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

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PRELIMINARY DRAFT - DO NOT CITE OR CIRCULATE WITHOUT PERMISSION OF AUTHOR

**Abstract**

School assignment policies are a key policy 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 and Springfield Massachusetts to relatively wealthier and predominantly White suburbs. Using a combination of digitized historical records and administrative data, we analyze the short and long run effects of attending a high-performing suburban school for applicants to the METCO program. Attending a suburban school boosts Math and English test scores by 0.2 standard deviations in grades 3 through 10. The program reduces dropout rates and increases high school graduation. The suburban schools increase four-year college aspirations, enrollment, persistence, and graduation. Enrollment also results in increased earnings and employment in Massachusetts at age 25 through 35. Evidence of tracking to lower performing classes in the suburban schools suggests these effects could be larger with access to more advanced coursework.

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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 intra-district school integration and using race in school assignment. Segregation is linked with wide disparities in access to advanced curricula, resources, and outcomes. To increase equity, access to opportunity, and integration, districts utilize school assignment and school choice policies.

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 and Springfield Massachusetts to over 35 predominantly White and relatively wealthier suburban school districts since 1966. Urban students and suburban districts opt-in to the voluntary desegregation program. METCO enrolls students in suburban public schools with higher graduation and college-going rates, more advanced coursework, and higher performing peers. While METCO participants have access to higher performing schools and peers, they also face long bus rides, racial isolation, and potentially low expectations or discrimination which could hinder their performance.

This project will identify the causal effect of attending a suburban, high performing school on the academic outcomes of students of color in Boston and Springfield, Massachusetts. Students and families who choose to apply for the METCO program may be different than the average Boston or Springfield student in ways that we cannot control for using available data. For example, their parents may be more likely to be involved with their child's schooling. Therefore, to properly estimate the effect of the program, we need to compare students who applied to METCO and randomly received an offer to enroll to those who applied but did not receive an offer. We collected and digitized over 50 years of detailed application records to compare applicants with similar unobserverable characteristics. Using waitlist instruments and a rich set of controls from birth records and the application data, we estimate the impact of the program on applicants who attended primary or secondary school sometime between 2001 and 2020. Earlier applicant cohorts and the impact on suburban students are estimated in other papers.

We find large positive effects on academic achievement. Students score 0.13 - 0.25 standard deviations higher in Math in grades 3 - 10 and 0.18 - 0.23 standard deviations higher in English. METCO enrollment increases school attendance by 2 - 4 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 for middle and high school grades and two-thirds for elementary grades. Participating in METCO increases SAT taking and scores, but has no impact on AP exam taking or scores. The program increases the likelihood students graduate from high school on time by 7.4 percentage points, and reduces the dropout rate by half. METCO increases increases four-year college aspirations, going, and graduation. It also increases the employment rate and earnings.

Participation in the program changes the types of peers, teachers, courses, and school traits that students encounter. METCO students have more White and special education classmates and fewer English learners (ELs), low-income, Black, and Latinx classmates. 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 teachers of color and it reduces class sizes by about two students on average. Participants attend schools with more AP class options, but are no more likely to take advanced coursework and they are more likely to be tracked to lower performing Math and English classes. METCO increases the likelihood students are classified as special education and receive special education services in an inclusive setting, but students are less likely to be classified as autistic or receive special education services in a separate classroom.

With the 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. 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 referred and non-referred METCO applicants' grades 3 - 8 test scores and high school graduation and college enrollment for seven and three birth cohorts respectively. This project builds upon that work by analyzing a broader range of outcomes and mechanisms, utilizing a rich set of birth and applicant record control variables to test for selection bias, analyzing the full set of cohorts, and using instrumental variables analysis.

This research contributes to the literature on the effects of court-ordered and voluntary desegregation (Johnson, 2015; Reber, 2010; Bergman, 2018) by analyzing the short and long-term causal impact of a long-running, high-profile desegregation program.[1] Johnson (2011) finds 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. Bergman et al. (2018) studies ten cohorts of a smaller desegregation bussing 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 investigating a broader range of outcomes and mechanisms including college persistence, graduation, and earnings on a large sample that allows for more heterogeneity analysis.

This paper also contributes to the literature on school choice and school quality by studying how access to higher performing, more-resourced schools impacts student outcomes. The paper also contributes to the literature on how school versus neighborhood quality impact student outcomes. The Moving to Opportunity (MTO) experiment, which gave vouchers for families to move to lower-poverty neighborhoods, found heterogeneous short-term effects on educational outcomes,

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

risky behaviors, and mental health and positive long-run effects for children who moved at a young age (Sanbonmatsu et al., 2006; Rosenbaum, 1991; Kling et al., 2007; Gould et al., 2011; Schwartz, 2010; Chetty et al., 2016). This project isolates the impact of enrolling in a high-performing suburban school while holding students' neighborhood fixed.[2] The next section provides background on the METCO program. Section 2 details descriptive statistics and Section 3 overviews the application process and selection issues. The next section overviews the identification strategy, followed by the results. Section 6 discusses mechanisms and heterogeneity and Section 7 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 community 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 – bussing 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 bussing 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.[3] METCO accepted new districts until 1975. Except for four districts that ended their METCO programs, after joining METCO, districts have continuously enrolled METCO students.[4] The city of Springfield started its own METCO program with four nearby suburbs. It currently enrolls 150 K-12 students a year. Figure 1 shows the growth in METCO enrollment as new districts joined and relatively stable enrollment of over 3,000 students since the 1980s.

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 degree 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, such as late buses, so that students can participate in after school activities, 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 to have inclusive curriculums that are free from racial and gender stereotypes and include African and African-American history and culture in all disciplines.[5] METCO also encouraged the districts to hire Black teachers and staff.[6] Today, METCO is working with suburban districts to help them strive to be antiracist institutions.

## Funding

Districts receive $8,900 on average for each METCO student, though this amount varies by district and year.[7] Funding comes from a state METCO grant of approximately $5,000 per student and from state education funding because METCO students count towards the districts' total enrollment which is used to calculate state education aid.[8] Since the state aid is not itemized into funding for METCO and resident students, it is not transparent to districts how much funding they

[2] In a related study, I incorporate all of the applicant and referral data from 1966 to present and use two-stage least squares methods to estimate the causal impact of METCO on its participants for a broad range of K-12, college, and longer-run outcomes (Setren 2022).

[3] METCO rejected Beverly, Georgetown, Randolph, and Winchester in 1974 and Winchester was also rejected in 1967.

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

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

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

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

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

receive from the METCO program beyond the grant.[9]

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, we collected application records from the start of the program in 1966 to 2019. 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. We 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 of referral or application. If the applicant was referred, we collected the date of the referral and the suburban district they received a referral for. METCO staff wrote this referral information each referred applicant's file folder. We hand entered the handwritten METCO staff notes and application forms because they could not reliably be digitized by a computer software. Often the notes about referrals 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 into an electronic database, but they still used the paper application folder system. Staff did not always update the electronic database after a student was referred, so we combine information from the electronic and paper files to determine whether and when a student received a referral.

We 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 hand entered. These supplemented the applicant folders by providing another source of referrals 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, we digitized over 200 bankers boxes of application files and rosters.

## State Administrative Education Records

We 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 2002 through 2019 so that we have state administrative baseline and outcomes data. We exclude the most recent cohorts so that we can look at test score outcomes.[10] Ninet**y** percent of applicants match to the education data (see Appendix Table 2). Those who do not match either never attended public school in Massachusetts or we were not able to confidently match them.[11]

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.[12] 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, we 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. We categorized the course titles to distinguish advanced coursework, key courses (such as Algebra I), core subject area, foreign languages, and the arts.

## College Data

The National Student Clearinghouse (NSC) database provides college enrollment, persistence, and graduation data. We received NSC data for applicants who enrolled in grades 8-12 in a Massachusetts public school from MA DESE. NSC

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

[10] We analyze the long run social and civic outcomes of the 1966-2010 applicants and their peers in a forthcoming paper.

[11] Details about the matching algorithm are available at the request of the author.

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

provided data for students who attended private or out of state schools during those grades.[13] College data ranges from 2002 through 2022.

### 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. 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 who graduated a Massachusetts public high school have a DUA record.

### 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 we 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, occupation, and industry 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, Figlio, Imberman, and Persico 2019) 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. We do the same linkages with the census tracts of their neighborhoods at the time they apply to METCO.

## 3 Descriptive Statistics

Table 1 describes the demographics of students who apply to and participate in METCO. 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 22 percent of the applicant pool, compared to 42 percent of the BPS non-applicants. Asian students and not-surprisingly White students are also under-represented in the applicant pool.[14] The racial composition of METCO participants is similar to that of applicants, but Black students are more prevalent and the other groups are less prevalent. 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 2.7 percent Black, 6.5 percent Latinx, and 10.4 percent Asian students.

Students with disabilities that might require additional transportation assistance like a smaller bus or an aide are less likely to apply for METCO.[15] Only five percent of applicants have one of these disabilities compared to seven percent of BPS students that did not apply. Participants are 22 percent less likely than applicants to have one of these disabilities.

