0.019)		(0.028)
N	3775	3852	3422	3743	6639	7224	1516	1677	3500	4188	1228	1521
Enroll in a "most competitive" college	0.023	0.015**	0.038	0.002	0.025	0.010*	0.052	0.023	0.027	0.009	0.068	0.001
		(0.007)		(0.008)		(0.005)		(0.015)		(0.007)		(0.015)
Enroll in a "highly competitive" college	0.052	0.032***	0.081	0.019	0.055	0.025***	0.117	0.055***	0.066	0.029***	0.143	-0.025
		(0.011)		(0.012)		(0.008)		(0.021)		(0.010)		(0.021)
Enroll in a "very competitive" college	0.099	0.040***	0.144	0.034**	0.108	0.040***	0.181	0.058**	0.126	0.054***	0.216	-0.025
		(0.015)		(0.015)		(0.010)		(0.025)		(0.014)		(0.025)
Enroll in a "competitive" college	0.299	0.171***	0.430	0.138***	0.351	0.156***	0.439	0.127***	0.414	0.161***	0.546	0.095***
		(0.021)		(0.020)		(0.015)		(0.030)		(0.019)		(0.028)
N	3775	3852	3422	3743	6639	7224	1516	1677	3500	4188	1228	1521
6-year college graduation 4-year college	0.183	0.103***	0.317	0.146***	0.229	0.127***	0.335	0.166***	0.286	0.153***	0.431	0.058
		(0.022)		(0.024)		(0.017)		(0.037)		(0.022)		(0.041)
N	2273	2345	2049	2235	3976	4350	905	980	2007	2441	631	793

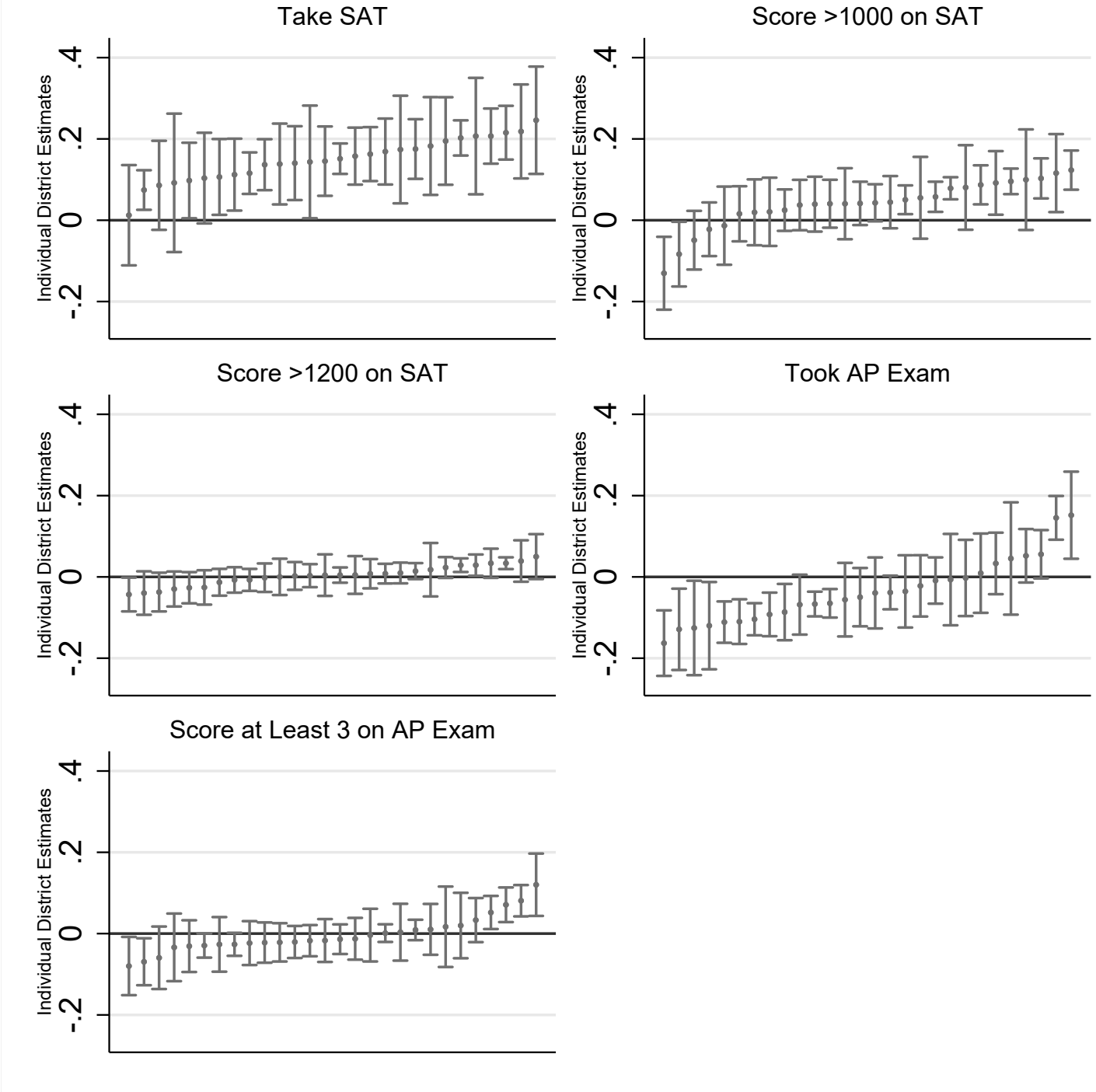
Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on high school and college outcomes by subgroups. All models use individual school district METCO offers as instrumental variables. See Table 3 notes for the full list of control variables. Data include applicants who were projected to graduate high school in 2004 and later. College competitiveness comes from Barron's rankings based on admissions rates.

