Stuck in the Middle: Impacts of Grade Configuration in Public Schools

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Abstract

We examine the implications of separating students of different grade levels across schools for the purposes of educational production. Specifically, we find that moving students from elementary to middle school in 6^{th} or 7^{th} grade causes significant drops in academic achievement. These effects are large (about 0.15 standard deviations), present for both math and English, and persist through grade 8, the last year for which we have achievement data. The effects are similar for boys and girls, but stronger for students with low levels of initial achievement. We instrument for middle school attendance using the grade range of the school students attended in grade 3, and employ specifications that control for student fixed effects. This leaves only one potential source of bias—correlation between grade range of a student's grade 3 school and unobservable characteristics that cause decreases in achievement precisely when students are due to switch schools—which we view as highly unlikely. We find little evidence that placing public school students into middle schools during adolescence is cost-effective.

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One of the most basic issues in the organization of public education is how to group students efficiently. Public schools in the U.S. have placed students of similar ages into grade levels since the mid-1800s, but grade configurations have varied considerably over time. At the start of the 20th century, most primary schools in the U.S. included students from kindergarten through grade 8, while the early 1900s saw the rise of the "junior high school," typically spanning grades 7–8 or 7–9 (Juvonen et al., 2004). More recently, school districts have shifted toward the use of "middle schools," which typically span grades 6–8 or 5–8.[1] Interestingly, middle schools and junior high schools have never been popular among private schools.[2]

The impact of grade configuration has received little attention by economists relative to issues such as class size or teacher quality. There are a few studies which provide evidence that the transition to middle school is associated with a loss of academic achievement, elevated suspension rates, and reduced self esteem (Alspaugh (1998a, 1998b), Weiss and Kipnes, (2006), Byrnes and Ruby (2007), Cook et al. (2008)). There is also a large body of work by educational researchers and developmental psychologists documenting changes in attitudes and motivation as children enter adolescence (Eccles et al. (1984)), and some have hypothesized that instructional differences in middle schools contribute to these changes. However, these studies examine differences between middle school and elementary school students using cross-sectional data,

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[1] Between the school years 1969–1970 and 1999–2000, the number of middle schools in the U.S. rose from 1,526 to 11,521, displacing both junior high schools and other types of elementary schools (U.S. Department of Education (1973, 2007)). Over the period from 1987–2007, the fraction of 6th graders in K–6 schools fell from roughly 45 percent to 20 percent, caused mainly by the growth in schools serving grades 6–8. Similarly, the fraction of 7th graders enrolled in junior high schools (i.e., serving grades 7–8 or 7–9) shrank from around 40 percent to 20 percent, again in favor of middle schools. The fraction of 6th and 7th graders attending K–8 schools remained roughly 10 percent over this time period. (Source: National Center for Education Statistics, Common Core of Data, 1987, 2007).

[2] In 1989, the earliest year for which data is available, 88 percent of 6th graders and 84 percent of 7th graders in private schools attended a school that started in Kindergarten, but only about 1 percent of each group attended a school serving grades 6–8 or 7–8. In 2007, the fraction of 6th and 7th graders in private schools also serving Kindergarten students had risen to 90 and 86 percent, respectively, while private schools serving grades 6–8 or 7–8 served just 1.5 and 2 percent of, respectively, 6th and 7th graders in private schools. (Source: National Center for Education Statistics, Private School Universe Survey, 1989, 2007).

and therefore are unable to reject the hypothesis that differences across students, rather than differences in grade configuration, are responsible for divergent educational outcomes.[3]

In this study, we use panel data in New York City to measure the effects of alternative grade configurations. Specifically, we focus on variation in achievement within students over time, and examine how student achievement is affected by movement into middle schools. Elementary schools in New York City typically serve students until grade 5 or grade 6, while a smaller portion extend through grade 8; thus most students move to a middle school in either grade 6 or grade 7, while some never move to a middle school. We find that achievement falls substantially (about 0.15 standard deviations in math and English) when students move to middle school, relative to their peers who do not move. Importantly, these negative effects persist through grade 8, the highest grade level on which test data are available.

In order to estimate the causal effects of moving to middle school, we use instruments based on the terminal grade of the schools that students attended in grade 3, when we can first observe them. Thus, our identification assumption is that there are no unobservable factors that cause a drop in student achievement at precisely the same time as students must leave the elementary schools they attended in grade 3. While we cannot rule out the existence of such factors, we cannot think of a plausible alternative story that would explain our findings.

In order to gain a better understanding of what might drive the large achievement effects of middle schools, we use multiple sources of data on school resources and environment. While there is little evidence that middle schools use fewer resources, we find that they differ in several

[3] One exception is work by Bedard and Do (2005); using panel data on U.S. school districts, they find a small negative relationship between changes in the fraction of 6^{th} graders enrolled in middle schools and changes in high school completion rates seven years later. Additionally, using a pseudo-longitudinal analysis, Cook et al. (2008) provide evidence that students moving to middle schools in their sample are not systematically different.

structural ways (e.g., cohort sizes are considerably larger) and that they are perceived negatively on several dimensions by parents and students.

The paper proceeds as follows. In Section 2 we describe our data, and in Section 3 we present our methodology and our main findings. In Section 4, we present complementary results regarding school resources and environment, including an analysis of parent and student surveys. Section 5 contains a cost-benefit analysis, and Section 6 concludes.

2. Student Data and Descriptive Statistics

The primary data set used in our analysis contains information on the enrollment, academic achievement, and demographics of students in New York City in grades 3 through 8. These data span the school years 1998–1999 through 2007–2008 and include student characteristics such as ethnicity, gender, language spoken at home, and free lunch status, as well as academic and behavioral indicators, including annual standardized test scores in math and English, suspensions, and absences.

We exclude students who were missing school information, were retained for more than two years, skipped a grade level, or (in very few cases) moved down a grade level, or who attended a school that exclusively serves those with disabilities (which typically do not administer standardized exams in math and English). Because our empirical strategy uses the school attended in grade 3 as an instrument and examines outcomes through grade 8, we restrict our sample to a balanced panel of students in the five cohorts that attended grade 3 between the fall of 1998 and the fall of 2002 who took exams in both math and English during the following five years.[4]

[4] Outside of schools serving only the disabled, 62.3 percent of students we observe in grade 3 remained in NYC schools and were tested for the following five years. The percentage was slightly higher (65 percent) for students

Of the grade 3 students in our sample, 61.7 percent enrolled in a K–5 school, 24.4 percent enrolled in a K–6 school, and 7.4 percent enrolled in a K–8 school. The small fraction of remaining students attended K–3, K–4 or K–7 schools. Although we can use these additional grade spans as instruments for school changes at grades 4, 5, or 8, in practice the samples are too small for us to obtain reasonably precise estimates of these effects, and we therefore narrow our sample to students enrolled in K–5, K–6, and K–8 schools in grade 3.[5] Among the schools attended by grade 8 students in our sample, 25 percent served grade 3, while 72 percent had a minimum grade of 5, 6, or 7. Thus, as a stylized fact, New York City students typically attend either a school serving all elementary grades (K–8), or a school serving early elementary grades (K–5 or K–6) followed by a middle school (6–8 or 7–8).

Our identification strategy is based on the fact that whether (and when) students attend a middle school is strongly related to the grade range of the schools they attend in grade 3. While our estimation strategy includes student fixed effects, it is worthwhile to examine differences in the characteristics of 3rd graders in our sample across schools with different grade ranges (K–5, K–6, or K–8). Compared with students attending K–6 or K–8 schools, grade 3 students in K–5 schools are less likely to be Black or receive free or reduced price lunch. They also have higher test scores and fewer absences than their counterparts in the other schools, but similar percentages of students receiving special education or English Language Learner services, and

observed in K-8 schools than those in K-6 schools (63 percent) or K-5 schools (62 percent). While we believe that the use of a balanced panel simplifies the interpretation of our results, our estimates are quite robust to the inclusion of students who leave NYC public schools or were not tested despite continuous enrollment. See discussion of Figure A2.

[5] Among remaining grade 3 students, the most common type of school grade configuration is K–4, of whom many move to a school serving grades 5 to 8. Later, we add these students back to our sample as part of a robustness check; see discussion of Figure A1.

similar suspension rates.[6] If we look at the same students 5 years later, there is little change in relative rates of program participation across these groups. However, students who attended a K–8 school in grade 3 score nearly as well as students who attended a K–5 school on standardized tests and well outpace students who attended a K–6 school. Changes in absence rates tell a similar story—no gap remains between K–5 and K–8, while K–8 students now have fewer absences than their K–6 counterparts. Rates of suspensions remain similar across all groups.

Notably, the percentage of students who were held back during this five year period is slightly different across the three groups. Students who attended a K–5 school in grade 3 are somewhat less likely to repeat a grade level (9 percent) than students who attended K–6 or K–8 school (12 percent). Students tend to do well on standardized tests when they repeat a grade, so we control for whether a student was held back in the year in question and also for whether the student was held back in a prior year. We examine the importance of these controls as one of the robustness checks discussed in Section 3.1.

