Tracking to Retain Higher-Income Students: Evidence from the Addition of Advanced Courses*

Farah Mallah

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Abstract

Public schools may introduce academic tracks to attract or retain higher-income students. The role of intra-school policies in shaping higher-income families' demand for public schools has been underexplored. Using variation in the timing of advanced course introductions in Texas high schools, I find that adding an advanced course increases lower-income students' share of higher-income classmates. The increase is driven by a rise in the overall share of higher-income students in the school, which offsets increased within-school sorting by income. These results provide new insight into how academic tracking intersects with school choice, revealing potential unintended benefits for socioeconomic integration.

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1 Introduction

Recent research has established a strong relationship between cross-income friendships in neighborhoods and economic mobility (Chetty et al., 2022). In my work, I found that lower-income students in high school cohorts with a higher share of higher-income peers were more likely to enroll in college and earn higher wages in early adulthood (Mallah, 2025). Beyond economic outcomes, cross-group interactions are also important for social cohesion (Corno, La Ferrara, and Burns, 2022; Rao, 2019; Carrell, Hoekstra, and West, 2019). How schools are organized could facilitate or hinder friendships between lower- and higher-income students. While previous studies have explored the effects of school choice policies on school composition (see Phillips et al., 2015; Marcotte and Dalane, 2019; Alcaino and Jennings, 2020; Monarrez, Kisida, and Chingos, 2022), we know far less about how intra-school policies, such as course offerings, impact school composition and cross-income exposure.

The impact of intra-school policies in shaping the demand for public schools is also particularly important in light of the post-pandemic decline in the share of upper-income parents enrolling their children in public schools (Dee 2023; Goodman and Francis, 2025). Intra-school policies—especially the breadth and rigor of course offerings—may affect affluent families' perceptions of school quality and, consistent with a Tiebout sorting framework, influence both school enrollment decisions and residential location choices. Tracking via advanced course offerings may increase the attractiveness of public schools to higher-income families and thereby help sustain demand for public education among more advantaged households. Epple, Newlon, and Romano (2002) developed a theoretical model in which public schools use tracking to retain higher-achieving, upper-income students.

The equity implication of tracking through the addition of advanced courses is particularly salient in policy discussions, though the role of these policies in shaping the demand for public schools among higher income families is rarely discussed.[1] The assumption underlying many of the news headlines is that advanced courses would create separate tracks that increase economic segregation in schools—reinforcing existing inequities. Those debates typically ignore the potential between-

[1]Recent news articles: https://www.bostonglobe.com/2023/07/14/metro/cambridge-schools-divided-over-middle-school-math/; https://www.baronnews.com/2023/03/21/some-california-high-schools-remove-honors-classes-due-to-equity-issues/; https://www.virginiamercury.com/2021/04/26/virginia-isnt-eliminating-accelerated-math-courses-but-its-one-of-many-states-rethinking-math-education/

school sorting following the addition or removal of an advanced course. For example, higher-income students may elect to leave public schools when advanced courses are removed. While some research has addressed the impact of advanced courses on college enrollment (Jackson, 2014; Cohodes, 2020; Conger, Long, and McGhee Jr., 2023; Huynh and Zhu, 2025), these studies overlook the potentially mediating effect of advanced courses on exposure to higher-income and higher-achieving students.

This is the first paper to my knowledge to examine how school course offerings (a relatively low-cost school lever) may impact socioeconomic integration. I test the hypothesis that schools may track to retain or attract higher-income and/or higher-achieving students by studying whether adding Advanced Placement (AP) courses—the most common high school advanced course—impacts lower-income students' share of higher-income classmates. Theoretically, advanced course additions may impact lower-income students' exposure to higher-income classmates through two opposing mechanisms: increasing higher-income students' enrollment in the school ("composition shift") or increasing within-school, between classroom, sorting by income ("sorting change"). Lower-income students may be less likely to enroll in AP courses due to differences in parental involvement and preparation (Lareau 1987, 2000; Barg 2013; Kalogrides and Loeb 2013).

A concern with evaluating the impact of the addition of advanced courses is selection. Schools might introduce new courses for various reasons reflecting changes in the student populations (demand-side factors) or administrative priorities and teacher experience (supply-side factors). While demand and/or supply changes may determine course offerings, the precise timing of an advanced course's introduction may be quasi-random. Using administrative data from the Texas Education Research Center (2004–2022), I leverage variation in the timing of a school's first AP course introduction in a subject (e.g., science or fine arts). The assumption necessary for establishing a causal link is that treatment and comparison schools would have followed similar trends in lower-income students' share of higher-income students in the absence of the advanced course addition. Consistent with this assumption, I find no evidence of pre-existing trends in the share of higher-income classmates prior to the introduction of AP courses in a school subject, suggesting that the observed effects are indeed attributable to the new coursework.[2]

[2]I use both the full sample of school subject areas where no AP course is introduced, as well as a subsample of comparison school subjects that introduce an AP course but in a different subject area (e.g., add an AP course in science and not Math) since those schools are likely most similar. The pre-trend for the latter group is more centered around zero, but I show that the estimates are consistent regardless of the sample definition.

To capture student income, I define lower-income students as those always eligible for free/reduced-price lunch and higher-income students as those never eligible during their schooling years.[3] This classification effectively captures variations in parental income (Mallah, 2025). Median parental income reported in financial aid data for students "always eligible" is $22,000 and those "never eligible" is $117,119. I refer to the "always eligible" group as "lower income" (29% of students) and the "never eligible" group as "higher-income" (24% of students).

I find that AP course additions, contrary to common assumptions, increase lower-income students' share of higher-income classmates by 1.3 percentage point, or 12% over baseline. The magnitude is roughly one-third of the potential gain in exposure from randomly assigning students across schools within a district (Mallah, 2025). I find that while AP courses increase within-school sorting, they more substantially increase school-level share of higher-income students. Following the introduction of an AP course, the share of higher-income students in treated subjects rose by 1.6 percentage points ("composition shift") and the level of sorting by income increased by 0.7 percentage points ("sorting change"). The effect is concentrated in science, foreign language and fine arts.

The estimated impact on the share of upper-income classmates represents a general equilibrium effect that can be decomposed into two mechanisms: (1) reallocation of students across schools within the district, and (2) net changes in district-level enrollment of upper-income students. I find evidence for both mechanisms. The addition of an AP course in a school subject area decreases the share of upper-income students in other district schools by 1.0 percentage point, indicating substantial within-district reallocation. At the same time, there is suggestive evidence that AP course addition increases the district-level share of upper-income students by 0.9 percentage points, though this estimate is sensitive to sample selection.[4]

The estimated impact on the share of upper-income classmates is the general equilibrium effect– it may be driven by an increase overall in the district in the share of upper-income students or a shuffling of students from one school to another. At the district level, I find some suggestive evidence that the increase in the share of higher-income students in treated schools may be coming from

[3]The definition of economic disadvantage builds on Michelmore and Dynarski (2017), who find that the number of years on free/reduced lunch captures student economic disadvantage better than a binary measure of economic disadvantage.

[4]The district-level effect ranges from 0.3 to 0.9 percentage points across specifications. This suggests AP courses may help retain upper-income families who would otherwise exit to private schools or neighboring districts.

other schools in the same districts. The addition of an AP course in a school subject area appears to decrease the share of higher-income students in "other" district schools by 1.0 percentage point. These patterns suggest new higher-income enrollments in treated schools may be drawn from other public schools within the district.[5] The finding aligns with Epple, Newlon, and Romano (2002) model prediction that school tracking could attract higher-income students (though not necessarily from private schools only). However, while their model predicts that this increase would primarily involve higher-income, higher-achieving students, my results indicate that the increase is likely driven by an increase of both higher- and lower-achieving higher-income students.

This paper contributes to three strands of literature. First, it adds to studies on AP coursework and postsecondary outcomes (Jackson 2014; Cohodes 2020; Conger, Long, and McGhee Jr. 2023; Huynh and Zhu 2025) by identifying changes in classroom peer income composition as a potential mechanism. Second, it expands the literature on tracking by showing how course offerings can impact both within-school sorting and overall student body composition. Prior studies only document patterns of sorting within schools and how they may relate to differentiated coursework (e.g., Clotfelter, Ladd, and Vidgor, 2002; Clotfelter, Ladd, Clifton, and Turaeva, 2021; Antonovics, Black, Cullen, and Meiselman, 2022; Dalane and Marcotte, 2022), but do not address selection concerns and potential impact on school composition. Third, it contributes to the school choice and Tiebout sorting literature more broadly by examining how intra-school policies may shape upper-income parents' demand for public schools. While prior work has examined how school choice policies shape families' demand for public schooling (e.g., Kim, 2018; Monarrez, Kisida, and Chingos, 2022; Mumma, 2022), the role of intra-school policies in shaping families' demand for public schools remains underexplored.

Policymakers often face trade-offs between equity and academic rigor when determining whether to offer advanced coursework. This paper shows that such decisions influence not only how students are placed within schools but also the overall income composition of the student body. The finding that AP coursework can increase lower-income students' exposure to higher-income classmates—combined with prior evidence that incentivizing AP participation improves college enrollment and

[5]There is some evidence that the addition of an AP course also increases the share of higher-income students in the district by 0.9 percentage points, but the size of the estimate and its significance is sensitive to sample selection. The positive estimate suggest that AP course addition may help retain/attract higher-income students in public schools.

earnings (Jackson, 2014; Huynh and Zhu, 2025)—suggests that adding advanced courses may support both socioeconomic integration and long-term equity. The identification strategy used here also offers a framework for evaluating how course offerings shape school demographics, equipping decision-makers with tools to design more inclusive academic policies.

The paper is organized as follows. Section 2 presents the data used and context. Section 3 presents the identification strategy. Section 4 examines supply and demand side factors that may contribute to the addition of an AP course. Section 5 reports the main findings and section 6 concludes the paper.

2 Data and Context

I use longitudinal administrative data from the Texas Education Agency (TEA). These TEA data span from 2004 to 2022, covering student test scores, course enrollments (including class assignments from 2011 onward), demographics, attendance, graduation, and teacher assignments (including teacher certification and demographic information).[6]

To approximate student income levels, I use the proportion of years a student is eligible for free/reduced-price lunch as a measure of economic disadvantage.[7] Students are categorized into three income groups: always, sometimes, and never eligible for free/reduced-price lunch.

The categorization based on years in free/reduced lunch status effectively captures variation in parental income, as indicated in previous research (Michelmore and Dynarski, 2017; Mallah, 2025). Students who applied for financial aid for college have to report their parental gross income. Among students who applied for financial aid, average parental income for those who are never, sometimes, and always eligible for free/reduced lunch is $141,686, $51,406, and $27,305, respectively, with median incomes of $117,119, $39,145, and $22,000.[8] For simplicity, I refer to students who are never on free/reduced lunch as higher- or higher-income students, and those always on free/reduced lunch

[6]Test scores are primarily based on standardized grade 4 and 8 TAKS (2007–2011) and STAAR (2012–2018) reading and math tests. In this version of the paper I will not use the college enrollment and wage data and will only focus on the impact on cross-income exposure.

[7]This calculation uses data from all available years, 2004 to 2022.

[8]These averages represent students with financial aid data—a select group of students—and may be upper bounds for those always on free/reduced lunch. Financial aid data are available for 52%, 35%, and 30% of students in the never, sometimes, and always eligible groups, respectively.

as lower-income students. In this paper I focus on lower-income students since we are motivated by the relationship between cross-income friendships and economic mobility, and how school policies may impact lower-income students' exposure to higher-income peers.

In Texas high schools, students take an average of eight courses per year. They typically enroll in advanced courses during grades 11 and 12, averaging 1 and 1.6 advanced courses, respectively, per grade, as shown in Table A2. The largest advanced course category (around half of all advanced courses) are Advanced Placement (AP) courses.[9]

Schools offer an average of 97 courses per academic year, including approximately 13 advanced courses, of which 7 are typically AP courses as shown in Table A1. I focus on AP courses, as they are the largest category of advanced courses and make up more than half of advanced courses. Courses are classified into 10 main subject areas: English Language Arts (ELA), Mathematics, Science, Social Studies, Foreign Language, Fine Arts, Technology Application, Physical Education and Health, Business Education, and Career and Technical Education (CTE). Advanced courses are generally offered in the first seven subject areas.[10]

3 Identification Strategy

To evaluate the impact of introducing an advanced course in a given subject area, I exploit variation in the timing of the initial addition of an advanced course across schools and subject areas. The core assumption of this difference-in-difference design is that the exact timing of a school's adoption of an advanced course in a subject area is as good as random.

Consider, for example, School A, which introduced an Environmental Systems AP course in 2014 after previously offering no AP science courses, while the comparison school, School B, did not offer any advanced science courses between 2011 and 2022. The impact of adding the AP course in 2014 is estimated by comparing the change in lower-income students' share of higher-income classmates in School A after 2014, relative to the change in School B over the same period (2014–2022). For this difference to capture the effect of adding the AP course, it must hold that, absent the AP

[9]Students also take around two dual-credit courses in grades 11 and 12; however, most dual-credit courses are not classified as advanced by Texas state standards.

[10]The median number of courses offered in a school year is 71 courses, including a median of approximately 6 advanced courses.

course, trends in exposure to higher-income students would have been similar across Schools A and B. This assumption is more plausible if Schools A and B had similar trends in exposure before the AP course was added in School A (i.e., 2011-2013).