Immigrant families are also underrepresented: they are over four times less likely to apply for METCO compared to BPS non-applicants. Immigrants are also less likely to become METCO students after applying. 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 (25 percent) and those that do not apply for METCO (24 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, we do not have neighborhood information for non-applicants. Neighborhood representation is similar for students who ultimately enroll in the program (see Table 1 Column 3), 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 characteristics than they would have experienced otherwise. Boston resident students, including METCO participants have substantially higher rates of economic disadvantage than students who live in the METCO suburbs. About 56 percent of

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

[14] 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).

[15] 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.

METCO participants are classified as economically disadvantaged, compared to only 10 percent of their suburban peers.[16] Special education and English Learner rates among Boston resident students and METCO participants are higher than their suburban peers. Twenty-nine percent of METCO participants have a special education status compared to 19 percent suburban residents. Over five percent of METCO participants are English Learners compared to 3.8 percent of suburban residents. 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.

METCO participants have classmates that rarely get suspended: under 0.6 percent of suburban peers get suspended in the fifth grade. If they enrolled in BPS or Boston charter schools, they would attend schools with substantially higher suspension rates. METCO students also have peers with average attendance around 90 percent, marginally higher than rates in Boston public schools. Lastly, enrolling in METCO leads to a major change in classmates' academic performance. Suburban residents score over 0.45 standard deviations above the state mean on standardized Math and English tests while Boston students score below the state mean.

Table 1 also sheds light on the demand for the METCO program. Thirty-four percent of Boston students apply to the program and 11 percent enroll in METCO. Over half of all Black Boston students 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.

# 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. 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 refer to the district. Districts sent METCO, Inc. their enrollment requests from February to late summer, whenever the district was ready.

Students were supposed to be referred under a waitlist system that gave priority to those who applied earliest, within grade, gender, and racial subgroups. The waitlist system was not followed perfectly. Applications were kept in physical file folders and in an electronic database. When referrals were chosen from file folders, the exact waitlist order was not adhered to if the files were also out of order. Since these were non-intentional errors in file organization, we can think of these as random non-adherence to the waitlist. In addition, parental and staff intervention could have enabled students to get referred earlier. This non-adherence could result in selection bias if the types of students parents and staffs intervene differ from those that do not receive that advantage.

As the districts notified METCO, Inc. of available spots, METCO referred students and notified their families. Parent(s) 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 refer the next two first grade boys and girls to Weston. 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' waitlist position to get referred to a specific district.

If a student declined, they were supposed to lose their place on the waitlist. Parents were more likely to accept offers from nearby districts. In some cases, the district declined to accept the student and then the student returned to the top of the waitlist.

The referral and admissions process was subject to several potential biases. Parents who apply for METCO when their child was an infant may unobservably differ from parents who apply a few months before their child enters school. Instances where parents persistently followed up or METCO, Inc. selected certain students to get referred out of order also introduce bias. Lastly, parents interacted with the suburban school district after they were referred to register in the school system. These interactions could result in the district declining to accept the student or the parents choosing not to enroll their child in the district. Students getting deterred during this process also introduces selection bias.

[16] 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).

# 5 Identification Strategy

To estimate the effect of METCO on student outcomes, we use 2SLS analysis to adjust for the fact that not all students with METCO offers accept them. To hone in on 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, the instruments district-specific offer indicators.

The second stage is as follows:

$$y_i = \alpha_t + X_i^{'}\theta + \varphi M_{ig} + \sum_j \delta_j w_{ij} + \epsilon_{gt} \tag{1}$$

where $M_i$ indicates whether student $i$ participates in METCO at the time outcome $y_i$ is measured. We control for the year and grades that applicants are in the potential referral pool for with $\sum_j \delta_j w_{ij}$ where $w_{ij}$ is equal to one if student $i$ is actively on the waitlist for year and grade combination $j$. The terms $\alpha_t$ represents outcome year effects. Baseline demographic characteristics from the time of application, represented by vector $X_i^{'}$, include gender, race, economic disadvantaged status, home neighborhood indicators,[17] immigrant status, and age at the time of application (linear and squared). Controls also include whether the student has a documented disability by grade 1 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, they are not included in the causal analysis.

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

$$M_{ig} = \lambda_t + X_i^{'}\Gamma + \pi \sum_d Z_{id} + \sum_j \upsilon_j w_{ij} + \eta_i \tag{2}$$

Indicators for whether the student received a METCO offer to each of the districts $d$, $\sum_d Z_{id}$, will instrument for participation in METCO in grade $g$.

When suburban districts notify METCO of how many students in each grade they want to offer seats to, they can express a preference over gender and race. Female students are slightly more likely to be referred. Black, Latinx, and Asian students are more likely to be referred while White students and students who identify as "Other" are less likely to be referred. Due to this aspect of the referral process, we control for gender and race indicators in all analyses, including the balance tests.

Appendix Table 1 shows descriptive statistics and balance tests. About two percent of applicants have a diagnosed disability by the first grade that may require specialized busing. Only two percent of applicants are immigrants and about 20 percent are learning English. There are small imbalances between those who are referred to METCO and those who are not for disability status and English learners. To adjust for this, all specifications will control for these baseline variables.

Forty percent of applicants live in Dorchester at the time of application. Roxbury, Mattapan, and Roslindale are also popular neighborhoods. Those with and without offers have similar representation across Boston neighborhoods. Appendix Table 1 also shows the average characteristics of the applicants' Census block groups. The average applicant lives in a neighborhood with a median income of $62,000, an 82 percent high school graduation rate, and a 31 percent college graduation rate. The neighborhoods are over half single parents and 35 are home owners. Those with referrals come from similar neighborhoods to those who are not referred, but the homeownership rate is 5 percent higher and median income is 3 percent higher.

We link the applicant data to Massachusetts birth records to get baseline health and socioeconomic statistics. Referred applicants have similar health at birth, with similar Apgar 5 scores, weight, and gestational ages. The difference in infant weight is less than 1 percent of the non-METCO mean. Thirty-five percent of the applicants were born to married parents and a quarter did not have a second parent listed on the birth certificate (suggesting an absentee parent or single-parent by choice). Almost half of the applicants' parent(s) had Medicaid, or another government program, pay for pre-natal and/or birth care. This suggests that a substantial proportion of the families have low-income. Those that received offers to enroll in METCO were similarly likely to have married parents, but less likely to have an absent parent and government pay for healthcare. Ten percent of applicants have two parents that graduated college and almost 30 percent have at least one parent who graduated college at the time of their birth. Those with METCO offers are more likely to have at least one parent who graduated college.

Due to these imbalances, we will control for these rich socioeconomic variables in the analysis. All results are robust to including or excluding these controls, which suggests that selection along education, family structure, low-income status, or unobservables that are strongly correlated to them, cannot explain the effects. Further work will analyze the magnitude of the effects that might be due to these imbalances.

[17] 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.

# 6 Results

## 6.1 Test score & behavioral outcomes

Getting referred to a METCO suburban district in Kindergarten or first grade increases METCO enrollment by one year (see the first row of Table 2). Getting referred on or before 2nd grade similarly increases years in METCO by 1.6 years on average. 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 a portion of students get referred to middle school and high school and some students leave METCO in later grades. For example, having an offer by 12th grade to participate in METCO increases program enrollment by 4.75 years. Across all grades, receiving an offer to attend METCO increases the likelihood of enrolling by 66 percentage points.

METCO enrollment leads to higher test scores and attendance rates and lower suspension rates as shown in Table 2. Students who applied but never participated in METCO scored 0.45 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 0.13 standard deviations in Math and 0.21 in English. Effects of attending suburban schools in subsequent grades are similar and statistically significant, ranging from 0.13 to 0.24 standard deviations in Math and 0.18 to 0.23 standard deviations in English.

If we use years spent in METCO instead of whether the applicant participated in METCO in a given grade, then we can calculate 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 deviations on average. Subsequent grade levels have comparable effect sizes, around 0.04 standard deviations for grades 3 through 5 and around 0.02 to 0.03 standard deviations for grades 6 through 10. While the effects in lower 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 0.04 to 0.07 per year in grades 3 through 5 and 0.03 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 over 25 percent closer to the state test score average in Math and over 43 percent closer in English than those who were not referred. Tenth graders in METCO score over 0.23 standard deviations higher in both Math and English than their non-referred peers.

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 reduced attendance for METCO participants. We do not see evidence of this: students in METCO have marginally higher attendance rates. Third graders who do not get referred to METCO have a 91 percent attendance rate. Participating in METCO significantly increases attendance for nine of the grade levels with effects ranging from 1.0 to 3.6 percentage points. Grades 7, 11, and 12 have null effects and we can rule out negative effects on attendance larger than 0.8 percentage points. Therefore, METCO does not lower attendance and marginally increases it for most grade levels.

About five percent of applicants without offers get suspended in the third grade. Suspensions rates for this group reach over 14 percent in middle and high school. Participation in METCO lowers the likelihood of suspension substantially by 2 to 8 percentage points for each grade. For first through third grade, it reduces the likelihood of suspensions by about half. The point estimates are generally larger for the older grades when suspensions are more prevalent. Grade 9 has the largest effect of reducing suspensions by 60 percent. The program also reduces the number of suspensions students experience on average for most grades.

## 6.2 High School graduation & college preparation

Participating in METCO increases the four-year high school graduation rate by four years 10 percentage points. It also increases the likelihood of graduating high school in five years by 3.5 percentage points and reduces high school dropouts by 2.6 percentages points, over a 60 percent reduction (see Table 3).