3. Estimates of Grade Configuration on Achievement and Behavior

We base our estimates on variation in achievement and behavior within students over time and instrument for middle school entry using the school attended in grade 3. Thus, differences in student characteristics across grade configurations will not influence our results provided that the impact of those differences on academic outcomes in grade 8 is not correlated

[6] Some of the variation across school types in ethnicity and poverty rates is driven by the fact that elementary schools are nearly all K–5 in Staten Island, the borough of New York with the greatest percentage of White students and smallest percentage of students on free lunch. However, the negative impacts of middle school are, if anything, slightly stronger if we drop Staten Island from our estimation sample.

with their grade 3 enrollment and coincident with the timing of their movements into middle schools.

In addition to estimating the initial effect on student achievement and behavioral outcomes of entering middle school, we want to test whether entering middle school affects outcomes in subsequent years, and whether effects differ depending on the grade in which the student entered middle school. We posit that an outcome *Y* for student *i* in grade *g* can be represented by Equation 1, where α_i is a student fixed effect, δ_g is a grade fixed effect, and M_i^G is an indicator for whether student *i* entered middle school in grade *G*.

$$(1)\ Y_{ig} = \alpha_i + \delta_g + \beta_g M_i^G + \varepsilon_{ig}$$

We allow the coefficient on M_i^G to vary across grades for two reasons. First, we are interested in how the effect of entering middle school varies over time (β_g for $g \geq G$). Second, the coefficients prior to middle school entry (β_g for $g < G$) allow us to test whether students who switch to middle schools have different patterns of outcomes prior to changing schools. If students who entered middle school in grade 6 saw declines in achievement in grade 5, it would be difficult to argue that this represented a causal negative effect of switching to middle school. The final term, ε_{ig}, is a residual that includes unobserved time-varying individual characteristics and other factors that affect academic outcomes, along with any measurement error. In this specification, the grade fixed effects (δ_g) estimate patterns of achievement over grades for students that never enter a middle school.

One concern with estimating the specification in Equation 1 via OLS is that the choice to attend middle school in an upper elementary grade is endogenous and may be related to time varying factors that we do not observe. For example, consider a 5th grader attending a school serving grades K–8, and suppose that in the following year the student moves to a school serving grades 6–8. This choice might be driven by changes in the student's life—e.g., a bad experience in the previous school, a residential move—that impact academic achievement and have nothing to do with the movement to a middle school. In order to minimize this concern, we use a two stage least squares regression specification, in which we instrument for middle school entry in grade 6 or 7 using the terminal grade of the school a student attended in grade 3. Specifically, we instrument for entering middle school in grade 6 with an indicator for whether the school the student attended in grade 3 ended at grade 5 two years later. Likewise, we instrument for entering middle school in grade 7 with an indicator for whether the school the student attended in grade 3 ended at grade 6 three years later. The overwhelming majority of schools do not change grade configuration over this period, but our instruments reflect these changes when they occur. These instrumental variables are strongly related to actual entry into middle school; estimated coefficients on instruments for entry into middle school in grade 6 and grade 7 are both about 0.7, with t-statistics around 350 (Table 2).

Before presenting our main results, it is important to point out that our methodology identifies a local average treatment effect, i.e., the impact of middle school attendance on New York City students who attended a K–5 or K–6 school in grade 3 and moved to a middle school in accordance with their schools' grade ranges. This is a particular subset of the population, and the effect of middle school attendance might be greater or smaller for other students. For example, one might think that parents who believe their children would do better in a stable environment might tend to enroll them in a K–8 school. This process could lead us to estimate a relatively small local treatment effect. One might also speculate that students in New York City are more sensitive to school quality than students from more affluent areas, who have greater resources in the home, thus making the local effect we identify relatively large. Regardless, the population we study is of considerable interest.

We first estimate the impact of attending middle school on student achievement in math and English. While we prefer the instrumental variables strategy explained above, we also report results using OLS, which are quite similar. For ease of interpretation, and to remove variation from changes to the test, scores have been normalized within year and grade to have a mean of zero and a standard deviation of one. Recall that our coefficients of interest are the interactions between grade level and entering a middle school in grade 6 or grade 7 (β_g). These coefficients indicate whether the trajectories of student achievement for students entering middle schools are different than for students who never attend a middle school. Coefficients for these estimates are plotted in Figure 1, and these estimates and standard errors (clustered by the school the student attended in grade 3) are shown in Appendix Table A1.

There are no significant effects of eventually entering middle school on students' achievement trajectories from grade 3 to grade 4, and these students are estimated to make somewhat *more* progress from grade 4 to grade 5 than their counterparts who never enter middle school. However, in both subjects, we see achievement fall dramatically in grade 6 for students who enter middle school in that grade. In contrast, students who enter middle school in grade 7 continue to improve relative to their peers in grade 6, but then fall dramatically upon entering middle school in grade 7.

The negative effects of entering middle school are large and highly statistically significant at both grade 6 and grade 7. Estimates from our 2SLS regressions are that math achievement falls by 0.177 (0.166) standard deviations and English achievement falls by 0.162 (0.141) standard deviations for transitions at grade 6 (grade 7). Importantly, these negative effects persist through the end of grade 8. . Relative to students who never entered middle school, grade 8 students entering middle school in grade 6 are estimated to underperform by 0.172 standard deviations in math and 0.140 standard deviations in English (both significant at the 1 percent level), and students entering middle school in grade 7 are estimated to underperform by 0.098 standard deviations in math and 0.088 standard deviations in English (with p-values of .055 and .017 for math and English, respectively). These differences are economically important. Moreover, students who entered middle school in grade 6 underperform relative to students who entered middle school in grade 7. An F-test reveals that the expected difference in achievement in grade 8 between students who entered middle school in grade 6 and those that entered in grade 7 is significant at the 1 percent level for both subjects.

Point estimates for the drops in achievement at transition to middle school and the achievement gaps in grade 8 are only slightly smaller in the OLS regressions, and in all cases the OLS estimates are statistically significant. As our first-stage regressions indicate, parental decisions regarding grade configuration seem to be largely made up by the time a student is in grade 3. While some students in our sample change configurations later on, these enrollment decisions appear too uncommon and/or too unsystematic to change our overall findings.

Prior to middle school entry, we find that students do well relative to students that never transition to middle school, though these effects are more than negated upon entering middle school. There are a number of ways in which this finding might be interpreted. Elementary school education may be of relatively high quality, or it may be that exposure to older students is detrimental to the provision of education to younger students. It might also be that students do well when they are relatively old within their schools. We examine these issues further below.

3.1 Checks on Robustness and Interpretation

One threat to the validity of our results is if students who attend a K–5 (K–6) school in grade 3 differ in such a way that will cause their achievement to dip sharply in grade 6 (grade 7), even after showing somewhat greater progress in earlier grades. This possibility seems exceedingly unlikely. To further bolster our findings, we take the small fraction of students who attended a K–4 school in grade 3 and add them to our analysis sample in order to estimate the impact of moving to a middle school in grade 5. These students display a large drop in achievement during their first year in middle school (see Appendix Figure A1). The immediate effect of transition in grade 5 for students who attended a K–4 school is larger than for students who move to middle schools in grade 6 or 7, and the cumulative effect of middle school attendance on achievement through grade 8 is as large or larger. This lends further support to the idea that middle school attendance may be worse for students who enter at younger ages. Cook et al. (2008) come to a similar conclusion, and hypothesize that younger students may be more sensitive to negative influences of older students.

A second potential concern with our analysis is that schools might be selectively retaining students in a way that drives our results. As mentioned above (and shown in Table 1), students who attended a K–5 school in grade 3 were less likely to be retained over the next five years than students who attended K–6 or K–8 schools. While we control for grade retention in our regressions, we further gauge the importance of grade retention by running additional specifications that either drop these controls or drop any student who was ever held back. We find that these changes to our specification and sample have little impact on our findings, and, to illustrate this, we plot the point estimates for math in the top panel of Figure A2; results for English are quite similar.

Another possibility is that our results are biased due to non-random attrition from NYC public schools or non-random selection of students who are enrolled but not tested. To the degree such selection occurs, it could bias either toward or against our findings. For example, parents who send their children to a K–5 school but believe they will do poorly in a middle school may opt to send them to a private school in grade 6. However, it is also possible that students who suffer negative shocks in their last year of elementary school move to private schools or outside the district, which might create spuriously high scores in that year and low scores the following year among those who remain in the sample. While we cannot observe outcomes for students who leave the public schools or are not tested, we can re-estimate our regressions including them in our sample. Inclusion of students who remained in NYC public schools for five years after grade 3 but were not always tested, and students who left the school district within four years after grade 3 affect our estimates only slightly. Point estimates for math are shown in the bottom panel of Figure A2; again, English results are similar. If anything, the positive coefficients for students in their last year of elementary school are a bit larger, but achievement declines in middle school and differences at grade 8 are of similar magnitude and statistically significant. While these are not definitive tests for selection bias, they support a causal interpretation of the effects of middle school attendance.