Figure 1: 2SLS Effects of METCO on Special Education Status



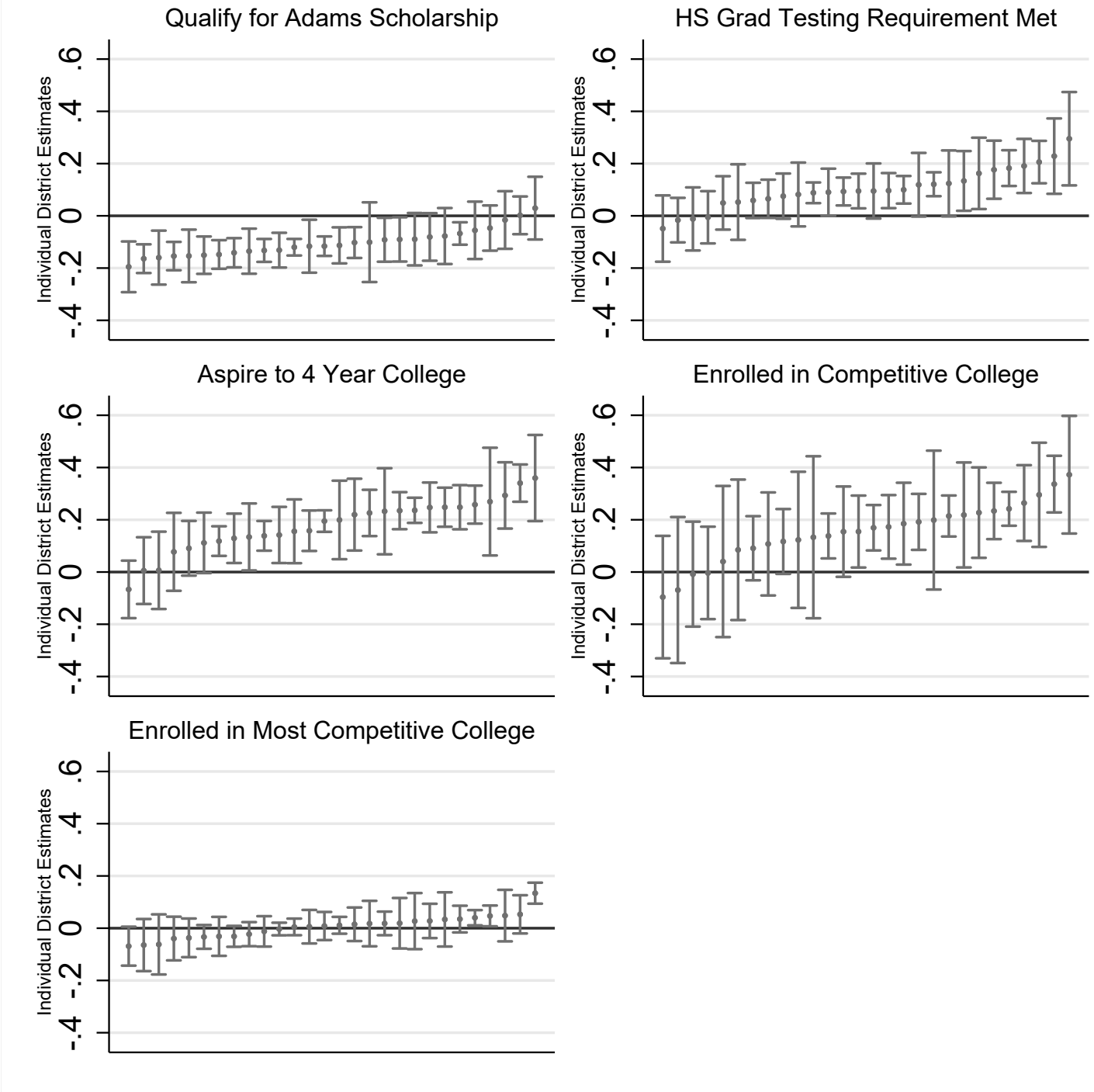
Notes: This figure shows the two-stage least squares estimates of the average impact of a year in METCO by each grade level on whether a student has any special education classification or a special education classification of a specific level of classroom inclusion. The endogenous variable is years in the METCO program by a given grade. The instrumental variables are a set of indicators that equal one of the student received an offer to enroll in each of the suburban districts by that grade. See Table 3 for the full list of control variables. Full inclusion means students spend less than 21 percent of their school day outside of a general education classroom. Partial inclusion means students spend between 21 and 60 percent of their time outside of a general education classroom. The substantially separate classroom designation means that students spend more than 60 percent of their time outside of a general education classroom.

Figure 2: Individual School District Estimates for SAT and AP Exams



Notes: This figure plots the estimates for individual suburban school districts, ordered from smallest to largest estimates. Figures show 90 percent confidence intervals. Each figure is estimated from a 2SLS model with multiple endogenous variables: indicators for whether the applicant ever attended each of the suburban districts. The instrumental variables are individual district METCO offers. The plotted estimates are the coefficients for each of the individual school districts. See Table 3 for the full set of controls. The sample includes students who were projected to graduate high school in 2003 and later.

Figure 3: Individual School District Estimates for College Preparation and Enrollment



Notes: This figure plots the estimates for individual suburban school districts, ordered from smallest to largest estimates. Figures show 90 percent confidence intervals. Each figure is estimated from a 2SLS model with multiple endogenous variables: indicators for whether the applicant ever attended each of the suburban districts. The instrumental variables are individual district METCO offers. The plotted estimates are the coefficients for each of the individual school districts. See Table 3 for the full set of controls. The sample includes students who were projected to graduate high school in 2003 and later.

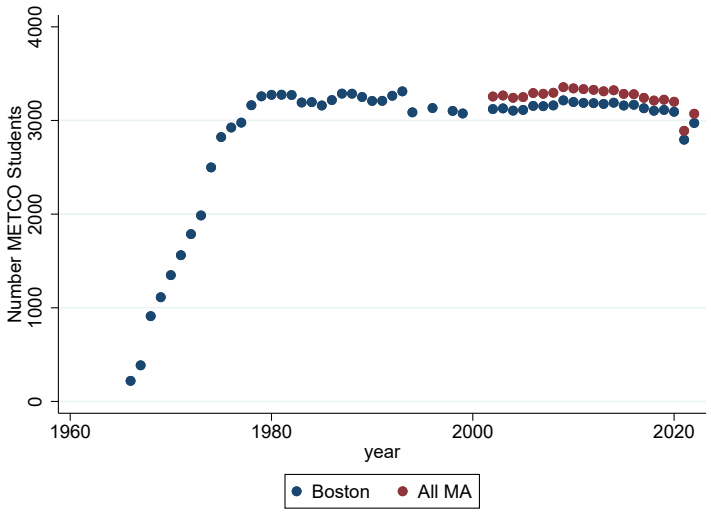
Online Appendix to

Busing to Opportunity? The Impacts of the METCO Voluntary School Desegregation Program on Urban Students of Color.

