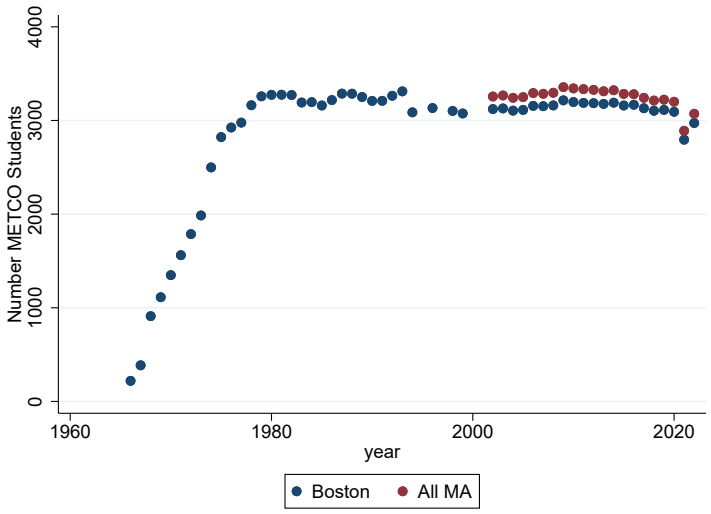
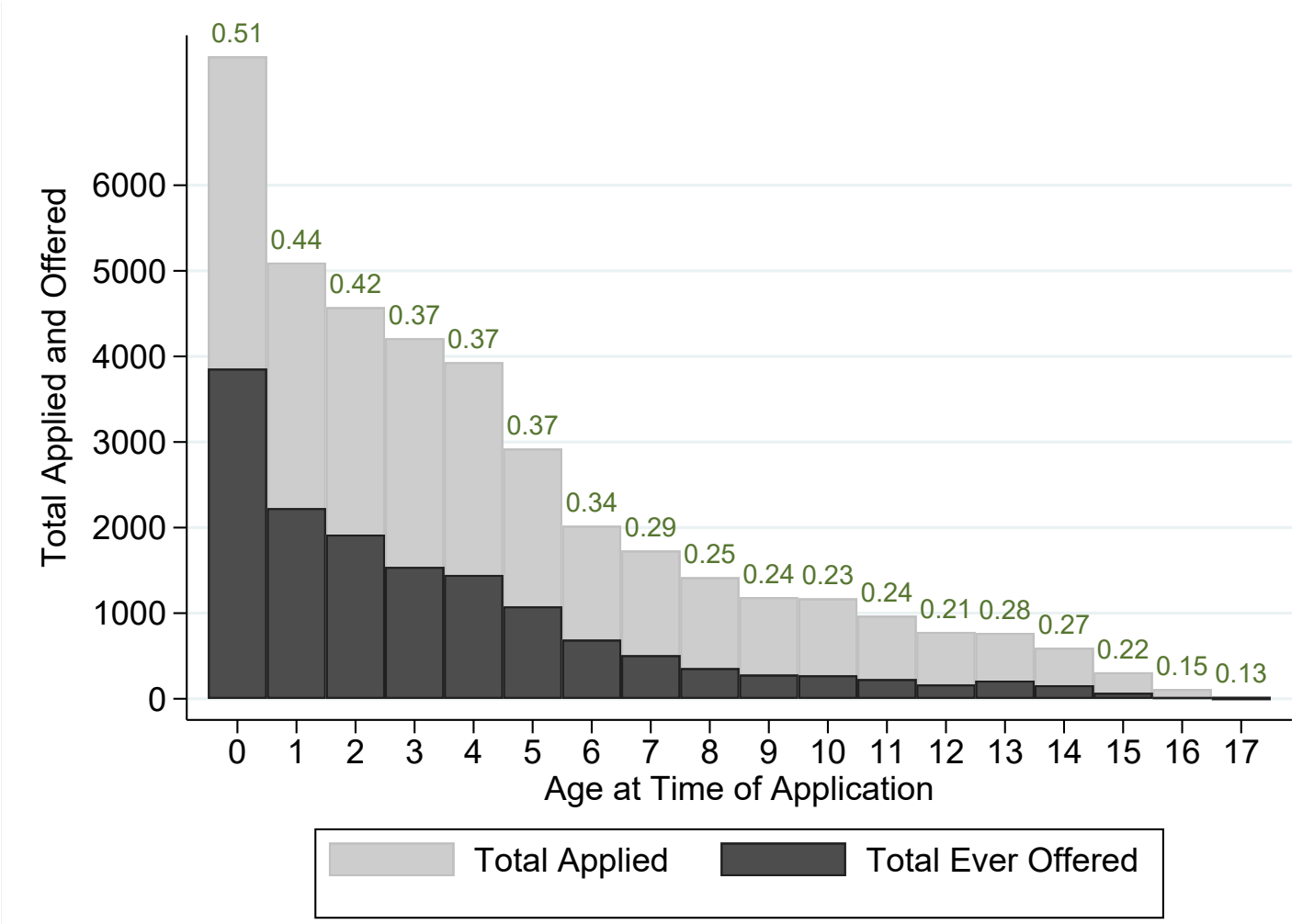
Appendix Figure 1: METCO Enrollment Over Time