Table 3shows mixed effects of the METCO program on outcomes related to college preparedness. METCO makes students 9 percentage points more likely to meet the standardized testing requirements for high school graduation in Massachusetts. These are based on 10th grade Math, English, and Science test scores. Meeting this requirement also means students continue with a college-preparatory course load instead of remedial coursework.

The Massachusetts-run 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 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 18.3 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 17.4 percentage points. Attending the suburban schools also boosts the likelihood students earn SAT scores of at least 1,000 or 1,200 by 8.3 and 1.7 percentage points respectively.

However, METCO does not increase the likelihood that students earn high SAT scores of 1400 or more, which only 1 percent of applicants achieve. Attending the suburban schools increases AP test taking by 4.1 percentage points, but does not change the average number of AP exams students take or their scores.

METCO shifts students' aspirations for after high school towards 4-year colleges. In a survey administered to 10th graders, METCO participants are 6 percentage points more likely to say that they want to go to college. METCO also increases the likelihood students aspire to 4-year colleges instead of 2-year colleges by 11 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. Combined, METCO increases the likelihood students plan to attend four-year colleges by 17 percentage points.

## 6.3 College outcomes

Table 4 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 70 percent of non-METCO applicants enroll in college. Attending a suburban school increases college enrollment by 14 percentage points. Similar to the effects on aspirations, students are 7.5 percentage points less likely to enroll in 2-year colleges and 21 percentage points more likely to enroll in 4-year colleges. This reflects a 40 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 4 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 20 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 five percentage points more likely to enroll in the next highest tier, very competitive, and four percentage points more likely to enroll in the second highest tier, highly competitive. METCO increases enrollment in the most selective category by 1.5 percentage points, a forty 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 college. METCO increases the likelihood students persist through college with effects declining in later semesters. For these analyses, we restrict the sample to students who are at least 24 years of age in the data so that we can see the persistence effects for the same sample. In this smaller and older sample, METCO increased initial 4-year college enrollment by 21 percentage points. The program still substantially increases the likelihood of persistence to the second, third, and fourth years of college, but the effect size falls over time. Thirty-seven percent of applicants who do not participate in the program enroll in a fourth year of college and METCO increases that likelihood by 14 percentage points. The program increases the likelihood of graduating from a 4-year college by 8 percentage points. This reflects about a 27 percent increase from the 30 percent graduation rate among the comparison group. There's no significant difference in the likelihood of earning a 2-year degree.

Attending majority White elementary and/or 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 54 percent non-White and 31 percent Black or Latinx. METCO participation does not induce students to choose colleges with different racial compositions. While it increases the likelihood of attending an Historically Black College or University (HBCU), but this is driven by the fact that METCO increases college enrollment overall.

## 6.4 Labor market outcomes

Table 5 shows that METCO improves earnings and increases the likelihood of working in Massachusetts. At age 25, METCO increased earnings in Massachusetts positions that were not federal, military, or self-employment by $6,562 annually. This effect size is more than double the non-METCO average of $5,649. By age 30 and 35, METCO has a larger positive effect on earnings of $11,630 and $19,533 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 (federal, military, or self-employment). Seventy-three 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 14 percentage points. This effect is still strong at age 30 and 35, with a 16 percentage point increase in the likelihood of appearing in the Massachusetts wage data. Without further information, we cannot disentangle how much of this effect is due to METCO reducing unemployment, movement out of state, becoming self-employed or a federal or military worker.

In Column 6 of Table 5, we estimate the effect of METCO on annual earnings for those that appear in the earnings data. This should be interpreted with caution because Column 4 finds differential selection into the earnings data. This shows that among earners, METCO participants earn more at age 25 through 35. The effect sizes are similar to Column 2 where we considered annual earnings to equal zero for those missing from the 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.

# 7 Mechanisms: Impact on school experience

The above analysis shows that attending a suburban school changed the trajectory of METCO applicants. It increased average Math and English performance. METCO increased 4-year college aspirations, enrollment, and graduation and resulted in higher earnings in adulthood. In this section, we will describe how the program altered the school, teacher, class, and peer traits that students experience to better understand how METCO impacts students' experience.

## 7.1 School & teacher traits

Over 70 percent of applicants with offers to attend METCO in Kindergarten or first grade accept. Half of those without offers by first grade enroll in a Boston Public School. Thirty percent of those without first grade offers enroll in private school or out of state. Approximately eight percent enroll in a Boston charter school and 10 percent move to a different school district. Less than two percent of those without referrals move to one of the suburban districts.

On average, METCO students attend schools with higher spending per pupil and average teacher salary. This varies by METCO district and the types of schools non-referred students attend. For example, Boston Public Schools have higher per pupil spending and average teacher salaries than many METCO districts.

METCO participation exposes students to more experienced teachers. Table 7 shows that METCO students' teachers in core classes have on average an additional 0.64 to 1.06 years of teaching experience. Five percentage points fewer of core teachers are novices while approximately 20 percent of non-METCO students teachers have fewer than 2 years of teaching experience.

Participating in METCO reduces exposure to teachers of color by about five percentage points and increases the proportion of White teachers. The teachers of non-METCO students are about 80 percent White and 20 percent Black or Latinx.

METCO participants also experience smaller class sizes with 2.5 fewer students per class. For elementary grades, this results in a class size of 21.5 versus 23 and for high school, a class size of 19 versus 21.5.

## 7.2 Course offerings & taking

The program alters the types of course offerings that applicants have access to and take (see Table 8). METCO increases the number of AP classes, foreign language classes, and arts classes that students have access to. The peers in METCO participants' core classes are substantially higher performing, with over 0.4 standard deviations higher average lagged Math and English, higher attendance rates, and lower suspension rates (see Table 6).

Despite the access to more rigorous classes and peers, METCO students are more likely to be placed in relatively lower performing classrooms. To determine this, we take the average lagged test scores of each core class in a given school and grade. Then we note the distance of the class average to the grade average. We also note which classes are in the bottom 25th percentile and bottom 50th percentile of class average lagged test scores. METCO participation increases the chance that students are in Math and English classes with relatively low performing peers. It is 5 percentage points more likely they are in a bottom 25th percentile class and approximately 15 percentage points more likely they are in a bottom 50th percentile class. The effects are similar for elementary, middle, and high school.

The average non-METCO student takes Math and English classes that have class lagged averages close to the grade mean. This suggests that on average, students are not tracked to lower performing classes. METCO students take Math classes where their peers score approximately 0.25 standard deviations below the grade mean on average in Math and 0.12 in English.

Being placed with relatively lower performing peers may relate to the type of curricula and rigor students experience. Even though METCO increases the number of available AP courses, it does not substantially change the likelihood that students take AP courses or the number of AP courses they take.

Participating in METCO increases the average number of Math, Science, foreign language, and arts classes that students take in high school. METCO participants also have classes with narrower skill distributions (as measured by the difference between the 90th and 10th percentile of lagged classmate scores), particularly in English. This may mean teachers can differentiate more easily.

### 7.3 Peers

Participating in METCO doubles the presence of White peers in students' classes and halves the presence of Black students. It also lowers the proportion of Latinx students by about a third. About 60 percent of non-METCO participants' classmates are low-income, which is approximately 30 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.

### 7.4 Classifications and Services

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.

Whether students sign up for services that classify them as "economically disadvantaged" in the state data may be influenced by the type of school they attend. In particular, the stigma of getting free or reduced price lunch in a suburban school might reduce the likelihood that applicants sign up in suburban schools versus urban schools. Consistent with this, those that do not participate in METCO, including those that applied, have are classified as economically disadvantaged at a higher rate. This holds even after controlling for socioeconomic factors such as parent level of education and whether the government paid for their healthcare from the birth records. This reduced likelihood for signing up for free or reduced price lunch could translate into lower likelihood of using other government supports.

## 8 Conclusion

Over 50 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 intra-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.

We find large, positive impacts on academic performance, college going and graduation, and labor market outcomes. Participating in the program leads students to have on average smaller class sizes, more funding per pupil, better paid teachers, more experienced teachers, and higher performing classmates. 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. Suburban school attendance also increases the likelihood students receive a special education classification and have more special education students in their classes.

Future work will analyze heterogeneous effects across districts and study the impacts on earlier cohorts' social outcomes - including marrying someone of a different race, housing location and ownership choices, and civic outcomes.