Elizabeth Setren

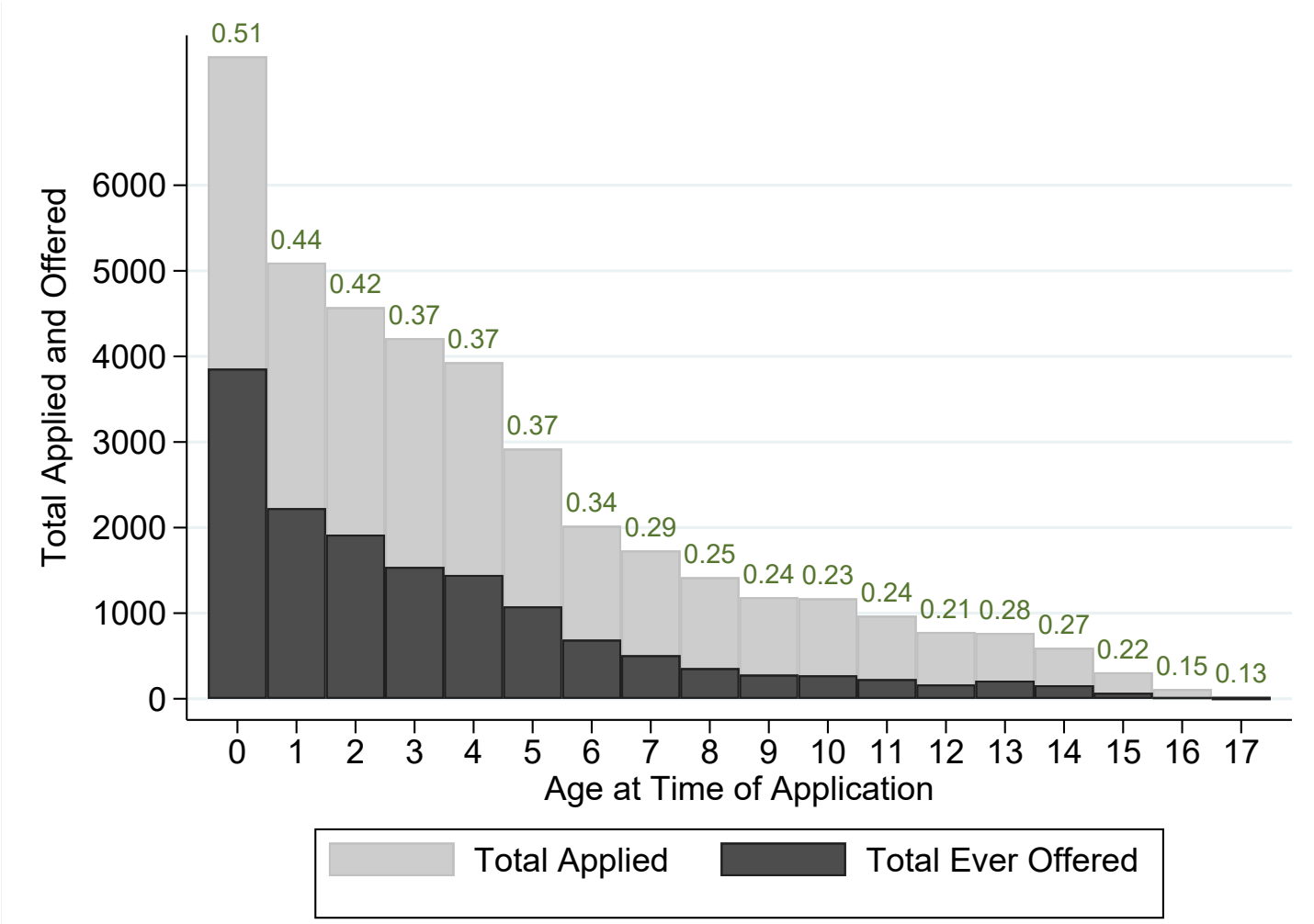
Updated August 2024

Appendix Figure 1: METCO Enrollment Over Time



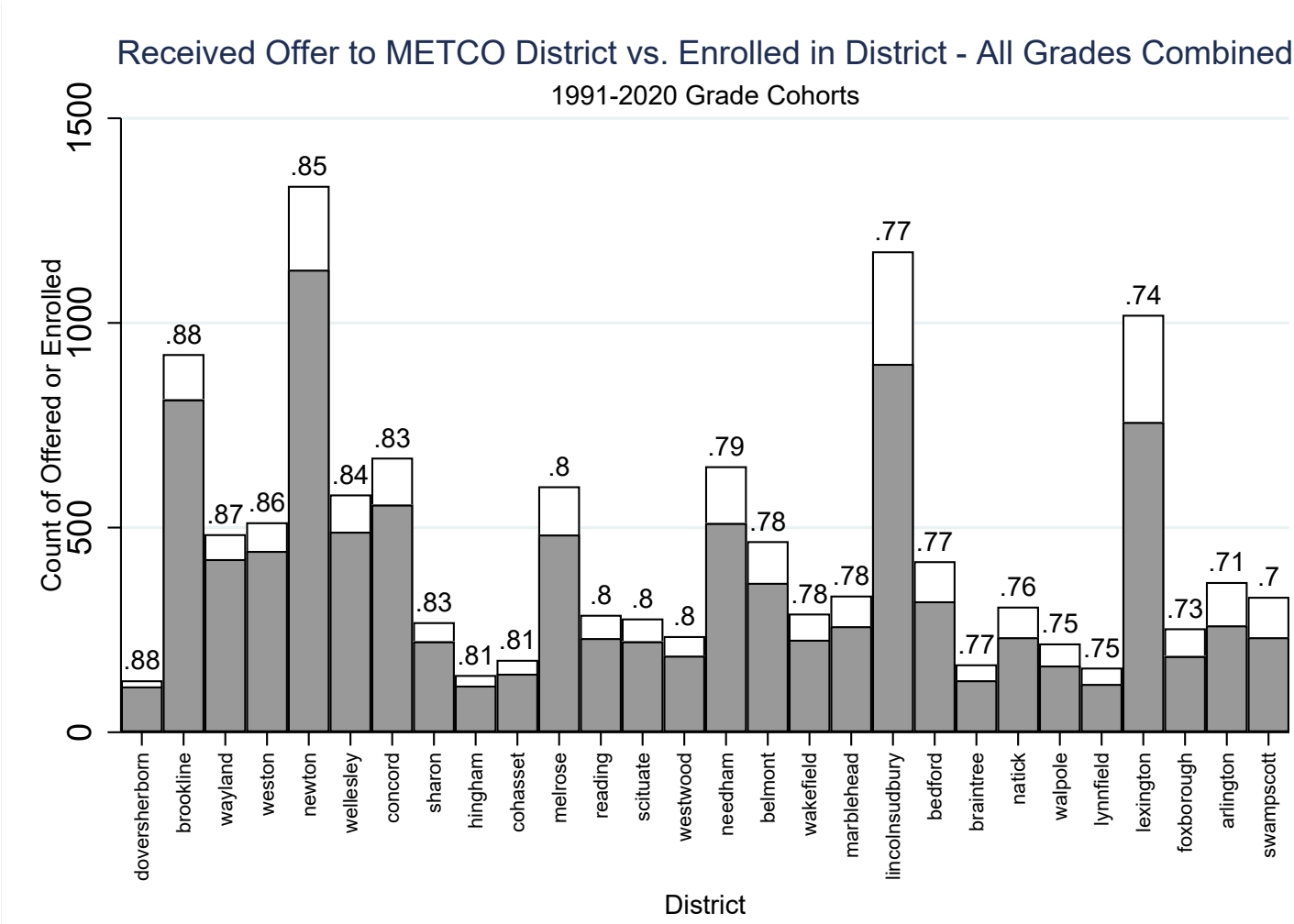
Notes: This figure plots the total METCO enrollment since the program started in 1966. Pre-2001 data comes from the Northeastern University Archives METCO Collection and was only available for Boston, not for Springfield. Not all years were available in the archives. The 2001 - present data come from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

