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How Important are Classroom Peer Effects? Evidence from Boston's METCO Program*

by,

Joshua D. Angrist

MIT and NBER

and

Kevin Lang

Boston University and NBER

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How Important are Classroom Peer Effects? Evidence from Boston's METCO Program

Abstract

Most integration programs transfer pupils between schools within districts. In this paper, we study the impact of METCO, a long-running desegregation program that sends mostly Black pupils out of the Boston public school district to attend schools in more affluent suburban districts. We focus on the impact of METCO on the pupils in one of the largest METCO-receiving districts. In the 2000 school year, METCO increased the proportion Black in this district from about 7.5 percent to almost 12.5 percent. Because METCO pupils have substantially lower test scores than pupils resident in the receiving district, this inflow generates a significant decline in scores, with an especially marked effect on the lower quantiles. The overall decline is due to a composition effect, however, since OLS estimates show no impact on average scores in the sample of all non-METCO pupils. On the other hand, there is some evidence of an effect on the scores of minority 3rd graders in reading and language. Instrumental variables estimates for 3rd graders are imprecise but generally in line with the OLS. Further analysis shows the negative effects on 3rd graders to be present for girls only. Given the highly localized nature of these results, we conclude that peer effects from METCO, if any, are modest and short-lived.

Joshua D. Angrist
MIT Department of Economics
angrist@mit.edu

Kevin Lang
Boston University Department of Economics
lang@bu.edu

Few questions in American public life are as controversial as the social consequences of school integration. Policy makers and researchers have debated the impact both on the individual pupils who are bused to school for the purposes of racial balance, and on residential patterns in school districts affected by busing. Even the proximate impact of desegregation efforts have not been clear cut. The Supreme Court's 1955 *Brown II* decision ambitiously declared that schools should be integrated "with all deliberate speed," but in many districts integration was slow and incomplete. Integration policies nevertheless appear to have been at least partly successful, in the sense that these policies increased the probability that White and Black pupils study togther (Welch and Light, 1987: Rosell and Armor, 1996). Moreover, research by labor economists strongly suggests that the end of *de jure* led to substantial economic gains for Blacks.[1]

Busing programs typically send Black pupils to schools that were previously all-White and vice versa, often in the face of resistance from local school boards and other elected officials. In an influential paper, Coleman (1975) argued that court-ordered busing accelerated the White exodus from central cities, sparking a literature looking at the impact of desegregation efforts on racial mixing in schools. Few studies, however, have looked at the impact of desegregation on the primarily White pupils who remain in the schools to which Black pupils are bused, i.e. on the pupils in schools where the percentage minority increased as a consequence of busing.[2] In this paper, we use the Boston area Metropolitan Council for Educational Opportunities (METCO) desegregation program to study the impact of busing on pupils in schools to which the METCO pupils were bused.

The METCO program, one of the largest and longest-running desegregation programs in the US, is unusual in that it sends mostly Black pupils *out of* the Boston district into schools in the surrounding, mostly White, suburban districts. In contrast with court-ordered desegregation efforts, METCO is voluntary on the part of both the families of students being bused and the school districts receiving the bused students.

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[1]See, e.g., Smith and Welch (1989) and Card and Krueger (1992).

[2]An exception is Guryan (2001), who looks at the impact of court-ordered busing on White and Black dropout rates. Clotfelter (1999) is a recent study of White flight.

METCO has not been associated with White flight. In 1970, four years before the 1974 Federal court decision that imposed busing within the Boston district, 29 METCO-receiving districts were enrolling almost 1400 pupils. In the 2000-2001 school year, almost 3,200 METCO pupils attended school in 32 suburban districts. METCO-receiving districts have remained relatively affluent suburban communities with growing populations. In many of these districts, METCO pupils account for the majority of minority pupils. These factors suggest that METCO provides a useful laboratory for the study of the impact of desegregation on pupils in host districts, without the possibly confounding effects of controversy over forced busing.

Our study focuses on the impact of METCO on the test scores of 3rd, 5th, and 7th graders in the Brookline Public Schools, one of the largest METCO-receiving districts. The Brookline experience is of historical interest since the METCO program was initiated by a group of Brookline civil rights activists. Along with representatives from nine other school districts, Brookline School Committee member and MIT professor Leon Trilling helped design the METCO program. While Brookline has one of the best school systems in the state, it also has a substantial minority and immigrant population. This fact allows us to assess the impact of METCO on different groups in the receiving district.

In addition to providing an evaluation of the impact of METCO on pupils in Brookline schools, the results presented here may shed light on more general questions regarding the school environment and peer effects. As noted above, the METCO program substantially increases the minority population in schools in the receiving districts. In addition, because METCO pupils have lower average test scores than suburban pupils, the METCO program lowers average scores in the district. The relatively low scores of METCO pupils, a fact noted by METCO critics, is politically significant in Massachusetts, where schools and districts are evaluated on the basis of average test scores. More importantly, the increased presence of lower-performing pupils in suburban districts may adversely affect pupils resident in the district if peer performance matters for pupil learning, as has been suggested by a large literature. Some authors have also looked directly at the impact of proportion minority (examples include Boozer, Krueger, and Wolkon, 1992; Hoxby, 2000;

Kain, Hanushek, and Rivkin, 2002; Rivkin, 2000).

The next section provides additional background on METCO program operations and the Brookline school district. Following this, Section II describes the data used here and presents descriptive statistics characterizing METCO's impact on the school environment. Section III discusses OLS estimates of the effect of METCO on the test scores of non-METCO pupils, while in section IV we report the results of an instrumental variables (IV) strategy for estimating the effect of METCO. Section V concludes with an assessment of the case for negative peer effects in the METCO program. There is some evidence of a negative effect on the scores of minority 3rd grade girls in some subjects. This suggests that negative peer effects, if any, are modest and short-lived. A noteworthy limitation of our study is a narrow focus on test scores. In particular, we have no information on the effect of METCO on racial attitudes and address only parenthetically the effect of suburban schools on the academic performance of the METCO pupils themselves. In future work, we hope to study these topics.

I. The METCO Program

A. Background

The birth of METCO was an important chapter in the battle over school desegregation in Boston.[3] In 1963 and 1964, Black parents boycotted Boston schools for failing to integrate and, in 1974, Boston school assignment was taken over by a Federal judge after a protracted legal struggle. Against this backdrop, the Brookline Civil Rights Committee approached the Brookline School Committee in 1964 to request that Black students from Boston be enrolled in the Brookline Public Schools. In the first half of 1966, the Brookline, Lexington, Newton, Wellesley, Braintree, Lincoln and Arlington School Committees agreed to accept two hundred twenty students the following year. By 1970, twenty-nine suburban school districts had enrolled 1,361 METCO pupils. Four of these districts later abandoned METCO, but 7 new districts joined

[3]This section draws on Batson and Hayden (1987) and METCO (1970).

the program.[4] The location of METCO-participating districts in the 2000-2001 school year, along with the number of METCO pupils and the proportion minority in each district, are indicated on the enclosed map. Five percent of the Boston district, or roughly 3,200 pupils, participate in METCO, and METCO pupils account for a substantial fraction of the Black and Hispanic pupils in most receiving districts.

Boston parents interested in METCO place their child on a waiting list. Every year, METCO coordinators in suburban districts notify METCO, Inc. of the number of openings they have for the following year at each grade level. Applicants are selected from the waiting list on a first-come first-served basis. Boston parents do not get to chose the suburban district where their child is placed although they may refuse a placement. The waiting time for kindergarten entry is about 5 years and varies by grade of entry. Generally METCO placement is more difficult as grade advances. The state provides funding to districts that accept METCO pupils according to a formula determined by legislators and the Massachusetts Department of Education. Today, state METCO funding hovers around $2,800 per pupil, plus transportation costs, an amount considerably below average per-pupil expenditure in the state and less than provided by a state-wide school-choice program.[5]

The METCO program remains controversial. There is a long waiting list for places, and most suburban districts still express strong support. But some Boston educators worry that METCO pulls relatively motivated or high-achieving pupils out of the Boston Public Schools. Others believe METCO's focus on race is anachronistic, since the Boston district itself no longer uses race as a factor for placement. METCO also generates controversy in some receiving districts. Critics argue that METCO is costly, pulls

[4]Hamilton-Wenham, Milton, Dover, and Sherborn dropped out, though Dover-Sherborn, a joint high school district, continues to enroll METCO students.

[5]Under the state's school choice law, school districts that participate in the school choice program receive 75% of per pupil cost, up to a limit of $5000 for students in regular, bilingual, or occupational education programs. The tuition rate is 100% of cost for special education students. Transportation costs are paid by participating families.

down average test scores (a factor of increasing importance since Massachusetts introduced mandatory state-wide testing), and negatively influences local pupils. In 1990, for example the Lincoln School Committee held a forum on METCO in response to concerns about costs and "behavior problems in the classroom and complaints about the time spent by teachers with METCO children" (Boston Globe, June 6, 1990, page 21). Lincoln's METCO participation continues to be high at about 13% of enrollment, but this is down from a target of 20% established in 1975. More recently, the Lynnfield School Committee voted to withdraw from METCO. According to the Superintendent, METCO wasn't "doing the students much academic good" (AP State and Local Wire, March 2, 1999, AM cycle). School administrators were also concerned that "the failures of the Boston kids could have a chain effect on the success of their own." The Lynnfield decision was unpopular and later reversed.

Despite strong public interest in the METCO program, there is little quantitative evidence on the effect of METCO participation on the students commuting daily from Boston. This largely reflects the difficulty of finding an appropriate comparison group for METCO pupils. Although METO pupils are more likely to graduate from high school than are other Boston public school students, METCO pupils might well have had more favorable outcomes in any event.[6] On the other side of the METCO equation, there has been almost no research on the impact of METCO participation in receiving districts, other than policy reviews of the sort mentioned above.[7]

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[6]Two early largely descriptive studies are Boardman and Brandt (1968) and Clarke (1975) , who interviewed METCO parents. Orfield, et al (1997) also surveyed METCO parents. More recently, Eaton (2001) discusses interviews with adults who participated in METCO. These studies establish that most participants strongly believe they benefitted from the program but were not designed to measure whether outcomes were improved for participants. Armor (1972) compared METCO participants with a small number of non-participating siblings. Recently, Elliott (1998) surveyed METCO graduates and a small comparison group, looking at the effect of METCO participation on high school graduation and college attendance. These studies suffer from lack of a good control group, and/or incomplete follow-up of applicants and controls. A small randomized study of the impact of a desegregation program in Hartford is discussed in Crain and Strauss (1985).

[7]Jaggia and Tuerck (2000) estimate the relation between district-level MCAS scores and a range of variables, including percent METCO in district. They find a positive association between percent METCO and scores, but this seems likely to be due to the fact that METCO districts are among the best in the state.

B. METCO in Brookline

Brookline has about 6,000 public school pupils attending eight elementary schools with grades kindergarten through eight and a single high school. Students generally attend neighborhood schools unless they participate in a district-wide bilingual program. The Brookline School Committee has a long-standing policy and a contractual agreement with the teachers' union to cap class size at twenty-five. This is accomplished by opening new classes where needed.

The Brookline school district is affluent relative to Boston, but more heterogeneous than most suburban districts farther out. Roughly 10% of Brookline pupils are Black (including METCO pupils), 17% are Asian and 4% are Hispanic. Typically, 10% are designated limited-English-proficient (LEP) and 12% qualify for a free or reduced-price lunch. More than 30% come from homes in which English is not the first language. Brookline also has a significant transient population with more renters than owners, yet maintains its reputation as one of the best school systems in the state if not the country. Brookline pupils consistently do well on national and state tests, have a low dropout rate and a high rate of college attendance.

As noted in the introduction, Brookline has a long-standing connection with the METCO program. Under its current METCO participation agreement, Brookline enrolls 300 METCO students each year, about 5% of total enrollment in the district. According to school administrators, METCO pupils are initially assigned to classes where class size is anticipated to be small. Once a METCO student is assigned to a particular Brookline school, transfer to a new school is highly unusual.

II. METCO and the School Environment

Data

For the purposes of this study, achievement is measured using the Iowa Test of Basic Skills (ITBS) for 3rd, 5th and 7th graders. ITBS tests were administered in March 1995 and March 1996 and then in November of each year after that. Data are available for the 1994-2000 school years. In principle, all pupils except LEP

or those with severe special needs are tested. Parents may request that their child not be tested but such requests are rare. Our analysis uses test scores reported as the national percentile rank (NPR), which measures achievement relative to the score distribution in a 1992 reference population.