If our argument is correct that middle school attendance has a large and persistent negative effect on student achievement, there are several ways in which this might be interpreted. First and foremost, it may be that average educational quality is low in middle schools. We explore this possibility in Section 4 using data on school resources, student composition, and the opinions of parents and students.

A second potential interpretation is that the mere act of switching schools during adolescence has long and lasting negative consequences, even if the student's new school is of equal quality. From the perspective of educational production, this latter interpretation also implies that the separation of adolescent students into middle schools is costly. Moreover, while one might try to improve the quality of middle school education, the use of middle schools is inextricably tied to school switching. One way to test these two alternative interpretations would be to compare students leaving K–5 or K–6 schools that are exogenously more likely to move into a K–8 school as opposed to a middle school. However, even if we set aside exogeneity, only three percent of students in our sample who leave K–5 or K–6 schools at the terminal grade move into K–8 schools, and we can find only ten schools that ever sent more than half of exiting K–5 or K–6 students to K–8 schools.

Another interpretation is that older students are easier to educate when the school also contains very young students, and that younger adolescent students are more difficult to educate when the school also contains older students. This is consistent with both the positive effects for students in grades 5 and 6 prior to the transition to middle school and the negative effects of middle school, relative to K–8 schools. However, the separation of students by age is inextricably tied to the use of elementary and middle schools, making this interpretation impossible to test with our data.

Finally, one might interpret our results as driven by an effect of relative age in school.[7] When a student moves from a K–5 to 6–8 school (or from K–6 to 7–8), they switch from being in the oldest cohort to the youngest cohort in their school. We can try to address this issue by

[7] There is little research that would suggest this is an important determinant of student achievement, but it is certainly plausible. There is considerable work demonstrating that older children *within a grade* typically have higher levels of achievement (e.g., Bedard and Dhuey (2006), but Cascio and Schanzenbach (2007) find this is due to biological age, not relative age among peers.

taking advantage of the fact that roughly half of the students who move out of a school serving grades K–6 enter a school serving grades 6–8 while a third move to a school serving grades 7–8. This generates variation in relative age within a school conditional on having moved to a middle school in grade 7. When we allow the impact of entering middle school in grade 7 to depend on whether the student also entered in the youngest cohort of the middle school, we find that the impact of middle school entry is quite similar regardless of relative age at entry. These estimates are available upon request.

3.2 Heterogeneous Effects, Absences, and Suspensions

It is possible that the average effects presented above may belie heterogeneity in the impact of middle school attendance. A number of recent studies find larger impacts of educational interventions and school quality on girls (e.g., Hastings et al. (2006), Angrist et al. (2009), Jackson (2009)), and, in light of these studies, we estimate the impact of middle school entrance on achievement separately by gender. However, results for girls and boys (not reported, but available upon request) are quite similar. We also estimate impacts separately by whether a student's grade 3 test score was above or below the city-wide median. This specification is based on the idea that students with lower achievement may possess fewer educational resources outside of school and may be more affected by variation in school quality. Although we find significant declines in achievement during middle school for both sets of students, both the immediate and cumulative effects of middle school attendance are greater for students who start at the lower end of the achievement distribution (Figure 2).[8] Indeed, for students with above

[8] P-values for the test of equality of coefficients at grade 8 for students with below and above median initial scores are 0.013 and 0.009 for math and English, respectively, for those entering middle school in grade 6. Corresponding p-values for students entering middle school in grade 7 are 0.004 in both math and English. Tests for equality of the fall in achievement at transition also confirm significantly larger declines for lower scoring students. These p-values

median initial achievement, estimated differences in grade 8 achievement between those who entered middle schools in grade 7 and those who never entered middle school are not statistically significant.

We perform similar analyses of the impact of middle school attendance on student absences and suspensions (Figure 3).[9] We estimate that absences rise upon students' entry into middle school, and absences for middle school entrants are significantly higher in grade 8 than for students that never enter middle school. Thus, one of the ways in which middle schools might lower student achievement is through increased absences. However, there is little chance that student absences explain the magnitude of the overall effect.[10] Suspension rates rise when students enter middle school in grade 6, but this effect subsides completely by grade 8. Similarly, suspensions rise for students who enter middle school in grade 7 and increase through grade 8, but these students also experienced a significant drop in suspensions prior to their transition to middle school, so the overall effect of grade configuration in grade 8 is statistically insignificant. While these estimates clearly may be affected by the propensity of schools to use suspension as a disciplinary measure, they do not support the notion that bad behavior in school is a principal mechanism driving the achievement results shown in Figure 1.

4. Differences in Resources and Environment across Grade Configurations

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are 0.146 and 0.021 at grade 6 and grade 7 transitions, respectively, for math, and 0.016 and 0.048 at grade 6 and grade 7 transitions, respectively, for English.

[9] The point estimates used in Figure 3 and standard errors from these regressions are provided in Appendix Table A2.

[10] Recent estimates of the impact of a teacher absence on student achievement are roughly –0.002 standard deviations (see Miller et al. (2008), Clotfelter et al. (2009), Herrmann and Rockoff (2009)). Even if student absences were ten times as detrimental, one additional absence could explain very little of the achievement decline in middle schools.

As mentioned above, one likely explanation for our results is that middle schools are less effective in educating adolescent students. In order to understand what could drive potential differences in educational quality, we use data from a number of sources to examine differences in the characteristics of schools with different grade configurations.

We first examine measures of resources available in schools with different grade configurations (Table 3, Panel A).[11] Overall, there is little support for the idea that variation in financial resources across school types explains the effects we find on student achievement. Average per pupil expenditures are nearly identical in K–5 and 6–8 schools ($10,144 and $10,094), while per pupil expenditures are lower on average in K–6 schools than 7–8 schools ($9,680 vs. $11,082) and expenditures in K–8 schools are $10,950. Class size is smaller for students in grade 5 in K–5 schools than for students in grade 6 in 6–8 schools (24.2 vs. 25.3 students), but students in K–8 schools see similar growth in class size between grades 5 and 6 (24.2 vs. 25.4). Class size is actually larger for grade 6 students in K–6 schools than for grade 7 students in 7–8 schools (24.8 vs. 23.9 students).

There is also little indication that variation in observable dimensions of teacher quality can explain our findings. The fraction of teachers with no prior experience is lower in K–5 and K–6 schools (6.8 and 8.3 percent) than in schools serving grades 6–8 or 7–8 (11.1 and 10.1 percent), but these differences likely explain little of the overall effect of middle school attendance.[12] Nevertheless, we cannot reject the hypothesis that middle school teachers are significantly worse on other, unobservable dimensions of quality.

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[11] This table is based on expenditure data from 1999 to 2007 (schools.nyc.gov/Offices/DBOR/SBER/default.htm), class size data by school and grade from 2006 to 2008 (schools.nyc.gov/AboutUs/data/classsize/classsize.htm), restricted access data on teacher education and experience from payroll records (see Kane et al. 2008 for a description), and restricted-access data on teacher absences (see Herrmann and Rockoff 2009 for a description).

[12] Estimates of the impact of having a new teacher vs. one with many years of experience range from about 0.03 to 0.1 standard deviations (e.g., Rivkin et al. (2005), Kane et al. (2008)), so that an additional 4 percent chance of being taught by an inexperienced teacher would reduce test scores by only 0.001 to 0.004 standard deviations.

While middle schools in New York City do not differ noticeably in resources, they typically draw students from multiple elementary schools, and this causes them to differ considerably in other dimensions (Table 3, Panel B). First, they have much larger cohort sizes. Average cohort size is about 75 students in K–8 schools, 100 students in K–5 and K–6 schools, and over 200 students in schools serving grades 6–8 or 7–8. Second, the convergence of students from multiple elementary schools also means that the stability of a student's peer group (i.e., the fraction of a student's school-grade peers who were school-grade peers in the prior year) is much lower in the first year of middle school. This measure of "peer stability" is substantially lower among 6th graders in 6–8 schools (23 percent) than among 5th graders in K–5 schools (77 percent), and higher among and 7th graders in 7–8 schools (36 percent) than 6th graders in K–6 schools (77 percent). In contrast, peer stability does not vary greatly among students in grades 5 through 7 attending K–8 schools.

We know of no research from which we can gauge the importance of cohort size or peer stability, so we take our analysis sample and run a regression of student achievement on these variables, controlling for student and grade fixed effects. The estimated coefficients on peer stability are very small, positive for English and negative for math, and far from statistically significant. However, the cohort size coefficients are approximately –0.0002 and statistically significant in both math and English. If we take these estimates at face value, it suggests that the difference between K–8 and 6–8 schools in average grade 8 cohort size—around 200 students—would decrease student achievement by 0.04 standard deviations, a small but significant part of the decreases in achievement we document.