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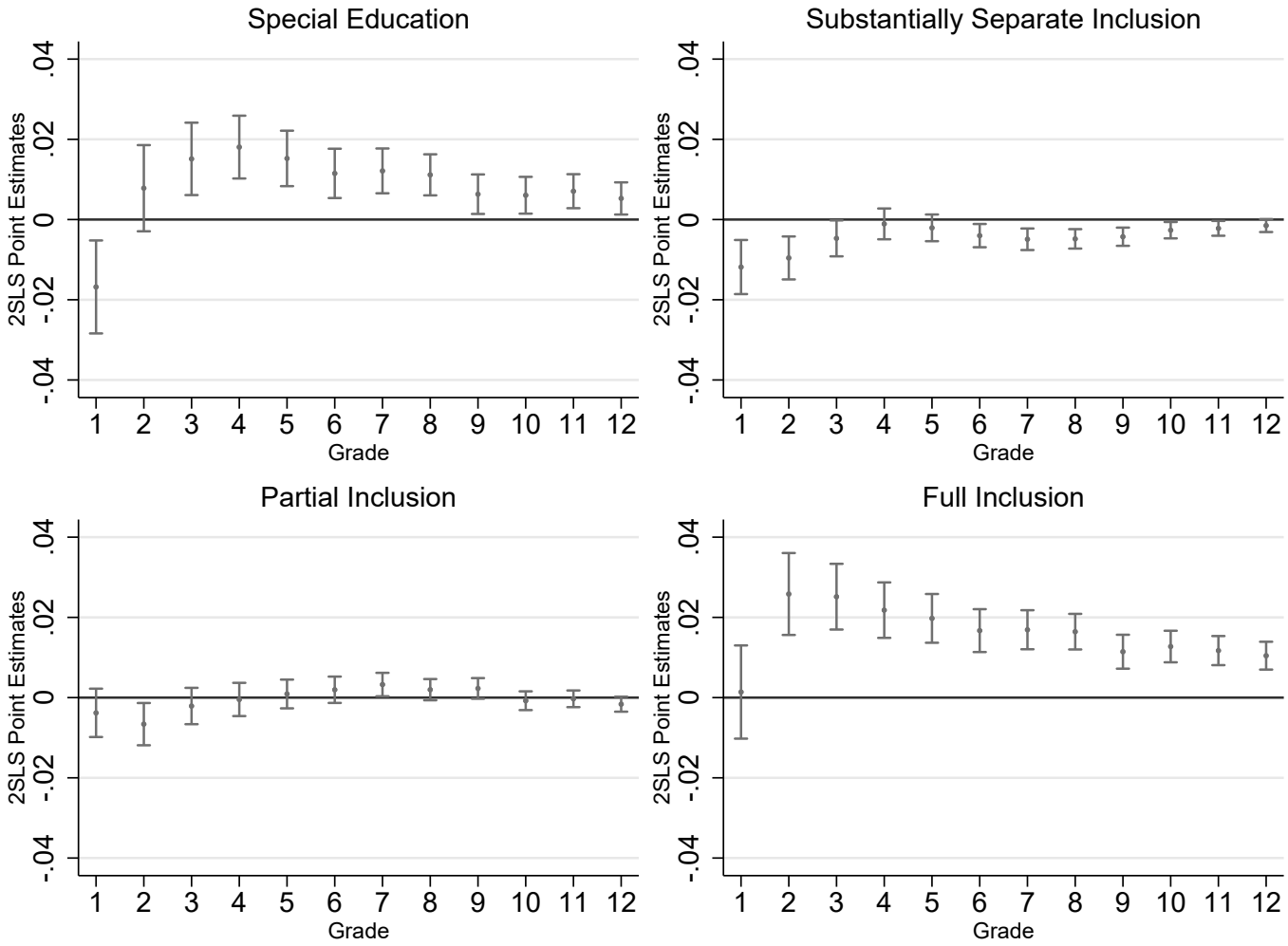
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Figure 1: 2SLS Effects of METCO on Special Education Status




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Table 1: Descriptive Statistics of K-12 Data

| | 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: Baseline Traits** | | | | | | |
| ***Demographics*** | | | | | | |
| Female | 0.503 | 0.487 | 0.547 | 0.493 | 0.483 | 0.497 |
| Black | 0.726 | 0.350 | 0.779 | 0.027 | 0.658 | 0.770 |
| Latino/a | 0.218 | 0.421 | 0.173 | 0.065 | 0.277 | 0.213 |
| Asian | 0.031 | 0.090 | 0.030 | 0.104 | 0.036 | 0.006 |
| White | 0.010 | 0.123 | 0.003 | 0.771 | 0.012 | 0.006 |
| Disability Affecting Bus Needs | 0.050 | 0.064 | 0.025 | 0.055 | 0.065 | 0.052 |
| Participation in Pre-K | 0.252 | 0.239 | 0.227 | 0.140 | 0.259 | 0.312 |
| Immigrant | 0.040 | 0.173 | 0.027 | 0.042 | 0.060 | 0.037 |
| **Panel B: 5th Grade Outcomes and Statuses** | | | | | | |
| Economically Disadvantaged | 0.658 | 0.735 | 0.557 | 0.098 | 0.777 | 0.666 |
| Special Education | 0.273 | 0.240 | 0.293 | 0.192 | 0.270 | 0.208 |
| English Learner (EL) | 0.094 | 0.314 | 0.056 | 0.038 | 0.155 | 0.093 |
| Suspension Rate | 0.087 | 0.046 | 0.047 | 0.007 | 0.071 | 0.217 |
| Attendance Rate | 0.943 | 0.917 | 0.952 | 0.955 | 0.927 | 0.959 |
| Math Exam | -0.387 | -0.410 | -0.302 | 0.455 | -0.505 | -0.233 |
| English Exam | -0.379 | -0.519 | -0.242 | 0.453 | -0.557 | -0.289 |
| Students | 23,071 | 45,515 | 7,336 | 145,706 | 8,247 | 3,536 |

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 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). 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. Downtown Boston includes Back Bay, Beacon Hill, Chinatown, Downtown, Financial District, Kenmore, Longwood, North End, South End, and West End. Other Boston includes: Allston, Brighton, Charlestown, East Boston, Hyde Park, Jamaica Plain, South Boston, and West Roxbury.

Table 2: 2SLS Effect of METCO on K-12 Outcomes

| | | Grade-level | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Non-METCO 3rd Grade Mean | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Effect of Any Referral on | | 1.072*** | 1.565*** | 2.049*** | 2.523*** | 2.933*** | 3.258*** | 3.671*** | 4.080*** | 3.508*** | 3.894*** | 4.385*** | 4.752*** |
| Years in METCO | | (0.009) | (0.013) | (0.016) | (0.020) | (0.024) | (0.027) | (0.029) | (0.032) | (0.037) | (0.041) | (0.046) | (0.050) |
| Math | -0.446 | | | 0.133*** | 0.153*** | 0.199*** | 0.132*** | 0.154*** | 0.193*** | | 0.244*** | | |
| | (1.060) | | | (0.044) | (0.043) | (0.042) | (0.038) | (0.040) | (0.042) | | (0.049) | | |
| N | 9748 | | | 10170 | 10508 | 10132 | 10796 | 10328 | 9689 | | 7836 | | |
| F-Stat | | | | 375 | 370 | 329 | 355 | 286 | 263 | | 152 | | |
| P-Value | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | 0.000 | | |
| English | -0.445 | | | 0.211*** | 0.184*** | 0.204*** | 0.188*** | 0.181*** | 0.218*** | | 0.234*** | | |
| | (1.063) | | | (0.042) | (0.043) | (0.043) | (0.039) | (0.041) | (0.043) | | (0.048) | | |
| N | 10464 | | | 10806 | 10504 | 10139 | 10817 | 10348 | 9700 | | 7895 | | |
| F-Stat | | | | 412 | 366 | 326 | 355 | 285 | 262 | | 152 | | |
| P-Value | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | 0.000 | | |
| Attendance Rate | 0.911 | 0.016*** | 0.012** | 0.017*** | 0.013** | 0.017*** | 0.010* | 0.005 | 0.013** | 0.036*** | 0.034*** | 0.018 | 0.019 |
| | (0.168) | (0.004) | (0.005) | (0.005) | (0.006) | (0.005) | (0.006) | (0.007) | (0.007) | (0.009) | (0.010) | (0.012) | (0.013) |
| N | 11877 | 11637 | 12289 | 12359 | 12207 | 11915 | 12135 | 11721 | 11042 | 10338 | 9217 | 7927 | 7241 |
| F-Stat | | 726 | 520 | 442 | 399 | 370 | 391 | 312 | 285 | 199 | 170 | 144 | 125 |
| P-Value | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Suspended | 0.048 | -0.021*** | -0.019*** | -0.022*** | -0.043*** | -0.057*** | -0.024* | -0.036** | -0.028* | -0.079*** | -0.045*** | -0.039** | -0.027* |
| | (0.214) | (0.006) | (0.007) | (0.008) | (0.009) | (0.011) | (0.013) | (0.015) | (0.016) | (0.016) | (0.017) | (0.017) | (0.016) |
| N | 11877 | 11078 | 12267 | 12359 | 12207 | 11915 | 12135 | 11721 | 11042 | 10338 | 9217 | 7927 | 7241 |
| F-Stat | | 672 | 517 | 442 | 399 | 370 | 391 | 312 | 285 | 199 | 170 | 144 | 125 |
| P-Value | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Number of Suspensions | 0.110 | -0.041* | -0.003 | -0.035 | -0.086*** | -0.151*** | -0.070 | -0.222** | -0.072 | -0.663*** | -0.277* | -0.278* | 0.030 |
| | (0.700) | (0.022) | (0.026) | (0.025) | (0.027) | (0.044) | (0.066) | (0.090) | (0.109) | (0.175) | (0.166) | (0.155) | (0.100) |
| N | 11877 | 11078 | 12267 | 12359 | 12207 | 11915 | 12135 | 11721 | 11042 | 10338 | 9217 | 7927 | 7241 |
| F-Stat | | 672 | 517 | 442 | 399 | 370 | 391 | 312 | 285 | 199 | 170 | 144 | 125 |
| P-Value | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: This table reports the 2SLS estimates of the impact of METCO participation in each grade on test score and behavioral outcomes. All models use individual school district METCO referrals as instrumental variables and control for race, gender, age at time of application (linear and squared), neighborhood indicators at the time of application, indicators for which grade and year combinations students were in the applicant pool, whether students ever had an English learner status, immigrant status, and whether the student had a special education classification that may require specialized bussing by first grade. Effects are robust to controlling for birth record controls including parental level of education, whether the government paid for prenatal care or childbirth, parents' marital status, whether a father is on the birth certificate, and quality of prenatal care.