For the purposes of this analysis and to assist the Brookline Schools with other evaluation efforts, ITBS scores were linked with administrative data on pupil characteristics. This provides information such as sex, race, and whether the pupil was a METCO student. Also included was programmatic information such as whether pupils participated in an English as a second language/transitional bilingual English (ESL/TBE) program or a special education program, and school characteristics such as enrollment in the grade, number of classes in the grade and METCO enrollment in the grade.

Table 1 presents descriptive information for the Brookline school system. A typical grade has close to 500 students with an average class size of 20-21. Third and fifth grade classes are largely self-contained except for special classes (e.g. art, physical education) so the class sizes for these grades represent the typical number of students in the class for core subjects. For 7th grade pupils, the reported number of classes is the number of "home rooms" and therefore a less accurate measure of class size for core subjects.

The proportion of pupils taking the ITBS ranges from a low of 79% among 5th graders in 1995 to a high of 95% among 7th graders in 1998. Special education and LEP students (in ESL/TBE programs) account for most of those who do not take the test. In particular, special education students with an individualized education plan (IEP) that exempts them from taking standardized tests do not take the ITBS. The remainder of those not tested consist of pupils who were ill or whose parents requested that they not take the exam. Most of the variation in the proportion tested comes from efforts by school administrators to increase the participation of special education students and from fluctuation in the number of special education and LEP students. Variation in ESL/TBE participation across grades reflects the fact that most pupils spend only one or two years in ESL or TBE programs.

The percentage of pupils enrolled in special education programs averages somewhat below 20%.[8] On the other hand, there has been a steady increase in the fraction of special education pupils tested. For example, in 1996, special education pupils accounted for 8 percentage points of the almost 19% of 3rd graders not tested. By the 2000 school year, special education pupils accounted for only about 4.5 percentage points of the 3rd graders not tested.

We use two different measures of the proportion METCO. The first is an estimate of the proportion of all pupils in a school, grade, and year from METCO. The second is the proportion of tested pupils from METCO. Although METCO status is reasonably well measured from 1996 forward, both measures rely on incomplete information for the 1994 and 1995 school years, for which METCO status must be inferred from a variety of sources. The proportion METCO varies from a low of 2.6% in 1995 in 3rd grade to a high of 7.4% in 1997 in 7th grade. METCO pupils generally represent a higher proportion of tested pupils than they do of all pupils because few METCO pupils are LEP or have severe special needs. Consistent with the program's historical emphasis on desegregation, METCO pupils are overwhelmingly Black. Hispanics constitute the second largest METCO ethnic group, followed by a small number of Asians. METCO pupils are also somewhat more likely to be female than male.

Table 2 reports the proportion of METCO pupils in total enrollment by grade, school, and year. The table, which orders school from lowest to highest proportion METCO in each year, documents the considerable variability in the proportion METCO across schools and over time. Nineteen of the 144 grade/school/year combinations had no METCO pupils. At the other extreme, at one school over one-fifth of 7th graders in 1998 were METCO students, and of the 18 possible grade/year combinations, in 12 cases, there are at least two schools where the proportion METCO was at least 9 percent of enrollment.

Not surprisingly given the relatively high average family income in Brookline and the reputation of

[8]This excludes children in out-of-district placements. Special education status is unavailable for the first two years in the sample but can be determined for pupils who remained in the school system after 1995.

the school system, Brookline pupils generally perform well on the ITBS. As shown in Table 3, the average core NPR is 72 for 3rd and 5th graders and 76 for 7th graders among non-METCO pupils. Test scores by subject are similarly high, although language scores tend to be slightly lower than the overall scores, possibly reflecting the high proportion of non-native English speakers. There is also a significant racial gap for Brookline residents, with the average score for Blacks around the national median (51st, 50th and 55th percentiles in the three grades) while the scores of Whites are around the top quartile (74th, 75th and 80th percentiles in the three grades). The standard deviation of test scores ranges from 22-26 points, depending on grade and subject. The standard deviation of school/year cell averages is naturally much smaller, in the 5-7 range.

Among Brookline residents, the average NPR is almost one point higher for 5th graders than for 3rd graders and 4 points higher for 7th graders than 5th graders. Since the ITBS is normed to a national standard for each grade, this relative advancement suggests that a Brookline education increases pupil achievement more than most school systems. Of course, this may also reflect differential selection, with Brookline 7th graders more favorably selected than 3rd and 5th graders.

METCO pupils have test scores significantly below those of Brookline residents.[9] The average core NPR is about 22 points lower for METCO pupils, a gap almost as large as the standard deviation of test scores among Brookline pupils. Black pupils in the METCO program have scores broadly similar to those of Blacks from Brookline, while non-Black METCO pupils, who are mostly Hispanic and Asian, have scores between those of non-METCO Hispanics and Asians.

Despite the gap in scores by METCO status, Table 3 suggests that METCO pupils benefit from time in the METCO program. In particular, METCO pupils generally show more improvement between 3rd and 7th grades than do Brookline residents. Again, it is possible that this reflects more favorable selection of

[9]Children of town employees may attend Brookline schools regardless of where they live, and there are a small number of (mostly foreign) students who pay tuition through a variety of programs. These groups are included in our definition of Brookline residents.

older METCO students than of younger METCO students, but the simplest explanation is that the Brookline METCO program raises the achievement level of participants. Of course, the ideal evaluation strategy for assessing the value of METCO for participants would use comparisons with an otherwise similar group of non-METCO pupils from Boston.

The differences in average achievement between resident and METCO pupils are large enough for METCO participation to reduce average test scores in Brookline. This can be seen in Table 4. In particular, Columns 1-8 report estimates of

$$\bar{y}_{gjt} = \alpha_g + \beta_j + \gamma_t + \delta m_{gjt} + \lambda s_{gjt} + u_{gjt}, \quad (1)$$

where $\bar{y}_{gjt}$ is the average score in the grade g/school j/year t cell. s_{gjt} is class size in the cell, including METCO, and m_{gjt} is percent METCO [g×j×t=3×8×7=168 cells]. The results in the upper panel show estimated effects of percent METCO enrolled and the lower panel shows estimates of coefficients on percent METCO tested. The leftmost columns show unweighted estimates, while the middle columns shows estimates weighted by the number of pupils tested in the cell. Columns 9-12 report the result of treating individual pupils as the unit of observation and replacing $\bar{y}_{gjt}$ with $\bar{y}_{gjt(i)}$, the average score of pupils in the cell, excluding pupil i. These estimates capture the effect of percent METCO on non-METCO pupils' peer means since METCO pupils are included in $\bar{y}_{gjt(i)}$ but excluded from the estimation sample.[10]

The estimates tell a similar story for both METCO regressors and all three estimation strategies. The presence of METCO students has a marked negative effect on the average performance of the class. Increasing the number of METCO students by ten percentage points (about two per class) lowers average performance by about 2½ percentage points, or about 40 percent of the standard deviation of the group averages. This does not imply that the presence of METCO pupils has a negative *causal* effect on non-METCO pupils, however. The estimated effect of percent METCO on average peer performance is

[10]Standard errors in columns 9-12 are adjusted for cell-clustering. All models include a set of cohort effects (for 11 grade/year cohorts) . Models using micro-data include dummies for sex and race.

consistent with a pure composition effect arising from the large gap between the scores of METCO and non-METCO pupils.

Because METCO pupils' scores are concentrated in the lower tail of the Brookline residents' score distribution, the percent METCO shifts the overall score distribution most dramatically in the lower tail. To illustrate this point, Table 5 shows the effect of percent METCO on the .2 quantile (2nd decile) of the score distribution in each cell, denoted $q^{.2}_{gjt}$. The estimates in columns 1-8 were constructed by replacing $\bar{y}_{gjt}$ with $q^{.2}_{gjt}$ in equation (1), while columns 9-12 report quantile regression estimates using micro data. The estimates in column 9 suggest that, on average, increasing the proportion METCO from 0 to 10 percent lowers the second decile of the core NPR score distribution by 4-6 points.

The results in Table 5, like those in Table 4, may simply reflect the fact that METCO pupils have lower scores than Brookline residents on the ITBS. But the magnitude of this decline is important for other reasons as well. First, previous research suggests a strong negative correlation between individual achievement and the achievement levels of peers in the classroom. While the proper interpretation of this correlation is disputed, it may indicate negative peer effects.[11] The effect of percent METCO on average scores is large enough that increases in percent METCO may induce a negative peer effect that should be evident in our data if the effect is large enough. Second, pupils at the bottom of the achievement distribution may have a large adverse impact on other pupils if, for example, classroom instruction is targeted at low-achievers or if low-achieving pupils are more likely to be disruptive or require more of the teacher's attention. Since percent METCO pulls down the lower tail of the score distribution, again there would seem to be scope for negative peer effects.

Another aspect of the relation between percent METCO and the Brookline school environment, not described in Tables 4 and 5, is the impact on racial composition. A number of authors have found a negative

[11]For references to empirical studies and a recent theoretical model of peer interactions in education see Lazear (2001). For a skeptical look at peer effects, see Evans, Oates, and Schwab (1992).

association between percent minority in schools or classes and academic performance, particularly for minority pupils. The percent minority is presumably a proxy for a variety of economic and social differences. Increasing the proportion METCO sharply increases the proportion minority in Brookline schools; indeed the "first-stage effect" of percent METCO on percent minority is close to one. As with peer effects that operate through test scores, any effects of school composition may therefore also be detected through an analysis of METCO.

III. OLS Estimates of the Impact of METCO on Non-METCO Pupils

We constructed OLS estimates of the effect of METCO pupils on the achievement of non-METCO pupils using two models similar to those used to construct the estimates in Table 4. The first set of estimates is from a regression of the average NPR of non-METCO pupils on the proportion METCO in a grade, school, and year cell. The regression includes grade, school, and year main effects, as well as controls for class size:

$$\bar{y}^{*}_{gjt} = \alpha_{0g} + \beta_{0j} + \gamma_{0t} + \delta_0 m_{gjt} + \lambda_0 s_{gjt} + \eta_{gjt}; \quad (2)$$

where $\bar{y}^{*}_{gjt}$ is the average score in the cell, omitting METCO kids. The model includes controls for cohort when grades are pooled since some pupils are observed more than once. Equation (2) is estimated without weighting, since weighted estimation generates the same results as estimation using micro data if there are no pupil-level controls.

The second approach implicitly allows for cell random effects in micro data, and adds controls for pupil characteristics. The regression model in this case can be written:

$$y_{gjti} = \alpha_{0g} + \beta_{0j} + \gamma_{0t} + \delta_0 m_{gjt} + X_i'\Gamma_0 + \lambda_0 s_{gjt} + \mu_{gjt} + \epsilon_{gjti}, \quad (3)$$

where X_i is a vector of race, sex, special education and TBE/ESL dummies; μ_{gjt} is a cell random effect; and ϵ_{gjti} is an individual random error term. As in (2), cohort dummies are included when grades are pooled.

The standard errors for the micro model are adjusted for clustering using the formula in Liang and Zeger (1986), i.e., the procedure implemented by the *Stata* cluster command. In practice, the standard errors

from this procedure may be misleading, especially when there are few clusters, and inference using grouped data has been shown to be more reliable (see, e.g., Feng, *et al*, 2001; or Donald and Lang, 2001). Unadjusted standard errors are also reported for purposes of comparison. Both grouped and micro equations use the percent METCO tested for m_{gjt} since this is more consistently measured and probably more accurate than the percent METCO enrolled (though estimates using percent enrolled are similar).

Pooled estimates of equation (2) show small positive, but insignificant, effects of percent METCO on average non-METCO scores in each subject. This can be seen in the first four columns of Panel A in Table 6. The estimates using micro-data, reported in columns 5-8, are negative but again small and insignificant, suggesting that the proportion METCO has no effect on non-METCO pupils. On the other hand, it should be noted that the standard errors for the micro-data estimates in column 5 are such that the smallest negative effect that could be detected (i.e., would be significant at the 5% level in a one-tailed test) is about 5.9×1.64=-9.7. Since the effect of percent METCO tested on peer means is -24 (see column 9 in Table 5), the smallest detectable peer effect that operates solely through the test scores of all classmates is therefor about .4. Moreover, if it is the lower tail of the score distribution that matters for achievement, then effects as small as .2 would be significant.