Appendix Figure 2: Offer Rates by Age of Application



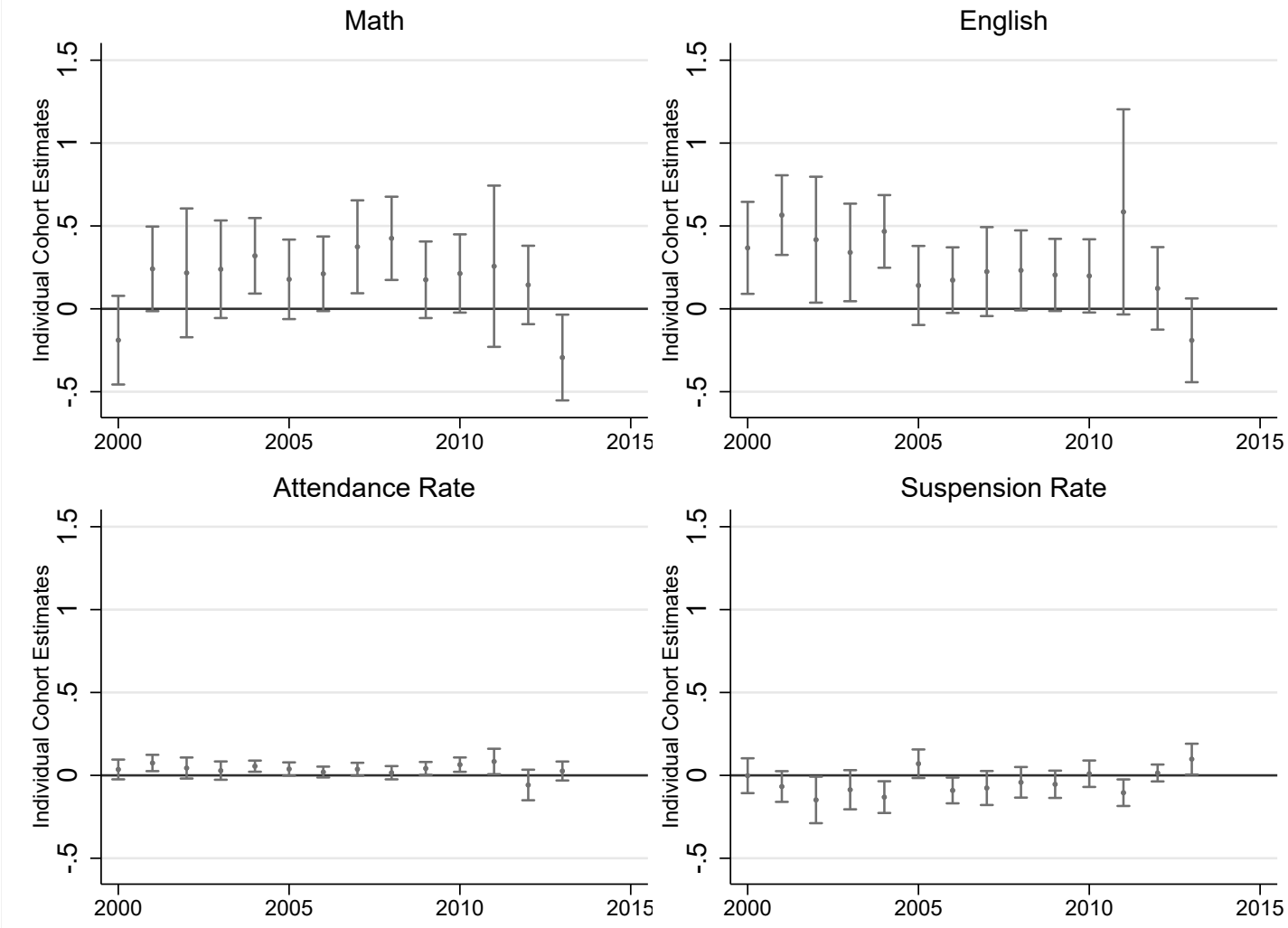
Notes: This figure plots the total METCO applications by children's ages in light gray. The number with offers by age is shown in dark gray and the proportion enrolled by age appears above the bar. Data include those who start first grade in 1991 through 2020.

Appendix Figure 3: District-Specific Offer 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.

Appendix Figure 4: 10th Grade Outcomes by Cohort



Notes: This figure plots the grade cohort-specific estimates for tenth grade outcomes.

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

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

Appendix 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.

