Bridging the Income Divide: Advanced Courses and Exposure to Higher Income Peers*

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Abstract

Recent work has highlighted the link between cross-income friendships and economic mobility. Schools can facilitate cross-group friendship formation. Although prior work has examined the impact of school choice policies on segregation, less is known about the impact of school factors such as school course offering on cross-income exposure. I use data from Texas to capture the impact of the addition of advanced courses on lower-income students' exposure to upper-income students. To capture the impact of advanced courses, I exploit variation in when an advanced course is first added to a school subject area. I find evidence that adding an Advanced Placement (AP) course in a subject area increases lower-income students' share of upper-income classmates by 1.4 percentage points. This effect is driven by three subject areas: science, foreign language, and fine arts. The increase in the proportion of upper-income students in the subject area counters any increase in sorting by income after the addition of an AP course.

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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 upper-income peers were more likely to enroll in college and earn higher wages in early adulthood (Mallah, 2024). How schools are organized could facilitate or hinder friendships between lower- and upper-income students. For instance, schools may inadvertently deepen inequalities by creating categories—such as gifted programs—that sort students by income (Kerckhoff, 1995; Domina, Penner, and Penner, 2017). While previous studies have explored the effects of school choice policies on segregation (see Phillips et al., 2015; Marcotte and Dalane, 2019; Alcaino and Jennings, 2020; Monarrez, Kisida, and Chingos, 2022), we know far less about how specific school factors, such as course offerings, influence cross-income exposure.

One common policy lever in schools is the choice of courses to offer. The implications of advanced courses for equity are particularly salient in policy discussions.[1] While some research has addressed the impact of advanced courses on college enrollment (Jackson, 2014; Cohodes, 2020; Conger, Long, and McGhee Jr., 2020), these studies overlook the potentially mediating effect on exposure to higher-income students and/or evaluate programs that are not representative of the typical case of the addition of an advanced course. For example, Jackson (2014) found that financial incentives for enrolling in Advanced Placement (AP) courses increased both course participation and college enrollment. However, it remains unclear whether these outcomes stem from the incentives themselves and/or the particular group of students who are induced to enroll in an AP course because of the incentive. In this paper I also compare the impact of AP courses to other advanced courses such as dual-enrollment courses.

The impact of the addition of advanced courses on cross-income exposure is theoretically ambiguous. On one hand, the introduction of an advanced course might decrease lower-income students' share of higher-income classmates by increasing within-school sorting by income. This would happen if lower-income students are less likely to enroll in an AP course. Lower-income student's lower likelihood of enrolling in advanced courses may be explained by differences in parental involvement (see Kalgorides and Loeb, 2013; Lareau, 1987; Lareau, 2000; Useem, 1992; Barg, 2012) or differences in academic preparation. In Texas, I find that upper-income students score an average of 0.5 standard deviations higher on eighth-grade reading tests than their lower-income counterparts in the same schools.

[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/

Conversely, the addition of advanced courses could enhance lower-income students' exposure to upper-income peers by making the public school and a subject area more appealing to higher-income families. In this scenario, higher-income students might be less inclined to transfer to private schools and more likely to enroll in subjects like Fine Arts when advanced courses are available. Domina et al (2017) find that schools with more advantaged students are more likely to increase tracking in response to policy pressures. It is also possible that schools were already tracking students before the introduction of an advanced course, in which case the new course may simply represent a rebranding of a classroom and so have no effect on sorting by income in a school.

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 or administrative priorities. To isolate the impact of adding an advanced course, I utilize a difference-in-differences approach, leveraging variations in the timing of the first advanced course addition to a subject area within a school between 2004 and 2022 in Texas Schools. The assumption necessary for establishing a causal link is that treatment and comparison schools would have followed similar trends in the absence of the advanced course addition. Consistent with this assumption, I find no evidence of pre-existing trends in subject area composition prior to the introduction of AP courses, suggesting that the observed effects are indeed attributable to the new coursework.