Because middle schools tend to pull students from a wider geographic area, they may also be more diverse in terms of student characteristics. We examine this by constructing dissimilarity indices (a measure of segregation) based on student ethnicity and poverty, by type of school and grade level.[13] We find these indices are similar across grade levels and school grade configurations, ranging from 0.5 to 0.6, though they tend to be lower in middle schools than elementary schools. With larger (and somewhat more diverse) cohorts of students, it is plausible that middle schools tend to "track" students more often, grouping them into classrooms based on achievement levels.[14] To gauge the extent to which schools with different grade configurations engage in "tracking," we calculate the standard deviation of prior test scores within a given classroom, and average these deviations across classrooms within school type and grade level. Again, we find similar levels of average dispersion across grades and school grade configurations, ranging from 0.6 to 0.7 standard deviations, though dispersion is lower in middle schools than elementary schools.[15]

The last source of evidence we examine on the experiences of students in schools with different grade configurations comes from city-wide surveys of students in grades 6 and higher and parents of students in all grades, conducted at the end of the school years 2006–2007 and 2007–2008.[16] We examine three topics covered in both parent and student surveys—safety, academic rigor, and adult pro-social behavior—as well as student opinions regarding student pro-social behavior and parental satisfaction with school and teacher quality. A list of the survey

[13] These indices range from zero to one and can be interpreted as the percentage of students who would have to switch schools to equalize the proportions in each ethnic (or poverty) group across schools, divided by the percentage who would have to transfer if groups were completely segregated (Reardon and Firebaugh (2002)).
[14] Via peer effects, tracking could lead to lower achievement among already low achievement students, but should also lead to higher achievement for higher achieving students, with overall effects ambiguous. Thus, while tracking is consistent with our finding of larger negative impacts of middle school on students who scored low initially, it is inconsistent with the negative impacts on higher achieving students.
[15] Feldlaufer and Eccles (1988) argue that middle school teachers provide lower quality instruction than elementary school teachers because they work with more students and see each student for short periods of time. In New York City, students in grades 6 and higher attending a K–7 or K–8 school closely resemble their middle school peers with regard to teacher assignment. That is, they are typically assigned subject-specific teachers, and these teachers are typically licensed in the subject they teach, rather than in general elementary education.
[16] The surveys were part of New York City's new school accountability system (see Rockoff and Turner (2008)). See http://schools.nyc.gov/Accountability/SchoolReports/Surveys/default.htm for copies of the survey instruments.

questions we examine is provided in Appendix Table A3. All of these questions were asked in both years, and survey responses were given on a four point scale. We average responses within respondent when multiple questions pertain to a topic, and we normalize (average) responses to have a mean of zero and a standard deviation of one.

Average survey responses by school type and grade level are largely consistent with the notion that parents believe middle schools provide a lower quality educational environment (Table 4). Parental evaluations of safety, academic rigor, adult pro-social behavior and school quality for those whose children attend middle school are clearly lower than for parents of students in K–5 and K–6 schools. In contrast, there is little perceptible decline across grade levels for parents of students at K–8 schools. Student results—which are only available for grades 6 and higher—also provide some, albeit weaker, evidence of lower school quality in elementary schools. Student evaluations of safety, academic rigor, adult pro-social behavior among grade 6 students are lowest in middle schools. In addition, student evaluations of safety, academic rigor, adult pro-social behavior and student pro-social behavior are much lower among grade 7 students in 7–8 schools than grade 6 students in K–6 schools. Evaluations are also worse among grade 7 students in K–8 schools relative to grade 6 students in K–8 schools, but the differences are much smaller.

One important caveat to the evidence provided by parent and student surveys is that it is based on a non-random subset of parents and students. Response rates (bottom of Table 4) were particularly low for parent surveys, which were sent by mail; student surveys were administered during school hours. Survey responses are also lower for parents of older students in general, and considerably lower for parents of grade 6 students in 6–8 schools relative to parents of grade 5 students in K–5 schools. While we cannot definitely eliminate the potential influence of sample selection, we can limit our survey data to parents and students who filled out the survey in both years. Doing so, we find very similar results (available upon request).

Given this caveat, we use the results of the environmental surveys to address two other issues with regard to the quality of middle schools. First, one might be concerned that our results are driven by a general decline in school quality in some neighborhoods as students move to higher grade levels. Table 5 reports the results from regressions of student and parent evaluations measured for students in grades 7 through 12 on an indicator for student attendance of a K–5 or K–6 school in grade 3, an interaction of this variable with an indicator for current attendance in grades 9–12, and grade level by year fixed effects. While the effect of having attended a K–5 or K–6 elementary school on evaluations of school environment in grades 7 and 8 is always negative—supporting the notion that these schools have worse environments—the coefficient on the interaction of this variable and high school attendance is always positive and of similar magnitude. Thus, most or all of the difference in evaluations of school environment between the groups of students (and parents) dissipates after the movement to high school.

Finally, we try to address the concern that middle schools are simply less focused on the math and English material tested on state exams. To do so, we use survey questions regarding participation and offerings of a variety of non-tested subjects (e.g., art, music, theater) answered by both students and parents. We find similar levels of course participation/offering across school structures, with most differences falling in favor of K–8 schools (Table 6). While we lack achievement data for subjects other than math and English, this survey evidence does not support the notion that middle schools focus more on non-tested subjects.

5. Cost-Benefit Analysis

Krueger (2003) estimates the present value of the benefits to earnings increases from class size reductions in Kindergarten, using evidence from the Tennessee STAR class size experiment. We follow his methodology and assumptions to arrive at a similar calculation for the costs, in terms of lost future earnings, of placing adolescent students in middle schools instead of using K–8 schools. Following Kreuger, we assume a one standard deviation rise in test scores raises future earnings by 8 percent. We update Krueger's age-earnings profile using the 2008 Current Population Survey March Supplement, and, like him, assume a 1 percent growth rate for real wages and productivity.

Our main estimates suggest the use of middle schools reduces average achievement across math and English subjects by about 0.16 or 0.09 standard deviations at the end of grade 8 for a student who enters middle school in grade 6 or 7, respectively. Unfortunately, our data do not allow us to measure persistence further than grade 8, and whether these effects persist through the end of high school is unclear. If transitioning to high school imposes achievement costs which are greater for students coming from K–8 schools than for students coming from middle schools, then the effects we document would be attenuated. We therefore also calculate costs using three different reductions in achievement: 0.12 standard deviations (an average of our baseline effects of 0.16 and 0.09), as well as 0.08 and 0.04 standard deviations to allow for possible convergence of achievement during high school.

Our calculations suggest that the future earnings costs of attending middle schools are substantial (Table 7). If the effects seen in grade 8 fully persist and we assume a discount rate similar to the current yield on inflation protected U.S. bonds (2 percent), we find present value costs of roughly $25,000 in lost earnings per student. Under these parameters, there is little chance that middle schools could generate enough cost savings to achieve efficiency. Under quite modest parameters (a loss of 0.04 standard deviations and a discount rate of 5 percent), we find costs of $2,940 per student. Thus, even in this case, middle schools would have to be substantially less expensive in order to be cost-effective. For example, if annual costs per student in elementary and K–8 schools were $10,000, then annual costs per student in middle schools (serving grades 6–8) would need to be less than $9,000. Currently, there is little evidence that educational provision is significantly less expensive in middle schools, either in New York City or nationwide.[17]

6. Conclusion

The issue of grade configuration has been the topic of substantial debate by educational researchers and policy-makers who have challenged the notion that separating adolescents into middle schools is a more economical way to provide education tailored to their needs (Carnegie Council on Adolescent Development (1989, 1996), Bickel et al. (2000), Juvonen et al. (2004)). Already, middle school reforms are underway in states such as Massachusetts, Pennsylvania, Ohio, Tennessee, Oklahoma, Maryland, and New York, including the large urban districts of Cincinnati and Cleveland, Philadelphia, and Baltimore. Moreover, at least eight other states across the nation are looking to convert their middle schools into K–8 schools. (Hough (2005), Pardini (2002), Reising (2002)). Our analysis suggests that such attention is warranted.

Using panel data and instrumental variables, we estimate that students' academic achievement falls by about 0.15 standard deviations in math and English when they move from elementary schools to middle schools. These effects are economically important, and similar to

[17] National school level data on expenditure is unfortunately unavailable, but pupil-teacher ratios for public primary and middle schools averaged 15.2 and 15.3, respectively, in the school year 2006–07 (authors' calculations, National Center for Education Statistics, Common Core of Data, 2007)).

estimates from the literature on raising teacher effectiveness by one standard deviation (Rivkin et al. (2005), Rockoff (2004)) or moving to a school with one standard deviation higher average test scores (Hastings and Weinstein (2008)). Moreover, the effects of movement to middle school persist through grade 8, and the loss for students who enter middle school in grade 6 is greater than for those who enter in grade 7.

We find two plausible interpretations for why moving to a middle school is detrimental to student outcomes. First and foremost, a number of factors common to middle schools may make educational production less efficient. For example, cohort sizes are much larger, students arrive from elementary schools with potentially diverse educational climates, and, at least in New York City, students are slightly more diverse. Moreover, adolescent children exhibit increased negativity, low self-esteem (Eccles et al. (1984)), poor ability to judge risks and consequences of their actions (Lewis (1981), Halpern-Felsher and Cauffman (2000)), and other traits that may make them difficult to educate when they are together in large groups.