Previous research on peer effects reports estimates that span the range of detectable effects based on the standard errors in Table 6, but smaller effects cannot be ruled out. For example, using data from Texas, Hoxby (2000) reports estimates of the effect of the average test scores of a student's peers ranging from .1 to .55. Our estimates for Brookline rule out the high end of these effects but not the low end. On the other hand, it should also be noted that previous research reports estimates of peer effects that are not fully captured by differences in test scores. For example, Hanushek, *et al* (2002), also using data from Texas schools, report large effects of racial composition that do not appear to be driven by the achievement differences of classmates.

Earlier analyses also suggest that peer effects may be more important within racial groups. For

example, Black pupils may interact more with other Blacks, including those from METCO. Since METCO pupils are mostly Black and Hispanic, this motivates an analysis in samples limited to minority pupils from Brookline, about 10.5% of the resident pupils tested.

Estimates for minority residents of Brookline, reported in Panel B for Blacks and Hispanics, and Panel C for Blacks only, show no significant METCO effects on 5th and 7th graders, but some of the estimates for 3rd graders are negative and significant. The microdata estimates in column 6 are probably more reliable since these control for individual pupil characteristics such as race (when Blacks and Hispanics are pooled), sex, special education status, and ESL/TBE status. These estimates show significant negative effects on reading and language scores for Blacks and Hispanics, and significant negative effects for all scores but math for Blacks. The difference between panels B and C suggest that the negative effect is coming primarily from the impact on Blacks. The estimated effects are such that adding a METCO pupil to a class (i.e., going from 0 to about 5% METCO) is expected to reduce Black test scores by 8-9 points, or .3 of the standard deviation of the score distribution for Black 3rd graders who live in Brookline.

The effects on Black pupils cannot be easily explained by a traditional peer effect that operates solely through test scores since Table 5 suggest that increasing percent METCO by 5 percentage points reduces average test scores among peers by only about 1.25 points. Effects a large as those in Panel C may therefore signal some sort of endogeneity problem or omitted variables bias. On the other hand, this result could be explained by a more localized peer effect where additional METCO pupils displace relatively high-scoring and high-SES resident pupils in a minority pupil's circle of friends and peers. And, as noted above, peer effects need not operate solely through test scores. The fact that the negative effects appear for language and reading is also consistent with Eaton's (2001) account of METCO, since some METCO pupils reported differences in speech patterns to be a major hurdle in adapting to the suburban environment. But the fact that negative estimates are limited to the 3rd grade sample and absent for Math scores also suggests these effects may be spurious or at least dissipate quickly. In the next section, we use an IV strategy in an attempt to

verify the results in Table 6.

IV. Instrumental Variables Estimates

There are at least two reasons why the OLS estimates may be biased by endogeneity or omitted variables. First, school officials may reduce class size when pupils are doing poorly. Since METCO pupils are more likely to be assigned to smaller classes, this can generate spurious negative correlation between percent METCO and non-METCO achievement. Indeed, the Superintendent could use the placement of additional METCO students in a class to justify or even subsidize the opening of additional classes in cases of perceived need. Although, the estimates in Table 6 control for class size, linear control may be inadequate and class size may not be measured accurately. Our concern with bias from omitted class size and composition effects is reinforced by a finding (not shown in the tables) that the coefficient on class size is generally *positive*, suggesting that non-METCO pupils in smaller classes (where size is measured including METCO pupils), generally perform worse than pupils in larger classes.

A second source of bias, and one that works in the opposite direction, may arise from efforts to place METCO pupils only in schools and grades where non-METCO pupils are doing relatively well. This would induce a spurious positive correlation between percent METCO and non-METCO achievement. Our discussions with school officials suggest that METCO placement is probably not as systematic or micro-managed as this hypothetical assignment mechanism would require. In any case, the instrumental variables strategy provides a check on both sorts of bias. The IV strategy is a variant of the regression-discontinuity approach employed by Angrist and Lavy (1999) to estimate the effects of class size.

A. Maimonides at 25

The IV estimates exploit the fact that METCO pupils are assigned to Brookline schools partly on the basis of a space constraint. Our model for the METCO allocation process begins with the fact that class

size in Brookline is contractually capped at 25. Moreover, in practice, classes as large as 25 are rare. This motivates the following version of what Angrist and Lavy (1999) termed Maimonides' rule, after the biblical scholar Maimonides', who proposed a maximum class size of 40. With a maximum size of 25, the rule is:

$$r_{gjt} = e_{gjt}/(\text{int}(e_{gjt}/25)+1),$$

where e_{gjt} is *non-METCO enrollment* and r_{gjt} is predicted class size. Figure 1 plots r_{gjt} against enrollment using a dotted line and actual class against enrollment using connected dots, for 3rd graders. The figure shows that r_{gjt} captures the relation between 3rd grade enrollment and class size remarkably well.

Our discussions with school officials suggest that METCO pupils are typically assigned to schools in light of information about enrollment anticipated for the coming year. When class sizes are expected to be small, the Boston METCO office is notified that space is available for METCO pupils. We model the METCO assignment process as allocating 1 METCO pupil per classroom if predicted enrollment is less than 23. We use predicted instead of actual class size to determine space availability since the latter may be endogenous and is unknown when METCO pupils are accepted. This reasoning leads to the following instrumental variable for the number of METCO pupils in a class:

$$z_{gjt} = \min[\max(23-r_{gjt},0),1].$$

The resulting first stage relation is plotted in Figure 2 for 3rd graders, with enrollment again shown on the X-axis.

Although much of the variation in the number of METCO pupils remains unexplained by this model, z_{gjt} clearly predicts METCO placements, at least in the 3rd grade. The IV analysis that follows is limited to 3rd graders since z_{gjt} is most highly correlated with the number of METCO pupils entering the Brookline school system. The first-stage relation for 5th and 7th graders is weak, probably because most METCO pupils in higher grades are inherited from earlier grades, and because the predictive power of r_{gjt} for class size is weaker for 5th and 7th grades.

The second-stage equation for the IV estimates is:

$$y_{jti} = \beta_{2j} + \gamma_{2t} + \delta_2 a_{jt} + \lambda_2 n_{jt} + \phi_2 e_{jt} + X_i'\Gamma_2 + \xi_{jti}, \quad (4)$$

where a_{jt} is the average number of METCO pupils per classroom in grade j in year t, n_{jt} is the corresponding number of non-METCO pupils, and e_{jt} is total grade enrollment. Note that this model differs from that used to construct the OLS estimates. Here, we replace m_{gjt}, the *percent* METCO in a grade, with a_{jt}, the average *number* METCO in a class, while total class size, s_{gjt}, is replaced with non-METCO class size, n_{jt}. Equation (4) is more attractive than equation (3) in this context because it allows us to experiment with alternative assumptions regarding non-METCO class size effects. In particular, it seems sensible to use equation (4) to explore specifications where a_{jt} is treated as endogenous while n_{jt} is not. In contrast, it is difficult to rationalize a model that treats the percent METCO, m_{jt} (= a_{jt}/s_{gjt}), as endogenous, while at the same time treating total class size, s_{gjt} (=$a_{jt} + n_{jt}$), as exogenous.

In principal, two instruments, z_{gjt} and r_{gjt}, are available for the two potentially endogenous variables, a_{jt} and n_{jt}. In practice, however, both of these instruments are nonlinear functions of the same underlying grade-level enrollment variable, e_{jt} (Note that z_{gjt} is approximately equal to a dummy variable for $r_{gjt} < 23$). Consequently, two-stage least squares (2SLS) estimates treating class size as endogenous are imprecise. We therefore begin by discussing models where only the number of METCO pupils per class is treated as endogenous, while imposing alternative assumptions regarding the impact of non-METCO class size. The first set of estimates treat non-METCO class size as an exogenous covariate. The second set is based on a model that restricts class size effects to be zero. Finally, we compute estimates assuming that λ_2 equals -.53, a value derived from the Angrist and Lavy (1999) class size study.

For purposes of comparison, the top panel of Table 7 reports OLS estimates of equation (4) for each score in the full sample of 3rd graders. Similar to the regressions in Table 6 with percent METCO as an explanatory variable, these estimates show no relation between the number of METCO pupils in a class and non-METCO pupils' test scores. The table also reports positive and significant coefficients on non-METCO class size when this variable is treated as an exogenous covariate. The positive class size coefficients seem

unlikely to have a causal interpretation, and probably reflect a tendency to group low achievers into smaller classes. The OLS estimates of the effect of the number METCO remain small and insignificant regardless of whether the model includes non-METCO class size and grade enrollment variables as controls.

B. First Stage and Reduced-form Effects

The first stage equation for models where non-METCO class size is treated as exogenous can be written

$$a_{jt,i} = \beta_{1j} + \gamma_{1t} + \delta_1 z_{jt} + \lambda_1 n_{jt} + \phi_1 e_j + X_i'\Gamma_1 + \nu_{jt,i}; \quad (5)$$

where $a_{jt,i}$ is the average number of METCO pupils per class in school j at date t, and the i subscript indicates that the equation is estimated using micro data. The reduced-form effect of z_{jt} on test scores is

$$\pi=\delta_1\delta_2,$$

obtained by substituting equation (5) into equation (4). First-stage estimates for models where the effects of non-METCO class size are assumed to be 0 or -.53 were calculated by setting $\lambda_1=0$ in this equation.

Panel B in Table 7 reports the first stage estimates for the sample with non-missing core NPR scores. The estimates of δ_1, ranging from .87 to .92, are largely insensitive to assumptions regarding the impact of non-METCO class size. The first-stage coefficients are precisely estimated with t-statistics of over 5 for each model. Because the first stage estimates are close to one, the reduced form effect, π, is almost the same as the second stage coefficient, δ_2.

The corresponding reduced form estimates are reported in the bottom panel of Table 7. Consistent with the OLS estimates reported in the top panel, estimates from models that treat non-METCO class size as exogenous show no relation between z_{jt} and test scores. The results become increasingly negative, however, as we move to models where the assumed class size effect is zero, and finally to models where the class size effect is set at -.53. In the latter specification, the estimated effect of METCO pupils on their non-METCO peers is negative and at least marginally significant for the core NPR score and for two of the three

subject tests. For example, the estimate in column (3) suggests that the presence of a METCO pupil reduces average non-METCO scores by 2.7 points, with a clustered standard error of 1.6.

The strong positive OLS estimates of the effects of class on achievement seem implausible and suggest an endogeneity problem with this variable. Discounting positive effects, however, it remains to chose between specifications where class size effects are zero and specifications where class size effects are substantially negative, as in Angrist and Lavy (1999)/ Because classes are much smaller and SES much higher in Brookline, zero may be a better estimate of the average causal effect in this context. In the next subsection, we discuss the results of 2SLS estimates using multiple instruments in an attempt to estimate the effects of number METCO and non-METCO class size jointly.

C. 2SLS estimates

As noted above, the instrumental variable z_{gjt} is approximately equal to an indicator variable for $r_{gjt} < 23$. Since predicted class size ranges from 16 to 24.67 in the 3rd grade sample, it seems natural to look for increased statistical power by adding dummy instruments for values of r_{gjt} other than 23. We therefore computed 2SLS estimates using an instrument set consisting of 6 indicator variables for high values of predicted class size:

$$(24 \leq r_{gjt} < 25),\ (23 \leq r_{gjt} < 24),\ (22 \leq r_{gjt} < 23),\ (21 \leq r_{gjt} < 22),\ (20 \leq r_{gjt} < 21) \text{ and } (19 \leq r_{gjt} < 20);$$

plus a linear term for r_{gjt} itself. Both the number METCO and non-METCO class size were treated as endogenous.

The resulting 2SLS estimates, reported in Table 8, support the notion that non-METCO class size has no effect on non-METCO achievement in Brookline. The estimates in columns 1-3 of Table 8, for all 3rd grade pupils, are from a model that includes the number METCO as a second endogenous variable and a linear enrollment term as an exogenous control. The resulting class size coefficients, while still positive, are much smaller than the corresponding OLS estimates in Table 7. The model used for column 1 includes

a linear enrollment control since the instruments are nonlinear functions of enrollment. But the estimates in column 2 show that dropping the enrollment control has little effect on the other coefficient estimates, consistent with the fact that the estimated enrollment effects in column 1 are very close to zero.