In line with this example, I define treatment as the first-time addition of an AP course in a high school's subject area. First, I identify AP course offerings across subjects from 2004 to 2022. I focus on schools that add an AP course after 2011 because I only have classroom-level data starting in 2011—38% of high schools in Texas add an AP course for the first time between 2011 and 2022 in at least one subject area. I include seven subject areas where AP courses may be introduced: social studies, English language arts, science, math, foreign language, fine arts, and technology.[11] In a given subject area, the share of schools that add an AP course for the first time in that subject between 2011 and 2022 ranges from 7% in English language arts, math and social studies to 16% in technology. Control (or comparison) school subject areas are defined as those in which no AP course was added during the observation period (2004-2022). I exclude any school subject areas that offered an AP course before 2012 (always-treated).

Once a subject area within a school adds an AP course, it is considered treated in all subsequent years. The sample covers 4,397 school-subject areas across 1,322 schools, with 891 school-subjects treated.[12] The primary analysis is conducted at the school subject area level. Since we are interested in how the addition of an AP course impacts the average lower-income students, I weight the estimates by the number of lower-income students enrolled in the school subject area at baseline.[13] This framework is represented in Equation 1:

$$Prophighincome_{btas} = \sum_{k=-11}^{10} \beta_k AdvancedSection_{btak} + \delta_{tas} + \delta_{bas} + \epsilon_{btas} \tag{1}$$

where β_k captures the impact of adding an advanced course to subject a in school b on lower-income students' exposure to higher-income classmates. $AdvancedSection_{btak}$ equals 1 beginning in the year an AP course is introduced in subject a at school b and remains 1 in all subsequent

[11] The most taken course in the technology subject area is computer science. Other technology courses include web design, animation and robotics.

[12] Effective sample based on schools with lower-income students at baseline.

[13] I use the baseline number of lower-income students instead of the number of lower-income students in a given year to make sure the estimates are not driven by changes in the weights given to each school after the addition of an AP course.

years. The primary outcome, $Prophighincome_{btas}$, is defined as the average proportion of higher-income classmates in lower-income students' classrooms subject a of school b in year t.[14] I also estimate equation 1 separately for higher-income students to assess differential impacts on each group's exposure to higher-income peers.

All coefficients with the exception of the treatment coefficients are estimated within stack s. A potential concern with the traditional difference-in-differences design when treatment timing varies is that treatment effects may be gradual and heterogeneous, making [previously] treated units poor comparison units. To address this concern, I estimate treatment effects separately for each treated unit based on the timing of when an advanced course is added and only use never-treated school-by-subject-a cells as the comparison group. I then take the weighted average of those estimates.[15] This approach applies the stacked difference-in-differences estimator proposed by Callaway and Sant'Anna (2021), which corrects for biases in traditional difference-in-difference designs caused by heterogeneous treatment effects and staggered treatment timing.

The model includes subject-year fixed effects, δ_{tas}, which control for any time-varying changes in the proportion of higher-income students within a subject-stack, serving as the standard time fixed effect in a difference-in-difference model. I also incorporate school-subject fixed effects, δ_{bas}, to capture baseline differences in exposure to higher-income student in a school subject. Standard errors are clustered at the school level.

Schools that do not add an AP course in any subject area during the analysis period may be systematically different compared to schools that add an AP course. Therefore, I also present estimates where I limit the comparison group to schools that add an AP course in another subject area. For example, I compare the average lower-income students' share of higher-income classmates in the Math subject in school A where an AP course is added in 2014 to the share of higher-income classmates in the Math subject in school B where no AP course is added between 2012-2022 in Math, but an AP course is added in the Science subject during that period. The idea here is that schools that add an AP course in Science are likely very similar to schools that add an AP course in

[14] I also look at share of total classmates that are higher-income across subjects for the average lower-income student in school b.

[15] I use the regression weighting of the coefficients where the weights are based on the variance and number of units in each treatment group. This weighting method tends to over weight units treated in the middle of the time period. The main estimates are not sensitive to weighting by the number of observations only.

Math instead. Though those schools may serve as better comparison, we may be concerned about spillovers across subjects. I also present estimates excluding all years in comparison schools that may be prone to spillover concerns. For instance, in the prior example, if school B added a science AP course in 2018 and we are using school B as a comparison school for school A for the math subject, I exclude years 2018 and later for school B that may be contaminated by spillovers from the science treated subject.

As shown in Figure A1 panel (b) about 20% of schools that added an AP course added the course in their second year of operation. We may be concerned that the estimates are driven by "new school" changes rather than AP course addition. I later show that the estimates are not sensitive to sample choice, including excluding new schools, and including additional controls.

To identify β_k from Equation 1, the key assumption is that changes in the proportion of higher-income students in a classroom are driven by the introduction of an AP course. This assumption would be invalid if treated school subjects experienced concurrent increases in higher-income enrollment or if other school-level changes (e.g., hiring of experienced teachers, changes in school leadership) correlated with AP course introduction were driving the observed effects. While I can examine pre-trends to test for compositional changes, unobserved simultaneous changes at the school level cannot be fully ruled out. I provide some suggestive evidence using data on teachers that the impact is not driven by changes in teacher experience or general expansion of the number of courses offered, but acknowledge the potential for other unobserved confounding factors like changes in school principal or parents' involvement.

Students in control and later treated school subjects tend to have similar demographics compared to always treated school subjects as shown in Table 1. The identification strategy does not require later treated and control school subjects to be identical, but rather that, in the absence of AP course addition, they would have exhibited similar trends. Since the treatment is defined at the subject level, schools could have some treated subjects and some never treated (control) subjects.

4 Supply and Demand-Side Changes Leading Up to the Addition of an AP Course

To better understand and interpret the results, we need to examine the factors that may lead schools to add an AP course in a given year. The Northwest Independent School District in Texas states on its website that "Campuses base decisions to offer courses by considering the number of requests from students and the availability of qualified staff." Administrative constraints that may limit a school's ability to offer an AP course may include finding a teacher who is both able and qualified to teach the course and completing an AP course audit requirement to get approval for the "AP" designation from the College Board (TEA, 2023).[16] Iatarola, Conger and Long (2011) find that in Florida the number of advanced (AP and IB) courses a school offers is primarily driven by having a large enough number of high-achieving students; the number and qualifications of teachers, in contrast, appear to play a minor role.[17]

In the absence of data on student requests for AP courses or detailed teacher qualifications (beyond years of experience),[18] I analyze potential shifts in student income and achievement composition within school subjects leading up to the addition of an AP course (demand-side changes). It is plausible that an increase in the proportion (and/or number) of higher-income students or students with stronger academic preparation could drive demand for AP courses. These students may be more likely to request advanced courses, prompting schools to introduce them.

There does not appear to be an increase in the share of higher-income students or higher-achieving students prior to the addition of an AP course, as shown in Figure A2—if anything, the share of higher-achieving students based on grade 8 math seems to be decreasing. Higher-achieving students are defined as those scoring in the top 25th percentile of their grade 8 reading or math test scores, based on the distribution of student test scores in the full sample for a given year. There is also no

[16] The AP designation is unlikely to pose significant barriers. The College Board typically grants approval for the AP course designation 60 days after submitting an AP course audit, and schools may assign the "AP" designation before receiving official authorization if they are in the process of obtaining it (College Board, 2025). Approval is teacher-specific; the College Board requires a new audit submission if a different instructor is assigned to the course (College Board, 2025).

[17] They determine the relative importance of the number of students versus the number of teachers by running a cross-sectional probit regression, using these variables along with a vector of other student characteristics, with the number of AP courses offered by the school as the outcome.

[18] There is no clear description of what qualifies a teacher to teach an AP course besides having to submit for an AP course audit to offer an AP course. In Texas, I find no evidence that AP course teachers are more/less experienced than other teachers in the same school.

clear pattern in students' average reading and math scores prior to the addition of an AP course in subject area, as depicted in Figure A2. The number of students enrolled in the school might also determine if there is enough demand for AP courses. Prior to adding an AP course, schools independent of treatment status seem to be experiencing similar patterns in the number of students enrolled (overall and by income and achievement) leading up to the addition of an AP course in the subject area as shown in Figure 1.[19]

In Table 2 I summarize the estimated change in student composition prior to the addition of an AP course. There seems to be no detectable difference in student composition prior to the addition of an AP course–the estimates are generally small and insignificant at the 5% level. Though, there is evidence of potential pre-trends in the share of ESL students—The share of ESL students seems to be increasing leading up to the addition of an AP course in a subject area.[20] First column, "Full" sample, summarizes the pre-trends using all comparison school subjects where an AP course is not added during the study period. Second column, "Other AP", limits the comparison group from the first column to school subjects in schools that add an AP course during the study period in another subject area. Third column, "No Spill", further limits the comparison group from the second column to only years prior to an AP course addition in another subject area in the same school.

I also investigate potential shifts in teacher experience or the arrival of new administrators before the addition of an AP course (supply-side changes). For instance, a newly hired teacher might advocate for adding and teaching an AP course. Similarly, a new principal with a strong belief in the value of AP courses might prioritize introducing them. Schools appear more likely to hire a new teacher in the year preceding the addition of an AP course. The share of new teachers—defined as those who did not work at the treated school in the prior year—seems to drop significantly after the addition of an AP course suggesting that the addition of an AP course may coincide with higher stability (less turnover) among teachers, though this does not seem to be correlated with changes

[19]There seems to be a slight increase in the number of higher-achieving students defined by reading test-score prior to the addition of an AP course, but the average pre-period estimate is small and insignificant (2.2 students more students, p=0.657)

[20]There is also some evidence of a decrease in average grade 8 math scores for students prior to the addition of an AP course, though this estimate is sensitive to model specification. I show later on that the estimates are consistent when controlling for student achievement and ESL status.

in the average teacher experience in the school, as shown in Figure 2.[21] This may indicate that around the time schools add an AP course their teaching staff may also have become more stable.

While I cannot observe principal hires in the data, I can track the hiring of "administrators," defined as individuals employed in non-teaching roles within the district. There is some evidence of a slight increase in the share of new administrators in the district leading up to the addition of an AP course, followed by a modest decline in subsequent years suggesting that the addition of an AP course may coincide with new administrators being hired as shown in Figure 2.[22]

These patterns suggest that the addition of an AP course is likely to coincide with changes in school staff (teachers and administrators) rather than changes in student composition. That said, if I exclude new schools, the decrease following the addition of an AP course in the share of new teachers is less pronounced (2.6 relative to 8.6 percentage points fewer new teachers following the addition of an AP course) as shown in Figure A3, suggesting the pattern in hiring new teachers is mainly driven by "new schools". Similarly, the change in the share of new administrators is smaller and insignificant (0.6 relative to 1.7 percentage points decrease in hiring new administrators) when excluding new schools. As I show later, the estimated impact on the share of higher-income students is consistent when excluding new schools suggesting the estimates are not driven entirely by concurrent changes in teacher and administrator turnover.

5 Results

5.1 Impact of AP Courses on Lower-Income Students' Exposure to Higher-Income Students

After the initial addition of an AP course, the number of AP courses in the subject area grows, reaching approximately 1.5 courses by the fourth year, as shown in Figure 3.[23] This sustained increase suggests that the addition of an AP course is not a temporary change, on average. The introduction of an AP course increases AP enrollment among lower-income students by 6 percentage

[21] Average teacher experience is based on a teachers years of experience across all schools they taught at. The "new teacher" definition, on the other hand, is based on years in the school they are currently teaching at.

[22] The share of new administrators in the district is 0.8 percentage points lower prior to the AP course addition as shown in Table 3. In Table 3 I summarize the estimated difference in staffing prior to the addition of an AP course.

[23] 85% of treated subjects add only one course in the first year an AP course is added.

points. The increase in AP course enrollment is slightly higher for higher-income students at about 8 percentage points as shown in Figure 3 (a).[24] Lower-income students with higher eighth-grade reading test scores are more likely to enroll in AP courses overall. As shown in Figure A6 (a), lower-income students who scored in the bottom and top quintile of the grade 8 reading test are 4 and 13 percentage points more likely to enroll in an AP course following the addition of an AP course in the subject area.

I find that adding an AP course does not decrease lower-income students' share of higher-income classmates. If anything, the addition of an AP course seems to increase lower-income students' exposure to higher-income classmates, measured by the share of a student's total classmates in the subject area who are higher-income. The increase in exposure to higher-income students unfolds gradually, increasing by the sixth year to about 2 percentage points, as shown in Figure 4. The trend line is more centered around zero in the pre-period when using schools that add an AP course in another subject area, suggesting that those schools serve as a better comparison group. The average estimated impact on lower-income students' share of higher-income classmates is consistent across models at around 1.3 percentage points in Model (1) using the full sample, and 0.8-0.9 percentage point increase in Models (2) and (3) using the more restrictive sample as shown in Table 4—a 12-7% increase in the share of higher-income classmates.

In the full sample, there appears to be a slight pre-trend (increase) in the share of upper-income peers prior to the addition of an AP course (Figure 4, panel (a)). To provide a lower-bound on the estimates assuming there is a pre-trend in the share of upper-income peers, I follow Rambachan and Roth 2023 and subtract the expected coefficients that would arise if the trend observed in periods $t = -4$ to $t = -1$ continued linearly into the post-treatment period.[25] This approach provides a lower bound on the treatment effect under the assumption that any violation of parallel trends follows the same linear pattern observed in the pre-treatment prior four-years period. As shown in Figure A4, the trend-adjusted estimates remain positive throughout the post-treatment period, suggesting the observed increase in upper-income peer exposure is not simply a continuation of pre-existing trends.

[24] So that I am comparing higher- and lower-income students in the same schools, I weighted the estimate for higher-income students, similar to that for lower-income students, by the number of lower-income students at baseline.

[25] The estimated pre-trend slope for the full sample is 0.14 percentage points per year ($p = 0.130$).