Table 3: 2SLS Effects 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 | 0.041 | -0.026*** | (0.008) | 7405 | 289 | 0.000 |
| Graduate in 4 Years | 0.782 | 0.102*** | (0.017) | 7405 | 289 | 0.000 |
| Graduate in 5 Years | 0.906 | 0.035*** | (0.012) | 6125 | 258 | 0.000 |
| **Panel B: Testing** | | | | | | |
| Meets Standardized Testing High School Graduation Requirement | 0.687 | 0.089*** | (0.020) | 7027 | 289 | 0.000 |
| Qualify for Adams Scholarship | 0.206 | -0.051*** | (0.016) | 7039 | 290 | 0.000 |
| Take SAT | 0.452 | 0.183*** | (0.020) | 9346 | 354 | 0.000 |
| SAT 800 or Higher | 0.357 | 0.174*** | (0.019) | 9346 | 354 | 0.000 |
| SAT 1000 or Higher | 0.172 | 0.083*** | (0.016) | 9346 | 354 | 0.000 |
| SAT 1200 or Higher | 0.050 | 0.017** | (0.009) | 9346 | 354 | 0.000 |
| SAT 1400 or Higher | 0.011 | 0.001 | (0.004) | 9346 | 354 | 0.000 |
| Took AP | 0.293 | 0.041** | (0.018) | 9346 | 354 | 0.000 |
| Number of APs | 0.857 | 0.036 | (0.064) | 9346 | 354 | 0.000 |
| AP Score Above 3 | 0.128 | 0.022 | (0.013) | 9346 | 354 | 0.000 |
| AP Score 4 or 5 | 0.071 | 0.011 | (0.010) | 9346 | 354 | 0.000 |
| **Panel C: Post High School Aspirations** | | | | | | |
| Any College | 0.726 | 0.059*** | (0.019) | 6897 | 276 | 0.000 |
| 2 Year College | 0.179 | -0.111*** | (0.017) | 6897 | 276 | 0.000 |
| 4 Year College | 0.548 | 0.169*** | (0.022) | 6897 | 276 | 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 referrals as instrumental variables.See Table 2 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 2.

Table 4: 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 | 0.311 | -0.005 | (0.010) | 5718 | 234 | 0.000 |
| Percent Non-white | 0.538 | 0.010 | (0.011) | 5718 | 234 | 0.000 |
| Percent Attend Historically Black College or University | 0.030 | 0.023** | (0.010) | 5968 | 239 | 0.000 |
| **Panel B: College Enrollment** | | | | | | |
| Any College | 0.697 | 0.141*** | (0.020) | 7648 | 294 | 0.000 |
| Two-Year College | 0.230 | -0.075*** | (0.019) | 7648 | 294 | 0.000 |
| Four-year College | 0.523 | 0.213*** | (0.022) | 7648 | 294 | 0.000 |
| Four-year Public | 0.260 | 0.068*** | (0.021) | 7648 | 294 | 0.000 |
| Four-year Private | 0.286 | 0.164*** | (0.021) | 7648 | 294 | 0.000 |
| Four-year Public in MA | 0.201 | 0.057*** | (0.019) | 7648 | 294 | 0.000 |
| **Panel C: Four-Year College Ranking** | | | | | | |
| Most Competitive | 0.037 | 0.015* | (0.009) | 7648 | 294 | 0.000 |
| Highly Competitive | 0.083 | 0.040*** | (0.013) | 7648 | 294 | 0.000 |
| Very Competitive | 0.157 | 0.048*** | (0.017) | 7648 | 294 | 0.000 |
| Competitive | 0.471 | 0.198*** | (0.023) | 7648 | 294 | 0.000 |
| **Panel D: Four-Year College Persistence+** | | | | | | |
| One academic semester | 0.522 | 0.214*** | (0.033) | 3007 | 143 | 0.000 |
| Three academic semesters | 0.473 | 0.191*** | (0.033) | 3007 | 143 | 0.000 |
| Five academic semesters | 0.414 | 0.159*** | (0.033) | 3007 | 143 | 0.000 |
| Seven academic semesters | 0.366 | 0.137*** | (0.033) | 3007 | 143 | 0.000 |
| **Panel E: College Graduation within 6 years+** | | | | | | |
| Any | 0.330 | 0.067** | (0.031) | 3007 | 143 | 0.000 |
| Two-Year College | 0.042 | -0.002 | (0.013) | 3007 | 143 | 0.000 |
| Four-year College | 0.301 | 0.081*** | (0.031) | 3007 | 143 | 0.000 |

Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on college enrollment, persistence, and graduation. All models use individual school district METCO referrals as instrumental variables.See Table 2 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 2.

Table 5: 2SLS Effects on Labor Market Outcomes

| | Annual Income | | Not in Wage Data (Unemployed, Out-of-State, Self-Employed, or Federal) | | Wages for Employed in MA | |
|---|---|---|---|---|---|---|
| | Non-METCO | | Non-METCO | | Non-METCO | |
| Age | Mean | 2SLS | Mean | 2SLS | Mean | 2SLS |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| 25 | 5,649 | 6,562** | 0.726 | -0.139** | 22,622 | 6,293** |
| | | (1094) | | (0.029) | | (1583) |
| 30 | 11,190 | 11,630** | 0.593 | -0.165** | 34,613 | 9,641** |
| | | (1830) | | (0.030) | | (2149) |
| 35 | 12,628 | 19,533** | 0.578 | -0.162** | 42,469 | 24,289** |
| | | (3891) | | (0.030) | | (6270) |
| N | | 3,607 | | 3,607 | | 1,798 |
| F-stat | | 1923 | | 1923 | | 1194 |
| p-value | | 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 individual school district METCO referrals as instrumental variables.See Table 2 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 2. 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 6: 2SLS Effects on Classroom Characteristics

| | Grade 4 | | Grade 7 | | Grade 9 | |
|---|---|---|---|---|---|---|
| | Mean | 2SLS | Mean | 2SLS | Mean | 2SLS |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Tracking - distance between class avg and class avg in grade | | | | | | |
| Math | 0.002 | -0.263*** | -0.035 | -0.250*** | -0.078 | -0.275*** |
| | | (0.011) | | (0.010) | | (0.010) |
| English | 0.014 | -0.128*** | -0.006 | -0.110*** | -0.035 | -0.113*** |
| | | (0.009) | | (0.009) | | (0.009) |
| In bottom 25th percentile of classes: Math | 0.016 | 0.044*** | 0.037 | 0.043*** | 0.045 | 0.039*** |
| | | (0.004) | | (0.004) | | (0.004) |
| In bottom 25th percentile of classes: English | 0.018 | 0.048*** | 0.038 | 0.047*** | 0.053 | 0.044*** |
| | | (0.004) | | (0.004) | | (0.004) |
| In bottom 50th percentile of classes: Math | 0.681 | 0.150*** | 0.698 | 0.144*** | 0.728 | 0.157*** |
| | | (0.008) | | (0.008) | | (0.007) |
| In bottom 50th percentile of classes: English | 0.699 | 0.040*** | 0.773 | 0.040*** | 0.886 | 0.038*** |
| | | (0.007) | | (0.007) | | (0.006) |
| Bottom half class: math | 0.475 | 0.140*** | 0.482 | 0.128*** | 0.545 | 0.139*** |
| | | (0.010) | | (0.010) | | (0.010) |
| Bottom half class: English | 0.438 | 0.102*** | 0.440 | 0.094*** | 0.472 | 0.100*** |
| | | (0.010) | | (0.010) | | (0.010) |
| **Average of lagged classmate traits** | | | | | | |
| Math exam | -0.305 | 0.430*** | -0.258 | 0.447*** | -0.376 | 0.480*** |
| | | (0.011) | | (0.011) | | (0.011) |
| English Exam | -0.322 | 0.437*** | -0.299 | 0.454*** | -0.410 | 0.501*** |
| | | (0.011) | | (0.011) | | (0.011) |
| Attendance rate | 0.937 | 0.014*** | 0.933 | 0.017*** | 0.899 | 0.023*** |
| | | (0.001) | | (0.001) | | (0.001) |
| Suspension rate | 0.039 | -0.037*** | 0.105 | -0.046*** | 0.128 | -0.057*** |
| | | (0.001) | | (0.002) | | (0.002) |
| **Distributional spreads of lagged scores** | | | | | | |
| 90th - 10th percentile: Math | 2.204 | -0.047*** | 1.745 | -0.042*** | 1.654 | -0.044*** |
| | | (0.010) | | (0.010) | | (0.010) |
| 90th - 10th percentile: English | 2.205 | -0.185*** | 1.862 | -0.198*** | 1.814 | -0.218*** |
| | | (0.011) | | (0.011) | | (0.010) |
| **Class traits** | | | | | | |
| Average class size | 23.171 | -2.252*** | 22.719 | -2.247*** | 21.668 | -2.418*** |
| | | (0.210) | | (0.234) | | (0.249) |
| Average # METCO in class | 0.727 | 1.352*** | 1.282 | 1.644*** | 1.415 | 2.238*** |
| | | (0.036) | | (0.041) | | (0.046) |
| Average Proportion of METCO from cohort in classes | 0.309 | 0.172*** | 0.138 | 0.203*** | 0.090 | 0.213*** |
| | | (0.006) | | (0.007) | | (0.007) |
| **Class Demographics** | | | | | | |
| % Low income | 0.595 | -0.279*** | 0.573 | -0.304*** | 0.551 | -0.343*** |
| | | (0.004) | | (0.004) | | (0.004) |
| % White | 0.187 | 0.209*** | 0.212 | 0.235*** | 0.228 | 0.284*** |
| | | (0.004) | | (0.004) | | (0.004) |
| % Black | 0.408 | -0.175*** | 0.405 | -0.186*** | 0.399 | -0.216*** |
| | | (0.003) | | (0.004) | | (0.004) |
| % Latinx | 0.310 | -0.085*** | 0.291 | -0.091*** | 0.279 | -0.107*** |
| | | (0.003) | | (0.003) | | (0.003) |
| % Special Education | 0.226 | 0.026*** | 0.242 | 0.019*** | 0.251 | 0.011*** |
| | | (0.003) | | (0.004) | | (0.004) |
| % English Language Learner | 0.196 | -0.041*** | 0.126 | -0.045*** | 0.113 | -0.054*** |
| | | (0.002) | | (0.003) | | (0.003) |