Appendix Table 3: Robustness to Inclusion of Control Variables

		(1)	(2)	(3)	(4)	(5)	(6)
3rd Grade Math Score		0.103***	0.105***	0.122***	0.118***	0.117***	0.067*
		(0.026)	(0.026)	(0.035)	(0.035)	(0.038)	(0.037)
	N	14,345	14,345	9,009	9,008	7,501	7,501
3rd Grade English Score		0.186***	0.188***	0.196***	0.191***	0.177***	0.129***
		(0.024)	(0.025)	(0.033)	(0.033)	(0.036)	(0.035)
	N	15,410	15,410	9,557	9,556	7,927	7,927
10th Grade Math Score		0.169***	0.169***	0.134***	0.132***	0.152***	0.115**
		(0.031)	(0.031)	(0.044)	(0.044)	(0.047)	(0.046)
	N	9,545	9,545	5,487	5,486	4,512	4,512
10th Grade English Score		0.252***	0.257***	0.213***	0.211***	0.212***	0.174***
		(0.030)	(0.030)	(0.043)	(0.042)	(0.045)	(0.045)
	N	9,609	9,609	5,522	5,521	4,543	4,543
Dropout		-0.032***	-0.031***	-0.027***	-0.027***	-0.026***	-0.020**
		(0.007)	(0.007)	(0.009)	(0.009)	(0.010)	(0.010)
	N	9,078	9,078	5,109	5,108	4,210	4,210
Graduate high school in 4 years		0.153***	0.146***	0.113***	0.112***	0.120***	0.104***
		(0.014)	(0.014)	(0.018)	(0.018)	(0.019)	(0.019)
	N	9,078	9,078	5,109	5,108	4,210	4,210
Meets standardized testing high school graduation requirement		0.085***	0.079***	0.065***	0.065***	0.066***	0.050**
		(0.018)	(0.019)	(0.023)	(0.023)	(0.025)	(0.025)
	N	7,609	7,609	4,247	4,246	3,492	3,492
Take SAT		0.170***	0.169***	0.174***	0.173***	0.175***	0.163***
		(0.017)	(0.017)	(0.022)	(0.022)	(0.024)	(0.024)
	N	11,062	11,062	6,265	6,264	5,052	5,052
SAT 1000 or higher		0.098***	0.096***	0.101***	0.101***	0.101***	0.087***
		(0.013)	(0.014)	(0.018)	(0.018)	(0.019)	(0.019)
	N	11,062	11,062	6,265	6,264	5,052	5,052
Aspire to 4-year college		0.199***	0.199***	0.192***	0.192***	0.181***	0.162***
		(0.019)	(0.019)	(0.024)	(0.024)	(0.026)	(0.026)
	N	8,343	8,343	4,705	4,704	3,879	3,879
Enroll in 4-year college		0.158***	0.164***	0.157***	0.156***	0.165***	0.171***
		(0.020)	(0.021)	(0.026)	(0.025)	(0.028)	(0.020)
	N	7,947	7,947	4,515	4,514	3,509	3,509
Graduate 4-year college within 6 years		0.151***	0.145***	0.135***	0.134***	0.139***	0.121***
		(0.019)	(0.019)	(0.024)	(0.024)	(0.026)	(0.019)
	N	7,947	7,947	4,515	4,514	3,509	3,509
Income at age 25		6,523***	7,054***	7,518***	7,513***	8,394***	8,293***
		(606.878)	(456.433)	(784.314)	(785.413)	(659.874)	(959.750)
	N	10,010	10,010	6,205	6,205	4,437	4,437
Income at age 30		10,371***	11,646***	12,792***	12,743***	13,811***	14,033***
		(976.966)	(734.438)	(1312.360)	(1314.503)	(1124.842)	(1634.789)
	N	10,010	10,010	6,205	6,205	4,437	4,437
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.

Appendix Table 4: 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 offer 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 offers 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.

Appendix Table 5: Balance on Predicted College Outcomes

	Not Offered Mean of Real Outcome	Correlation of Predicted Outcome and Real Outcome	Difference Between Offered and Non-offered	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 offers. 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.

Appendix Table 6: Oster Specification

	R-Squared			Intent to Treat Estimates		Alternative δ
	Uncontrolled	Controlled	δ $\max R^2 = 1.3 * R\text{^}2$	Simple Estimate	Adjusted Estimate	δ $\max R^2 = 2 * R\text{^}2$
	(1)	(2)	(3)	(4)	(5)	(6)
3rd Grade Math Score	0.002	0.117	54.8	0.079	0.079	16.9
3rd Grade English Score	0.006	0.118	10.3	0.116	0.108	3.3
6th Grade Math Score	0.000	0.132	49.9	0.018	0.018	15.0
6th Grade English Score	0.003	0.165	9.3	0.083	0.076	2.9
10th Grade Math Score	0.000	0.164	-96.0	0.044	0.045	-29.0
10th Grade English Score	0.003	0.181	19.0	0.078	0.075	5.8
Dropout	0.006	0.039	24.3	-0.021	-0.021	9.2
Graduate high school in 4 years	0.016	0.101	11.0	0.072	0.068	4.0
Meets standardized testing high school graduation requirement	0.002	0.066	-47.2	0.033	0.035	-14.8
Take SAT	0.017	0.131	27.2	0.143	0.142	10.6
SAT 1000 or higher	0.005	0.126	43.3	0.061	0.060	14.1
Aspire to 4-year college	0.012	0.120	14.2	0.093	0.089	4.9
Enroll in 4-year college	0.027	0.143	15.6	0.137	0.134	5.9
Complete one academic semester	0.030	0.129	17.4	0.123	0.121	6.8
Complete three academic semesters	0.024	0.128	22.7	0.127	0.126	8.6
Complete five academic semesters	0.017	0.144	16.7	0.117	0.114	6.0
Complete seven academic semesters	0.013	0.131	18.4	0.108	0.105	6.5
Graduate 4-year college within 6 years	0.008	0.130	15.4	0.072	0.069	5.0
Income at age 25	0.000	0.043	5.3	6164.502	6212.596	2.8
Income at age 30	0.000	0.046	8.7	10101.285	10431.225	4.4

Notes: This table displays selection on observables estimates as suggested by Altonji, Elder, and Taber (2005) and Oster (2019). Column 1 shows the R-squared of the regression of the outcome on ever participating in METCO. Column 2 shows the R-squared from the same regression with the full set of baseline demographic controls including race, ethnicity, gender, English learner status, immigrant status, disability status, age at time of application, neighborhood traits, grade cohort, and vital statistics traits. The estimates of the minimum ratio of selection on unobservables to selection on observables needed to make the estimated coefficients zero appear in Column 3. These estimates assume the R-squared of a model with unobserved and observed controls is 1.3 times the size of the R-squared in the controlled model. Column 6 shows an R-squared multiplier of two. The simple intent to treat estimates with all observable controls appear in Column 4. Column 5 shows the estimates adjusted for unobservable controls with an R-squared ratio of 1.3 and assumes that bias from unobservables is equal to the bias from observables.