Not surprisingly given the estimated non-METCO class size effects and the IV results in Table 7, the expanded instrument set generates coefficient estimates for the effect of METCO that are not significantly different from zero. For example, the estimated effect of METCO on core NPR scores without enrollment controls is -.80, with a standard error of 1.35. The estimate in column 3, which reports the results of dropping class size from the model is -1.35 with a standard error of 1.1, similar to the estimate in column 2 of Table 7, and slightly more precise. In other words, "zero" seems to be the right number for a class size control when using z_{gjt} as an instrument for the number of METCO pupils. Note, however, that the 2SLS estimates are only about half as precise as the OLS estimates in Table 6. (To make the conversion, multiply the standard error of 11 in the first row of column 6 in Table 6 by .05).

The 2SLS estimates for minority pupils are reported in columns 4-9 of Table 8. These estimates and are also broadly consistent with the OLS estimates reported in Table 6, suggesting METCO pupils have a negative impact on the reading and language scores of their 3rd grade Black peers, with weaker effects in the sample that includes Hispanics. Like the OLS estimates, the 2SLS estimates show no effect on math scores. A zero non-METCO class size effect for minority pupils also appears to be a reasonable presumption. The estimated effects on reading scores without class size controls are significantly different from zero, while other estimates are not as sharp. Some of the estimates in columns 8 and 9 are also markedly larger than the corresponding OLS estimates, perhaps implausibly so. On the other hand, the 2SLS estimates in column 7 are reasonably close to the OLS estimates in Table 6.

As a final check on the results in Tables 6, 7, and 8, we re-estimated the OLS model separately for male and female pupils. Just as the number of METCO pupils seem more likely to affect minority residents of Brookline, the fact that METCO pupils are disproportionately female suggests it is worth looking for

differential effects by sex. We return to OLS for this analysis since the IV and OLS estimates are broadly consistent, while the OLS estimates are more precise. The additional OLS results, reported in Tables 9a for boys and 9b for girls, support the notion that within-gender effects are more important. The only significant estimates in the two tables are for minority girls in 3rd grade, especially Blacks.

V. Conclusions

Although METCO pupils have much lower test scores than pupils in the Brookline host district, we find little evidence of a socially significant effect of METCO students on their non-METCO classmates. Both OLS and IV estimates show no effect of METCO pupils in the full sample of non-METCO pupils. The standard errors for the OLS estimate are such that we can rule out test-score-mediated peer effects at the high end of those reported in the literature, though the results are consistent with smaller effects. In contrast with previously reported results, our results also suggest there is no adverse impact of increasing the percent minority on most pupils.

On the other hand, consistent with previous research, which shows racial composition effects to be strongest within racial groups, we find some evidence for a negative impact of percent METCO on the reading and language scores of minority 3rd graders, especially Blacks. These results turn out to be driven by effects on 3rd grade girls, consistent with the fact that METCO pupils are more likely to be female. Many of these estimates are imprecise. Moreover, the highly localized nature of this finding, and the fact that it does not appear in higher grades, lead us to conclude that effects of the METCO program on minority pupils in the host district are modest and short-lived.

It bears emphasizing that our analysis of METCO is limited to a narrow study of test scores as measured by achievement on the ITBS. These results should be weighed against any possible effects of METCO on racial attitudes in Boston and host districts, and any benefits for METCO participants. For example, our results suggest that METCO pupils benefit from their time in the Brookline system since their

relative achievement improves as grade advances. In future work, we hope to address these and other aspects of the historically significant and innovative METCO program.

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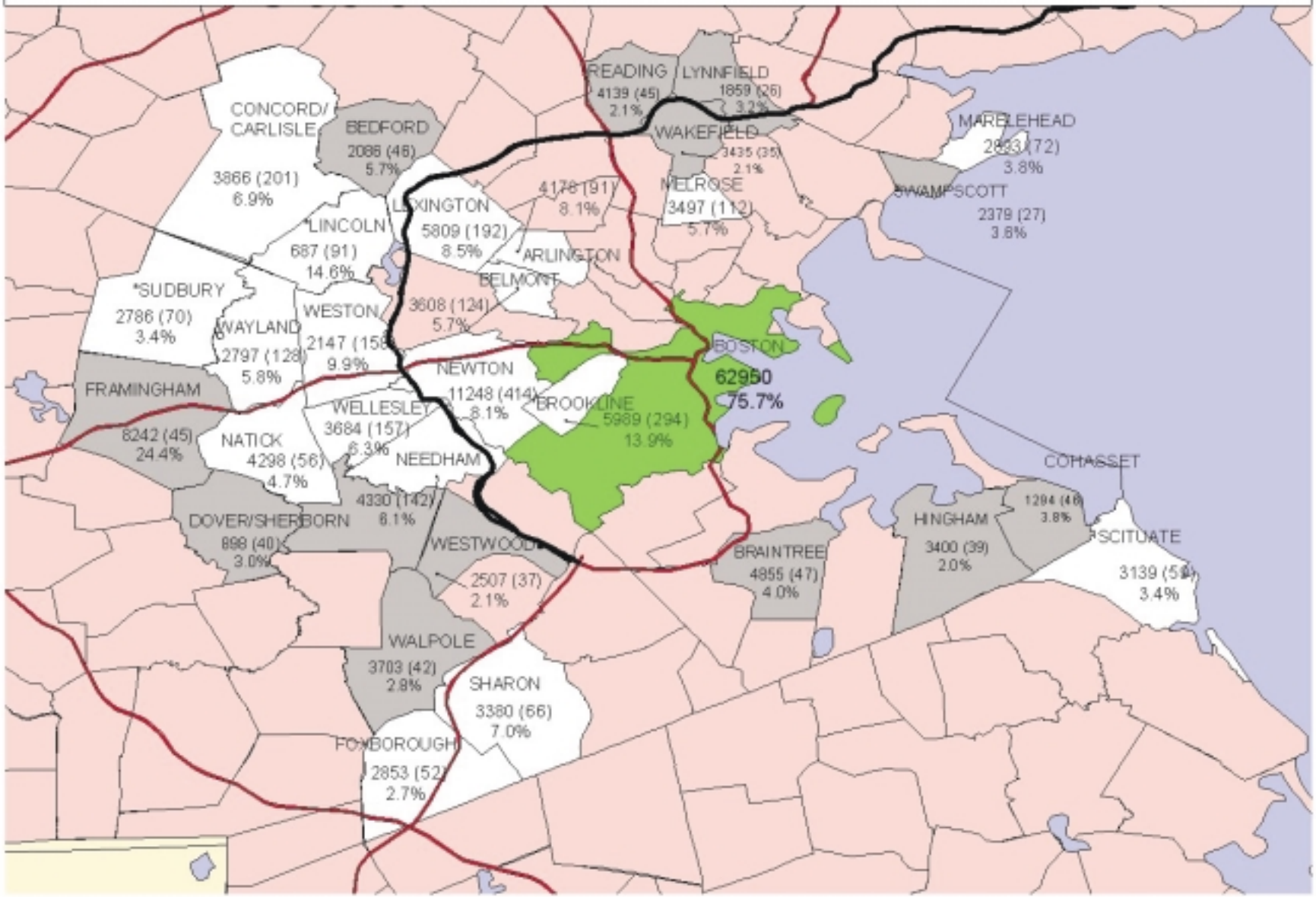
METCO Districts in Metropolitan Boston



5 0 5 10 Miles

Boston
Receiving more than 50 METCO Students
Receiving fewer than 50 METCO Students
Non-Participating Districts

total enrolled (number of METCO received)
percentage black or hispanic

*K-8 district;
Lincoln omits Hanscom AFB.
All data are for Fall 2000.

N

Table 1

Summary Statistics

		School Characteristics		All Pupils						Tested Pupils			Metco Tested Pupils			
		classes	class size	Enrolled	Metco	% Metco	% ESL/TBE	% Sp. Ed.	% Tested	% Metco	% Black	% Sp. Ed.	% Black	% Asian	% Hispanic	% Male
Grade	School Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
3	1994*	24	20.8	498	16	3.21	9.24	0.00	88.2	3.64	9.79	14.12	81.3	6.25	6.25	25.0
	1995*	24	20.7	496	13	2.62	9.07	0.00	86.5	3.03	8.16	14.45	84.6	0.00	15.38	38.5
	1996	23	22.2	511	20	3.91	11.94	18.79	81.2	4.34	9.64	15.42	88.9	0.00	5.56	38.9
	1997	24	20.4	490	25	5.10	11.43	21.22	85.3	4.78	11.48	16.99	85.0	15.00	0.00	50.0
	1998	23	21.9	503	34	6.76	9.94	21.27	87.9	7.24	14.03	21.27	90.6	3.13	6.25	37.5
	1999	22	20.6	454	16	3.52	11.45	18.50	87.9	3.76	6.77	18.05	66.7	13.33	13.33	33.3
	2000	24	18.8	451	19	4.21	11.09	18.18	88.9	4.24	10.97	16.46	100.0	0.00	0.00	35.3
5	1994*	24	21.1	506	27	5.34	9.29	0.00	89.1	5.99	11.53	10.86	88.9	3.70	0.00	51.9
	1995*	23	20.3	467	27	5.78	9.42	0.00	79.0	7.32	11.38	15.45	85.2	0.00	3.70	40.7
	1996	24	20.1	483	24	4.97	6.63	19.05	88.0	4.94	12.00	14.12	85.7	4.76	4.76	33.3
	1997	22	22.8	501	18	3.59	6.39	19.76	91.4	3.06	7.64	16.59	85.7	0.00	14.29	35.7
	1998	23	21.2	487	27	5.54	6.57	21.77	90.3	6.14	12.27	19.32	85.2	0.00	7.41	40.7
	1999	24	20.5	493	25	5.07	7.91	20.08	89.2	5.45	10.45	17.95	83.3	16.67	0.00	50.0
	2000	23	20.4	470	34	7.23	7.87	20.43	90.9	7.49	13.35	20.14	87.5	3.13	6.25	31.3
7	1994*	19	21.9	417	25	6.00	6.95	0.00	89.4	6.70	13.14	13.40	88.0	4.00	0.00	52.0
	1995*	23	19.9	457	24	5.25	7.00	0.22	87.3	6.02	11.28	16.54	79.2	4.17	12.50	37.5
	1996	23	20.8	479	30	6.26	8.35	13.78	89.4	6.54	10.51	12.62	82.1	3.57	3.57	53.6
	1997	21	20.0	420	31	7.38	6.19	24.52	93.1	7.42	12.28	20.46	69.0	13.79	10.34	41.4
	1998	23	20.0	460	28	6.09	3.91	20.43	94.6	6.21	11.95	18.16	88.9	3.70	3.70	44.4
	1999	23	20.6	473	20	4.23	6.13	19.87	93.7	4.29	9.26	17.83	94.7	0.00	5.26	36.8
	2000	23	19.9	457	26	5.69	7.44	22.54	92.8	6.13	12.74	21.46	84.6	0.00	11.54	38.5

Note. Columns (1) shows the number of classes per grade. Column (2) shows the average number of students per class. Columns (3-8) show statistics for the population of all pupils. Column (7) shows the percent of students designated as special education. Column (7) has no values for the 1994 and 1995 school years due to lack of data. Columns (9-10) show statistics for the population of those pupils tested on the stated dates. Columns (11-15) show statistics for the population of Metco students tested on the stated dates. * Testing occurred in March in the 1994 and 1995 school years. Testing occurred in November for all other school years.