Notes: This table reports the 2SLS estimates of the impact of participating in METCO in grades 4, 7, or 9 on characteristics of the core classes students take. All models use individual school district METCO referrals as instrumental variables.See Table 2 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 2.

Table 7: 2SLS Effects on Teacher Characteristics

| | Grade 4 | | Grade 7 | | Grade 9 | |
|---|---|---|---|---|---|---|
| | Mean | 2SLS | Mean | 2SLS | Mean | 2SLS |
| Average teacher salary (district-level) | 90,315 | 6,114*** | 88,435 | 5,722*** | 89,675 | 6,665*** |
| | | (209) | | (229) | | (241) |
| Average spending per pupil (district-level) | 20,074 | 1,430*** | 19,767 | 1,378*** | 19,893 | 1,294*** |
| | | (44) | | (47) | | (49) |
| Average students per guidance counselor | 385 | -47*** | 351 | -53*** | 301 | -67*** |
| | | (4.643) | | (5.248) | | (5.712) |
| % of Teachers licensed in teaching assignment | 0.961 | 0.019*** | 0.911 | 0.015*** | 0.958 | 0.018*** |
| | | (0.002) | | (0.003) | | (0.003) |
| % of core academic classes taught by highly qualified teachers | 0.937 | 0.013*** | 0.897 | 0.011** | 0.894 | 0.019*** |
| | | (0.004) | | (0.004) | | (0.004) |
| % of teachers with advanced degree | 0.059 | -0.007** | 0.054 | -0.009*** | 0.050 | -0.009*** |
| | | (0.003) | | (0.003) | | (0.003) |
| Average years of teaching experience in MA | 11.062 | 0.750*** | 9.185 | 0.610*** | 9.048 | 1.037*** |
| | | (0.105) | | (0.116) | | (0.122) |
| % novice teacher (<2 years) | 0.175 | -0.048*** | 0.247 | -0.037*** | 0.196 | -0.053*** |
| | | (0.005) | | (0.005) | | (0.005) |
| % new to school (<2 years in school) | 0.106 | -0.032*** | 0.178 | -0.028*** | 0.116 | -0.037*** |
| | | (0.004) | | (0.004) | | (0.004) |
| % White teachers | 0.803 | 0.029*** | 0.782 | 0.028*** | 0.767 | 0.042*** |
| | | (0.004) | | (0.005) | | (0.005) |
| % Black or Latinx teachers | 0.203 | -0.050*** | 0.228 | -0.046*** | 0.204 | -0.060*** |
| | | (0.004) | | (0.005) | | (0.005) |
| Average Math Teacher VAM | 0.052 | -0.007** | 0.078 | -0.005 | 0.065 | -0.012*** |
| | | (0.003) | | (0.003) | | (0.003) |
| Average English Teacher VAM | 0.250 | -0.055*** | 0.295 | -0.051*** | 0.264 | -0.071*** |
| | | (0.005) | | (0.005) | | (0.006) |

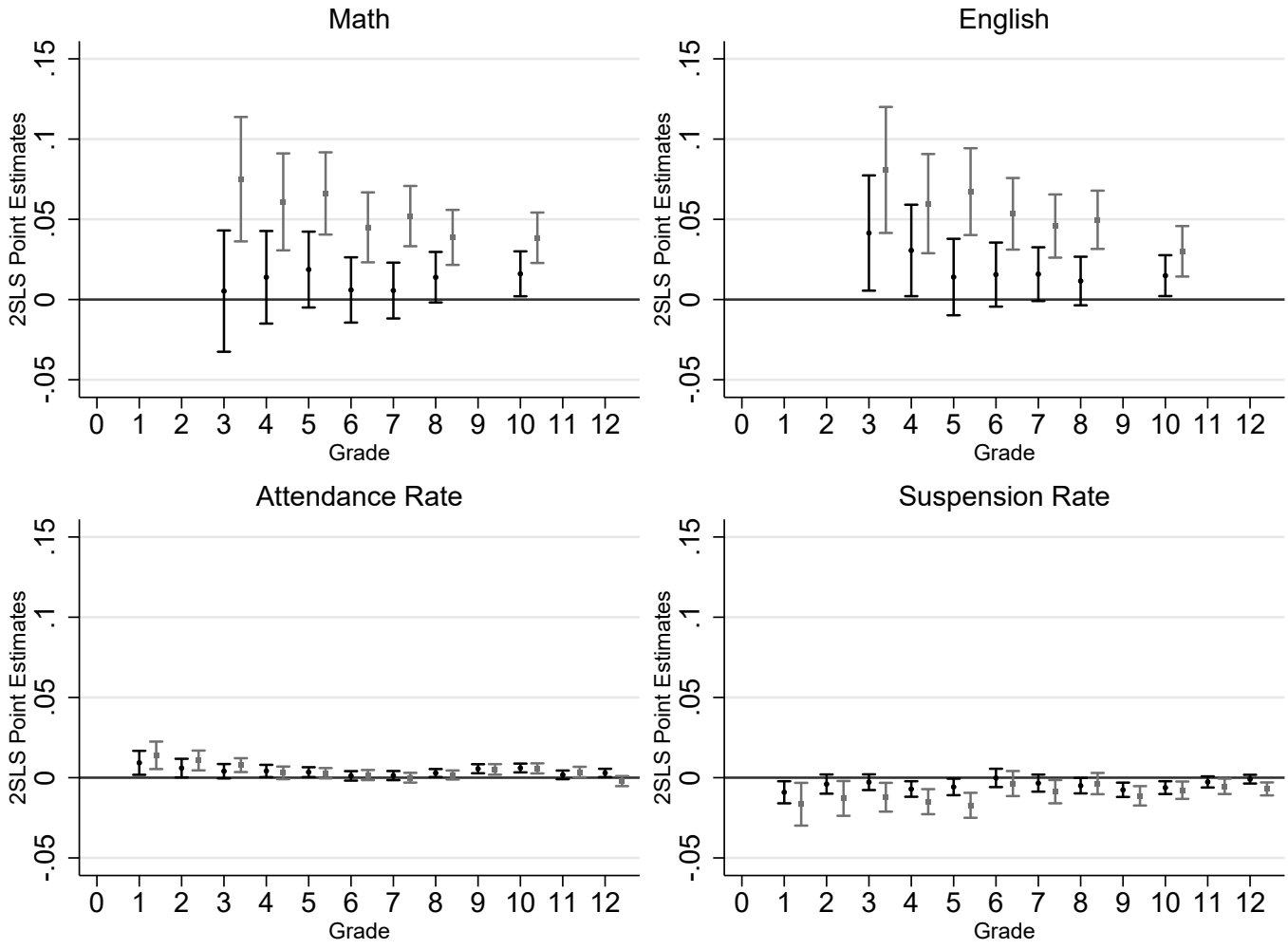
Notes: This table reports the 2SLS estimates of the impact of participating in METCO in grades 4, 7, or 9 on teacher characteristics in core classes. All models use individual school district METCO referrals as instrumental variables.See Table 2 notes for the full list of control variables. Results are robust to controlling for birth record variables listed in Table 2.