I use data from the Texas Education Research Center (2004-2022) which includes information on student test scores, course enrollments (and class assignments starting in 2011) and teacher assigned. To capture student income, ideally, I would have parental income for all enrolled students. In the absence of this, I measure economic disadvantage using the proportion of years each student in on free/reduced lunch status.[2] I categorize students into three income groups: those who are always, sometimes, or never eligible for free/reduced lunch. This classification effectively captures variations in parental income, with financial aid reported average adjusted parental incomes of $141,686 for those never eligible, $51,406 for those sometimes eligible, and $27,305 for those always eligible (Mallah, 2024).[3] I refer to to the "never eligible" group as "higher/upper-income" (24% of students) and the "always eligible" group as "lower income" (29% of students).

My primary outcome of interest is the proportion of upper-income students in lower-income students' classrooms within a subject area. In this paper, I focus on the impact of adding AP courses, as they

[2]To identify the proportion of years on free/reduced lunch, I use all years from 2004 to 2022. This 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 based on one year of free/reduced lunch eligibility status.

[3]Their median parental income is $117,119, $39,145 and $22,000, respectively.

represent the majority of advanced offerings. In future iterations, I will compare the effects of AP courses with those of other advanced courses, such as dual-enrollment programs. I define treatment as the first addition of an AP course in a high school subject area (e.g., sciences), while control schools are those where an AP course is never added in that same subject area (e.g., sciences) between 2004 and 2022.[4]

My findings indicate that the addition of an AP course increases lower-income students' exposure to higher-income classmates. Specifically, I observe a 1.4 percentage point increase in lower-income students' share of upper-income peers ($p < 0.001$). The increase in exposure to higher-income students is experienced by all lower-income students, regardless of grade 8 test scores.

This change in lower-income students' classroom composition may arise from two opposing mechanisms:1) the addition of an advanced course might alter the proportion of upper-income students enrolled in that subject area (a "composition shift"), and 2) it might increase income-based sorting within the subject (a "gap change"). I find evidence for the two counter mechanisms. Following the introduction of an AP course, the proportion of higher-income students in treated subjects rose by 1.6 percentage points. However, I also observed an increase in income sorting; the difference in the share of upper-income classmates in the treated subject area between upper- and lower-income students increased by 0.7 percentage points. This suggests that while sorting by income increased post-AP course addition, the overall exposure of lower-income students to upper-income peers also rose due to the influx of higher-income students in these subjects.

The relationship between AP coursework and exposure to higher-income students may vary by subject area. For example, in subjects like math, where enrollment in an AP course might highly depend on prior preparation, lower-income students may be less likely to benefit from the addition of an AP course. My findings indicate that the increase in exposure to upper-income peers primarily occurs in three subject areas: science, foreign language, and fine arts, with no evidence of an effect in math.

These findings highlight the importance of considering not only how course offerings affect student sorting within schools but also how they influence overall school composition by attracting and retaining higher-income students. The identification strategy employed in this study also provides a framework for examining how various course offerings impact student demographics and long-term outcomes, enabling schools to make more informed decisions about which courses to offer and to whom.

An important limitation of this study is that there may have been other concurrent changes in the subject area that may be driving the increase in exposure to higher-income peers. The results are robust to include teacher fixed effects, suggesting that the impact is not driven by a simultaneous change in teacher quality

[4]I exclude school subject areas that at any point before 2012 had an AP course (always-treated). Once an AP course is added, a school subject area is considered treated for the remainder of the years.

following the addition of an AP course. That said, there may be other unobserved concurrent changes influencing the results.

This paper contributes to the literature on advanced coursework and tracking. There are a few papers on the impact of advanced coursework on students' college enrollment (Jackson, 2014; Cohodes, 2020; Conger, Long and McGhee Jr., 2020). These papers do not look at employment which may be particularly sensitive to cross-income friendships formed in school, or the (potentially) mediating impact on exposure to higher-income students. Cohodes (2020) finds providing an advanced track program in schools for students above an academic cutoff increases college enrollment for those on the margin, particularly for Black and Latin-American students. The results are for a particular group of students: those on the margin. It is not clear how this policy impacted students who did not get into the program: lower performing students on the margin. Similarly, Jackson (2014) finds offering students and teachers incentives to enroll in AP courses increased AP course taking and college enrollment. On the other hand, Conger, Long and McGhee Jr., (2020), find that randomly offering an AP science course in 23 schools had no effect on students' plans to apply to college or on their entrance exam. They also find that students who enroll in AP courses end up enrolling in less selective colleges. This suggests the impact of access to advanced coursework may vary depending on how it is offered and the students' baseline academic performance.