Table 2

Metco Pupil Percent by School

Grade	School Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3	1994*	0.0	0.0	2.2	3.8	3.9	4.7	5.6	6.0
		(0,1)	(0,2)	(1,3)	(3,4)	(3,5)	(3,6)	(3,7)	(4,8)
	1995*	0.0	0.0	1.4	2.0	2.3	3.0	3.5	8.1
		(0,3)	(0,6)	(1,1)	(1,7)	(1,2)	(2,5)	(3,4)	(5,8)
	1996	0.0	1.4	1.6	2.2	3.3	5.8	6.0	11.6
		(0,2)	(1,5)	(1,7)	(1,8)	(3,4)	(4,6)	(5,1)	(5,3)
	1997	1.2	1.4	2.8	3.4	5.3	7.0	11.1	12.7
		(1,5)	(1,4)	(2,1)	(2,7)	(3,6)	(3,2)	(5,3)	(8,8)
	1998	1.7	1.8	4.5	6.1	6.3	7.4	9.3	12.0
		(1,5)	(1,6)	(2,2)	(3,8)	(3,3)	(5,7)	(8,4)	(11,1)
	1999	0.0	0.0	0.0	2.3	4.4	4.5	4.9	9.5
		(0,6)	(0,8)	(0,3)	(1,7)	(4,4)	(2,2)	(3,5)	(6,1)
	2000	0.0	0.0	1.3	1.7	5.8	6.1	7.7	18.4
		(0,7)	(0,1)	(1,4)	(1,6)	(4,5)	(3,2)	(3,3)	(7,8)
5	1994*	1.5	1.5	3.7	4.3	6.6	7.0	8.9	9.6
		(1,6)	(1,1)	(2,7)	(3,5)	(4,2)	(4,8)	(7,4)	(5,3)
	1995*	2.4	2.6	2.9	3.8	7.0	8.9	9.5	14.3
		(2,4)	(2,1)	(2,5)	(2,2)	(3,8)	(4,7)	(4,3)	(8,6)
	1996	0.0	0.0	2.7	4.5	4.9	7.1	9.1	14.0
		(0,2)	(0,1)	(2,5)	(3,8)	(4,4)	(4,7)	(5,6)	(6,3)
	1997	0.0	1.4	1.5	2.0	2.8	3.9	5.9	10.0
		(0,3)	(1,1)	(1,6)	(1,7)	(2,5)	(2,2)	(5,4)	(6,8)
	1998	0.0	1.6	1.8	2.4	3.3	9.1	10.2	12.7
		(0,2)	(1,5)	(1,7)	(1,8)	(3,4)	(6,6)	(5,3)	(10,1)
	1999	1.2	1.6	2.7	3.6	4.2	6.0	12.2	14.0
		(1,5)	(1,6)	(2,4)	(2,7)	(3,1)	(3,2)	(5,3)	(8,8)
	2000	2.0	3.4	6.7	7.3	7.7	7.7	9.3	12.5
		(1,6)	(2,5)	(3,2)	(3,3)	(5,7)	(6,4)	(8,1)	(6,8)
7	1994*	0.0	0.0	2.2	6.1	6.3	11.1	11.5	12.3
		(0,6)	(0,4)	(1,3)	(3,7)	(3,2)	(5,1)	(7,5)	(7,8)
	1995*	1.7	2.5	3.5	4.7	6.3	6.5	8.5	10.4
		(1,1)	(2,4)	(2,8)	(2,2)	(4,5)	(4,6)	(4,3)	(5,7)
	1996	1.7	4.0	4.5	5.3	5.4	8.9	10.4	11.1
		(1,6)	(2,7)	(3,5)	(3,1)	(3,8)	(7,4)	(7,2)	(5,3)
	1997	2.6	3.9	4.6	4.8	7.5	7.7	16.2	19.1
		(2,4)	(2,2)	(3,1)	(3,5)	(3,7)	(3,8)	(6,3)	(9,6)
	1998	0.0	0.0	4.0	5.0	5.3	7.1	9.8	21.3
		(0,2)	(0,1)	(3,5)	(3,8)	(4,4)	(3,3)	(5,7)	(10,6)
	1999	1.7	2.0	2.0	2.3	2.8	3.0	6.0	14.0
		(1,6)	(1,7)	(1,2)	(1,3)	(2,1)	(2,5)	(5,4)	(7,8)
	2000	0.0	1.4	2.0	2.2	2.8	10.0	12.5	14.9
		(0,2)	(1,5)	(1,7)	(2,4)	(1,8)	(5,6)	(5,3)	(11,1)

Note. Metco pupil percent is displayed in ascending order by school. The first number in parentheses is the number of Metco pupils. The second number in parentheses is the school identifier. The school identifier is based on the school order in grade 3, 1994. * Testing occured in March in the 1994 and 1995 school years. Testing occured in November for all other school years.

Table 3

Test Scores

		Non-Metco					Metco		
		All	Black	Hispanic	Asian	White	All	Black	Non-Black
Grade	Subject	(1)	(2)	(4)	(3)	(5)	(6)	(8)	(9)
3	Core	71.6	51.2	54.2	71.9	74.3	49.0	47.2	60.1
		(24.2)	(27.6)	(27.6)	(22.8)	(22.7)	(25.5)	(25.1)	(25.2)
		[6.8]					[22.2]		
	Reading	70.7	51.7	54.9	63.7	74.8	47.9	46.1	58.8
		(24.7)	(28.4)	(26.4)	(23.8)	(22.8)	(26.8)	(26.8)	(24.8)
		[5.9]					[21.4]		
	Math	72.0	50.8	54.9	76.4	74.0	47.9	45.7	62
		(24.7)	(28.4)	(28.0)	(22.6)	(23.3)	(26.4)	(26.3)	(23.4)
		[7.3]					[22.9]		
	Language	67.8	49.9	52.9	71.6	69.5	52.9	51.6	60.8
		(25.7)	(27.4)	(28.5)	(23.7)	(24.8)	(25.9)	(25.6)	(27.2)
		[7.1]					[21.2]		
5	Core	72.3	49.8	56.9	72.2	75.0	50.6	48.0	67.3
		(22.7)	(25.7)	(26.3)	(21.8)	(20.9)	(22.1)	(20.9)	(22.8)
		[5.1]					[15.8]		
	Reading	72.4	52.2	57.9	65.2	76.3	52.5	49.9	68.9
		(22.7)	(25.9)	(25.8)	(23.4)	(20.3)	(23.6)	(22.8)	(21.9)
		[4.3]					[16.9]		
	Math	70.6	47.8	57.2	76.0	72.3	46.7	44.4	61.6
		(23.2)	(25.3)	(26.8)	(21.3)	(21.8)	(26.4)	(22.3)	(24.3)
		[6.1]					[18.3]		
	Language	69.2	49.2	54.8	70.1	71.5	52.9	50.5	67.8
		(24.4)	(27.3)	(28.2)	(23.3)	(23.0)	(23.4)	(22.4)	(24.4)
		[6.1]					[16.6]		
7	Core	76.4	55.0	59.6	76.4	79.5	57.1	55.1	66.5
		(21.8)	(24.4)	(27.9)	(19.8)	(19.8)	(20.7)	(20.2)	(20.5)
		[4.7]					[15.7]		
	Reading	77.0	57.4	63.8	70.7	80.8	57.5	55.6	66.4
		(22.6)	(25.3)	(27.5)	(23.5)	(20.2)	(22.6)	(22.5)	(21.2)
		[4.4]					[15.9]		
	Math	74.0	51.4	55.4	78.7	76.4	55.9	54.5	63.3
		(23.4)	(25.7)	(29.0)	(20.2)	(21.5)	(22.2)	(22.0)	(20.2)
		[5.0]					[17.1]		
	Language	73.9	55.0	59.0	75.0	76.5	57.1	55.1	66.8
		(22.4)	(24.6)	(27.9)	(19.9)	(21.1)	(21.8)	(21.3)	(20.9)
		[5.3]					[17.5]		

Note. Columns (1) - (5) show statistics for the population of tested non-Metco students. Columns (6) - (9) show statistics for the population of tested Metco students. Reported test scores are means of the National Percentile Rank from the Iowa Test of Basic Skills administered from the 1994-1995 school year through the 2000-2001 school year. Standard deviations are reported in parentheses. Standard deviations for the school year, school, and grade cell mean are in brackets.

Table 4

Test Score Regression Results

	Unweighted Means				Weighted Means				Peer Means*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Subject	**Pool**	**3rd**	**5th**	**7th**	**Pool**	**3rd**	**5th**	**7th**	**Pool**	**3rd**	**5th**	**7th**
					A. %Metco Enrolled							
Core	-25.5	-22.7	-34.8	-15.6	-26.4	-18.8	-34.4	-17.9	-27.0	-19.2	-35.6	-18.1
	(8.8)	(17.3)	(16.0)	(13.2)	(8.9)	(17.9)	(16.2)	(13.0)	(7.5)	(15.5)	(12.1)	(10.3)
	[8.0]	[16.5]	[13.9]	[12.6]	[8.0]	[17.9]	[14.2]	[11.8]				
Reading	-20.4	-21.3	-31.4	-14.5	-21.2	-16.7	-31.0	-16.5	-21.6	-16.6	-31.6	-16.5
	(7.8)	(16.2)	(14.0)	(11.3)	(7.9)	(16.5)	(13.9)	(11.3)	(6.7)	(14.2)	(12.0)	(9.1)
	[7.24]	[15.96]	[13.93]	[10.97]	[7.16]	[16.36]	[14.12]	[10.47]				
Math	-23.5	-16.9	-40.4	-12.0	-25.1	-12.1	-39.7	-14.5	-25.6	-11.4	-40.7	-14.8
	(10.1)	(19.2)	(19.7)	(14.9)	(10.1)	(19.9)	(19.5)	(14.5)	(8.9)	(18.5)	(15.7)	(11.4)
	[9.5]	[20.0]	[18.9]	[14.3]	[9.5]	[21.3]	[18.2]	[13.1]				
Language	-25.0	-29.9	-25.2	-13.0	-27.0	-31.3	-25.7	-16.2	-28.1	-33.0	-26.7	-16.5
	(9.3)	(17.2)	(17.2)	(13.0)	(9.5)	(18.0)	(17.8)	(13.0)	(7.9)	(15.7)	(12.1)	(10.5)
	[8.5]	[16.6]	[13.7]	[12.5]	[8.5]	[18.2]	[14.1]	[12.2]				
N	56	56	56	168	56	56	56	168	8159	2672	2797	2690
					B. %Metco Tested							
Core	-22.1	-21.8	-28.0	-16.9	-23.3	-17.7	-29.2	-18.9	-23.9	-18.1	-30.3	-19.3
	(8.0)	(15.4)	(15.1)	(11.8)	(8.1)	-(62.2)	(15.1)	(11.8)	(6.7)	(13.5)	(11.2)	(9.5)
	[7.2]	[14.6]	[12.8]	[11.8]	[7.2]	[15.6]	[13.1]	[10.9]				
Reading	-18.7	-22.7	-27.3	-14.0	-19.6	-18.6	-27.1	-15.9	-20.1	-18.7	-27.7	-16.1
	(7.1)	(14.3)	(13.1)	(10.2)	(7.2)	(14.6)	(12.9)	(10.2)	(6.1)	(12.0)	(10.9)	(8.4)
	[6.7]	[14.0]	[12.8]	[10.2]	[6.5]	[14.0]	[12.8]	[9.6]				
Math	-20.7	-19.8	-30.2	-14.3	-22.7	-15.0	-32.0	-16.5	-23.2	-14.6	-33.0	-17.0
	(9.2)	(17.0)	(18.7)	(13.4)	(9.2)	(17.7)	(18.2)	(13.2)	(7.8)	(14.9)	(14.4)	(10.5)
	[8.4]	[16.5]	[17.2]	[13.5]	[8.4]	[17.1]	[16.7]	[12.2]				
Language	-19.5	-22.0	-19.0	-14.2	-21.7	-22.6	-21.1	-17.1	-22.6	-24.1	-22.0	-17.6
	(8.5)	(15.6)	(16.1)	(11.6)	(8.7)	(16.3)	(16.4)	(11.8)	(7.3)	(14.3)	(11.7)	(9.6)
	[7.8]	[15.1]	[13.3]	[11.6]	[7.8]	[16.6]	[13.5]	[11.2]				
N	56	56	56	168	56	56	56	168	8159	2672	2797	2690

Note. Columns (1) - (4) report OLS estimates of the coefficient on the percent Metco variable. Columns (5) - (8) report weighted least squares (WLS) estimates of the coefficient on the percent Metco variable. The weights are the number of micro observations in the relevant grade/school/school year cell. Columns (9)-(12) report student-level OLS estimates of the coefficient on the percent Metco variable. Standard errors are reported in parentheses. Robust standard errors are reported in brackets. Standard errors in columns (9)-(12) are clustered by grade/school/school year cell. In columns (1) - (8) the dependent variable is the mean test score for the grade/school/school year cell. In columns (9)-(12), the dependent variable is the peer mean score. The peer mean score is the grade/school/school year cell mean score omitting the students own score from the mean. Covariates include class size and fixed effects for school and school year. Columns (1) , (5) and (9) include cohort and grade fixed effects. The N row displays the number of observations (or cells) utilized in the regression. For Columns (9) - (12) , the N row displays the number of observations in the Core test score regression. Panel A uses a measure of the percent Metco variable constructed from enrollment data. Panel B uses a measure of the percent Metco variable constructed from the Riverside testing data. * Metco students are omitted from columns (9)-(12). Metco student test scores, however, are included in the peer means.