I find a similar impact on lower-income students' share of higher-income classmates if I define exposure as the share of total classmates in the school (not only in the treated subject) who are higher-income as shown in Table A3.[26]

The increase in exposure to higher-income classmates for lower-income students may arise from two primary mechanisms: (1) a composition shift, whereby the addition of an AP course increases the share of higher-income students participating in the subject area, and (2) a sorting change, whereby income-based sorting within the subject increases. I define sorting as the difference between the average proportion of higher-income classmates in upper- relative to lower-income students' classrooms in a subject area.[27]

Evidence supports both mechanisms. Following the addition of an AP course, the proportion of higher-income students enrolled in treated school subjects rises by 1.6 percentage points, as shown in Table 4 Model (1) and Figure 5, consistent with a composition change.[28] Simultaneously, there is evidence of an increase in income-based sorting within the subject: the difference in the proportion of higher-income classmates between upper- and lower-income students widens by 0.7 percentage points (a 35% increase in sorting by income), as shown in Table 4.[29] The increase in sorting across classrooms by income seems to be offset by the larger increase in the share of higher-income students in the subject. The 1.6 percentage point increase in share of higher-income students in treated subjects is slightly larger than the 1.3 percentage point increase in lower-income students' share of higher-income classmates in treated subjects, suggesting that in the absence of sorting by income lower-income students would have been exposed to slightly more higher-income students in treated subjects.[30]

[26] We might be concerned that lower-income students in treated subjects may be more likely to be higher-achieving following the addition of an AP course in the subject, and so happen to share more classrooms with higher-income students. To address this concern I also look at the average lower-income students' share of higher-income classmates independent of if the lower-income student enrolls in the treated subject or not. I similarly find that the average lower-income students' share of higher-income classmates increased by around 1 percentage points following the addition of an AP course as shown in Table A3.

[27] This measure of sorting is very similar to the variance ratio, but instead of looking at the difference between upper- and all other income students' classrooms, I look at upper- relative to lower-income students' classrooms. I do not include students' own income status.

[28] The estimates are similar in Models (2) and (3) at 1.0 and 1.2 percentage points more upper income students in treated subject when limiting the sample to schools that add an AP course in another subject.

[29] The estimated impact on sorting is smaller at 0.5 percentage points and no longer significant when using the "no spill" sample.

[30] These estimates are based on Model (1), but we see a similar pattern in Models (2) and (3). Note that higher-income students' share of higher-income classmates increased by more than that for lower-income students (by about 2 percentage points) following the addition of an AP course as shown in Figure 4.

The increase in the share of higher-income students in the subject area may result from shifts in students' course-taking patterns, without any change in the overall school composition—that is, students may simply be redistributing across classrooms. To determine if the school composition itself changes, I examine the effect of adding an AP course in a subject on the share of higher-income students in the entire school. The results, shown in Table 4, indicate that following the introduction of an AP course in a subject area, the proportion of higher-income students enrolled in the school increased by 1.4 percentage points. As such, the rise in exposure to higher-income peers may be driven, at least in part, by a growing share of higher-income students choosing to enroll in the school.

The estimated impact on the share of upper-income classmates represents a general equilibrium effect that can be decomposed into two mechanisms: (1) reallocation of students across schools within the district, and (2) net changes in district-level enrollment of upper-income students. It is important to note here that because AP introduction may affect both treated and comparison schools through reallocation the standard SUTVA assumption may be violated. The main estimated effects should therefore be interpreted as direct effects (on treated schools) and indirect effects (on comparison schools) in a setting with partial interference, rather than effects that would occur if only one school changed its offerings in isolation.

I find evidence for both mechanisms, with stronger evidence for reshuffling students across schools within a district. There is some suggestive evidence that the share of higher-income students in the district slightly increased, though the estimate precision and size depends on the sample ranging from 0.3 to 0.9. The positive estimate suggests that the addition of AP courses could slightly increase the share of higher-income students who remain in the district (Table 6). That said, I find stronger evidence that the addition of an AP course in a subject area decreases the share of higher-income students in other (not treated) district schools by 0.8 to 1 percentage points, as shown in Table 6, suggesting that the addition of an AP course likely attracts higher-income students who would have otherwise attended another public school in the same district.

The impact of adding AP coursework on the share of higher-income students may vary by subject area. For example, in subjects such as mathematics, where AP enrollment may rely heavily on prior preparation, lower-income students may benefit less from the addition of AP courses. The observed

increase in exposure to higher-income students is primarily driven by AP courses in science, foreign languages and fine arts, as shown in Figure A7. Though the increase in level of sorting by income following the addition of an AP course does not seem to vary across subjects with the exception of ELA and Technology Application where the addition of an AP course does not seem to increase the level of sorting by income.

The increase in the share of higher-income classmates following the introduction of an AP course appears similar across students with varying test scores, as shown in Figure A6 (b). The similar impact on the share of higher-income classmates across achievement levels is consistent with the notion that the addition of an AP course led to an overall increase in the proportion of higher-income students in the school. Consequently, regardless of whether a student enrolls in an AP course, they are more likely to share a classroom with higher-income peers.[31]

The identification assumption for these results requires that the observed impacts stem from the AP course addition rather than from other simultaneous school-level changes. AP courses may be introduced alongside other changes——such as a new principal or the arrival of an experienced teacher——that could also affect outcomes. Some of these simultaneous changes, like hiring a new teacher, could be thought of as part of the "treatment package"—what would need to take place for an advanced course to be added. That said, it is important to understand what part of this package may be driving the estimates. I include teacher-school-subject fixed effects to isolate the impact of AP course additions accounting for teacher changes. The estimates remain consistent, though slightly smaller, with the inclusion of teacher fixed effects as shown in Table A7, suggesting that the estimates are not solely driven by changes in teacher quality.

Adding an AP course appears to increase the total number of courses offered in a school subject area by approximately six courses. The increase in number of courses suggests that the addition of an AP course is not merely a rebranding or substitution of an existing course but represents a genuine expansion of course offerings. However, it also raises the possibility that the observed change in exposure to higher-income students could be driven by the simultaneous increase in course options, rather than the specific characteristics of the AP course itself. To address this concern, in Model (1) of Table A5, I control for the total number of courses offered in a school subject in a given

[31] There may be a slight upward trend by test-score in the increase in the share of higher-income classmates, but I am not powered enough to detect a clear difference if there is one across test-score percentiles.

year. The estimates remain consistent at 1.1 percentage points when controlling for the number of courses offered, suggesting that the observed change in the share of higher-income students is likely not only attributable to the increase in the number of courses.

The increase in the number of courses offered (beyond just the AP course) might also be driven by changes in the school size following the addition of an AP course. The number of students enrolled in a school subject (i.e., number of students who take at least one course in the subject) increases by about 70 students on average following the addition of an AP course as shown in Table A8 and Figure A9 panel (a). There appears to be no detectable impact on the number of higher income students enrolled in the school, though the direction of the estimate is positive (around five to seven more higher-income students on average) and as shown in the trend line in Figure A9 panel (b).[32]

Because schools tend to add an AP course in their earlier years (20% of schools add an AP course in their second year, as shown in Figure A1, the estimates might be influenced by new schools undergoing multiple simultaneous changes. To test this, I exclude new schools (defined as those open for three years or less by 2011) from the analysis. The results remain consistent as shown in Table A6 model (2).

We may also be concerned that the estimates are driven by changes in the school subjects that are in the sample at a given point in time (concerns about an imbalanced sample). For example, schools that add an AP course may be more likely to remain in the sample and contribute to the outcome in later years. I show that the estimates are consistent when only including school subjects that are offered for all 12 years (2012-2022) as shown in Table A6 as Model (1). Alternatively, I also include fixed effects for the total number of years a subject is offered so that treated subjects are compared to control subjects offered for the same number of years. The estimates are consistent when including fixed effects for the total number of years a subject is offered as shown in Table A5 model (2).[33]

Another concern is that my income measure relies on free or reduced-price lunch (FRPL) status,

[32] I also find a similar increase in the number of students enrolled in the school of about 70 to 100 more students following the addition of an AP course as shown in Table A9.

[33] Earlier, I showed that there may be some evidence of changes in student test-score composition and share of ESL and Hispanic prior to the addition of an AP course. I show in Table A5 Model (3) that the estimates are consistent when controlling for student test-score changes and share of ESL and Hispanic students.

which AP course availability might indirectly influence. If introducing an AP course changes students' propensity to apply for FRPL, the data could falsely show an increase in the share of higher-income students even when underlying incomes are unchanged. To address the concern, I classify students as upper- or lower-income using FRPL records from the years before grade 9, when AP exposure has not yet occurred. Specifically, I define a student as lower-income if they are on FRPL in every year observed in Texas public schools prior to grade 9, and as higher-income if they are never on FRPL in those years. As shown in Table A6 Model (4) the estimates are consistent when classifying students as upper- or lower-income using FRPL records from the years prior to grade 9.

5.2 Impact of AP Courses on Lower-Income Students' Exposure to Higher-Achieving Students

Epple, Newlon, and Romano (2002) hypothesize that tracking in public schools retains higher-income, higher-achieving students who might otherwise attend private schools. However, they also suggest that higher-income, lower-achieving students may leave public schools in favor of less-tracked private school environments. I do find that the share of higher-income higher-achieving students (students who scored above the 75th percentile on their grade 8 test scores) increased by around 0.3 percentage points–a 10% increase, as shown in Table 5.[34] The increase in the share of higher-achieving higher-income students suggests that the increase in the share of higher-income students is partially (not fully) driven by an increase in the share of higher-achieving higher-income students.

I also find a slight decrease in lower-income students' exposure to higher-achieving classmates following the addition of an AP course (-0.6 percentage points), as shown in Table 5.[35] However, this decrease appears to be temporary, returning to approximately zero by the sixth year after the AP course is added, as illustrated in Figure A10.

Additionally, I find no evidence of changes in the level of sorting by test score following the

[34]The estimates are similar when using grade 8 math test scores, as shown in Table A4.

[35]The estimated decrease is not significant at the conventional 5% level in Models (1) and (2), but is larger and significant in Model (3). The estimate is sensitive to comparison group choice (Model), particularly when using grade 8 math to define achievement as shown in Table A4.

addition of an AP course, as shown in Table 5. Sorting by test score is defined as the difference in the share of higher-achieving students in the school between higher-achieving (75th percentile) and lower-achieving (25th percentile) students, based on grade 8 reading scores.[36]

6 Discussion and Conclusion

The results in this paper challenge the assumption that tracking must always increase stratification. I find that lower-income students' share of higher-income classmates increases by about 1 percentage point following the addition of an AP course—roughly one-third of the exposure gain from randomly assigning students to schools within a district (Mallah, 2025). This increase is driven by a rise in the overall share of higher-income students at the school, which offsets increased classroom sorting by income within school. These findings underscore the importance of considering both within-school sorting and broader school composition when evaluating the equity implications of advanced coursework.

It is possible that other concurrent changes, that we are not able to observe like hiring a new principal, coincide with the addition of AP courses. While I find similar estimates when limiting the sample to older schools that are similarly likely to hire new administrators and/or new teachers, as well as when including teacher fixed effects, there may be other unobserved concurrent changes. Thus, the results are best interpreted as reflecting the combined effect of the typical package of changes that accompany AP course additions.

These results offer a more nuanced understanding of how advanced coursework influences both classroom and school demographics. While previous research has focused on the academic benefits of AP courses, it has largely overlooked their implications for socioeconomic integration. By analyzing how course offerings reshape peer environments, this study provides a more comprehensive perspective on the role of advanced courses in promoting educational equity. It suggests advanced coursework may serve as a tool to attract and retain higher-income families in public schools, potentially reducing socioeconomic stratification.

[36]The estimates are consistent when using math test scores, as shown in Table A4.

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8 Main Tables and Figures

Table 1: Student Demographics by Subject Area Treatment Status

Variable	Control	Later Treated	Always Treated
Higher-Income Students	.243	.255	.282
	(.429)	(.436)	(.45)
Lower-Income Students	.265	.304	.287
	(.441)	(.46)	(.452)
Hispanic Students	.396	.469	.506
	(.489)	(.499)	(.5)
Black Students	.093	.121	.139
	(.291)	(.326)	(.346)
White Students	.502	.39	.313
	(.5)	(.488)	(.464)
ESL Students	.041	.047	.082
	(.197)	(.211)	(.274)
Std. Reading Score G8	.174	.136	.049
	(.802)	(.825)	(.942)
Std. Math Score G8	.154	.12	.12
	(.907)	(.936)	(.949)
Missing Reading Score G8	.121	.078	.137
	(.327)	(.267)	(.344)
Missing Math Score G8	.129	.082	.145
	(.336)	(.275)	(.352)
Number of Students	976584	1109609	5615235
Number of Subject Areas	3794	898	6687
Number of Schools	1142	581	1475

Notes. Table summarizes demographics of students in always treated, later treated and control subject areas. The averages and number of students are based on all years in the sample from 2011 to 2022 (including post-period for treated students).