Alternatively, it may be that any move to a new school has long lasting negative impacts on student achievement. Given the limitations of our data and the types of structures currently used in New York City, we cannot estimate the impacts of switching schools at other grade levels, nor can we estimate the impact of exogenous movement by upper elementary students into K–8 schools. While further research is necessary to evaluate the merits of this interpretation, a large and persistent negative effect of moving adolescents to a new school still has important implications for how public school districts determine school grade configurations.

Despite causing a significant and persistent loss in student achievement in math and English, the use of middle schools could still be optimal. However, the evidence we present here rules out several likely sources of compensating benefits, such as cost reduction, wider course offering, or greater parental or student satisfaction with school quality. Additionally, our analysis suggests the achievement costs of middle schools are greater for students lower in the achievement distribution, lending no support for their use on the basis of equity.

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Table 1: Summary Statistics on Students in Sample, by Grade 3 School Structure

Panel A: Static Attributes	Range of School, Grade 3		
	K–5	K–6	K–8
Number of Students	127,440	50,392	15,239
White	20%	10%	16%
Black	32%	42%	43%
Hispanic	35%	32%	35%
Asian	13%	15%	6%

Panel B: Dynamic Attributes, Grade 3	Range of School, Grade 3		
	K–5	K–6	K–8
Free or Reduced Lunch	81%	84%	86%
Special Education	3.1%	3.2%	2.9%
English Language Learners	1.5%	1.3%	1.5%
Math Achievement	0.08	-0.05	-0.09
	(1.01)	(1.01)	(0.97)
English Language Arts Achievement	0.08	-0.04	-0.07
	(1.00)	(1.00)	(0.98)
Absences Per Year	10.55	11.77	12.10
	(9.84)	(10.74)	(10.32)
Suspensions Per Year	0.01	0.01	0.01
	(0.11)	(0.10)	(0.12)

Panel C: Dynamic Attributes 5 Years Later	Range of School, Grade 3		
	K–5	K–6	K–8
Ever Held Back	9%	12%	12%
Free or Reduced Lunch	78%	82%	84%
Special Education	5.4%	5.3%	4.9%
English Language Learners	0.8%	0.7%	0.8%
Math Achievement	0.01	-0.05	0.00
	(1.01)	(1.01)	(0.94)
English Language Arts Achievement	0.01	-0.05	-0.02
	(1.02)	(1.01)	(0.96)
Absences Per Year	14.79	15.25	14.77
	(13.47)	(14.20)	(13.29)
Suspensions Per Year	0.10	0.10	0.09
	(0.55)	(0.53)	(0.51)

Note: Sample includes a balanced panel of students who attended grade 3 between the school years 1998–1999 and 2002–2003 and were tested in the NYC school system for the following five years. Achievement scores are normalized within year-grade cells. Where relevant, standard deviations are shown in parentheses.

Table 2: School Structure as a Predictor of Middle School Entrance

	Enter Middle School in Grade 6	Enter Middle School in Grade 7
Instrument for Grade 6 Middle School Entry	0.721	
	[0.002]**	
Instrument for Grade 7 Middle School Entry		0.700
		[0.002]**
Constant	0.172	0.054
	[0.001]**	[0.001]**
R^2	0.50	0.51

Note: The number of observations in these regressions is 193,071. The instrument for grade 6 middle school entry is whether a student was enrolled in a K-5 school in grade 3; likewise the instrument for grade 7 middle school entry is enrollment in a K-6 school in grade 3. Standard errors (in brackets) clustered by school. * significant at 5%; ** significant at 1%

Table 3: Resources and Cohort Composition by School Grade Range

	School Grade Range		
	K–5	K–6	K–8
	6-8	7-8	
Panel A: School Resources			
Per-Student Expenditure	$10,144	$9,680	$10,950
	$10,094	$11,082	
Percentage of Rookie Teachers	6.8%	8.3%	8.6%
	11.1%	10.1%	
Teacher Absences	7.9	8.0	7.4
	7.7	8.0	
Class Size			
5th Grade	24.2	24.6	24.2
6th Grade	25.3	24.8	25.4
7th Grade	26.7	23.9	25.4
Panel B: Cohort Composition			
Cohort Size			
5th Grade	118.4	103.3	78.4
6th Grade	235.5	93.9	75.4
7th Grade	271.6	202.7	74.6
Peer Group Stability			
5th Grade	77%	73%	67%
6th Grade	23%	77%	56%
7th Grade	64%	36%	68%
Ethnic Dissimilarity Index			
5th Grade	0.595	0.580	0.582
6th Grade	0.547	0.577	0.560
7th Grade	0.548	0.502	0.563
S.D. of Prior Math Score within Classroom			
5th Grade	0.70	0.71	0.71
6th Grade	0.65	0.69	0.69
7th Grade	0.65	0.65	0.68

Note: Data for schools with grade ranges 6-8 and 7-8 are bordered by solid lines. Data on class size is only available for the school years 2006–2007 to 2008–2009. Expenditure data covers the years 1999–2000 to 2007–2008. Peer group stability measures the fraction of a students current school-grade peers who were in the same school-grade cell with him/her during the prior school year.

Table 4: Parent and Student Survey Responses By Grade and School Type

	Parent Survey Responses			Student Survey Responses		
School Grade Range(s):	K–5 & 6-8	K–6 & 7-8	K–8	6-8	K–6 & 7-8	K–8
Safety						
3rd Grade	0.10	0.05	-0.10			
4th Grade	0.13	0.10	-0.07			
5th Grade	0.20	0.14	-0.07			
6th Grade	-0.15	0.15	-0.07	0.08	0.41	0.14
7th Grade	-0.20	-0.20	-0.10	-0.05	-0.09	0.05
8th Grade	-0.17	-0.23	-0.05	-0.07	-0.19	0.11
Academic Rigor						
3rd Grade	0.06	-0.05	0.06			
4th Grade	0.06	-0.05	0.02			
5th Grade	0.10	-0.01	-0.01			
6th Grade	-0.05	0.05	0.01	0.16	0.31	0.24
7th Grade	-0.11	-0.15	-0.02	-0.03	-0.10	0.05
8th Grade	-0.11	-0.23	0.07	-0.16	-0.30	-0.07
Adult Prosocial Behavior						
3rd Grade	0.00	-0.07	0.01			
4th Grade	0.03	-0.06	-0.02			
5th Grade	0.10	-0.01	-0.02			
6th Grade	-0.06	0.04	0.00	0.14	0.37	0.20
7th Grade	-0.07	-0.14	-0.01	-0.07	-0.20	0.05
8th Grade	-0.02	-0.12	0.06	-0.11	-0.29	0.01
Quality of Education						
3rd Grade	0.14	0.03	0.13			
4th Grade	0.14	0.06	0.08			
5th Grade	0.18	0.08	0.00			
6th Grade	-0.11	0.06	-0.03			
7th Grade	-0.23	-0.33	-0.15			
8th Grade	-0.24	-0.40	-0.08			
Student Prosocial Behavior						
6th Grade				0.10	0.30	0.09
7th Grade				-0.05	-0.11	-0.02
8th Grade				-0.08	-0.19	0.02
Average Response Rate						
3rd Grade	37%	34%	30%			
4th Grade	37%	33%	30%			
5th Grade	37%	32%	29%			
6th Grade	30%	28%	27%	80%	78%	75%
7th Grade	27%	23%	24%	79%	78%	77%
8th Grade	26%	19%	23%	79%	75%	77%

Note: Surveys were taken in the 2006–2007 and 2007–2008 school years. Cells bordered by solid lines denote (parents of) students in middle schools.

Table 5: Effect of Middle School Attendance on High School Survey Responses

	Student Survey Responses			
	Safety	Adult Prosocial Behavior	Academic Rigor	Student Prosocial Behavior
Middle School Students	-0.06	-0.108	-0.067	-0.035
	[0.026]*	[0.021]**	[0.016]**	[0.027]
High School Students Who	0.046	0.051	0.041	0.035
Attended Middle School	[0.025]	[0.025]*	[0.020]*	[0.025]
Number of Observations	333,179	333,410	331,189	332,882

	Parent Survey Responses			
	Safety	Adult Prosocial Behavior	Academic Rigor	Overall Quality
Middle School Students	-0.085	-0.075	-0.127	-0.107
	[0.026]**	[0.022]**	[0.028]**	[0.026]**
High School Students Who	0.091	0.04	0.062	0.058
Attended Middle School	[0.027]**	[0.025]	[0.029]*	[0.029]*
Number of Observations	91,194	91,193	92,289	93,311

Note: All regressions include year-grade fixed effects. Standard errors (in brackets) clustered by school.
* significant at 5%; ** significant at 1%

Table 6: Course Variety and School Grade Structure

	School Type	
Panel A: Grade 7 and 8 Students	K–8	Middle School
Art	75%	64%
Music	61%	57%
Dance	47%	46%
Theater	37%	39%
Foreign Language	68%	62%
Computer Skills/Technology	79%	58%
	School Type	
Panel B: Grade 7 and 8 Parents	K–8	Middle School
Art	50%	37%
Music	38%	32%
Dance	18%	16%
Theater	9%	10%
Foreign Language	43%	43%
Computer Skills/Technology	60%	38%

Note: These data come from responses to citywide surveys of students in grades 7 and 8 and their parents; see the text for more details. For students, we report the fraction stating that they either participated in or were offered the chance to participate in these courses either before, during, or after school. For parents, we report the fraction who said that their child participated in these courses before, during, or after school.