Table 5

Test Score Regression Results
Dependent Variable: 2nd Decile of Test Score

	Unweighted Means				Weighted Means				Micro Data Quantile Regression			
	Pool	3rd	5th	7th	Pool	3rd	5th	7th	Pool	3rd	5th	7th
Subject	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					A. %Metco Enrolled							
Core	-56.9	-64.3	-51.2	-46.1	-59.3	-65.4	-50.7	-48.9	-55.8	-63.6	-62.9	-49.1
	(16.8)	(34.9)	(29.9)	(26.5)	(17.2)	(36.3)	(30.4)	(26.8)	(18.7)	(50.2)	(31.9)	(27.4)
	[16.2]	[37.4]	[26.0]	[25.4]	[16.3]	[38.5]	[27.5]	[24.4]				
Reading	-50.4	-53.5	-54.8	-43.9	-52.8	-49.6	-57.5	-47.6	-48.7	-63.5	-60.6	-37.1
	(16.4)	(33.4)	(25.5)	(26.6)	(16.7)	(33.6)	(26.1)	(27.3)	(19.8)	(34.1)	(34.7)	(39.6)
	[16.7]	[39.2]	[25.1]	[25.4]	[16.2]	[36.4]	[26.8]	[26.0]				
Math	-39.8	-38.9	-44.1	-34.0	-42.8	-31.5	-44.3	-36.1	-45.2	-29.0	-48.3	-24.7
	(18.9)	(38.0)	(31.8)	(31.7)	(19.2)	(39.9)	(31.9)	(31.3)	(21.2)	(42.4)	(37.2)	(41.1)
	[19.1]	[41.5]	[31.3]	[31.8]	[18.9]	[43.2]	[31.8]	[29.7]				
Language	-42.1	-53.5	-14.8	-40.4	-45.4	-55.7	-17.2	-46.4	-48.4	-73.7	-30.8	-37.8
	(17.0)	(36.2)	(32.6)	(26.2)	(17.6)	(38.4)	(33.3)	(26.8)	(17.3)	(45.0)	(33.1)	(27.7)
	[15.6]	[35.8]	[24.7]	[23.7]	[16.2]	[40.5]	[25.8]	[24.1]				
N	168	56	56	56	168	56	56	56	8629	2798	2966	2865
					B. %Metco Tested							
Core	-51.4	-61.7	-37.8	-48.6	-54.4	-62.2	-40.1	-51.5	-48.6	-56.7	-43.0	-51.9
	(15.3)	(31.0)	(28.1)	(23.6)	(15.7)	(32.2)	(28.2)	(24.1)	(15.5)	(38.0)	(31.2)	(28.1)
	[14.4]	[31.8]	[23.3]	[23.1]	[14.4]	[32.7]	[24.7]	[22.1]				
Reading	-45.2	-58.3	-41.3	-41.1	-47.8	-54.3	-44.3	-44.6	-43.3	-57.5	-45.8	-31.7
	(15.0)	(29.4)	(24.1)	(24.0)	(15.2)	(29.6)	(24.4)	(24.9)	(16.5)	(33.8)	(25.8)	(32.0)
	[15.2]	[35.1]	[22.0]	[23.8]	[14.7]	[32.3]	[23.5]	[24.2]				
Math	-37.6	-48.3	-31.4	-35.3	-40.6	-41.7	-33.1	-37.8	-44.4	-40.5	-40.0	-31.2
	(17.2)	(33.5)	(29.8)	(28.5)	(17.5)	(35.2)	(29.6)	(28.4)	(14.5)	(47.1)	(36.7)	(33.2)
	[17.1]	[34.6]	[28.7]	[29.3]	[16.7]	[35.2]	[29.2]	[27.1]				
Language	-35.7	-43.0	-1.8	-44.5	-39.7	-44.9	-8.7	-50.1	-40.3	-47.4	-23.0	-49.6
	(15.5)	(32.5)	(30.3)	(23.3)	(16.0)	(34.4)	(30.8)	(24.1)	(15.6)	(42.8)	(31.5)	(29.5)
	[14.1]	[31.2]	[23.4]	[21.7]	[14.7]	[35.3]	[24.1]	[22.1]				
N	168	56	56	56	168	56	56	56	8629	2798	2966	2865

Note. Columns (1) - (4) report OLS estimates of the coefficient on the percent Metco variable. Columns (5) - (8) report weighted least squares (WLS) estimates of the coefficient on the percent Metco variable. The weights are the number of micro observations in the relevant grade/school/school year cell. In columns (1) - (8), the dependent variable is the 2nd decile of the test score for the grade/school/school year cell. Columns (9) - (12) report student-level quantile regression estimates of the coefficient on the percent Metco variable. The quantile regressions correspond to the 2nd decile of the test score. Standard errors are reported in parentheses. Robust standard errors are reported in brackets. Standard errors in columns (9) - (12) are bootstrapped. Covariates include class size and fixed effects for school and school year. Columns (1), (5) and (9) include cohort and grade fixed effects. The N row displays the number of observations (or cells) utilized in the Core test score regression. Panel A uses a measure of the percent Metco variable constructed from enrollment data. Panel B uses a measure of the percent Metco variable constructed from the Riverside testing data.

Table 6

OLS Results for Non-Metco Students

	Means				Micro Data			
	Pool	3rd	5th	7th	Pool	3rd	5th	7th
Subject	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. All Non-Metco Students								
Core	3.2	1.4	1.6	6.6	-5.2	-1.6	-6.6	-3.5
	(8.0)	(14.8)	(15.6)	(12.2)	(5.4)	(11.4)	(10.6)	(7.5)
	[7.5]	[14.2]	[13.7]	[12.3]	[5.9]	[10.9]	[10.2]	[8.2]
Reading	5.3	-2.1	-1.1	10.2	-2.9	-3.9	-5.9	0.0
	(7.1)	(13.9)	(13.5)	(10.3)	(5.5)	(11.5)	(10.5)	(8.0)
	[6.9]	[13.9]	[13.5]	[10.1]	[5.1]	[9.7]	[11.2]	[6.9]
Math	4.5	4.7	-0.3	8.3	-4.8	4.5	-11.8	-2.9
	(9.3)	(17.5)	(18.7)	(13.9)	(5.7)	(11.6)	(11.2)	(8.3)
	[8.7]	[16.7]	[17.5]	[14.1]	[7.0]	[12.1]	[12.9]	[9.4]
Language	0.5	-4.6	4.9	5.4	-8.4	-11.5	-3.2	-5.0
	(8.5)	(14.8)	(16.8)	(12.0)	(5.7)	(12.1)	(11.4)	(7.8)
	[8.1]	[14.1]	[13.9]	[12.3]	[6.6]	[11.6]	[10.2]	[8.1]
N	168	56	56	56	8146	2672	2796	2678
B. Black and Hispanic Non-Metco Students								
Core	-33.3	-152.4	39.1	-19.9	-12.2	-95.7	5.8	10.0
	(30.0)	(64.7)	(62.2)	(41.9)	(22.3)	-(62.2)	(47.0)	(30.2)
	[33.2]	[60.1]	[69.9]	[45.6]	[23.3]	[53.4]	[42.5]	[29.3]
Reading	-49.9	-256.2	17.7	16.8	-23.3	-116.6	-14.7	10.8
	(28.0)	(65.9)	(50.4)	(32.9)	(22.7)	(50.0)	(46.8)	(32.5)
	[34.8]	[68.7]	[54.9]	[32.5]	[21.7]	[50.2]	[33.4]	[26.3]
Math	-10.1	-54.9	27.3	-16.0	13.1	19.2	0.2	14.2
	(31.0)	(66.4)	(69.2)	(42.8)	(23.6)	(52.1)	(48.2)	(33.8)
	[33.1]	[62.2]	[78.3]	[45.9]	[25.9]	[57.2]	[50.8]	[34.1]
Language	-34.8	-120.8	41.8	-23.0	-15.9	-116.2	35.4	10.5
	(32.2)	(58.9)	(68.7)	(48.7)	(22.5)	(49.1)	(47.9)	(30.0)
	[38.2]	[65.0]	[77.2]	[54.6]	[22.7]	[43.7]	[45.3]	[30.0]
N	162	53	54	55	859	281	286	292
C. Black Non-Metco Students								
Core	-78.1	-218.0	21.8	-68.0	-33.1	-170.2	26.9	-3.7
	(32.5)	(77.1)	(71.9)	(45.2)	(28.2)	(67.9)	(60.9)	(38.4)
	[36.6]	[92.8]	[79.8]	[45.0]	[24.5]	[54.4]	[49.8]	[30.4]
Reading	-66.2	-288.2	14.9	-2.4	-29.7	-180.5	20.0	19.2
	(32.9)	(81.4)	(65.5)	(43.2)	(29.4)	(69.9)	(60.7)	(41.3)
	[36.0]	[94.9]	[62.1]	[43.6]	[24.5]	[56.6]	[39.5]	[33.2]
Math	-50.0	-92.1	22.5	-61.2	-5.4	-31.1	32.7	2.6
	(33.6)	(73.6)	(72.7)	(50.8)	(30.0)	(71.2)	(60.4)	(43.1)
	[37.0]	[81.0]	[81.6]	[51.9]	[28.3]	[66.1]	[55.6]	[36.5]
Language	-102.3	-236.6	0.5	-83.4	-47.3	-174.6	29.4	-12.4
	(34.7)	(66.0)	(80.2)	(49.9)	(28.0)	(63.2)	(62.3)	(37.7)
	[41.0]	[65.7]	[88.9]	[52.5]	[25.0]	[52.9]	[57.8]	[32.0]
N	146	45	49	52	534	169	183	182

Note. Columns (1) - (4) report OLS estimates of the coefficient on the percent Metco variable. The percent Metco variable is constructed from the Riverside testing data. Columns (5) - (8) report student-level OLS estimates. Standard errors are reported in parentheses. Robust standard errors are reported in brackets in columns (1) - (4). Clustered standard errors are reported in brackets in columns (5) - (8). Clustered standard errors are clustered by grade/school/school year cell. The dependent variable is the relevant test score. Covariates include class size and fixed effects for school and school year. Columns (5) - (8) also include race, gender, ESL/TBE and special education indicator variables as covariates. Columns (1) and (5) contain grade and cohort fixed effects. The N row displays the number of observations (or cells) utilized in the regression. For Columns (5) - (8), the N row displays the number of observations in the Core test score regression. Panel A restricts the sample to non-Metco students. Panel B restricts the sample to hispanic and black non-Metco students. Panel C restricts the sample to black non-Metco students.

Table 7

OLS, Reduced Form and First-Stage Estimates for All Non-Metco 3rd Graders

	Dependent Variable											
	Core			Reading			Math			Language		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						A. OLS						
# Metco in class	0.59 (0.63) [0.60]	0.16 (0.61) [0.63]	-0.15 (0.62) [0.71]	0.37 (0.62) [0.50]	0.08 (0.61) [0.52]	-0.18 (0.62) [0.60]	0.59 (0.64) [0.66]	0.34 (0.63) [0.65]	0.06 (0.63) [0.73]	-0.018 (0.66) [0.65]	-0.34 (0.65) [0.67]	-0.61 (0.65) [0.73]
#Non-Metco enrolled	-0.033 (0.067) [0.076]		-0.038 (0.067) [0.077]	-0.0029 (0.067) [0.060]		-0.0042 (0.067) [0.061]	-0.047 (0.068) [0.084]		-0.049 (0.069) [0.084]	0.012 (0.070) [0.080]		0.0089 (0.071) [0.081]
#Non-Metco in class	0.66 (0.22) [0.22]		-0.53	0.58 (0.22) [0.21]		-0.53	0.37 (0.22) [0.25]		-0.53	0.66 (0.23) [0.21]		-0.53
N		2672			2773			2716			2763	
				B. First-Stage - Dependent Variable is Number Metco in Class								
Instrument	0.92 (0.034) [0.18]	0.88 (0.030) [0.16]	0.87 (0.030) [0.17]									
#Non-Metco enrolled	0.0014 (0.0018) [0.016]		0.0016 (0.0018) [0.016]									
#Non-Metco in class	0.021 (0.0064) [0.040]											
N		2812										
						C. Reduced Form						
Instrument	-0.069 (1.22) [1.39]	-1.50 (1.09) [1.33]	-2.67 (1.10) [1.60]	0.28 (1.25) [1.01]	-1.10 (1.11) [1.02]	-2.36 (1.12) [1.32]	0.37 (1.26) [1.63]	-0.51 (1.12) [1.41]	-1.64 (1.13) [1.63]	-0.43 (1.31) [1.53]	-1.85 (1.16) [1.49]	-3.13 (1.17) [1.75]
#Non-Metco enrolled	-0.029 (0.067) [0.078]		-0.0209 (0.067) [0.073]	-0.0020 (0.067) [0.062]		0.0087 (0.067) [0.058]	-0.045 (0.069) [0.086]		-0.037 (0.069) [0.082]	0.015 (0.07) [0.080]		0.025 (0.071) [0.076]
#Non-Metco in class	0.61 (0.24) [0.26]		-0.53	0.59 (0.24) [0.24]		-0.53	0.36 (0.24) [0.30]		-0.53	0.62 (0.25) [0.24]		-0.53
N		2672			2773			2716			2763	

Note. Panel B shows the impact of predicted Metco on actual Metco. Panel C shows estimates of the effect of predicted Metco (the instrument) on test scores. Models include school year and school fixed effects and race, sex, ESL/TBE and special education dummies. Standard errors are reported in parentheses. Standard errors clustered by grade/school/school year cell are reported in brackets. Models in columns (3), (6), (9) and (12) of Panels A and C constrain the effect of the number of non-Metco in class to -.53 - similar to the effect found in Angrist and Lavy (99).