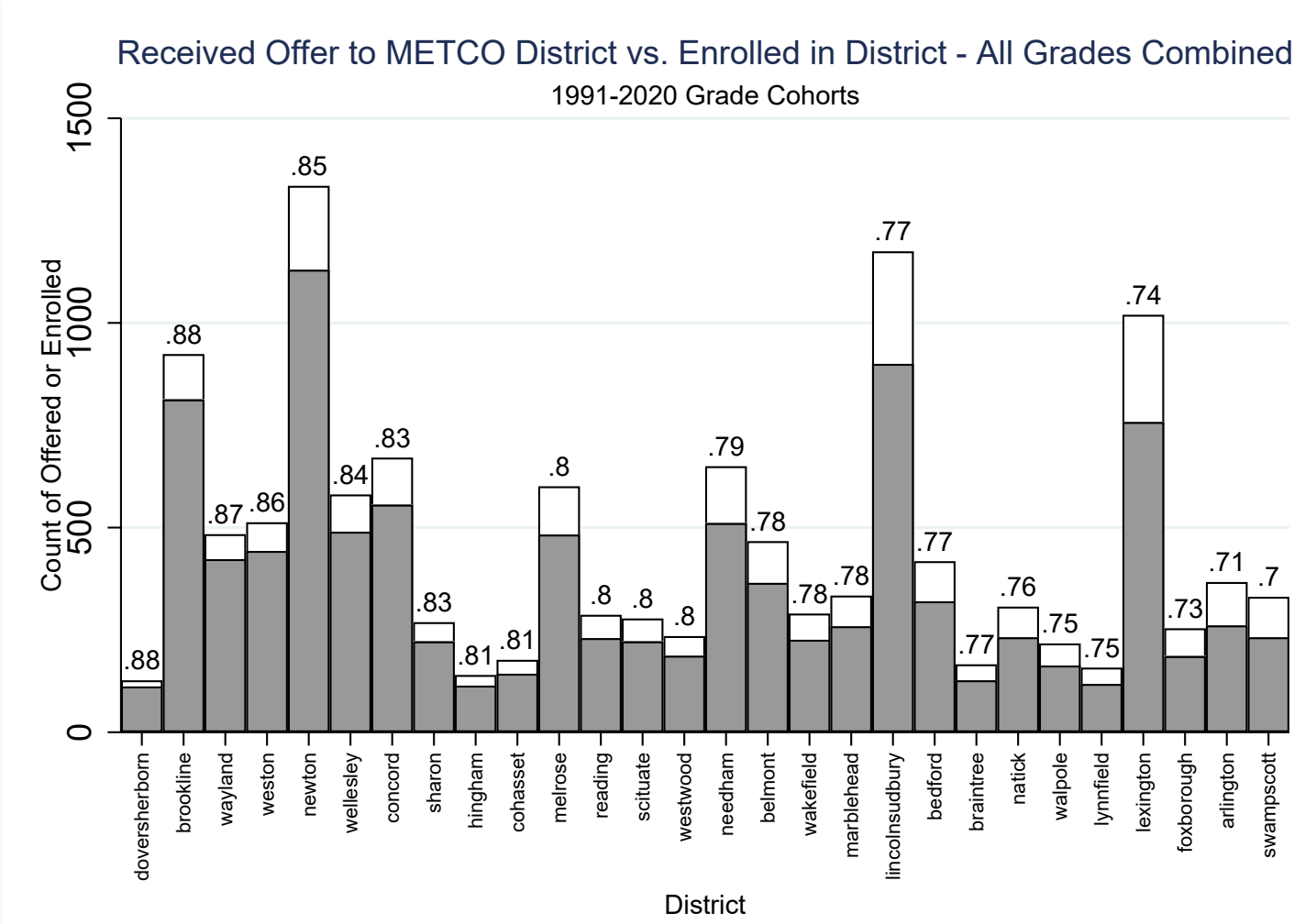

Notes: This figure plots the total METCO enrollment since the program started in 1966. Pre-2001 data comes from the Northeastern University Archives METCO Collection and was only available for Boston, not for Springfield. Not all years were available in the archives. The 2001 - present data come from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