Table 7: Estimated Cost of Middle School Enrollment

	Present Value of Loss in Future Income Assuming Persistent Achievement Difference of:		
Discount Rate	0.12 SD	0.08 SD	0.04 SD
0.02	-$25,848	-$17,232	-$8,616
0.03	-$17,749	-$11,833	-$5,916
0.04	-$12,405	-$8,270	-$4,135
0.05	-$8,819	-$5,879	-$2,940

Note: This table shows the estimated cost of sending a child to a sequence of K-5 and 6-8 schools relative to a K-8 school. Our baseline estimates suggest the use of middle schools reduces achievement by .12 standard deviations (SD), but we calculate costs using .08 and .04 SD to allow for the possible convergence of achievement during high school. Following Kreuger (2003), we assume a 1 standard deviation rise in test scores yields an 8% increase in each year of future earnings. We use the 2008 Current Population Survey March Supplement to find the current age-earnings profile, and we assume real wages grow at 1%.

Table A1: Achievement Regression Results

	Normalized Achievement Scores, Relative to Students in K–8 Schools			
	Math		English	
	2SLS	OLS	2SLS	OLS
Students Entering Middle School in Grade 6				
Grade 4	-0.018	-0.012	-0.004	0.012
	[0.028]	[0.012]	[0.027]	[0.012]
Grade 5	0.053	0.049	0.080	0.056
	[0.023]*	[0.010]**	[0.023]**	[0.009]**
Grade 6	-0.124	-0.107	-0.082	-0.074
	[0.028]**	[0.012]**	[0.025]**	[0.011]**
Grade 7	-0.131	-0.094	-0.096	-0.071
	[0.033]**	[0.014]**	[0.029]**	[0.012]**
Grade 8	-0.172	-0.116	-0.140	-0.097
	[0.048]**	[0.022]**	[0.033]**	[0.015]**
Students Entering Middle School in Grade 7				
Grade 4	-0.009	-0.018	-0.003	-0.005
	[0.031]	[0.013]	[0.030]	[0.013]
Grade 5	0.059	0.047	0.082	0.042
	[0.027]*	[0.012]**	[0.028]**	[0.012]**
Grade 6	0.133	0.110	0.106	0.076
	[0.032]**	[0.014]**	[0.030]**	[0.013]**
Grade 7	-0.033	-0.018	-0.035	-0.031
	[0.037]	[0.016]	[0.034]	[0.015]*
Grade 8	-0.098	-0.061	-0.088	-0.063
	[0.051]	[0.023]**	[0.037]*	[0.017]**

Note: The number of observations in each regression is 1,158,426. All regressions include student fixed effects, as well as controls for grade, for whether the student was held back that year, and for whether the student was held back in any previous year. Standard errors (in brackets) clustered by school. * significant at 5%; ** significant at 1%

Table A2: Absence and Suspension Regression Results

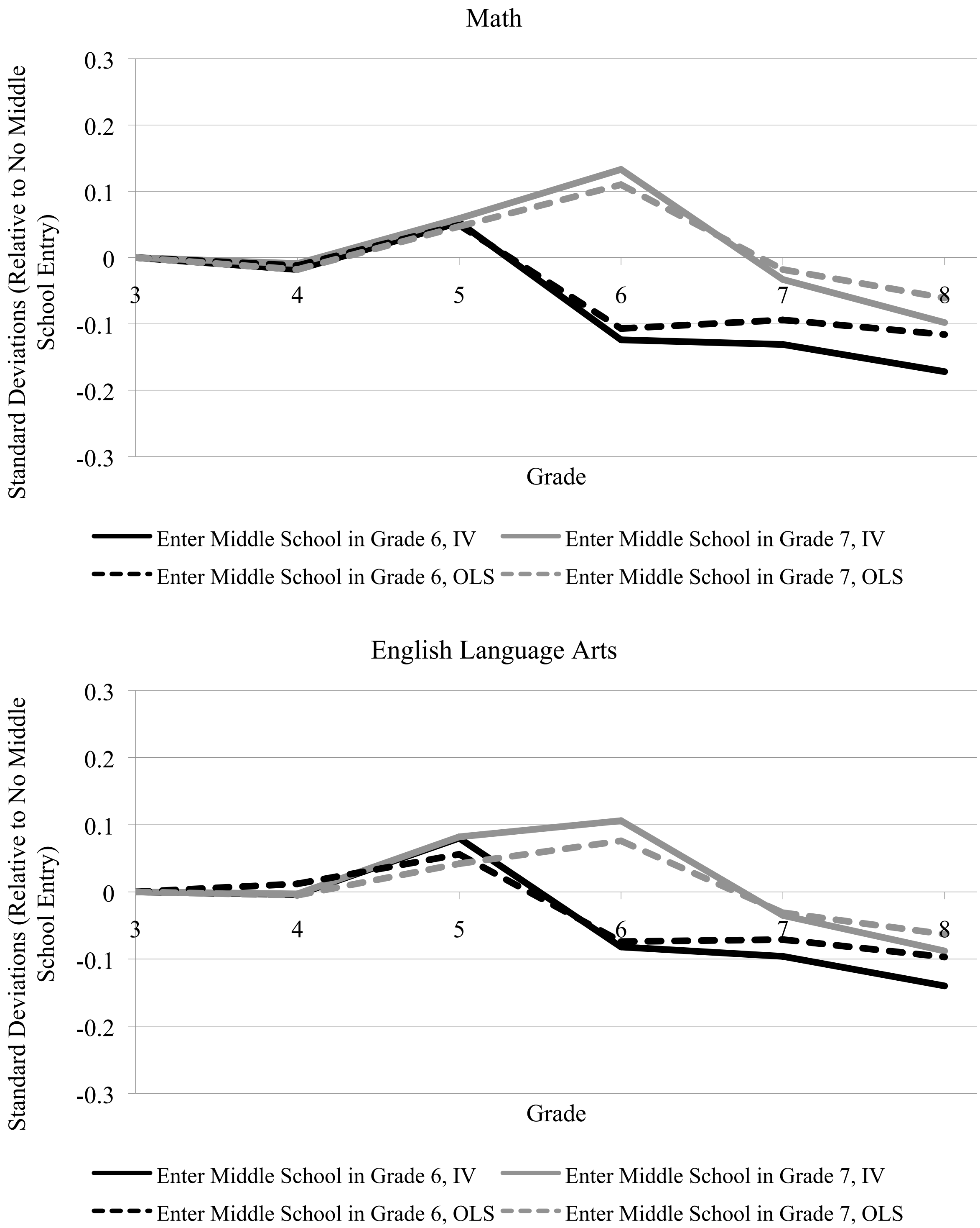
	Relative to Students in K–8 Schools	
	Absences	Suspensions
Students Entering Middle School in Grade 6		
Grade 4	0.217	0.002
	[0.132]	[0.003]
Grade 5	0.393	0.003
	[0.219]	[0.003]
Grade 6	0.977	0.009
	[0.247]**	[0.005]
Grade 7	1.150	0.008
	[0.313]**	[0.009]
Grade 8	1.827	-0.002
	[0.435]**	[0.012]
Students Entering Middle School in Grade 7		
Grade 4	0.001	0.005
	[0.162]	[0.004]
Grade 5	-0.077	0.000
	[0.231]	[0.004]
Grade 6	0.139	-0.009
	[0.301]	[0.006]
Grade 7	0.509	-0.008
	[0.364]	[0.010]
Grade 8	0.729	-0.002
	[0.475]	[0.013]

Note: The number of observations in both regressions is 1,158,295. All regressions are based on a two-stage least squares specification that includes student fixed effects, as well as controls for grade, for whether the student was held back that year, and for whether the student was held back in any previous year. See text for details on the first stage instrumental variables. Standard errors (in brackets) clustered by school. * significant at 5%; ** significant at 1%