Table 2: Demand Side Student Composition Changes Prior to AP Course Addition

	(1) Full	(2) Other AP	(3) No Spill
Share Hispanic Students	-0.00232	-0.00302	-0.00212
	(0.00301)	(0.00314)	(0.00401)
	0.660	0.660	0.660
Share Black Students	-0.000484	-0.000700	0.000100
	(0.00190)	(0.00206)	(0.00208)
	0.140	0.140	0.140
Share White Students	0.00354	0.00410	0.00299
	(0.00256)	(0.00262)	(0.00358)
	0.190	0.190	0.190
Share ESL Student	-0.00882	-0.00620	-0.00711
	(0.00376)	(0.00352)	(0.00261)
	0.0900	0.0900	0.0900
Share Higher-Income	-0.00261	-0.000178	-0.00224
	(0.00248)	(0.00246)	(0.00293)
	0.120	0.120	0.120
Average G8 Reading Score	0.0190	0.0158	0.0201
	(0.0121)	(0.0127)	(0.0126)
	0.0200	0.0200	0.0200
Average G8 Math Score	0.0398	0.0313	0.00526
	(0.0183)	(0.0170)	(0.0183)
	0	0	0
Missing G8 Reading Score	-0.000558	-0.00157	-0.00672
	(0.00219)	(0.00243)	(0.00261)
	0.0900	0.0900	0.0900
Missing G8 Math Score	-0.000791	-0.00152	-0.00500
	(0.00268)	(0.00294)	(0.00371)
	0.0900	0.0900	0.0900
N Clusters	1318	586	586

Standard errors in parentheses and the control mean is below the standard errors. The table captures the correlation between the addition of an AP course and any differences in pre-trends (before the addition of an AP course) between control subject areas that do not add an AP course and treated subject areas that add an AP course. The estimates are based on equation 1 but including a pre-trend indicator (indicator for periods prior to the addition of an AP course). The coefficients presented here are based on the pre-trend indicator. Standard errors in parentheses are clustered at the school-level. Number of clusters is based on the number of schools. Control Mean is reported below the standard errors and is based on treated units' average prior to the addition of an AP course. Model (1) includes all comparison school subjects where no AP course is added during the study period. Model (2) "Other AP", limits the comparison group from to school subjects in schools that add an AP course during the study period in another subject area. Model (3) "No Spill", further limits the comparison group to only years prior to an AP course addition in another subject area in the same school.

Table 3: Supply Side Changes Prior to AP Course Addition

	(1) Full	(2) Other AP	(3) No Spill
Average Teacher Experience	-0.146	-0.166	-0.208
	(0.267)	(0.290)	(0.302)
Control Mean	9.460	9.460	9.460
N clust	1289	585	583
Share of New Teachers	-0.0200	-0.0209	-0.0321
	(0.0179)	(0.0171)	(0.0169)
Control Mean	0.340	0.340	0.340
N Clusters	1305	585	583
Share of New Administrators	-0.00832	-0.0113	-0.00135
	(0.00466)	(0.00469)	(0.00565)
Control Mean	0.190	0.190	0.190
N Clusters	1317	586	586

Similar to Table 2. The sample varies across measures because some schools and districts are missing teacher and/or administrator information.

Table 4: Impact of Adding an AP Course on Lower-Income Students' AP Course Enrollment, Classroom, Subject and School Share Higher-Income

	(1) Full	(2) Other AP	(3) No Spill
AP Course Enrollment	0.0630	0.0623	0.0587
	(0.00668)	(0.00624)	(0.00535)
Control Mean	0	0	0
N Clusters	1318	586	586
Proportion Higher-Income Classmates in Subject	0.0134	0.00829	0.00912
	(0.00305)	(0.00338)	(0.00490)
Control Mean	0.110	0.110	0.110
N Clusters	1318	586	586
Proportion Higher-Income in Subject	0.0158	0.0102	0.0119
	(0.00335)	(0.00370)	(0.00515)
Control Mean	0.120	0.120	0.120
N Clusters	1318	586	586
Proportion Higher-Income in School	0.0138	0.00877	0.0107
	(0.00310)	(0.00336)	(0.00487)
Control Mean	0.120	0.120	0.120
N Clusters	1318	586	586
Sorting by Income	0.00704	0.00746	0.00490
	(0.00201)	(0.00259)	(0.00361)
Control Mean	0.0200	0.0200	0.0200
N Clusters	1318	586	586

The table captures the impact of the addition of an AP course on students' share of higher-income students across courses taken that year in a subject. The estimates are based on coefficient $beta_t$ from equation 1 for post-treatment indicator (after the first AP course addition in subject area) for lower-income students. I imputed the sorting outcome with 0 if a school does not have either lower- or higher-income students in a given year. Standard errors in parentheses are clustered at the school-level. Number of clusters is based on the number of schools. Control Mean is based on treated units' average at $t = -1$. Models (1)-(3) define the comparison group differently as described in Table 2.

Table 5: Impact of Adding an AP Course on Lower-Income Students' Classroom, Subject and School Share Higher-Achieving (Reading)

	(1) Full	(2) Other AP	(3) No Spill
Proportion Higher-Achieving Classmates in Subject	-0.00579	-0.00613	-0.0106
	(0.00335)	(0.00353)	(0.00531)
Control Mean	0.180	0.180	0.180
N Clusters	1318	586	586
Proportion Higher-Income Higher-Achieving Classmates in Subject	0.00209	0.00244	0.00335
	(0.00158)	(0.00170)	(0.00265)
Control Mean	0.0300	0.0300	0.0300
N Clusters	1318	586	586
Sorting by Achievement	0.00208	0.000715	0.00129
	(0.00423)	(0.00455)	(0.00682)
Control Mean	0.0800	0.0800	0.0800
N Clusters	1318	586	586

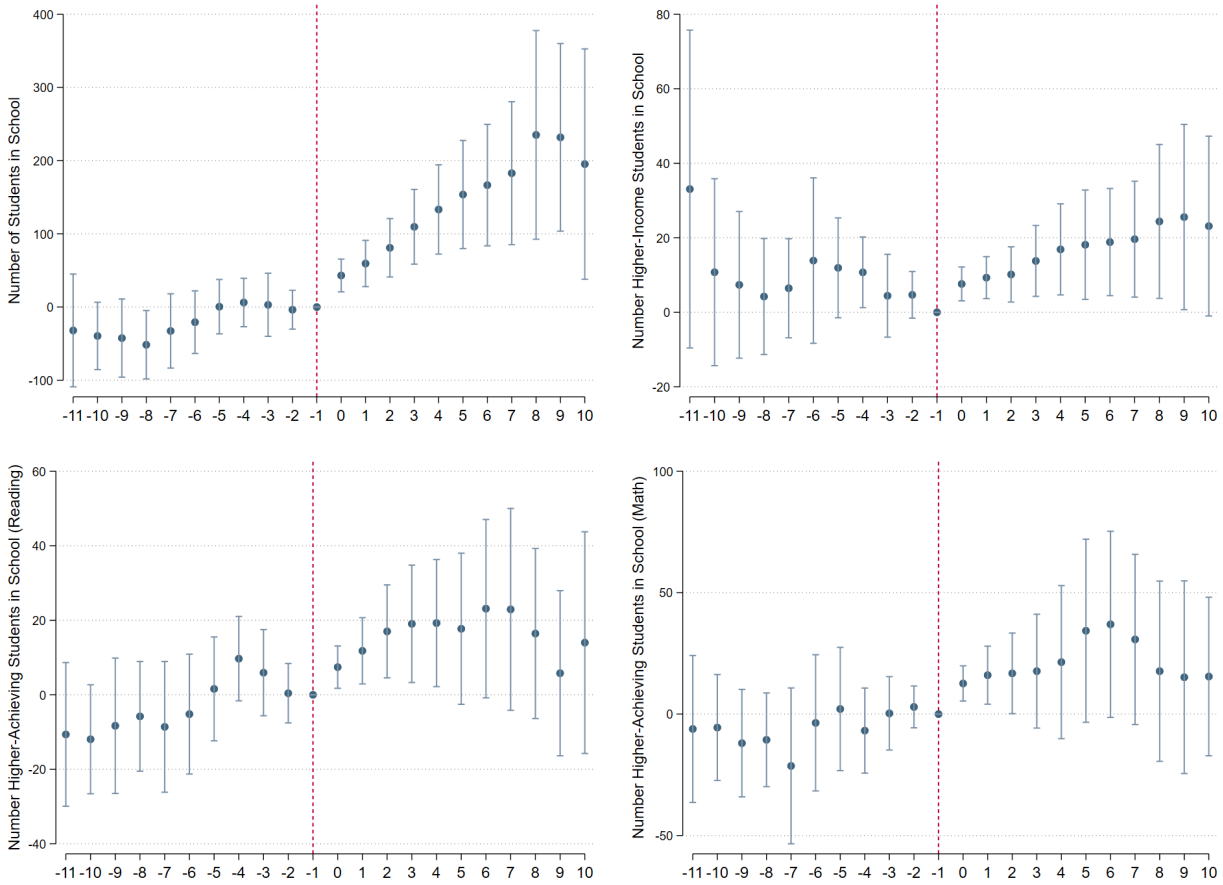
Similar to Table 4 but looking at the share of higher-achieving students instead of the share of higher-income students. A student is defined as higher-achieving if they scored in the top 25th percentile of their grade 8 reading test-score based on the distribution of student test-scores in the full sample in a given year. Sorting by income is the difference between the average share of higher-achieving students in 25th compared to the 75th percentile students based on their grade 8 reading test-scores. Table A4 in the appendix uses math score instead of reading.

Table 6: Impact of Adding an AP Course on Lower-Income Students' District Composition

	(1) Full	(2) Other AP	(3) No Spill
Proportion Higher-Income in District	0.00860	0.00311	0.00643
	(0.00300)	(0.00317)	(0.00462)
Control Mean	0.140	0.140	0.140
N Clusters	1318	586	586
Proportion Higher-Income in Other (Not Treated) District School	-0.0101	-0.00803	-0.0109
	(0.00269)	(0.00231)	(0.00235)
Control Mean	0.0700	0.0700	0.0700
N Clusters	1318	586	586

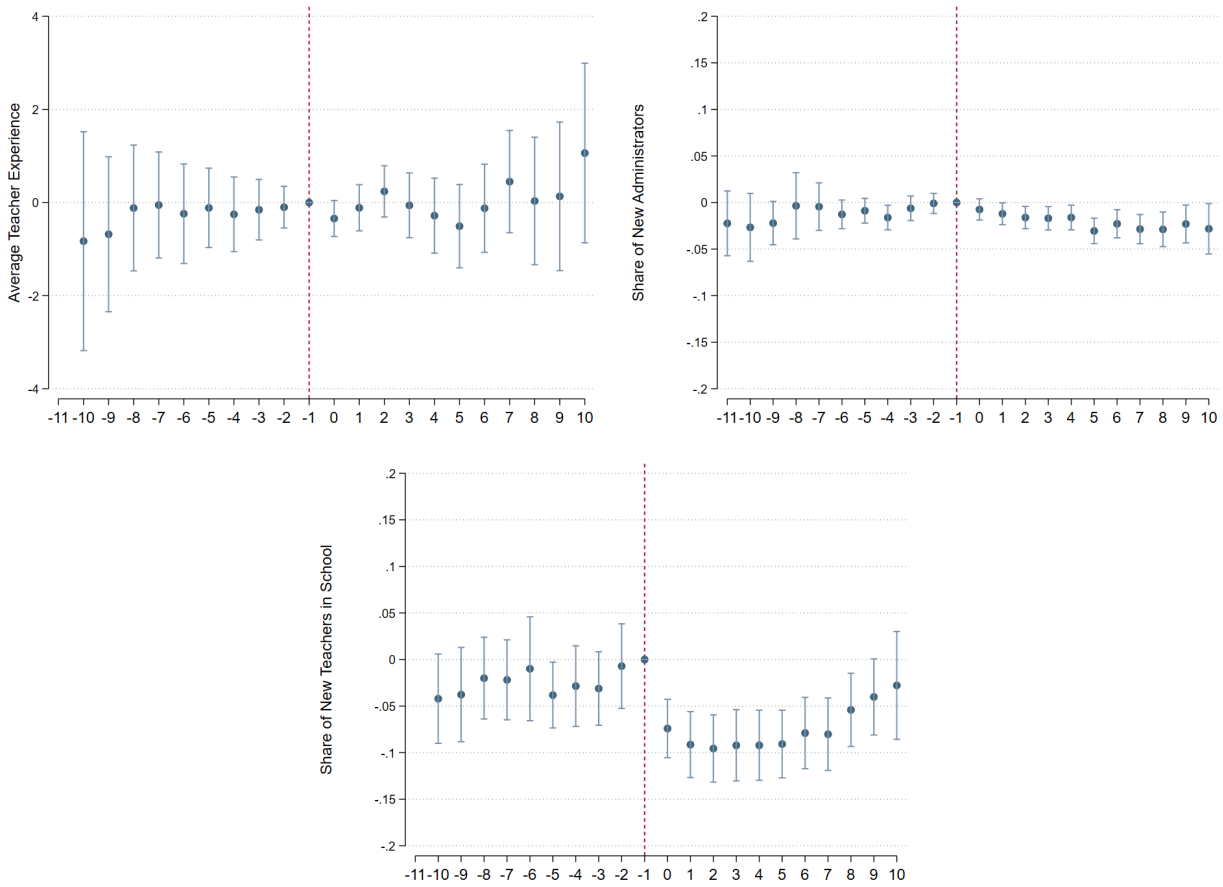
Similar to Table 4 looking at the impact on district share of higher-income students and the share of higher-income students in other schools in the district excluding treated school. In districts with only one school, the share of higher-income students in "other public schools" is set to 0.