Table 8: 2SLS Effects on Class Options and Taking

| | Non-referred mean (1) | 2SLS Estimate (2) | Standard Error (3) | N (4) | F-stat (5) |
|---|---|---|---|---|---|
| Panel A: Course Offerings | | | | | |
| Number of AP classess offerred | 14.527 | 4.132*** | (0.446) | 8871 | 360.035 |
| Average number of foreign languages offered in elementary | 0.435 | 0.232*** | (0.022) | 11801 | 473.741 |
| in middle | 1.529 | 0.902*** | (0.052) | 12216 | 510.363 |
| in high school | 2.834 | 1.309*** | (0.078) | 8871 | 360.035 |
| Average number of arts course types offerred in elementary | 2.035 | -0.010 | (0.023) | 11801 | 473.741 |
| in middle | 2.415 | 0.211*** | (0.030) | 12216 | 510.363 |
| in high school | 2.659 | 0.350*** | (0.039) | 8871 | 360.035 |
| Panel B: Individual Student Course-Taking | | | | | |
| Take any AP classes | 0.321 | 0.034* | (0.018) | 9902 | 383.137 |
| Number of AP classes taken | 0.857 | 0.038 | (0.064) | 9346 | 354.799 |
| Years of HS Math | 3.870 | 0.050*** | (0.017) | 5898 | 263.965 |
| Years of HS Science | 3.562 | 0.104*** | (0.028) | 5898 | 263.965 |
| Years of HS Foreign Language | 2.292 | 0.388*** | (0.054) | 5898 | 263.965 |
| Years of HS Arts | 1.483 | 0.179*** | (0.059) | 5898 | 263.965 |
| Years of MS Arts | 1.323 | 0.067** | (0.029) | 16371 | 658.963 |

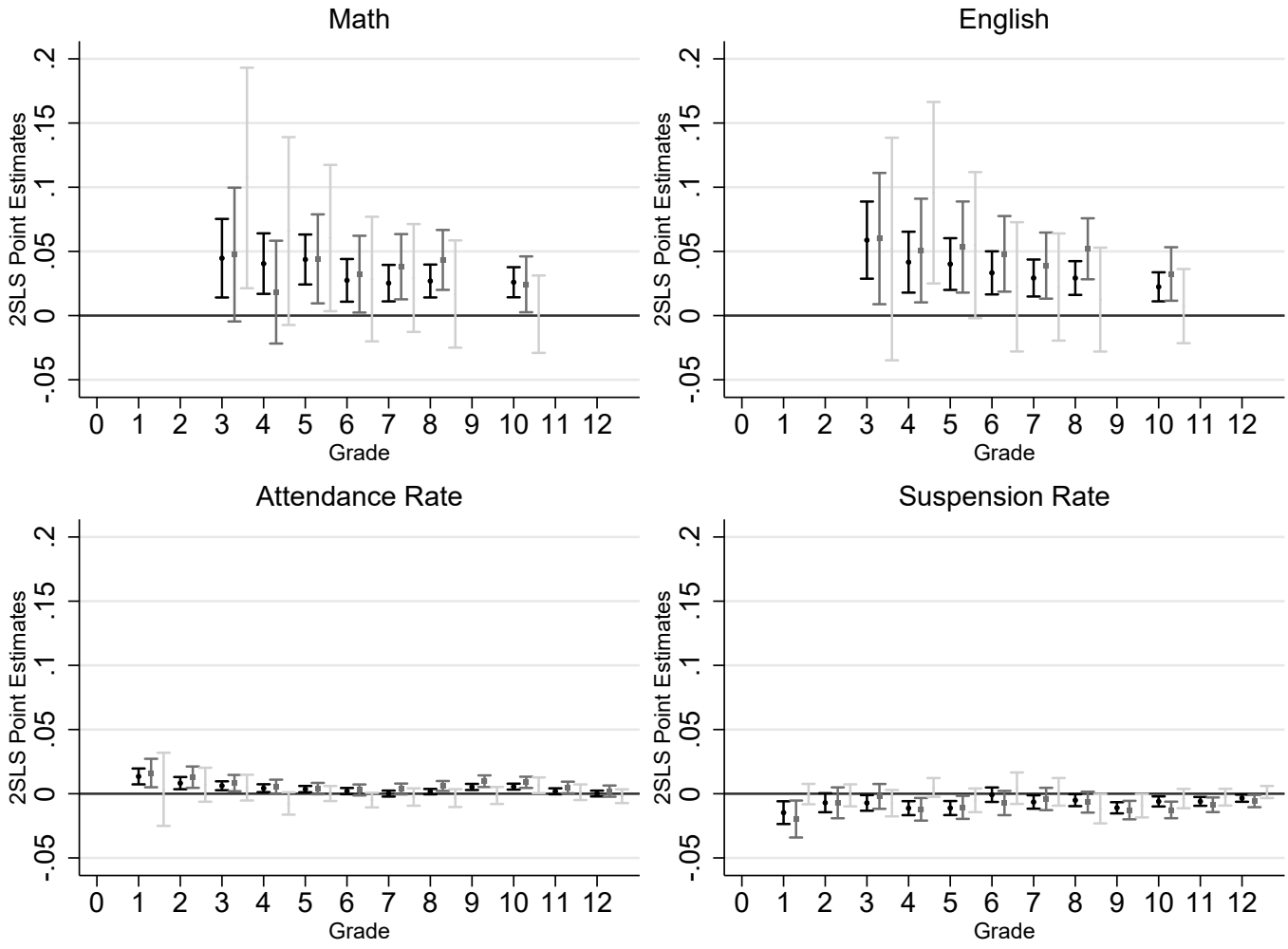
Notes: This table reports the 2SLS estimates of the impact of ever participating in METCO on the classes available in the school and the courses completed. All models use individual school district METCO referrals as instrumental variables.See Table 2 notes for the full list of control variables. Results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

Figure 2: 2SLS K-12 Effects by Gender



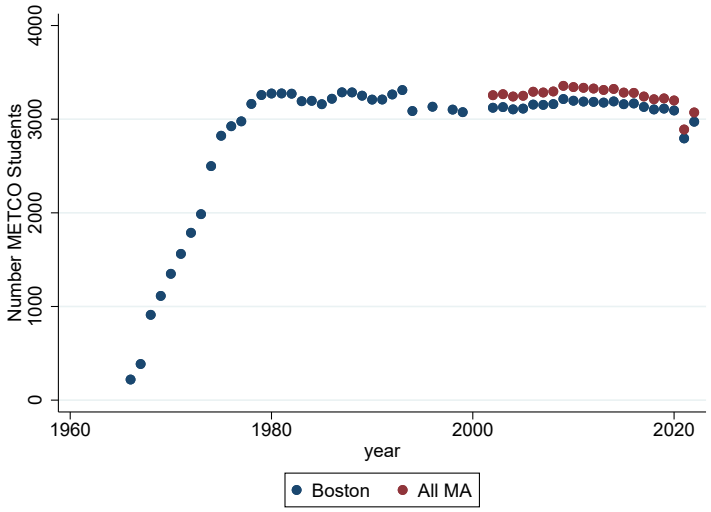

Note: Black denotes female students and gray denotes male students. 95% confidence interval bars are shown.

Figure 3: 2SLS K-12 Effects by Race




Note: Black denotes Black students, dark gray denotes Latinx students, and light gray denotes Asian students.

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.

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Figure 2: Student Enrollment Rate after Referrals Varies by District