The findings also contribute to the literature on school tracking. Prior work provides evidence of school tracking by academic performance and within-school sorting by race and income (e.g., Antonovics, Black, Cullen, and Meiselman, 2022; Clotfelter, Ladd, Clifton, and Turaeva, 2021; Dalane and Marcotte, 2022; Clotfelter, Ladd, and Vidgor, 2002). While it is known that tracking within schools occurs, it is unclear how school course offerings impact the level of tracking within schools and lower-income students' exposure to upper-income peers. Antonovics et al. (2022) find that Texas middle schools with more curricular differentiation, measured by the number of math courses offered, tend to have higher levels of sorting by test scores. However, the higher level of within school sorting may be driven by factors correlated with the number of math courses offered in a school, like students' income composition. Additionally, the overall effect on lower-income students' exposure to upper-income classmates remains unclear; tracking may simultaneously raise the proportion of upper-income students in the school by making the school more attractive to higher income households. In this paper, I use variation in the timing of an advanced course's introduction in a subject area within a school to address selection concerns. I document the impact of adding an advanced course on the composition of the subject area within the school and the rate of income-based sorting to capture the overall effect on exposure to upper-income students.

The paper is organized as follows. In Section 2, I begin by laying out the conceptual framework of the analysis. Section 3 presents the data used. Section 4 presents the identification strategy. Section 5 reports the main findings and section 6 concludes the paper. In this version of the paper I will only present the impact of AP courses, in future versions I will present the impact of other advanced courses included dual enrollment courses.

2 Conceptual Framework

The impact of adding advanced courses on cross-income exposure within schools is theoretically ambiguous. On one hand, advanced course additions may decrease lower-income students' exposure to higher-income classmates by intensifying within-school sorting by income. On the other hand, adding an AP course could increase the exposure of lower-income students to higher-income classmates by increasing the attractiveness of the public school or subject for higher-income families.

Lower-income students with equal academic standing may be less likely to enroll in an AP course. Klopfenstein (2004) found that minority students are less likely to participate in AP courses conditional on academic performance, and that the difference in AP course enrollment appears to be driven by differences in family income. Similarly, Card and Giuliano (2016) found that lower-income students were less likely to enroll in gifted programs prior to universal screening.

One potential explanation for lower advanced course enrollment rates among lower-income students with similar academic qualifications is differences in parental involvement. Several studies suggest that higher-income parents are more likely to be involved in children's classroom assignment (Kalgorides and Loeb, 2013; Lareau, 1987; Lareau, 2000; Useem, 1992; Barg, 2012). Useem (1992) found that higher-income parents are more willing to intervene in the assignment of students into academic tracks, and therefore their children were more likely to be assigned to the advanced math track. Additionally, students from higher-income families are less likely to require remediation (LiCalsi et al., 2019). In Texas, I find that, conditional on academic performance, higher-income students are 8.4 percentage points more likely to enroll in any AP course.

Beyond parental involvement, if income is correlated with academic achievement, adding an advanced course could increase income-based sorting by grouping students according to academic performance. In Texas, I find that, within the same school, higher-income students score approximately 0.5 standard deviations above their lower-income peers on Grade 8 reading tests.

However, the addition of an advanced course may not increase academic tracking in the school if school classrooms were already tracked prior to the addition of an advanced course. In which case the advanced designation may be a simple renaming and so have no effect on sorting within schools.