Figure 1: Changes in the Number of Students Enrolled Leading Up to the Addition of an AP Course



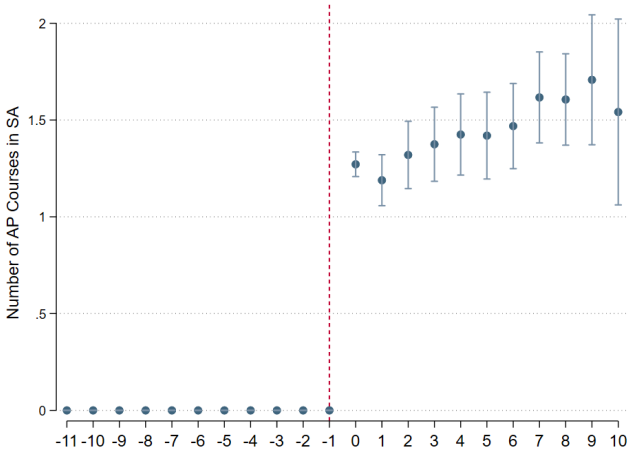
Notes: Each figure presents a change in the average student composition averaged across all treated schools at time t where $t = 0$ is when an AP course is first added to a school subject. Average is weighted by the number of lower income students enrolled in the first year in the subject area. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated.

Figure 2: Changes in School Personnel Leading Up to the Addition of an AP Course

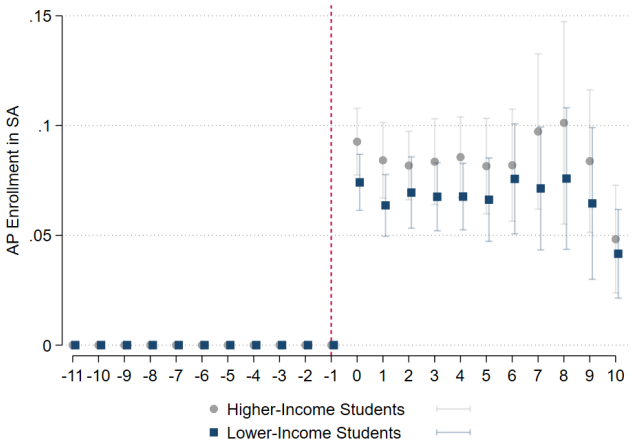


Notes: Similar to Figures 1 but looking at change in the teachers and administrators. The teacher averages are based on the treated subject average. Teachers are linked to student classroom data. A new teacher is defined as a teacher who is first observed in a treated school, since the teacher data can only be linked to students starting 2012, at $t = -10$ I cannot determine if a teacher was enrolled in that same school the prior year, which is why the proportion of new teacher is imputed at 0 that year. I cannot observe administrators role in the data or what school they are assigned, only the district they are assigned. As such, a new administrator is defined as an administrator that was not observed in the treated district in the prior year.

Figure 3: Impact of AP Course Addition on the AP Courses Offered in Subject Area



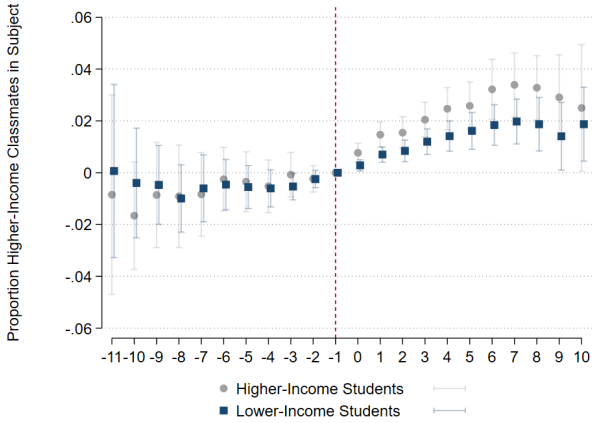
(a) Number of AP Courses Offered in Subject Area



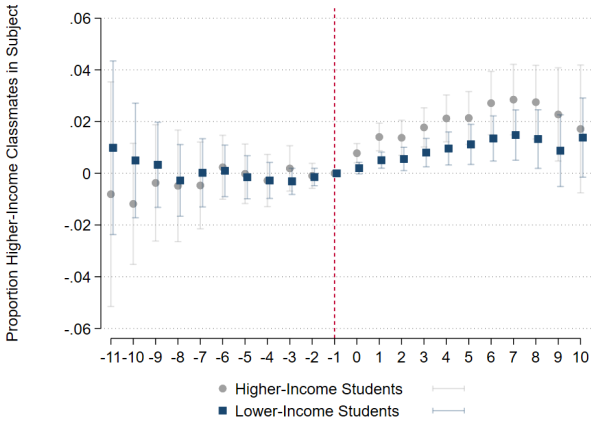
(b) Share of Students Enrolled in an AP Course

Notes: Plot captures the impact on the number of AP courses offered in a subject area after an AP course is first added in $t = 0$. Average is weighted by the number of students enrolled. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated. The estimates are by definition set to 0 in the prior to AP course addition years. In panel (b) higher and lower-income students' averages are both weighted by the number of lower-income students at baseline in a school subject so that we are comparing students in similar schools.

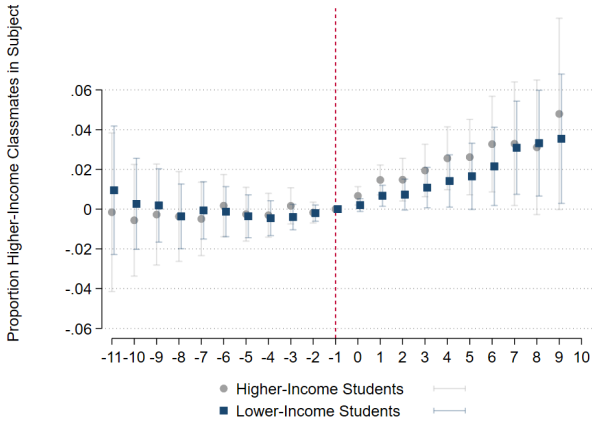
Figure 4: Impact of AP Course Addition on the Share of Higher-Income Classmates



(a) Sample: Full



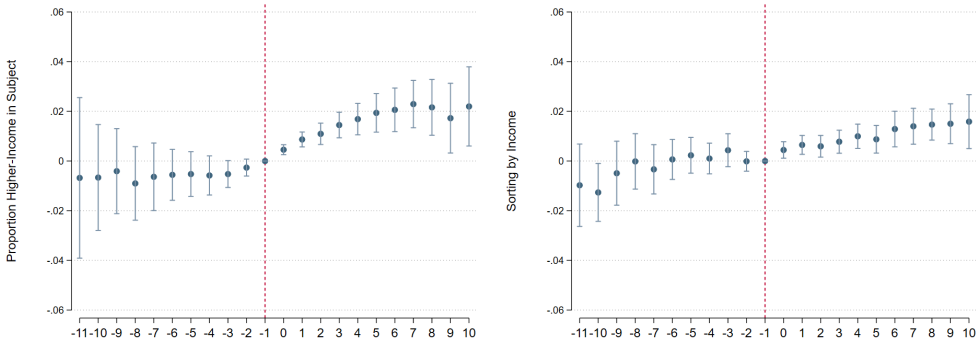
(b) Sample: Other AP



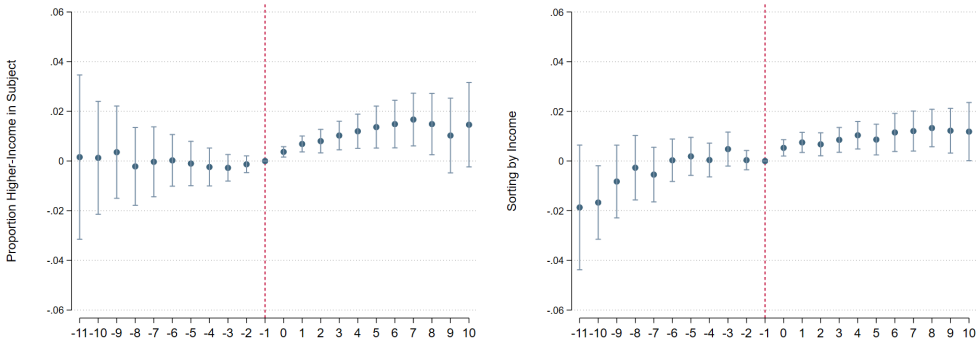
(c) Sample: No Spill

Notes: Plots are based on coefficient $beta_t$ from equation 1 for each income group. The blue dots and lines present the estimates for lower-income students–always on free/reduced lunch status. The grey dots present the estimates for higher-income students–students never on free/reduced lunch status. The regression includes one observation per subject area. The estimates are weighted by the number of lower-income students at baseline. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated. Panel (a) includes all comparison school subjects where no AP course is added during the study period. Panel (b) "Other AP", limits the comparison group from to school subjects in schools that add an AP course during the study period in another subject area. Panel (b) "No Spill", further limits the comparison group to only years prior to an AP course addition in another subject area in the same school. Figures A5 in the appendix present the estimates binning together treatment periods -6 to -11 together and periods 7 to 11 since those years have much fewer observations.

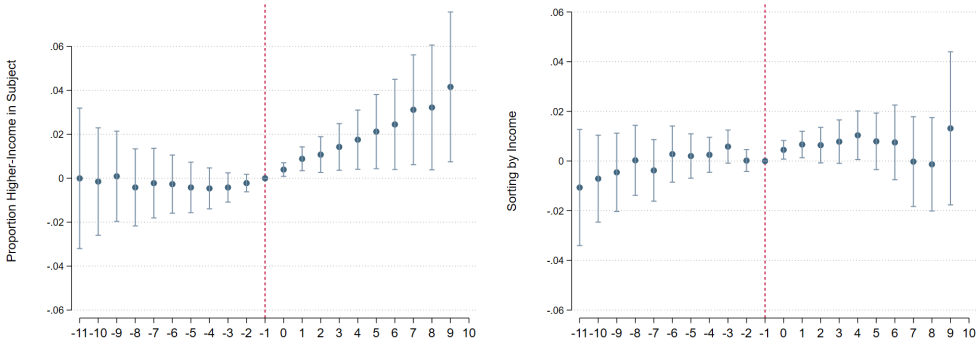
Figure 5: Impact of the Addition of AP course on Subject Area Composition and Sorting by Income



(a) Sample: Full



(b) Sample: Other AP



(c) Sample: No Spill

Notes: The Column to the left captures the impact of AP coursework on subject area composition: the share of total classroom student enrollments in the subject area who are higher-income. The column to the right captures sorting: the difference in the proportion of higher-income classmates in higher- relative to lower-income students' classrooms in a given year. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. All estimates are weighted by the number of lower-income students in the subject at baseline. The comparison school subject areas differ across panels as described in Figure 4.

9 Supplemental Appendix

Table A1: High School Average of Number of Courses Offered in 2019

Variable	Mean
Number of Courses	96.949
	(74.861)
Advanced Courses	13.285
	(15.574)
AP Courses	6.652
	(9.163)
IB Courses	.585
	(3.431)
Advanced (Other) Courses	6.048
	(5.941)
ELA Courses	11.632
	(8.074)
Advanced ELA Courses	1.915
	(2.128)
Math Courses	7.443
	(3.436)
Advanced Math Courses	2.309
	(1.813)
Science Courses	6.69
	(3.733)
Advanced Science Courses	1.438
	(2.206)
Social Studies Courses	9.048
	(4.84)
Advanced Social Studies Courses	2.16
	(2.75)
Foreign Language Courses	6.045
	(6.586)
Advanced Foreign Language Courses	1.251
	(2.325)
Fine Arts Courses	16.775
	(18.471)
Advanced Fine Arts Courses	3.375
	(4.693)
Technology Courses	1.264
	(2.144)
Advanced Technology Courses	.688
	(1.314)
Physical Ed. and Health Courses	6.258
	(4.46)
Advanced Physical Ed. and Health Courses	0
	(0)
Business Courses	0
	(0)
Advanced Business Courses	0
	(0)
CTE Courses	29.333
	(27.647)
Advanced CTE Courses	.106
	(.422)
Number of Schools	2285

Notes. Table summarizes the average number of courses offered in a high school in Texas in 2019. The number in brackets is the standard deviations from the mean.

Table A2: High School Student Courses by Grade (2019)

Variable	G9	G10	G11	G12
Total Courses Enrolled In	8.21	8.265	8.110	7.826
	(1.637)	(1.688)	(1.803)	(1.902)
Total Advanced Courses	.224	.418	1.161	1.565
	(.487)	(.78)	(1.655)	(1.842)
Total AP Courses	.143	.311	.743	.906
	(.38)	(.644)	(1.269)	(1.565)
Total IB Courses	0	.001	.07	.062
	(.013)	(.048)	(.608)	(.587)
Total Advanced (Other) Courses	.081	.105	.348	.598
	(.284)	(.34)	(.569)	(.746)
Total Dual-Credit Courses	.257	.521	1.772	2.28
	(.619)	(.964)	(1.459)	(1.625)
Total ELA Courses	2.37	2.355	2.343	2.243
	(.895)	(.887)	(.916)	(.963)
Total Math Courses	2.053	2.07	2.054	1.774
	(.531)	(.566)	(.672)	(1.017)
Total Science Courses	1.985	2.044	1.938	1.239
	(.394)	(.564)	(.94)	(1.188)
Total Social Studies Courses	1.897	2.069	2.332	2.193
	(.577)	(.738)	(.944)	(1.001)
Total Foreign Language Courses	1.418	1.322	.671	.275
	(.968)	(1.001)	(.982)	(.727)
Total Fine Arts Courses	1.291	1.229	1.084	.92
	(1.228)	(1.313)	(1.391)	(1.392)
Total Technology Courses	.109	.102	.103	.083
	(.457)	(.479)	(.508)	(.461)
Total Physical Ed. and Health Courses	1.66	1.079	.810	.594
	(.968)	(1.04)	(1.004)	(.893)
Total Business Courses	0	0	0	0
	(0)	(0)	(0)	(0)
Total CTE Courses	1.675	2.245	2.635	2.753
	(1.392)	(1.695)	(1.981)	(2.187)
Number of Students	431824	396810	369572	344011

Notes. Table summarizes high school students' course patterns who are enrolled in Texas public schools in 2019. The course categorizations are based on Texas grouping of courses to subject areas. The number in brackets is the standard deviations from the mean.