Appendix Table 7: Family Fixed Effects

Outcome	Non-METCO mean (1)	Endogenous Variable: Ever Participate in METCO Estimate (2)	Standard Error (3)	N (4)	Endogenous Varible: Ever Offered METCO Estimate (5)	Standard Error (6)	N (7)
5th Grade Math Score	-0.269	0.157*	0.081	471	0.158**	0.066	677
5th Grade English Score	-0.301	0.223***	0.083	474	0.177***	0.064	684
Graduate high school in 4 years	0.797	0.127***	(0.026)	822	0.065**	(0.026)	935
Meets standardized testing high school graduation requirement	0.671	0.113***	(0.032)	848	0.075***	(0.029)	970
Take SAT	0.557	0.144***	(0.034)	864	0.094***	(0.031)	987
SAT 1000 or higher	0.174	0.042**	(0.021)	864	0.017	(0.020)	987
Aspire to 4-year college	0.533	0.258***	(0.036)	760	0.155***	(0.034)	855
Enroll in 4-year college	0.415	0.249***	(0.029)	989	0.129***	(0.026)	1250
Complete one academic semester	0.393	0.245***	(0.029)	989	0.125***	(0.026)	1250
Complete three academic semesters	0.346	0.225***	(0.028)	989	0.131***	(0.025)	1250
Complete five academic semesters	0.305	0.197***	(0.028)	989	0.130***	(0.025)	1250
Complete seven academic semesters	0.270	0.180***	(0.026)	989	0.126***	(0.023)	1250
Graduate 4-year college within 6 years	0.223	0.119***	(0.025)	989	0.089***	(0.023)	1250

Notes: This table displays the OLS and intent to treat estimates with family fixed effects. The sample is restricted to families where at least two children applied and at least one was offered a METCO seat and at least one was not. Columns 2 through 4 use an indicator for whether the student ever participated in METCO as the endogenous variable. Columns 5 through 7 display the intent to treat estimates: ever receiving a METCO offer is the endogenous variable. Estimates for college outcomes restrict to the set of applicants who have reached six years past their projected high school graduation date. Analysis of high school outcomes restrict to those who have reached age 18 or older in the data. Fifth grade test score estimates restrict to those who are old enough to have completed the fifth grade in the data. College results include those who went to private school and out-of-state schools for K-12.

Appendix Table 8: Attrition

	Excludes Students That Never Match to Public School Data			All Applicants (including always out of state or in private school)		
Outcome variable	Non-treated Mean (1)	Intent to Treat (2)	2SLS (3)	Non-treated Mean (4)	Intent to Treat (5)	2SLS (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 received offers on or before grade 1. The endogenous variable for the 2SLS models is whether the student ever participated in METCO and individual district offers 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.

Appendix Table 9: Lee Bounds Specification

	Full sample				Parents did not graduate college			
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3rd Grade Math Score	-0.183	0.487	-0.055	0.352	-0.120	0.370	-0.061	0.311
3rd Grade English Score	-0.059	0.582	0.068	0.460	-0.024	0.457	0.028	0.396
4th Grade Math Score	-0.120	0.486	0.011	0.355	-0.067	0.381	-0.010	0.334
4th Grade English Score	-0.033	0.568	0.095	0.432	0.000	0.427	0.049	0.375
5th Grade Math Score	-0.160	0.465	-0.025	0.334	-0.081	0.349	-0.022	0.289
5th Grade English Score	-0.069	0.533	0.051	0.391	-0.005	0.407	0.048	0.344
6th Grade Math Score	-0.186	0.364	-0.054	0.226	-0.140	0.241	-0.085	0.175
6th Grade English Score	-0.136	0.436	-0.008	0.295	-0.055	0.324	-0.003	0.270
7th Grade Math Score	-0.224	0.337	-0.076	0.204	-0.132	0.248	-0.068	0.199
7th Grade English Score	-0.102	0.458	0.027	0.322	-0.047	0.330	0.003	0.270
8th Grade Math Score	-0.210	0.349	-0.092	0.214	-0.127	0.245	-0.080	0.190
8th Grade English Score	-0.067	0.481	0.049	0.363	-0.033	0.371	0.017	0.313
10th Grade Math Score	-0.196	0.421	-0.085	0.290	-0.116	0.296	-0.067	0.241
10th Grade English Score	-0.104	0.433	-0.005	0.328	-0.065	0.313	-0.016	0.255
10th Grade Proficient Math	-0.044	0.212	-0.001	0.138	-0.014	0.147	0.003	0.116
10th Grade Proficient English	-0.003	0.132	0.019	0.111	0.003	0.095	0.012	0.088
Dropout	-0.036	-0.019	-0.036	-0.021	-0.029	-0.013	-0.029	-0.014
Graduate high school in 4 years	0.055	0.177	0.069	0.163	0.050	0.154	0.055	0.145
Meets standardized testing high school graduation requirement	-0.042	0.238	-0.003	0.163	-0.019	0.168	-0.004	0.129
Take SAT	0.087	0.242	0.137	0.153	0.089	0.156	0.108	0.122
SAT 1000 or higher	-0.022	0.125	0.069	0.084	0.005	0.072	0.045	0.059
Aspire to 4-year college	0.029	0.323	0.073	0.237	0.057	0.253	0.074	0.210
Enroll in 4-year college	0.163	0.160	0.112	0.120	0.143	0.135	0.142	0.137
Complete one academic semester	0.135	0.132	0.061	0.068	0.092	0.103	0.081	0.094
Complete three academic semesters	0.157	0.154	0.096	0.104	0.136	0.137	0.126	0.131
Complete five academic semesters	0.138	0.134	0.085	0.093	0.106	0.097	0.099	0.094
Complete seven academic semesters	0.124	0.121	0.079	0.087	0.086	0.077	0.079	0.075
Graduate 4-year college within 6 years	0.104	0.101	0.071	0.079	0.116	0.108	0.116	0.111
Tightend bounds on age app		X		X		X		X
Tightened bounds on grade cohort		X		X		X		X
Tightened bounds on Black (for K-12 outcomes)		X		X				
Restrict to ever in public school data				X				X
Restrict to parents did not graduate college						X		X