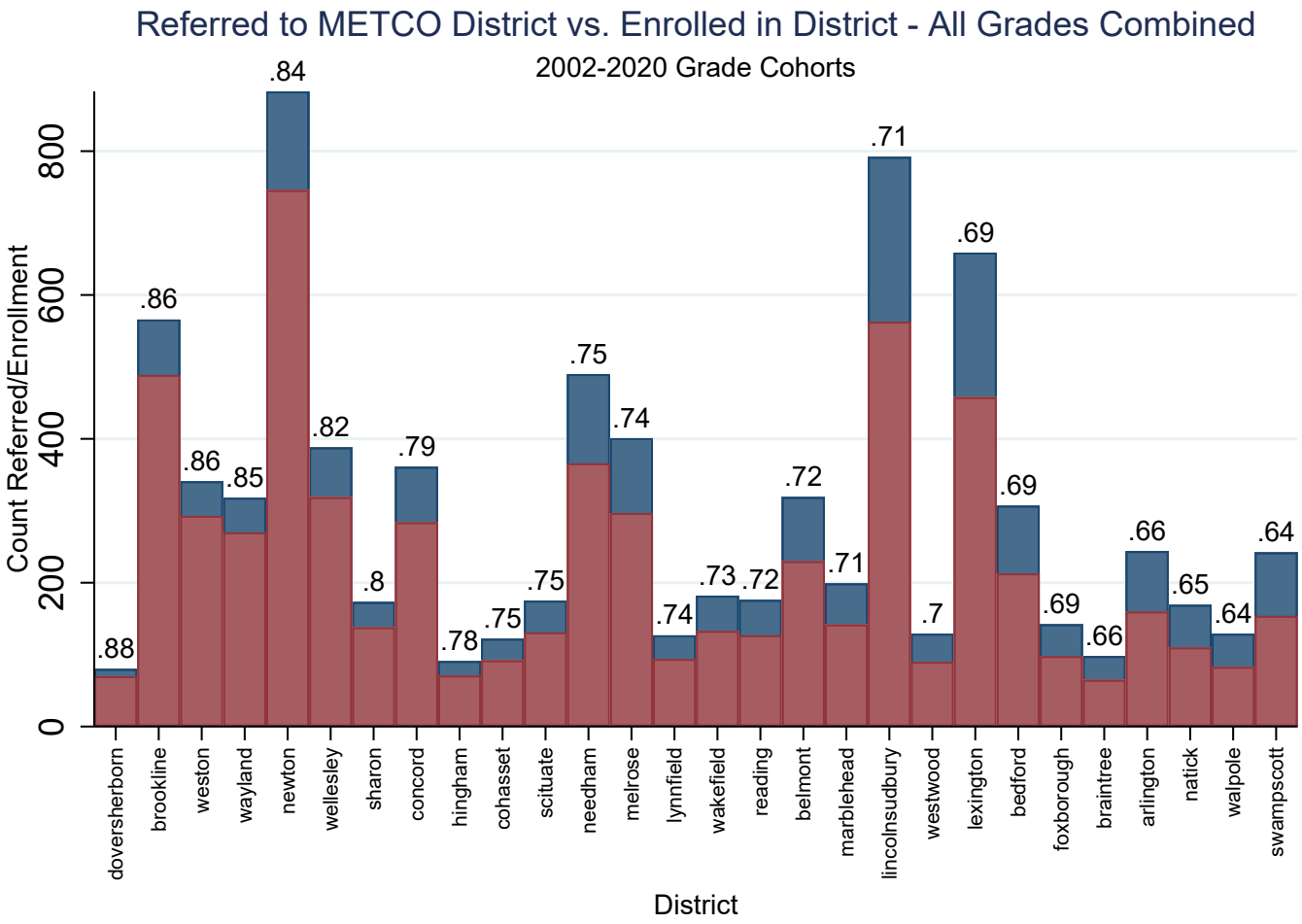


Table 1: Balance Table

| | 1st Graders | |
|---|---|---|
| | Not Referred Mean | Basic |
| | (1) | (2) |
| Disability Affecting Bus Needs* | 0.017 | -0.005** |
| | | (0.003) |
| Immigrant | 0.024 | -0.006** |
| | | (0.003) |
| Ever English-Language Learner | 0.213 | -0.027*** |
| | | (0.008) |
| *Neighborhood at Application Date* | | |
| Boston** | 0.070 | -0.011** |
| | | (0.005) |
| Dorchester | 0.398 | -0.005 |
| | | (0.010) |
| Roxbury | 0.145 | -0.003 |
| | | (0.007) |
| Mattapan & Roslindale | 0.169 | 0.012 |
| | | (0.008) |
| Other Boston*** | 0.218 | 0.007 |
| | | (0.008) |
| *Neighborhood Demographics (Census block group)* | | |
| Median income | $ 63,371 | 1,713** |
| | | (779.687) |
| % high school graduate | 0.828 | 0.002 |
| | | (0.002) |
| % college graduate | 0.315 | -0.003 |
| | | (0.004) |
| % homeowner | 0.357 | 0.027*** |
| | | (0.005) |
| % single parent | 0.539 | 0.004 |
| | | (0.006) |
| % public assistance | 0.043 | -0.002* |
| | | (0.001) |
| *Birth records data* | | |
| Apgar 5 | 8.808 | 0.010 |
| | | (0.015) |
| Infant weight (grams) | 3205.869 | 20.281 |
| | | (13.980) |
| Prenatal Care: Adequate | 0.785 | 0.044*** |
| | | (0.009) |
| Gestational Age in Weeks | 38.517 | 0.135** |
| | | (0.061) |
| Parents Married at Birth | 0.383 | -0.009 |
| | | (0.011) |
| Absent Father at Birth | 0.229 | -0.033*** |
| | | (0.009) |
| Govt Paid for Birth care | 0.885 | -0.009 |
| | | (0.007) |
| Both Parents College+ | 0.132 | 0.020** |
| | | (0.008) |
| at least one parent college+ | 0.337 | 0.044*** |
| | | (0.012) |
| N | 7,075 | 9,176 |

Table 2: Match from Applicant Data to Administrative Data

| | Sample | | | | |
|---|---|---|---|---|---|
| | K-12 | High School | College | Age 30 (has College Outcomes) | Age 30 (has HS & College Outcomes) |
| Applicants to METCO | 23065 | 18208 | 12941 | 13530 | 11297 |
| Applicants with MA Birth Records | 17148 | 13275 | 9202 | 8085 | 6886 |
| Non-Sibling Applicants in K or 1st grade | 19845 | 15800 | 11318 | 13475 | 11242 |
| Non-Siblings In MA Education Data | 17862 | 14219 | 10081 | 10427 | 9013 |
| Non-Siblings in Education & MA Birth | 13867 | 10876 | 7563 | 6951 | 6040 |
| Non-Siblings in MA Labor Data | 6043 | 6043 | 6043 | 7745 | 6795 |
| Non-Siblings In Birth and Labor Data | 4675 | 4675 | 4675 | 5337 | 4700 |

Notes:

Table 3: Sample Selection

| | 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*** | 0.197*** | 0.079*** | 0.075*** | 0.053*** | 0.113*** | 0.159*** | 0.176*** | 0.150*** | 0.147*** | 0.136* | 0.169*** |
| | (0.016) | (0.016) | (0.019) | (0.019) | (0.019) | (0.026) | (0.041) | (0.062) | (0.050) | (0.050) | (0.072) | (0.058) |
| N | 62,944 | 62,944 | 12,447 | 12,447 | 12,445 | 12,445 | 8,613 | 5,969 | 9,698 | 9,521 | 3,426 | 5,537 |
| English | 0.274*** | 0.357*** | 0.188*** | 0.177*** | 0.148*** | 0.185*** | 0.282*** | 0.250*** | 0.143*** | 0.141*** | 0.155** | 0.112* |
| | (0.015) | (0.016) | (0.019) | (0.020) | (0.019) | (0.026) | (0.042) | (0.064) | (0.052) | (0.052) | (0.074) | (0.059) |
| N | 62,187 | 62,187 | 12,461 | 12,461 | 12,459 | 12,459 | 8,630 | 5,978 | 9,703 | 9,526 | 3,436 | 5,547 |
| Attendance Rate | 0.030*** | 0.029*** | 0.026*** | 0.026*** | 0.026*** | 0.028*** | 0.026*** | 0.025*** | 0.004 | 0.003 | 0.021** | 0.001 |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.003) | (0.005) | (0.008) | (0.007) | (0.007) | (0.009) | (0.008) |
| N | 66,494 | 66,494 | 13,676 | 13,676 | 13,674 | 13,674 | 9,399 | 6,506 | 10,657 | 10,474 | 3,743 | 6,121 |
| Suspended | -0.045*** | -0.064*** | -0.073*** | -0.073*** | -0.074*** | -0.074*** | -0.084*** | -0.082*** | -0.030** | -0.030** | -0.083*** | -0.032* |
| | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.007) | (0.012) | (0.018) | (0.015) | (0.015) | (0.021) | (0.017) |
| N | 66,491 | 66,491 | 13,676 | 13,676 | 13,674 | 13,674 | 9,399 | 6,506 | 10,657 | 10,474 | 3,743 | 6,121 |
| Number of Suspensions | -0.131*** | -0.192*** | -0.205*** | -0.206*** | -0.207*** | -0.215*** | -0.258*** | -0.199*** | -0.074 | -0.070 | -0.204*** | -0.060 |
| | (0.008) | (0.009) | (0.013) | (0.014) | (0.014) | (0.029) | (0.044) | (0.070) | (0.059) | (0.059) | (0.075) | (0.064) |
| N | 66,491 | 66,491 | 13,676 | 13,676 | 13,674 | 13,674 | 9,399 | 6,506 | 10,657 | 10,474 | 3,743 | 6,121 |
| 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 |
| Sibling Control | | | | | | | X | | | | | |
| Exclude Siblings | | | | | | | | 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 |
| Exclude declined prior referrals and control for risk sets | | | | | | | | | X | X | | X |
| Prenatal care adequacy | | | | | | | | | | | X | X |
| Family structure at birth | | | | | | | | | | | X | X |
| Parental education | | | | | | | | | | | X | X |
| Medicaid at birth | | | | | | | | | | | 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 Selection

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

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

The digitization of the METCO applicant data allows us to control for the fact that those who apply to and enroll in METCO may be advantaged in unobservable ways. This could include student or family motivation and parental resources (time, social connections, knowledge of program). Restricting the sample to the 17 percent of Boston students that applied to METCO before 1st grade reduces the Math, English, and attendance point estimates by more than 50 percent (see Column 3). This suggests that students who were pre-disposed to do better on the exams were more likely to enroll in METCO, but a substantial positive association between enrolling in METCO and outcomes remains. The relationship between METCO enrollment and reduced suspensions becomes stronger, suggesting that the types of students who apply to METCO cannot explain the positive association between METCO and attendance and reduced suspensions.

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

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

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

Applicants with older siblings already in METCO have a higher likelihood of being admitted. Therefore the referral instruments are not valid for children with older siblings since they are not plausibly random. After excluding siblings from the analysis, Column 8 shows that the point estimates are higher in Math and English and similar in attendance and suspensions. Next, we properly control for which application grade X years students were eligible to be referred in Column 9, which shrinks the point estimates for English, attendance, and suspensions. Finally, we control for socioeconomic factors from the birth records: whether the child received adequate prenatal care, whether their parents were married when they were born, whether their parents were college educated, and whether they were on Medicaid at birth. The referred group is not positively selected on these socioeconomic controls.

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