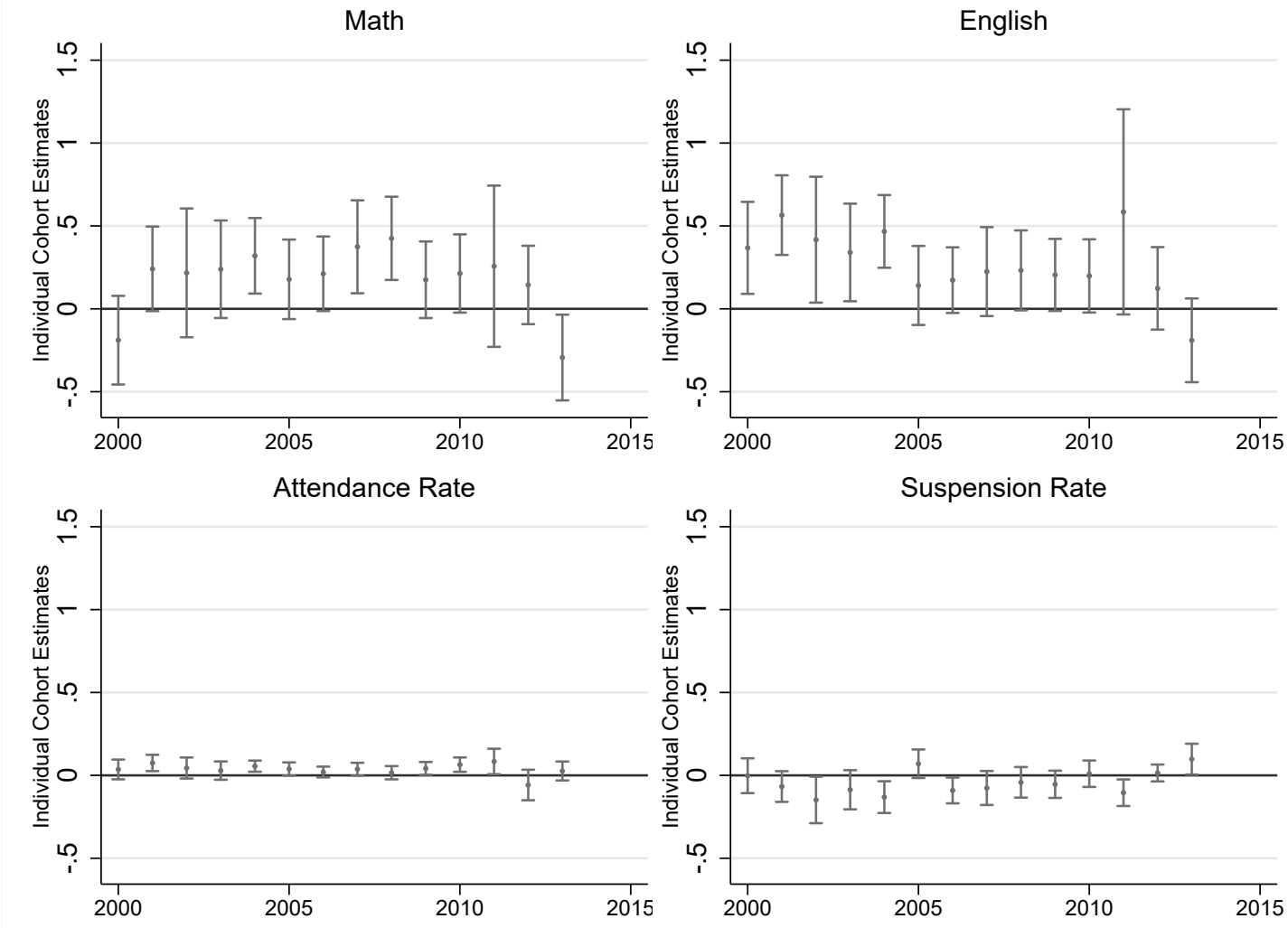

Notes: This figure plots the total METCO applications by children's ages in light gray. The number with offers by age is shown in dark gray and the proportion enrolled by age appears above the bar. Data include those who start first grade in 1991 through 2020.

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 $\delta$ |
|---|---|---|---|---|---|---|
| | Uncontrolled | Controlled | $\delta$ $\max R^2 = 1.3 * R\text{^}2$ | Simple Estimate | Adjusted Estimate | $\delta$ $\max R^2 = 2 * R\text{^}2$ |
| | (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.