Table A3: Survey Items Used to Construct Satisfaction Indices

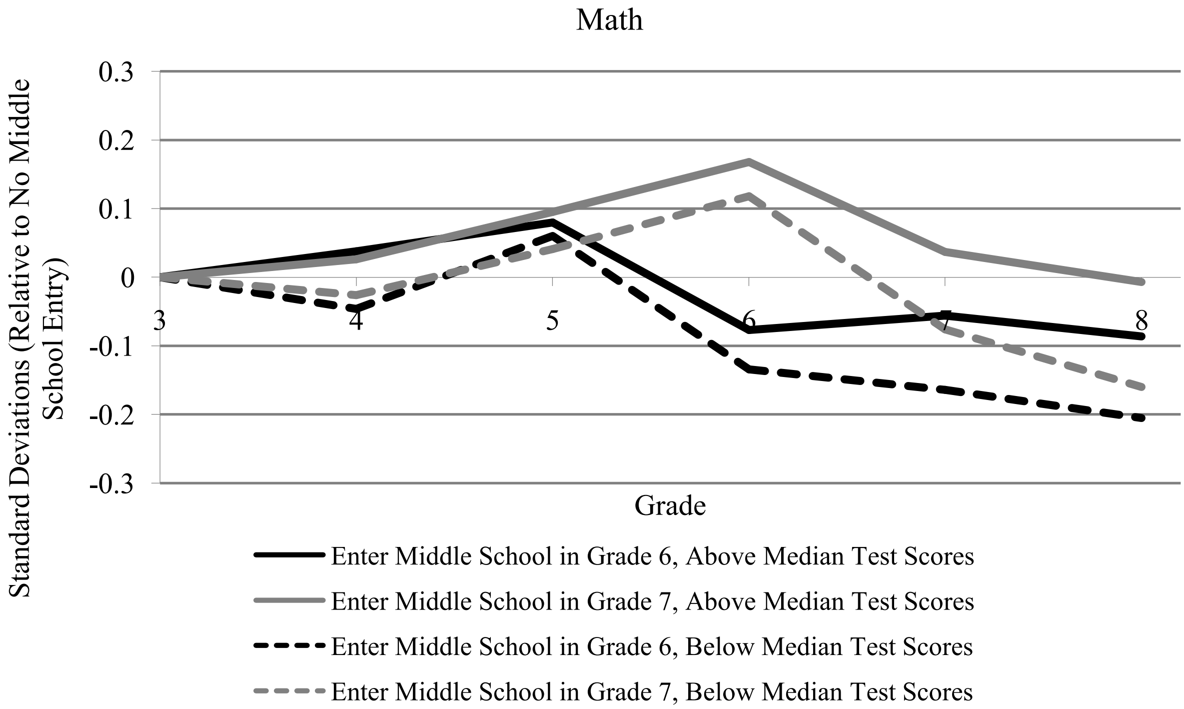
Student Indices	
Safety	
	I feel welcome in my school.
	I stay home because I don't feel safe at school.
	Students threaten or bully other students at school.
	Students get into physical fights at my school.
	Adults at my school yell at students.
	There is conflict in my school based on: race, culture, religion, sexual orientation, gender, or disabilities.
	Students use alcohol or illegal drugs while at school.
	There is gang activity at my school.
Academic Rigor	
	I need to work hard to get good grades at my school.
	Someone in my school helps me develop challenging goals for learning more in school.
	My teachers expect me to continue my education after high school.
Adult Prosocial Behavior	
	Most of the adults I see at school every day know my name or who I am.
	The adults at my school look out for me.
	The adults at my school help me understand what I need to do to succeed in school.
	My teachers encourage me to succeed.
	How comfortable are you talking to teachers and other adults at your school about a problem you are having in a class?
	How comfortable are you talking to teachers and other adults at your school about something that is bothering you?
	Teachers in my school treat students with respect.
Student Prosocial Behavior	
	Students who get good grades in my school are respected by other students.
	Most students in my school treat teachers with respect.
	Most students in my school help and care about each other.
	Most students in my school just look out for themselves.
	Most students in my school treat each other with respect.
Parent Indices	
Safety	
	My child is safe at school.
	Students threaten or bully other students.
Academic Rigor	
	The school has high expectations for my child.
	The school clearly communicates its expectations for my child's learning to me and my child.
	My child is learning what he or she needs to know to succeed in later grades or after graduating from high school.
Adult Prosocial Behavior	
	There is an adult at the school whom my child trusts and can go to for help with a school problem.
Overall Quality	
	My child's teacher(s) give helpful comments on homework, class work, and tests.
	How satisfied are you with the quality of your child's teacher(s) this year?
	How satisfied are you with the education your child has received this year?

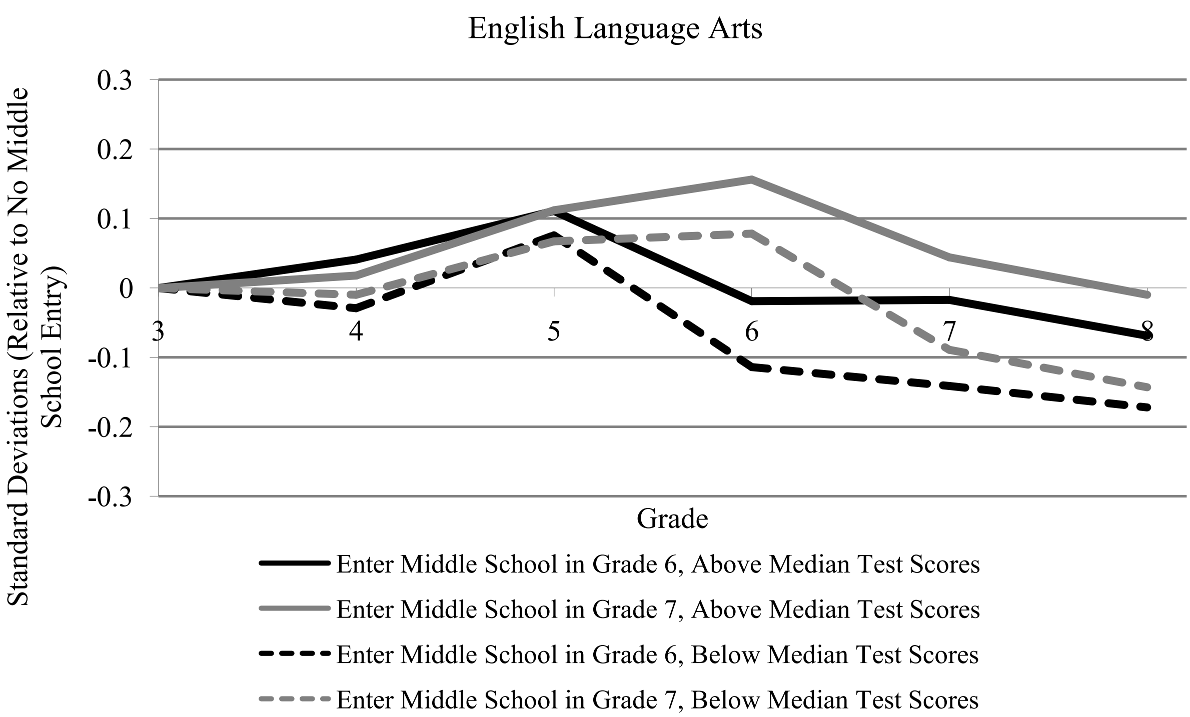
Figure 1: Estimates of the Impact of Entering Middle School on Student Achievement



Note: These figures plot coefficient estimates for grade interacted with an indicator for the year in which a student enters middle school. All regressions include student fixed effects, as well as controls for grade, for whether the student was held back that year, and for whether the student was held back in any previous year.

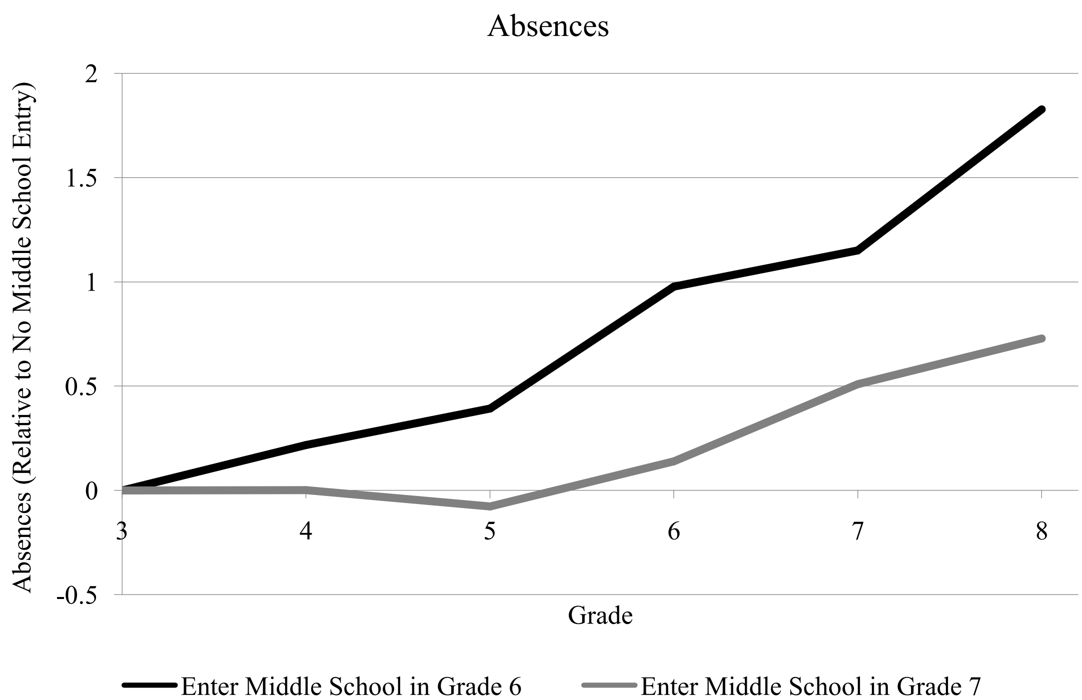
Figure 2: Impact of Entering Middle School on Student Achievement, Separated Into Above and Below Median 3rd Grade Test Scores