Notes: This table shows the Lee bounds intent to treat estimates for the effect of METCO offers by the first grade on outcomes. The first two columns use the whole applicant pool for years and tightens on age at the time of application and four-year bins of grade cohorts. The next two columns restrict to those who appear at least once in the public K-12 data and uses the same covariates. The remaining columns carry out the same analyses, but restrict to applicants whose parents did not graduate college. The grade 3 through 10 outcomes include applicants who entered first grade in 2002-03 through 2012-13. The late high school and high school graduation outcomes include applicants who entered first grade in 2002-03 through 2010-11. The college outcomes include those who entered first grade in 2000-01 through 2004-05.

Appendix Table 10: Subgroup Effects by Predicted Attrition Likelihood

	Predict Attrit>p75		Predict Attrit<=p25		Predict Attrit>p90		Predict Attrit<p10	
	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS	Non-METCO Mean	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3rd Grade Math	-0.417	0.067	-0.444	0.362***	-0.486	0.050	-0.537	0.058
		(0.064)		(0.124)		(0.075)		(0.200)
N	3552	4823	1043	1431	3017	4016	444	586
3rd Grade English	-0.403	0.147**	-0.451	0.321***	-0.472	0.152**	-0.492	0.131
		(0.060)		(0.121)		(0.071)		(0.196)
N	3800	5174	1096	1495	3245	4333	465	612
4th Grade Math	-0.446	0.106*	-0.490	0.183	-0.504	0.073	-0.593	-0.093
		(0.063)		(0.118)		(0.073)		(0.193)
N	3510	4770	1039	1419	3014	4013	452	593
4th Grade English	-0.413	0.158**	-0.455	0.219*	-0.484	0.186**	-0.549	0.181
		(0.063)		(0.117)		(0.075)		(0.192)
N	3510	4764	1039	1419	3012	4005	452	593
5th Grade Math	-0.351	0.114*	-0.388	0.338***	-0.408	0.088	-0.494	0.137
		(0.065)		(0.115)		(0.076)		(0.190)
N	3221	4396	991	1345	2754	3684	437	566
5th Grade English	-0.344	0.106	-0.394	0.237**	-0.410	0.124	-0.509	0.095
		(0.067)		(0.117)		(0.079)		(0.196)
N	3219	4398	993	1348	2752	3686	439	568
6th Grade Math	-0.329	-0.001	-0.334	0.353***	-0.390	0.000	-0.418	-0.086
		(0.058)		(0.119)		(0.067)		(0.178)
N	3329	4558	985	1339	2849	3823	418	549
6th Grade English	-0.302	0.071	-0.366	0.380***	-0.367	0.099	-0.484	0.385**
		(0.060)		(0.121)		(0.069)		(0.187)
N	3336	4569	990	1342	2855	3832	423	553
7th Grade Math	-0.318	0.060	-0.347	0.253**	-0.374	0.061	-0.433	0.006
		(0.060)		(0.123)		(0.068)		(0.173)
N	3111	4235	915	1254	2647	3538	387	512
7th Grade English	-0.273	0.091	-0.340	0.247**	-0.329	0.098	-0.433	0.208
		(0.062)		(0.123)		(0.071)		(0.188)
N	3120	4248	921	1258	2658	3553	390	513
8th Grade Math	-0.313	0.084	-0.346	0.317**	-0.366	0.104	-0.469	0.286
		(0.062)		(0.137)		(0.072)		(0.220)
N	2811	3859	845	1144	2414	3237	369	475
8th Grade English	-0.286	0.153**	-0.324	0.262*	-0.349	0.163**	-0.490	0.532**
		(0.064)		(0.137)		(0.075)		(0.226)
N	2811	3856	847	1149	2419	3240	369	476
10th Grade Math	-0.281	0.188**	-0.282	0.176	-0.338	0.203**	-0.383	-0.246
		(0.079)		(0.146)		(0.093)		(0.215)
N	2086	2939	620	878	1759	2432	277	368
10th Grade English	-0.234	0.190**	-0.255	0.266*	-0.304	0.226**	-0.325	-0.299
		(0.076)		(0.139)		(0.091)		(0.205)
N	2101	2963	620	879	1769	2448	273	366
Graduate HS in 4 Years	0.784	0.109***	0.753	0.107**	0.764	0.121***	0.716	0.135*
		(0.025)		(0.051)		(0.030)		(0.076)
N	1937	2718	566	782	1671	2286	250	325
Aspire to 4 Year College	0.584	0.196***	0.532	0.189***	0.564	0.199***	0.518	0.109
		(0.032)		(0.064)		(0.037)		(0.094)
N	1756	2530	523	735	1492	2098	226	298
Enroll in 4 Year College within 2 Years	0.387	0.156***	0.512	0.134*	0.362	0.165***	0.487	0.093
		(0.034)		(0.076)		(0.037)		(0.124)
Graduate College within 6 Years	0.212	0.067**	0.279	0.055	0.199	0.067**	0.299	0.061
		(0.032)		(0.070)		(0.034)		(0.113)
N	1874	1205	287	275	1701	1049	117	110
Income 25	8,583	6,026***	17,292	6,157	8,433	4,935**	16,145	5,143
		(1863)		(5080)		(2046)		(6345)
	8091	7570	659	862	7676	7052	231	344
Income 30	11,443	15,207**	20,207	-	11,383	15,047**	15,632	-
		(6090)		-		(6320)		-
	5629	5038	237	311	5395	4766	71	122
Income 35	11,491	8,372	-	-	11,551	8,184	-	-
		(10721)		-		(10771)		-
	2506	2081	-	-	2480	2059	-	-

Notes: This table shows the 2SLS estimates of the effect of METCO participation on a range out outcomes separately by predicted attrition likelihood. The predicted attrition likelihood measure is estimated on applicants that applied before first grade, entered first grade after 2002, and were never offered a METCO seat. The full set of baseline covariates, including vital statistics controls are included in the estimation. See Table 3 for the full list of control variables.