Table 8

2SLS Estimates for Non-Metco 3rd Graders with # Metco and # Non-Metco in class Endogenous

	All Students			Black and Hispanic			Black		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				A. Core					
# Metco	-0.77	-0.80	-1.36	-5.11	-6.88	-7.96	-8.27	-10.52	-12.33
in class	(1.35)	(1.35)	(0.95)	(6.86)	(6.43)	(5.02)	(8.75)	(7.91)	(6.95)
	[1.34]	[1.35]	[1.08]	[5.34]	[4.96]	[4.26]	[6.91]	[6.42]	[6.06]
# Non-metco	0.27	0.27		0.62	0.39		0.95	0.76	
in class	(0.46)	(0.46)		(1.48)	(1.48)		(1.61)	(1.62)	
	[0.47]	[0.47]		[1.23]	[1.24]		[1.16]	[1.17]	
# Non-Metco	-0.03			-0.02			-0.06		
enrolled	(0.07)			(0.29)			(0.40)		
	[0.08]			[0.28]			[0.28]		
1st stage F-Stat*	9.79	9.58		3.69	4.24		2.28	2.59	
N		2672			281			169	
				B. Reading					
# Metco	-1.14	-1.12	-1.27	-6.80	-8.97	-10.17	-11.05	-13.75	-16.09
in class	(1.29)	(1.29)	(0.98)	(6.70)	(6.12)	(4.87)	(9.46)	(8.18)	(7.17)
	[1.20]	[1.21]	[0.89]	[5.69]	[5.54]	[4.69]	[7.95]	[7.49]	[6.92]
# Non-metco	0.07	0.08		0.81	0.48		1.31	1.01	
in class	(0.42)	(0.42)		(1.48)	(1.47)		(1.77)	(1.76)	
	[0.43]	[0.43]		[1.20]	[1.26]		[1.22]	[1.31]	
# Non-Metco	0.01			0.04			-0.01		
enrolled	(0.07)			(0.31)			(0.45)		
	[0.06]			[0.32]			[0.33]		
1st stage F-Stat*	8.14	8.10		3.79	4.48		2.22	2.78	
N		2773			300			182	
				C. Math					
# Metco	-0.89	-0.95	-0.95	2.19	-0.51	0.20	2.72	-1.63	-0.61
in class	(1.36)	(1.35)	(0.97)	(6.88)	(6.53)	(5.02)	(9.21)	(8.60)	(7.24)
	[1.47]	[1.47]	[1.12]	[5.49]	[5.15]	[3.64]	[6.79]	[6.59]	[5.08]
# Non-metco	0.01	0.00		0.03	-0.26		-0.06	-0.39	
in class	(0.47)	(0.47)		(1.52)	(1.52)		(1.75)	(1.75)	
	[0.55]	[0.56]		[1.28]	[1.29]		[1.39]	[1.38]	
# Non-Metco	-0.04			-0.20			-0.25		
enrolled	(0.07)			(0.29)			(0.41)		
	[0.08]			[0.24]			[0.26]		
1st stage F-Stat*	9.89	9.72		3.93	4.44		2.48	2.65	
N		2716			291			176	
				D. Language					
# Metco	-1.16	-1.11	-1.62	-5.09	-7.46	-6.83	-10.36	-14.09	-10.91
in class	(1.36)	(1.35)	(1.03)	(6.56)	(6.13)	(4.68)	(8.20)	(7.51)	(6.19)
	[1.41]	[1.40]	[1.24]	[5.20]	[4.94]	[3.78]	[7.10]	6.89	5.30
# Non-metco	0.24	0.25		0.08	-0.24		-0.94	-1.29	
in class	(0.44)	(0.44)		(1.50)	(1.49)		(1.65)	(1.66)	
	[0.42]	[0.42]		[1.21]	[1.21]		[1.34]	[1.34]	
# Non-Metco	0.017			-0.08			-0.15		
enrolled	(0.07)			(0.29)			(0.38)		
	[0.08]			[0.23]			[0.33]		
1st stage F-Stat*	8.24	8.13		3.95	4.61		2.59	3.05	
N									

Note. Models include school year and school fixed effects and sex, ESL/TBE and special education dummies. Columns (1) - (4) include race dummies. Standard errors are reported in parentheses. Standard errors clustered by school/school year cell are reported in brackets. The sample is restricted to non-Metco 3rd graders. The instrumet set includes a linear term for predicted class size (pclass) and the following six indicator variables : 1(24<=pclass<25) 1(23<=pclass<24), 1(22<=pclass<23), 1(21<=pclass<22), 1(20<=pclass<21), 1(19<=pclass<20). *The 1st stage F-stat refers to the F-statistic on the vector of instruments in the first stage. The F-statistic is based upon standard errors clustered by school/school year cell.

Table 9a

OLS Results for Male Non-Metco Students

	Means				Micro Data			
	Pool	3rd	5th	7th	Pool	3rd	5th	7th
Subject	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. All Male Non-Metco Students								
Core	7.7	-1.9	8.3	16.7	2.5	-4.2	5.5	8.1
	(10.6)	(19.4)	(24.6)	(15.3)	(7.8)	(16.6)	(15.4)	(10.9)
	[8.8]	[18.7]	[23.0]	[12.7]	[8.0]	[16.7]	[16.5]	[11.5]
Reading	9.2	-11.3	5.8	22.2	2.8	-10.5	6.3	11.1
	(9.8)	(17.8)	(22.2)	(14.0)	(7.8)	(16.9)	(14.9)	(11.3)
	[9.0]	[17.2]	[22.7]	[10.8]	[7.6]	[13.8]	[17.3]	[10.4]
Math	0.4	-7.7	-5.9	10.4	-4.0	-7.3	-12.1	5.3
	(10.9)	(20.5)	(24.4)	(16.1)	(8.1)	(16.4)	(16.0)	(12.1)
	[8.8]	[19.2]	[21.3]	[13.6]	[8.0]	[16.4]	[15.1]	[11.4]
Language	9.0	-7.0	21.8	18.4	2.4	-9.3	16.4	8.3
	(11.7)	(23.2)	(25.3)	(15.8)	(8.4)	(18.0)	(16.8)	(11.7)
	[9.8]	[21.3]	[22.4]	[14.1]	[8.9]	[18.9]	[16.0]	[12.3]
N	168	56	56	56	4086	1322	1395	1369
B. Black and Hispanic Male Non-Metco Students								
Core	-72.8	-25.4	-139.2	-47.0	-3.9	-57.0	32.9	-15.4
	(42.7)	(112.3)	(109.2)	(56.6)	(36.4)	(96.2)	(92.9)	(44.9)
	[47.6]	[117.6]	[135.9]	[58.5]	[34.5]	[89.6]	[89.0]	[43.7]
Reading	-52.6	-113.9	-86.5	-3.8	-11.1	-85.2	19.1	-14.5
	(40.0)	(101.0)	(94.2)	(49.5)	(35.8)	(88.9)	(86.9)	(45.5)
	[44.4]	[111.9]	[113.1]	[53.6]	[31.7]	[89.4]	[78.3]	[39.0]
Math	-42.1	116.7	-192.3	-18.6	19.8	107.7	-35.4	11.5
	(43.9)	(105.0)	(95.4)	(63.2)	(37.8)	(92.2)	(87.7)	(50.2)
	[48.6]	[109.6]	[109.3]	[59.6]	[38.3]	[95.7]	[82.0]	[47.0]
Language	-71.3	10.3	-62.3	-83.5	-14.7	-64.3	89.8	-29.0
	(44.8)	(94.9)	(115.1)	(62.6)	(36.3)	(83.1)	(89.2)	(46.6)
	[49.5]	[110.8]	[137.8]	[62.3]	[35.1]	[96.2]	[89.1]	[46.5]
N	138	45	45	48	417	123	141	153
C. Black Male Non-Metco Students								
Core	-72.8	-25.4	-139.2	-47.0	-3.9	-57.0	32.9	-15.4
	(42.7)	(112.3)	(109.2)	(56.6)	(36.4)	(96.2)	(92.9)	(44.9)
	[47.6]	[117.6]	[135.9]	[58.5]	[34.5]	[89.6]	[89.0]	[43.7]
Reading	-52.6	-113.9	-86.5	-3.8	-11.1	-85.2	19.1	-14.5
	(40.0)	(101.0)	(94.2)	(49.5)	(35.8)	(88.9)	(86.9)	(45.5)
	[44.4]	[111.9]	[113.1]	[53.6]	[31.7]	[89.4]	[78.3]	[39.0]
Math	-42.1	116.7	-192.3	-18.6	19.8	107.7	-35.4	11.5
	(43.9)	(105.0)	(95.4)	(63.2)	(37.8)	(92.2)	(87.7)	(50.2)
	[48.6]	[109.6]	[109.3]	[59.6]	[38.3]	[95.7]	[82.0]	[47.0]
Language	-71.3	10.3	-62.3	-83.5	-14.7	-64.3	89.8	-29.0
	(44.8)	(94.9)	(115.1)	(62.6)	(36.3)	(83.1)	(89.2)	(46.6)
	[49.5]	[110.8]	[137.8]	[62.3]	[35.1]	[96.2]	[89.1]	[46.5]
N	138	45	45	48	417	123	141	153

Note. Columns (1) - (4) report OLS estimates of the coefficient on the percent Metco variable. The percent Metco variable is constructed from the Riverside testing data. Columns (5) - (8) report student-level OLS estimates. Standard errors are reported in parentheses. Robust standard errors are reported in brackets in columns (1) - (4). Clustered standard errors are reported in brackets in columns (5) - (8). Clustered standard errors are clustered by grade/school/school year cell. The dependent variable is the relevant test score. Covariates include class size and fixed effects for school and school year. Columns (5) - (8) also include race, gender, ESL/TBE and special education indicator variables as covariates. Columns (1) and (5) contain grade and cohort fixed effects. The N row displays the number of observations (or cells) utilized in the regression. For Columns (5) - (8), the N row displays the number of observations in the Core test score regression. Panel A restricts the sample to male non-Metco students. Panel B restricts the sample to hispanic and black male non-Metco students. Panel C restricts the sample to black male non-Metco students.