Table A3: Impact of Adding an AP Course on Lower-Income Students' Share of Higher-Income Classmates in all Subjects in the School

	(1) Full	(2) Other AP	(3) No Spill
Proportion Higher-Income Classmates in School	0.0132	0.00903	0.0111
	(0.00288)	(0.00321)	(0.00480)
Control Mean	0.110	0.110	0.110
N Clusters	1318	586	586
Lower-Income Students' Avg. Proportion of Higher-Income Classmates in School	0.0126	0.00851	0.0108
	(0.00284)	(0.00318)	(0.00479)
Control Mean	0.110	0.110	0.110
N Clusters	1318	586	586

The first outcome in the table captures impact of the addition of an AP course on students' share of higher-income students across courses taken that year in all subjects in the school. In the second outcome it captures the average lower-income students' share of higher-income classmates across school subjects, independent of if they take a course in the treated subject or not. The estimates are based on coefficient $beta_t$ from equation 1 for post-treatment indicator (after the first AP course is added in the subject area) for lower-income students. Number of clusters is based on the number of schools. Control Mean is based on treated units' average at $t = -1$. Models (1)-(3) define the comparison group differently as described in Table 2.

Table A4: Impact of Adding an AP Course on Lower-Income Students' Classroom Share Higher-Achieving (Math)

	(1) Full	(2) Other AP	(3) No Spill
Proportion Higher-Achieving Classmates in Subject	-0.00923	-0.00178	0.00351
	(0.00566)	(0.00590)	(0.00744)
Control Mean	0.180	0.180	0.180
N Clusters	1318	586	586
Proportion Higher-Income Higher-Achieving Classmates in Subject	0.00209	0.00244	0.00335
	(0.00158)	(0.00170)	(0.00265)
Control Mean	0.0300	0.0300	0.0300
N Clusters	1318	586	586
Sorting by Achievement	-0.00460	-0.00343	-0.00304
	(0.00605)	(0.00663)	(0.00970)
Control Mean	0.0800	0.0800	0.0800
N Clusters	1318	586	586

Similar to Table 5 but defining achievement by students' grade 8 math instead of reading test-scores. A student is defined as higher-achieving if they scored in the top 25th percentile of their grade 8 math test-score based on the distribution of student test-scores in the full sample in a given year. Sorting by income is the difference between the average share of higher-achieving students in 25th compared to the 75th percentile students based on their grade 8 math test-scores.

Table A5: Sensitivity to Specification: Impact of Adding an AP Course on Lower-Income Students

	(1)	(2)	(3)
Proportion Higher-Income Classmates in Subject	0.0113	0.0134	0.0139
	(0.00265)	(0.00305)	(0.00299)
Control Mean	0.110	0.110	0.110
N Clusters	1318	1318	1318
Proportion Higher-Achieving Classmates in Subject	-0.00257	-0.00579	0.00190
	(0.00284)	(0.00335)	(0.00251)
Control Mean	0.180	0.180	0.180
N Clusters	1318	1318	1318
Proportion Higher-Income Higher-Achieving Classmates in Subject	0.00297	0.00362	0.00460
	(0.00115)	(0.00128)	(0.00128)
Control Mean	0.0300	0.0300	0.0300
N Clusters	1318	1318	1318
Sorting by Income	0.00520	0.00704	0.00556
	(0.00195)	(0.00201)	(0.00198)
Control Mean	0.0200	0.0200	0.0200
N Clusters	1318	1318	1318
Sorting by Achievement	-0.000295	0.00208	0.00305
	(0.00385)	(0.00423)	(0.00397)
Control Mean	0.0800	0.0800	0.0800
N Clusters	1318	1318	1318
Number of Courses	X		
Years SA Offered		X	
Demographic and Test-Score			X

Similar to Table 4 and Table 5 but using different specifications. Model (1) controls for the number of courses offered in a given year. Model (2) controls for the years the subject is offered. Model (3) controls for average reading and math grade 8 test scores in a school subject area in a given year and the share of Hispanic and ESL students. All models are fully interacted with subject area. Achievement is based on grade 8 reading test-scores.

Table A6: Sensitivity to Sample and Specification: Impact of Adding an AP Course on Lower-Income Students

	(1)	(2)	(3)	(4)
Proportion Higher-Income Classmates in Subject	0.0125	0.0123	0.0154	0.0151
	(0.00395)	(0.00404)	(0.00347)	(0.00328)
Control Mean	0.130	0.130	0.110	0.130
N Clusters	797	986	1310	1314
Proportion Higher-Achieving Classmates in Subject	-0.00974	-0.00399	-0.00518	-0.00476
	(0.00395)	(0.00346)	(0.00393)	(0.00329)
Control Mean	0.170	0.160	0.180	0.180
N Clusters	797	986	1310	1314
Proportion Higher-Income Higher-Achieving Classmates in Subject	0.00234	0.00299	0.00428	0.00356
	(0.00162)	(0.00172)	(0.00146)	(0.00144)
Control Mean	0.0400	0.0400	0.0300	0.0400
N Clusters	797	986	1310	1314
Sorting by Income	0.00716	0.00474	0.00658	0.00603
(0.00255)	(0.00270)	(0.00221)	(0.00199)	
Control Mean	0.0300	0.0300	0.0200	0.0200
N Clusters	797	986	1310	1314
Sorting by Achievement	-0.00156	-0.00587	0.00284	0.00274
	(0.00536)	(0.00542)	(0.00465)	(0.00404)
Control Mean	0.0900	0.0900	0.0800	0.0800
N Clusters	797	986	1310	1314
Always Offered	X			
Excluding New Schools		X		
Never Add Any AP			X	
FRPL Prior to HS				X

Similar to Table 4 and Table 5 but using different samples. Model (1) limits the sample to school subjects that are offered for all 12 years we observe schools in. Model (2) excludes schools that have been open for three years or less by 2011. Model (3) only includes comparison school subjects in schools that do not add any AP course in any subject area between 2011 and 2022. Model (4) defines students as upper- or lower-income based on their free/reduced lunch status in all years they were enrolled in prior to grade 9 (this model excludes students who were not enrolled in Texas schools prior to grade 9).

Table A7: Impact on Exposure to Higher-Income Students, Including Teacher Fixed Effects

	(1)
Proportion Higher-Income Classmates in Subject	0.0102
	(0.00268)
Control Mean	0.190
N Clusters	1306

Similar to Table 4 Model (1) "full" sample but including teacher-subject area fixed effects. The sample is averaged on lower-income students who are in classrooms that could be linked over time.

Table A8: Impact of Adding an AP Course on Number of Students Enrolled in the Subject

	(1) Full	(2) Other AP	(3) No Spill
Number of Students Enrolled in Subject	74.60	60.29	55.87
	(17.82)	(16.43)	(14.85)
Control Mean	631.0	631.0	631.0
N Clusters	1318	586	586
Number of Higher-Income Students in Subject	5.984	7.193	4.574
	(4.277)	(5.631)	(4.850)
Control Mean	78.93	78.93	78.93
N Clusters	1318	586	586

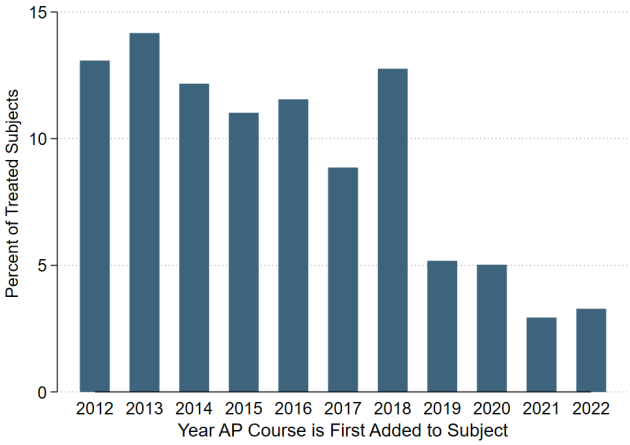
The outcomes capture the impact on the total number of students enrolled in the school subject following the addition of an AP course, i.e., the number of students who take at least one course in the subject in a given year. The estimates are based on coefficient $beta_t$ from equation 1 for post-treatment indicator (after the first AP course is added in the subject area) for lower-income students. Number of clusters is based on the number of schools. Control Mean is based on treated units' average at $t = -1$. Models (1)-(3) define the comparison group differently as described in Table 2.

Table A9: Impact of Adding an AP Course on Number of Students Enrolled in the School

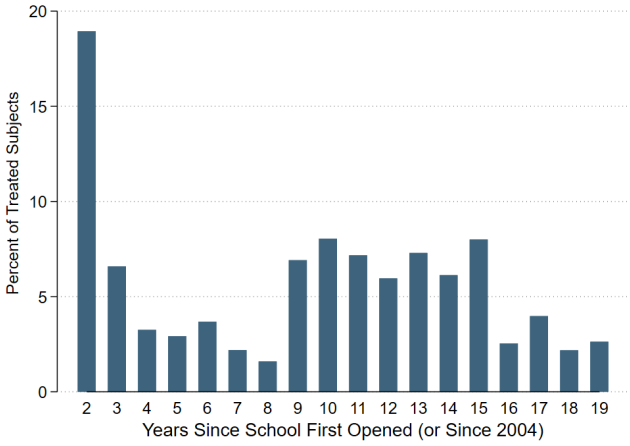
	(1) Full	(2) Other AP	(3) No Spill
Number of Students Enrolled in School	104.1	83.30	69.66
	(24.30)	(22.58)	(19.40)
Control Mean	999.0	999.0	999.0
N Clusters	1318	586	586
Number of Higher-Income Students in School	8.117	9.036	2.350
	(5.615)	(6.948)	(6.064)
Control Mean	119.1	119.1	119.1
N Clusters	1318	586	586

Similar to Table A8 but looking at the total number of students in the school instead of just the subject.

Figure A1: Timing of AP Course Addition



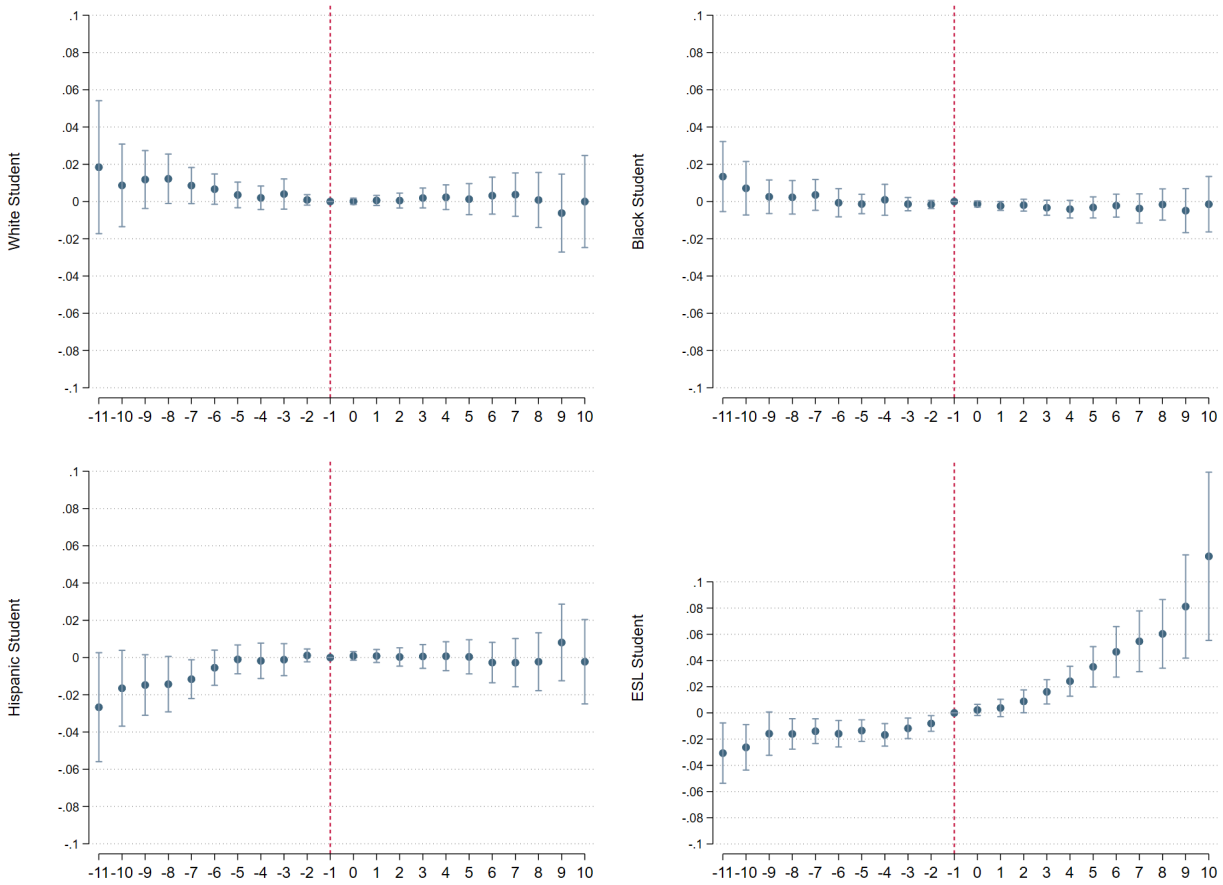
(a) Year School Subject First Adds an AP Course