Appendix Table 11: 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.

A Data Appendix

A.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 offer 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.

A.2 Selection into the METCO Applicant Sample

Appendix Table 11 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 offers 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 offer 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 get offers 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 group with offers 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 offer 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 offers 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.

A.3 Additional robustness

Later offers

Parents have more information about their child's academic ability as they progress through school. They may be more or less motivated to apply for METCO if their child has higher or lower test scores and grades. For this reason, the analysis sample only includes those who applied before first grade. The parents who applied, but did not receive an offer by first grade might also be more or less interested in the program as they have more knowledge about their child's academic ability and school. As a result, there is more potential for selection bias among those who receive offers after first grade. Defining the treatment variable as METCO participation in first grade and the instrumental variables as offer status for first grade participation avoids this concern by counting those who join METCO at an older grade as untreated. The estimates are similar with this specification.

Attrition

Receiving a METCO offer makes students more likely to enroll or remain in Massachusetts public schools and therefore appear in the administrative education data. This differential matching to administrative data can lead to selection bias for the K-12 and labor market outcomes which are only available for Massachusetts public school students. Appendix Table 8 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 8 show that 80.1 percent of applicants who enroll at least one year in Massachusetts public schools have at least one elementary school 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. Eighty-six percent of applicants that did not receive an offer appear in the state administrative data and contribute outcomes to the analysis. This is 5.8 percentage

points lower than the match rate for those with offers. For elementary and middle school outcomes the difference in match rate across offer status ranges from 7.9 percentage points to 10.2 percentage points. Receiving a METCO offer increases the likelihood of having high school graduation outcomes by 14.0 percentage points. Therefore, METCO offers reduce 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 (NSC) college outcomes data. Dynarski, Hemelt and Hyman (2015) find that NSC covers over 95 percent of Massachusetts colleges and universities and over 90 percent of US undergraduate institutions in 2011. Over time NSC's coverage has increased and the college outcomes for this paper start in 2013 (Dynarski, Hemelt and Hyman, 2015). Attrition is more difficult to measure with NSC data because students do not match to the college data if they do enroll in college. 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. Typos and spelling changes should be similar across offer status. As a result, the college results are unlikely to be biased from differential attrition.

Knowing that the college outcomes are not biased from differential attrition can help us understand potential bias in the K-12 estimates. The key concern is that not receiving a METCO offer makes students more likely to enroll in private school and that those students may be pre-disposed to do better academically and in the labor market. This would lower the average outcomes of the non-offered group and overestimate the effect of the METCO program on K-12 and labor outcomes.[33]

One approach to understanding the extent of bias is to look at two similar outcomes across the K-12 data which is subject to differential attrition concerns and the college enrollment data which does not have differential attrition. I find that METCO increases the likelihood students aspire to attend 4-year college in 10th grade by 17 percentage points which is similar to the actual 4-year college enrollment effect of 21 percentage points. The similarity of these estimates suggest that differential attrition is not leading to a large overestimation of the high school effects.

[33]Differential attrition concerns for the labor market outcomes are similar to the concerns for K-12 because labor market data is only available for those who attended Massachusetts public high schools.

Next, I use the rich baseline characteristics to predict who will not match to the state administrative education data. I use applicants who do not receive offers to estimate the relationship between each baseline trait and attrition and then use that model to calculate a predicted likelihood of attrition in the full sample. Appendix Table 10 shows the effect of METCO participation estimated separately by predicted attrition likelihood. Effects for those who are most likely to attrit based on their baseline characteristics are similar to the results for the full sample for 4-year college aspiration, enrollment, and graduation and high school graduation. This is robust across whether most likely to attrit is defined as the top quartile or top decile of predicted attrition. Income at age 25 and 30 also have similar effect sizes for those most likely to attrit. Tenth grade Math and English test score results are also similar for those who are predicted more likely to attrit and for the full sample. The earlier testing grades, particularly Math and middle school exams, are less robust to attrition concerns. However, estimates for those that are likely to attrit are generally positive and of similar magnitude to the full sample (with the exception of 6th grade Math).

Lastly, Appendix Table 9 shows the range of intent to treat effects using Lee bounds Lee (2009). The first two columns show the lower and upper bound of the treatment effects in a simple model that tightens on age at the time of application (in years), whether the applicant is Black, and grade cohort range (in 4 year groups).[34] Similar to the predicted attrition exercise, the high school and college aspiration results are robust to attrition concerns. The test score Lee bounds estimates have a large, noisy range. So I cannot rule out that the effect of METCO participation on test scores is negative or null. Columns 3 and 4 restrict to those who appear in public school data at least once and shows that the bounds on English effects are positive. Restricting to those whose parents did not graduate from college yields similar findings as the first four columns. Test score results are more precise with a binary outcome: passing the tenth grade Math and English exams. Those Lee bounds estimates allow us to rule out substantial negative METCO impacts on test scores.

While college outcomes are not subject to the same differential attrition concerns, Appendix Table 9 also shows Lee bounds for college outcomes. I assume that a random 30 percent of applicants without NSC data did not appear in NSC due to their college not appearing in NSC or to mismatching, instead of

[34] Additional covariates result in cells without variation which prevent estimation.

because they did not enroll in college. Thirty percent is likely an overestimation of the potential attrition since over 10 percent of US institutions are present in NSC. The results of this exercise suggest that the college results are robust to attrition concerns. Foote and Stange (2022) argue that Lee bounds are inappropriate to understand attrition for state administrative employment records because the bounds are wide and uninformative.

Combined, these three approaches find that the high school graduation, dropout, SAT, and college outcomes are robust to attrition concerns. The test scores, particularly Math, are less robust to attrition. The earnings and employment face similar attrition concerns as the high school outcomes because METCO offers decrease the likelihood students enroll in a public high school in Massachusetts – the sample that is matched to the earnings and employment records. This sample has good coverage in the labor records: over eighty-five percent of students who graduated from a Massachusetts public high school appear in the adult earnings data. As a result, the labor outcomes should be interpreted as the impact of the program on earnings and enrollment in Massachusetts among those who attended Massachusetts public schools.

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.