Table 9b

OLS Results for Female Non-Metco Students

	Means				Micro Data			
	Pool	3rd	5th	7th	Pool	3rd	5th	7th
Subject	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. All Female Non-Metco Students								
Core	-1.4	8.7	-5.5	-3.5	-11.8	2.9	-19.4	-15.2
	(10.0)	(19.5)	(19.4)	(15.8)	(7.4)	(15.7)	(14.6)	(10.3)
	[10.9]	[21.7]	[14.3]	[17.2]	[7.8]	[12.6]	[10.7]	[10.7]
Reading	1.2	11.0	-7.0	-3.2	-7.6	5.5	-19.8	-11.3
	(9.7)	(19.8)	(18.0)	(15.9)	(7.7)	(15.8)	(15.0)	(11.4)
	[10.0]	[20.8]	[15.3]	[16.8]	[7.0]	[11.2]	[11.8]	[11.0]
Math	6.3	18.3	-0.8	4.9	-3.7	15.3	-10.9	-10.5
	(11.6)	(20.9)	(23.0)	(18.1)	(8.0)	(16.5)	(15.9)	(11.5)
	[11.9]	[22.4]	[20.4]	[18.8]	[9.1]	[14.1]	[15.2]	[11.6]
Language	-6.9	1.2	-7.4	-7.0	-18.2	-8.8	-23.1	-19.4
	(10.5)	(19.5)	(21.9)	(15.5)	(7.7)	(16.3)	(15.4)	(10.5)
	[11.8]	[20.3]	[19.1]	[17.0]	[9.1]	[13.9]	[15.4]	[11.1]
N	168	56	56	56	4060	1350	1401	1309
B. Black and Hispanic Female Non-Metco Students								
Core	6.3	-144.5	84.8	28.7	-14.1	-127.7	-11.6	28.4
	(33.7)	(77.1)	(72.6)	(42.8)	(28.9)	(66.3)	(53.7)	(43.8)
	[39.5]	[70.6]	[75.5]	[53.5]	[31.0]	[69.8]	[48.0]	[41.7]
Reading	-15.9	-220.7	65.3	35.3	-23.5	-109.5	-24.9	21.4
	(36.1)	(88.1)	(70.8)	(44.9)	(30.6)	(65.6)	(56.7)	(50.1)
	[42.7]	[81.7]	[72.0]	[51.4]	[31.3]	[65.7]	[43.5]	[38.9]
Math	28.1	-30.3	83.2	9.1	10.8	-21.1	-4.7	1.3
	(34.2)	(76.2)	(75.6)	(45.6)	(31.0)	(68.0)	(58.5)	(48.3)
	[37.7]	[65.3]	[82.1]	[50.3]	[33.1]	[79.3]	[59.4]	[45.3]
Language	21.1	-126.3	94.0	57.7	-16.9	-145.5	0.4	48.8
	(33.7)	(68.6)	(78.7)	(42.7)	(29.5)	(66.5)	(57.6)	(41.9)
	[40.3]	[74.7]	[85.7]	[55.7]	[29.1]	[52.8]	[50.8]	[42.8]
N	152	52	49	51	442	158	145	139
C. Black Female Non-Metco Students								
Core	-42.9	-340.2	31.5	40.9	-37.8	-197.1	0.8	6.6
	(49.6)	(120.9)	(88.9)	(68.6)	(39.6)	(98.9)	(69.4)	(63.7)
	[55.0]	[137.7]	[93.1]	[66.4]	[38.0]	[107.4]	[53.3]	[54.3]
Reading	-37.0	-341.6	74.5	63.4	-40.7	-178.7	-0.4	17.4
	(52.5)	(127.1)	(91.3)	(70.0)	(42.7)	(102.3)	(76.4)	(70.8)
	[57.6]	[135.8]	[92.9]	[66.1]	[39.2]	[104.1]	[57.7]	[45.3]
Math	-36.5	-204.3	39.6	-10.4	-15.4	-74.8	7.2	-44.0
	(45.3)	(109.2)	(69.9)	(72.1)	(42.6)	(104.5)	(70.8)	(71.2)
	[47.6]	[116.2]	[70.2]	[64.9]	[41.5]	[117.6]	[57.3]	[62.9]
Language	-28.0	-360.9	22.0	82.1	-31.6	-195.2	0.2	39.7
	(49.8)	(114.4)	(91.6)	(66.5)	(40.2)	(96.6)	(74.4)	(60.5)
	[55.1]	[132.6]	[94.7]	[68.0]	[38.2]	[98.6]	[61.5]	[56.5]
N	124	41	40	43	258	88	90	80

Note. Columns (1) - (4) report OLS estimates of the coefficient on the percent Metco variable. The percent Metco variable is constructed from the Riverside testing data. Columns (5) - (8) report student-level OLS estimates. Standard errors are reported in parentheses. Robust standard errors are reported in brackets in columns (1) - (4). Clustered standard errors are reported in brackets in columns (5) - (8). Clustered standard errors are clustered by grade/school/school year cell. The dependent variable is the relevant test score. Covariates include class size and fixed effects for school and school year. Columns (5) - (8) also include race, gender, ESL/TBE and special education indicator variables as covariates. Columns (1) and (5) contain grade and cohort fixed effects. The N row displays the number of observations (or cells) utilized in the regression. For Columns (5) - (8), the N row displays the number of observations in the Core test score regression. Panel A restricts the sample to female non-Metco students. Panel B restricts the sample to hispanic and black female non-Metco students. Panel C restricts the sample to black female non-Metco students.

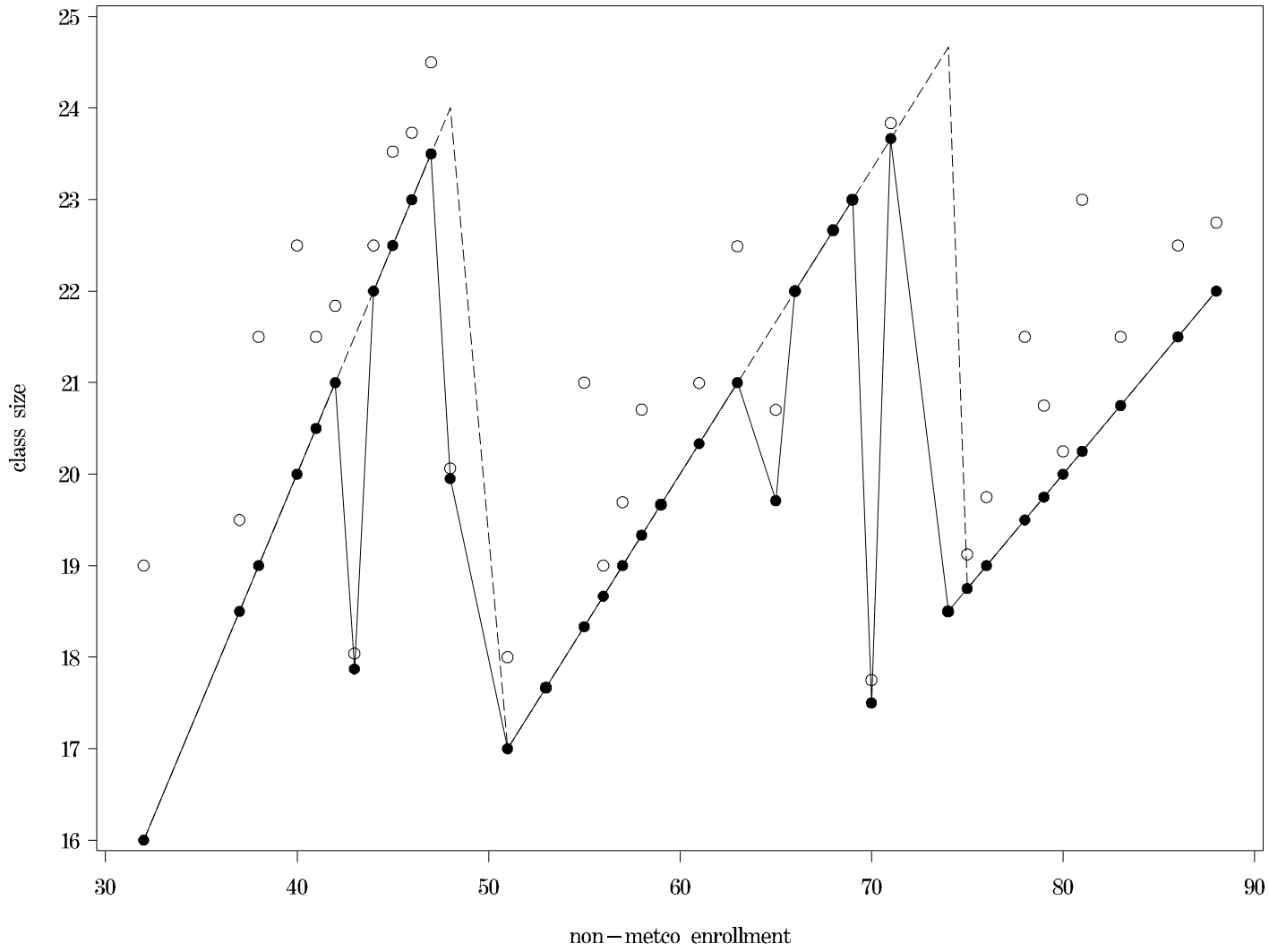


Figure 1. Predicted and actual class size (circles = size with METCO pupils included).
Data for Brookline 3rd graders.

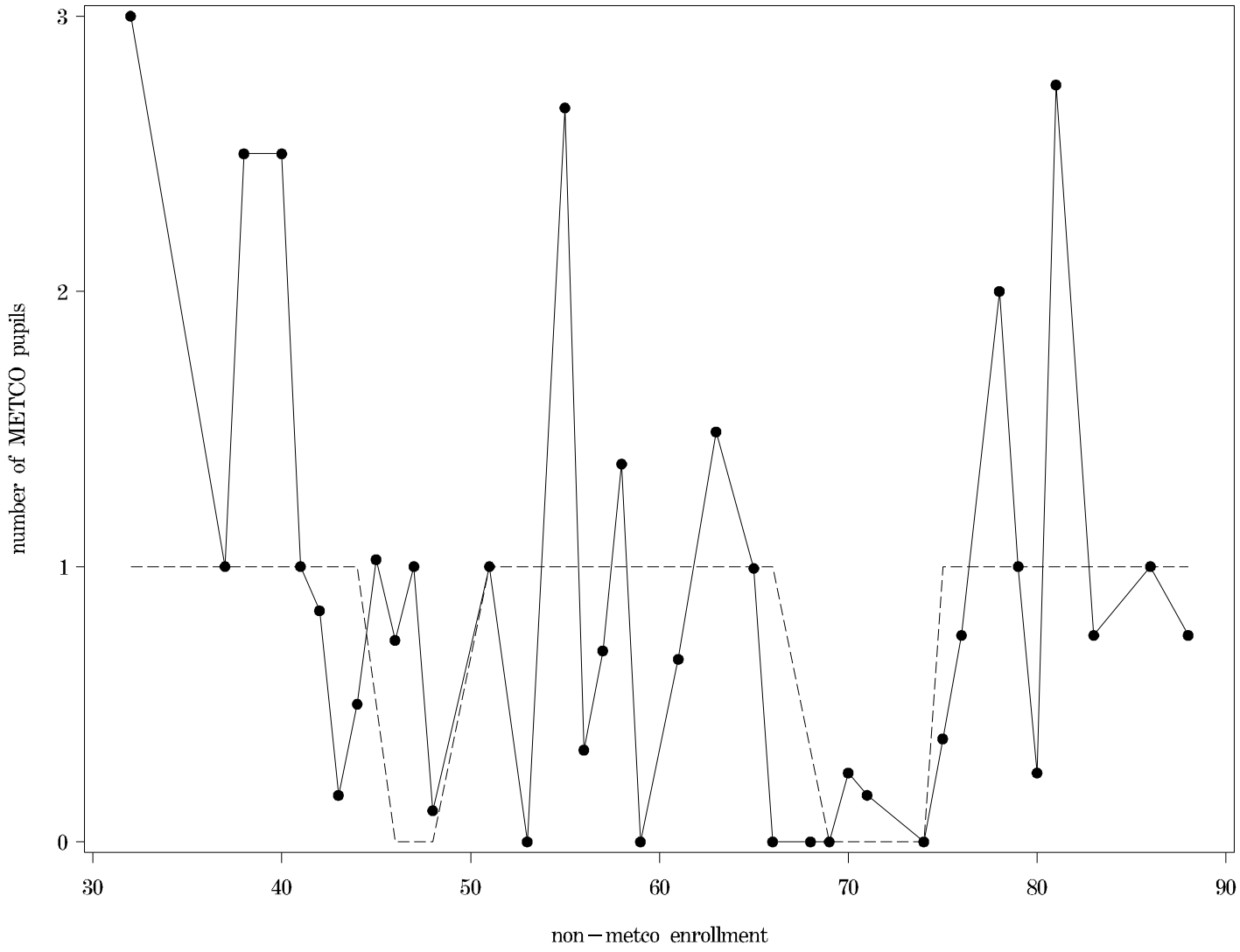


Figure 2. Predicted and actual number of METCO pupils per class.