(b) Year Relative to School Opening When an AP Course is Added

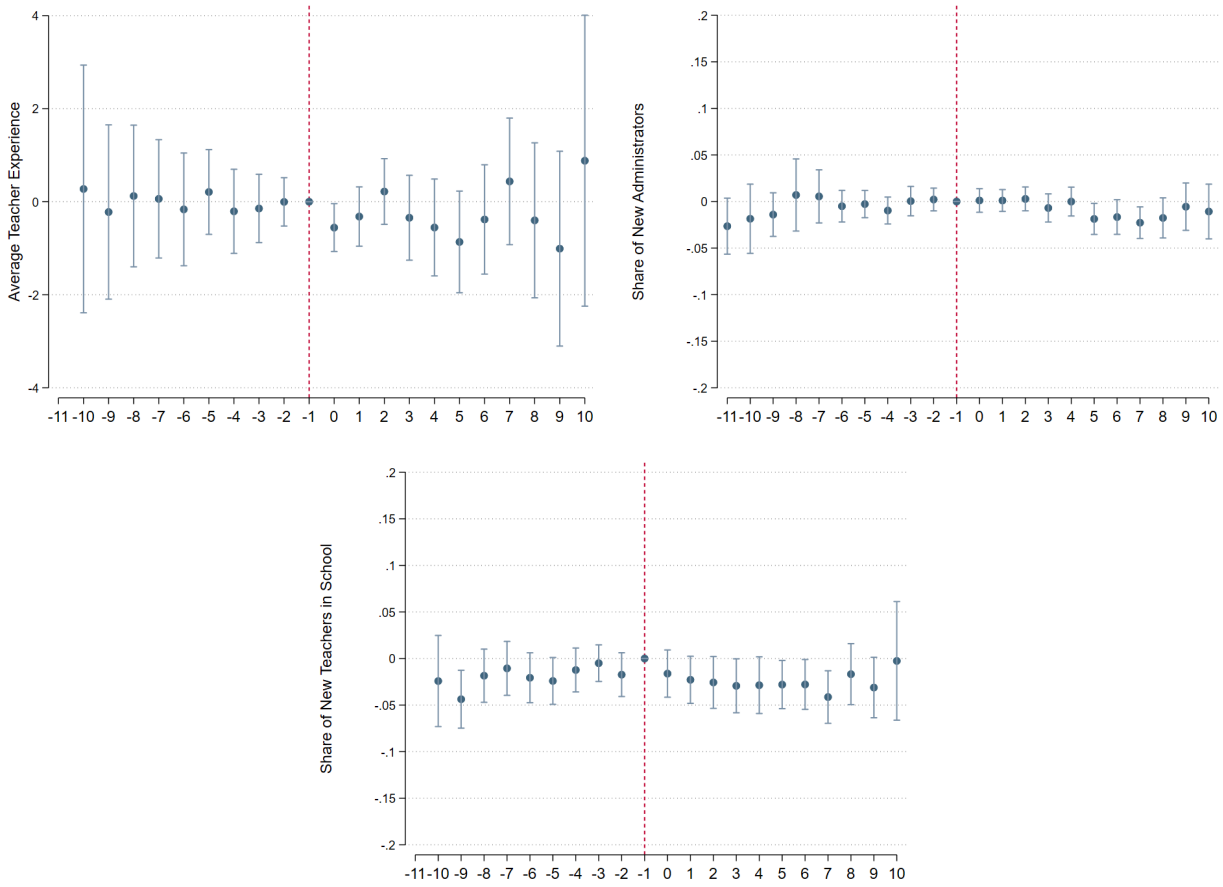
Notes: The histograms capture the timing of when AP courses are first added to a subject. In panel (a) I present the percentage of school subjects that first add an AP course in each year. In panel (b) I present when an AP course is first added relative to school opening year if the school opened after 2004. If the school first opened in 2004, then it shows the number of after 2004 the AP course is first added in the school subject.

Figure A2: Trends in Student Composition Leading Up to the Addition of an AP Course



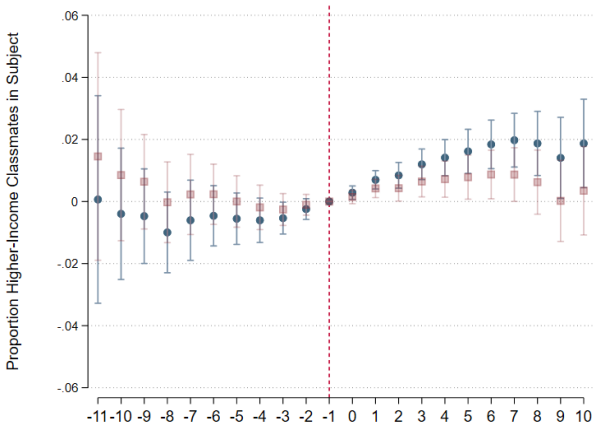
Notes: Each figure presents a change in the average student composition averaged across all treated schools at time t where $t = 0$ is when an AP course is first added to a school subject. Average is weighted by the number of lower income students enrolled in the first year in the subject area. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated.

Figure A3: Changes in School Personnel Leading Up to the Addition of an AP Course: Limiting the Sample to Schools that are Three Years or Older by 2011

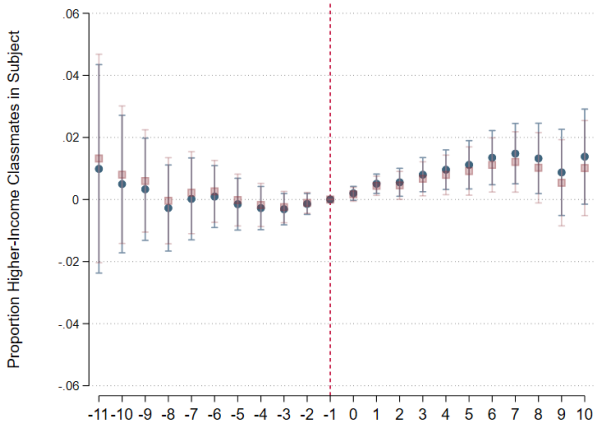


Notes: Similar to Figures A2 but looking at change in the teachers and administrators. The teacher averages are based on the treated subject average. Teachers are linked to student classroom data. A new teacher is defined as a teacher who is first observed in a treated school, since the teacher data can only be linked to students starting 2012, at $t = -10$ I cannot determine if a teacher was enrolled in that same school the prior year, which is why the proportion of new teacher is imputed at 0 that year. I cannot observe administrators role in the data or what school they are assigned, only the district they are assigned. As such, a new administrator is defined as an administrator that was not observed in the treated district in the prior year.

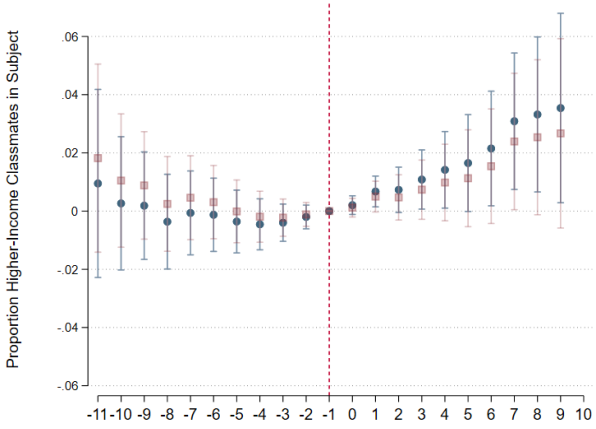
Figure A4: Impact of AP Course Addition on the Share of Higher-Income Classmates



(a) Sample: Full



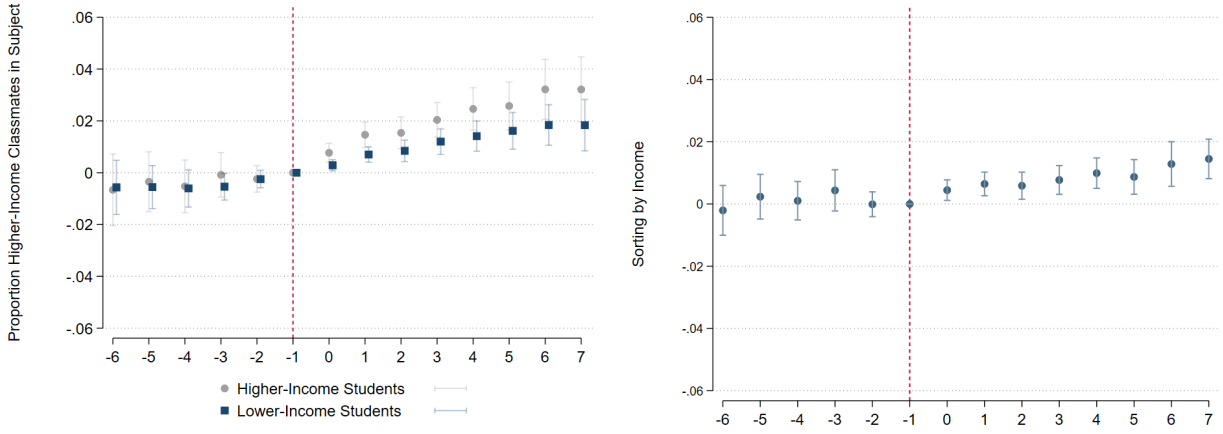
(b) Sample: Other AP



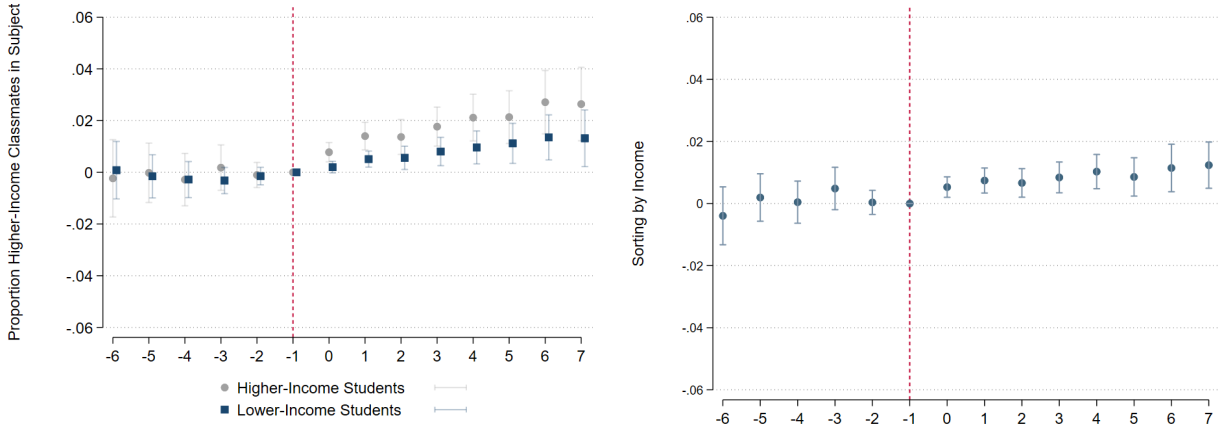
(c) Sample: No Spill

Notes: The navy lines replicates the main estimates for lower-income students from Figure 4. The red lines are based on the adjusted event study coefficients where we subtract from each coefficient the expected coefficient if the linear trend observed in periods t=-4 to t=-1 had continued into the post-treatment period. The adjustment provides a conservative lower bound on the treatment effect under the assumption that any violation of parallel trends follows the same linear pattern observed before treatment.

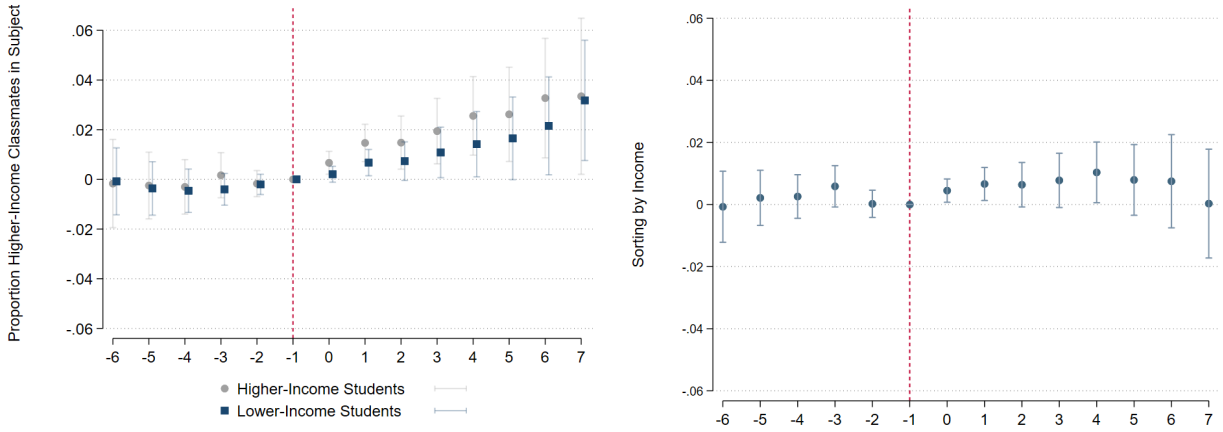
Figure A5: Impact of AP Course Addition on the Share of Higher-Income Classmates [Binned]



(a) Sample: Full



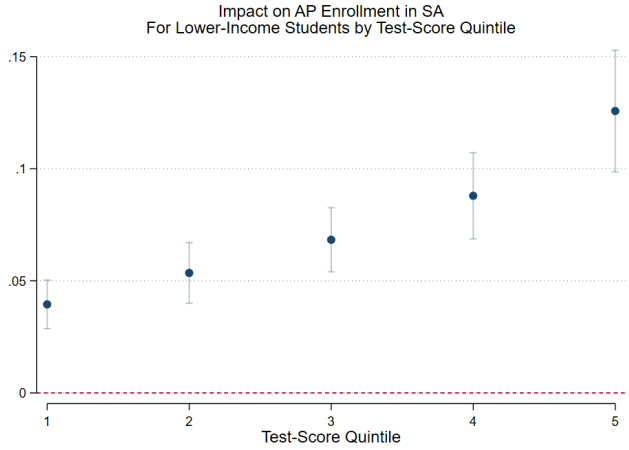
(b) Sample: Other AP



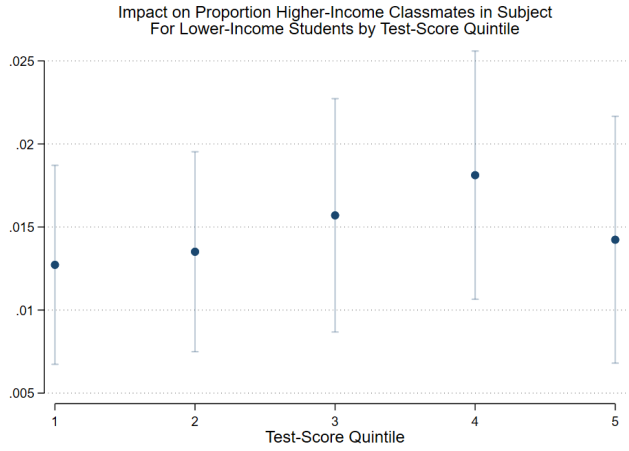
(c) Sample: No Spill

Notes: Similar to Figures 4 and 5, but binning treatment periods -6 to -11 together and periods 7 to 11 since those years have much fewer observations.