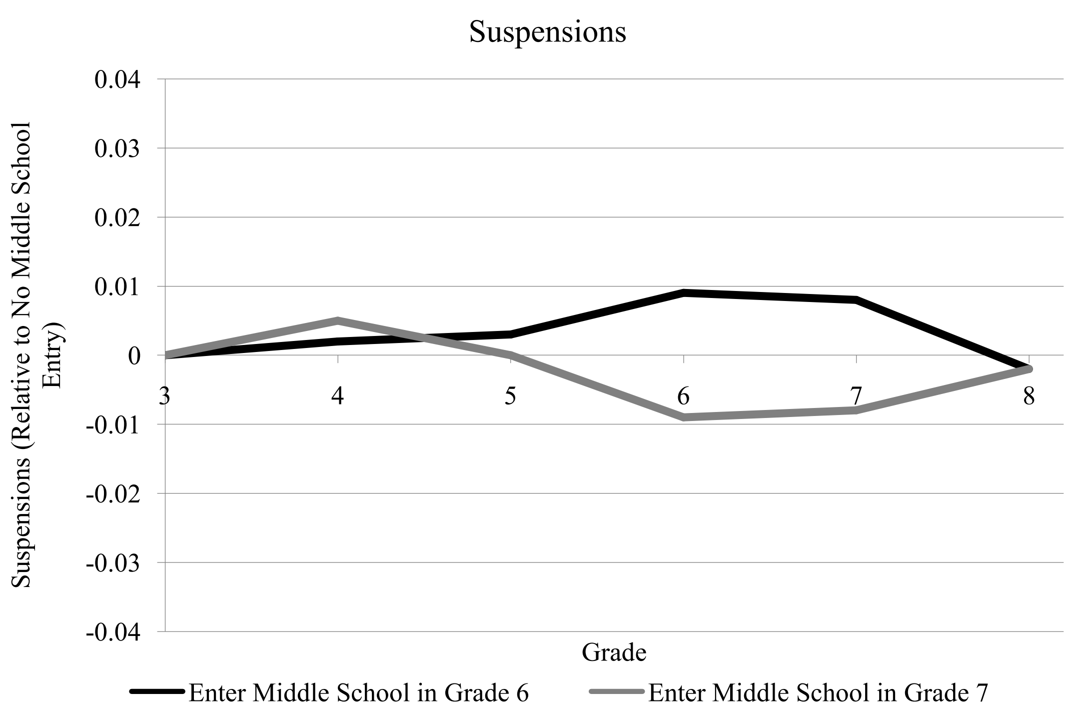




Note: These figures plot coefficient estimates for grade interacted with an indicator for the year in which a student enters middle school. Coefficients and standard errors for these regressions are available upon request. All regressions include student fixed effects, as well as controls for grade, for whether the student was held back that year, and for whether the student was held back in any previous year.

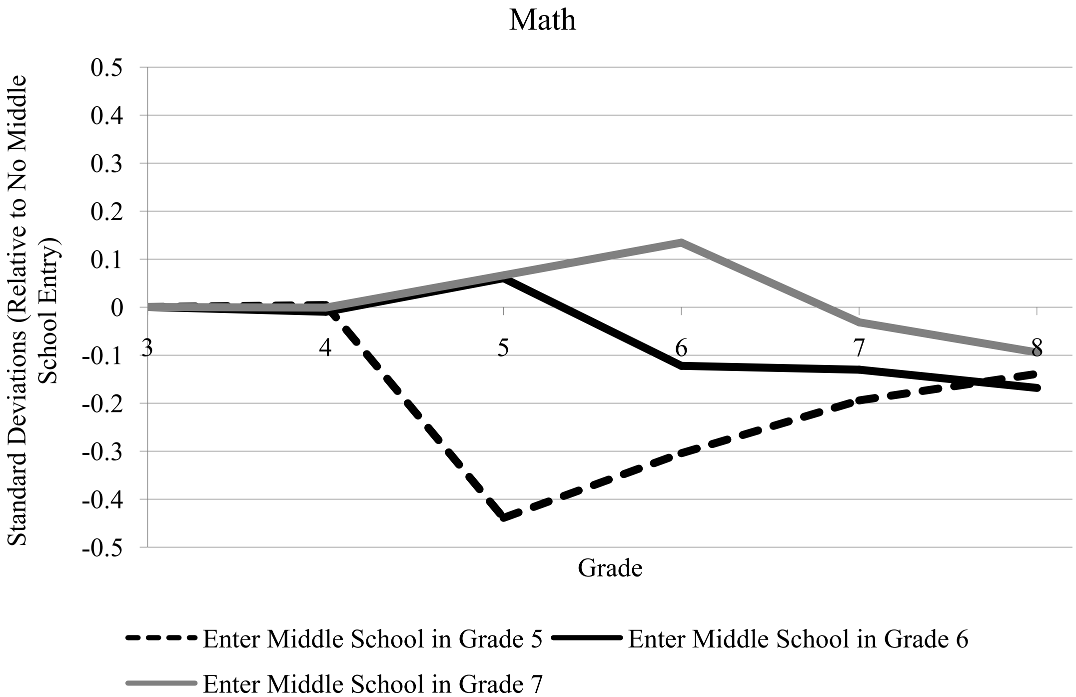
Figure 3: Estimates of the Impact of Entering Middle School on Student Behavior

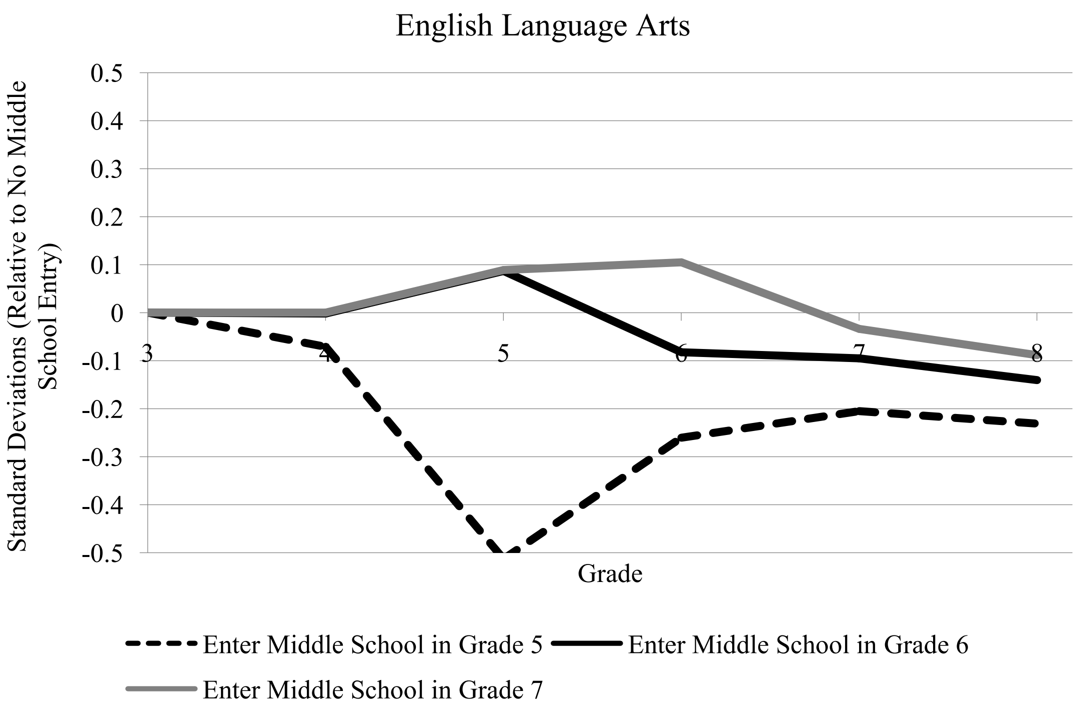




Note: These figures plot coefficient estimates for grade interacted with an indicator for the year in which a student enters middle school. The plotted coefficients and their standard errors are given in Appendix Table A2. All regressions include student fixed effects, as well as controls for grade, for whether the student was held back that year, and for whether the student was held back in any previous year.

Figure A1: Estimates of the Impact of Entering Middle School on Student Achievement, Including Students Entering Middle School in Grade 5





Note: These figures plot coefficient estimates for grade interacted with an indicator for the year in which a student enters middle school. All regressions include student fixed effects, as well as controls for grade, for whether the student was held back that year, and for whether the student was held back in any previous year.

Figure A2: Robustness Check Eliminating Held Back Students and Controls, and Including Students with Missing Test Scores and Attritors