Figure A6: Impact of AP Course Addition on Lower-Income Students by Student G8 Test-Score



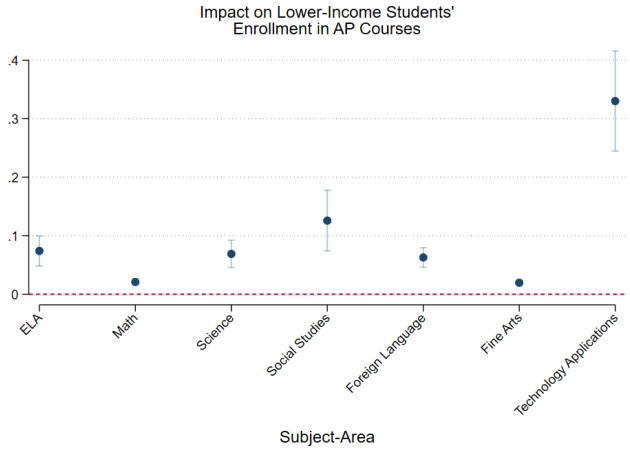
(a) Enrolled in AP Course



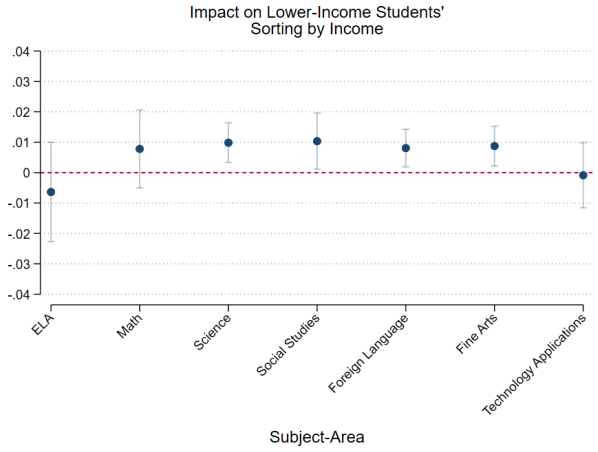
(b) Proportion Higher-Income students

Notes: The plots capture the overall average impact post-treatment for lower-income students in each test-score. The coefficients are based on running the regression with a post-treatment indicator with the same regression specifications as in equation 1. The estimates are based on using the full comparison school subjects sample. Test-scores are based on grade 8 reading test-scores. Test-scores are missing for 8% of students.

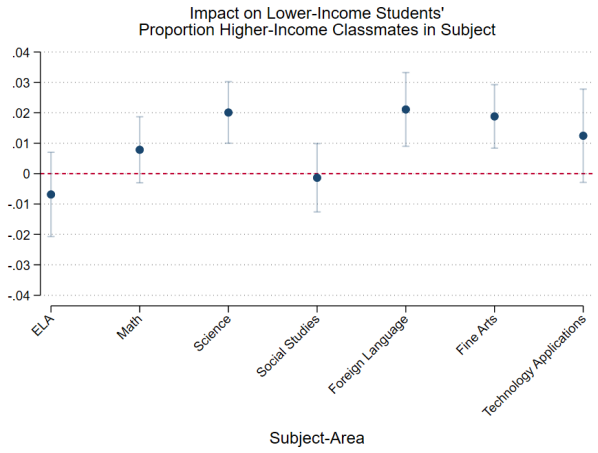
Figure A7: Impact of AP Course Addition on Lower-Income Students by Subject Area



(a) Enrolled in AP Course



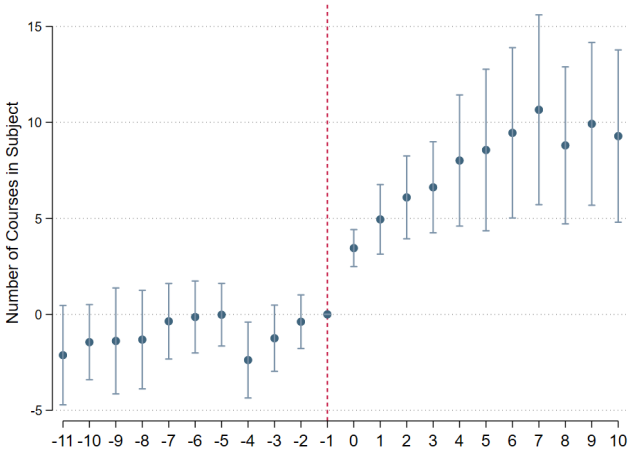
(b) Sorting by Income



(c) Proportion Higher-Income students

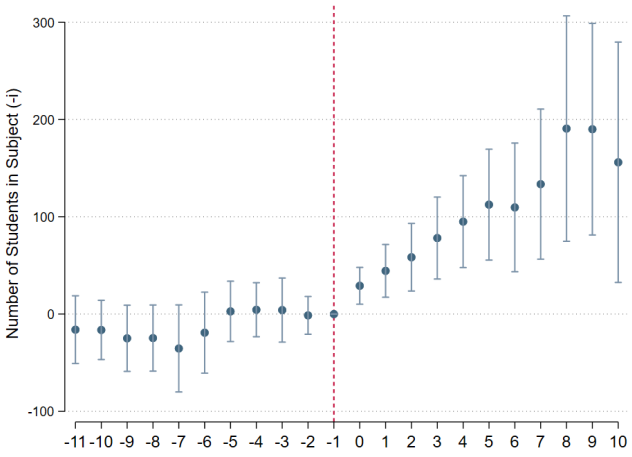
Notes: The plots capture the overall average impact post-treatment for lower-income students in each subject area. The coefficients are based on running the regression with a post-treatment indicator with the same regression specifications as in equation 1 in separate regression for each subject area. The estimates are based on using the full comparison school subjects sample.

Figure A8: Number of Courses in Subject Area Post Treatment

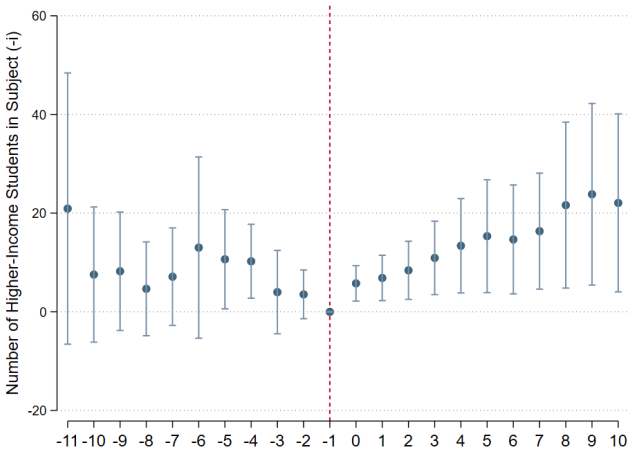


Notes: These event plot capture the impact of treatment on the number of courses in subject area. The outcome is weighted by the number of lower-income students enrolled in the subject area. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated.

Figure A9: Impact of AP Course Addition on the Number of Students Enrolled in At Least one course in the School Subject



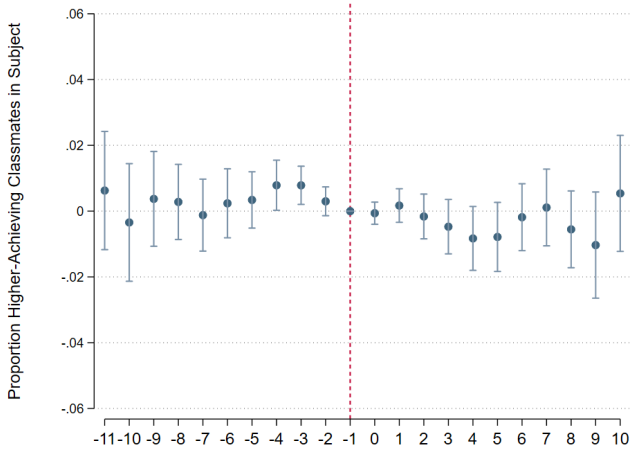
(a) Number of Students



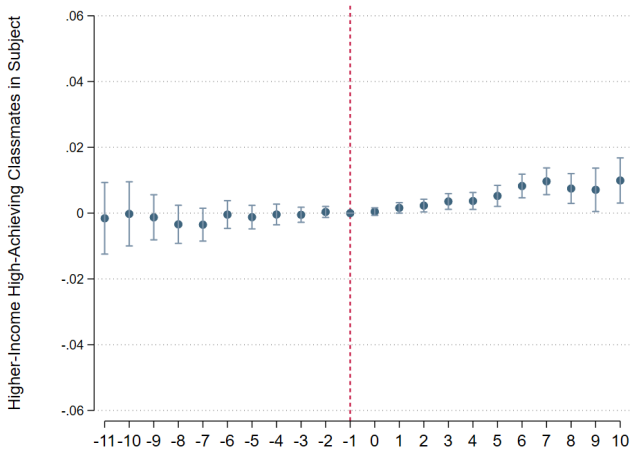
(b) Number of Higher-Income Students

Notes: Panel (a) and (b) capture the change in the number of students prior to and after an AP course is first added to the subject. The number of students enrolled is based on the number of students who take at least one course in the subject area. The estimates are based on using the "full" school subjects comparison sample.

Figure A10: Impact of AP Addition on Lower-Income Students' Share of Higher-Achieving Students (G8 Reading)



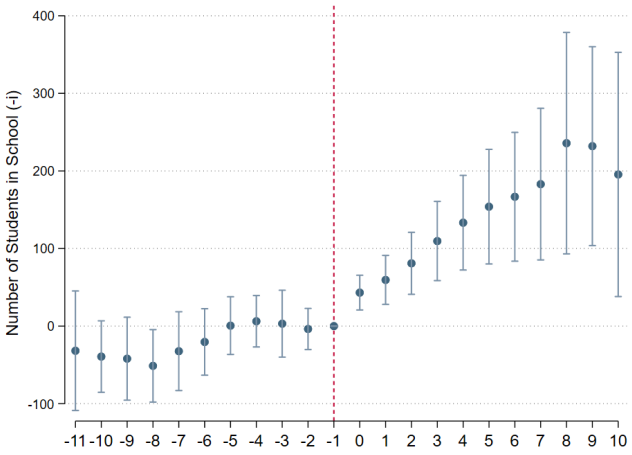
(a) Share of Higher-Achieving Students



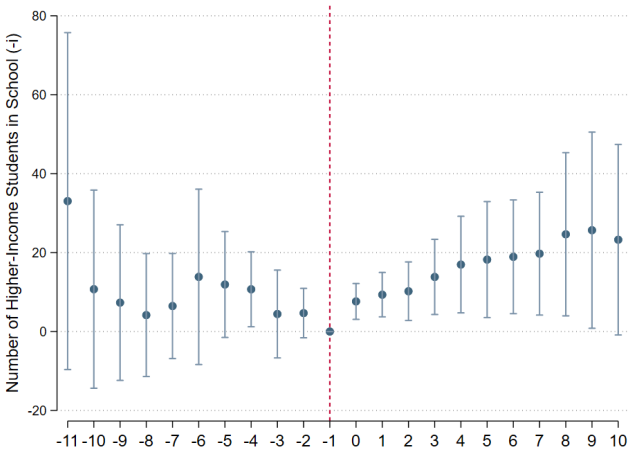
(b) Share of Higher-Income and Higher-Achieving Students

Notes: Panel (a) outcome is the average share of higher-achieving classmates for lower-income students in the subject. Panel (b) outcome is average share of higher-income and higher-achieving classmates for lower-income students in the subject. Higher-achieving students are those who scored in the top 25th percentiles of their grade 8 reading test. Estimates are weighted by the number of lower-income students enrolled in the subject area in a given year. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated.

Figure A11: Impact of AP Course Addition on the Number of Students Enrolled in the School



(a) Number of Students



(b) Number of Higher-Income Students

Notes: Panel (a) and (b) capture the change in the number of students prior to and after an AP course is first added to the subject. The number of students enrolled is based on the number of students enrolled in the school in a given year.