Alternatively, advanced course offerings could increase cross-income exposure by attracting higher-income families to public schools and/or specific subject areas within a school. If public schools implement tracking, higher-income students may be more inclined to stay in public schools rather than opting for private alternatives. Higher-income students might also be more likely to enroll in advanced courses in a subject area such as Fine Arts when an advanced course is offered. Epple, Newlon, and Romano (2002) suggest that schools may use tracking to retain higher-income students. Figlio and Page (2002) find that higher-performing students are more likely to choose schools that offer tracking. Similarly, Domina et al. (2017) observe that schools with more advantaged student populations tend to increase tracking in response to policy pressures.

Finally, it is possible that AP courses are less tracked than other advanced courses, partly due to state accountability measures and incentive programs. Some Texas schools participate in the Advanced Placement Incentive Program (APIP), which offers financial incentives based on AP exam performance. Under APIP, students receive $100 for each AP exam scored at 3 or above, and AP teachers receive the same amount for each of their students who achieves a 3 or higher. This incentive structure encourages teachers to enroll more students in AP courses who they believe can achieve a qualifying score. In future iterations of the paper I will compare the impact of AP courses to other advanced courses.

3 Data and Context

I use longitudinal administrative data from the Texas Education Research Center (ERC) that links student data from the Texas Education Agency (TEA) with data from the Texas Higher Education Coordination Board (THECB) and Texas Workforce Commission (TWC). 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).[5]

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.[6] 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

[5]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.

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

income, as indicated in previous research (Michelmore and Dynarski, 2017; Mallah, 2024). Among students with financial aid data, 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.[7] For simplicity, I refer to students who are never on free/reduced lunch as higher- or upper-income students, and those always on free/reduced lunch as lower-income students. In this paper I focus on higher- and lower-income students.

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. Most advanced courses are Advanced Placement (AP) courses. 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. Table 9.1 provides a summary of courses taken by high school students in grades 9–12.

Schools offer an average of 97 courses per academic year, including approximately 13 advanced courses, of which 7 are typically AP 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.[8]

4 Identification Strategy

To evaluate the impact of introducing an advanced course in a given subject area, ideally, we would randomly assign schools and subject areas to add advanced courses. Since this is not feasible, I instead 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-differences (DiD) design is that the exact timing of a school's adoption of an advanced course in a subject area is as good as random——specifically, that it is not related to any unobserved changes in student outcomes across cohorts.

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 exposure of lower-income students to upper-income students in School A from after

[7] These averages represent students with financial aid data 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.

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

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 course, trends in exposure to upper-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 subject areas 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. I exclude any school subject areas that offered an AP course before 2012 (always-treated). Control (or comparison) school subject areas are defined as those in which no AP course was added during the observation period (2004-2022). Once a subject area within a school adds an AP course, it is considered treated in all subsequent years. For this iteration of the paper, I primarily focuses on AP courses, as they constitute the majority of advanced courses offered. This framework is represented in Equation 1:

$$Prophighincome_{isat(-i)} = \sum_{t=-11}^{10} \beta_t AdvancedSection_{sat} + \delta_{at} + \delta_{sa} + \epsilon_{isat} \quad (1)$$

where β_t captures the impact of adding an advanced course to subject area a in school s on lower-income students' exposure to upper-income classmates. $AdvancedSection_{sat}$ equals 1 from the year t that an AP course is introduced in the subject area, with all subsequent years considered treated. The primary outcome, $Prophighincome_{isat(-i)}$, is defined as the proportion of upper-income students in the classrooms of student i in subject area a of school s in year t, excluding student i's own income status. Equation 1 is estimated separately for upper- and lower-income students to assess differential impacts on each group's exposure to upper-income peers.

The model includes subject-year fixed effects, δ_{at}, which control for any time-varying changes in the proportion of upper-income students within a subject area, serving as the standard time fixed effect in a DiD model. I also incorporate school-subject fixed effects, δ_{sa}, to capture baseline differences in exposure to upper-income student in a school subject. All estimates are clustered at the school level.

The analysis includes seven subject areas where AP courses may be introduced: social studies, English language arts, science, math, foreign language, fine arts, and technology. The sample covers 4,635 school-subject areas across 1,339 schools, with 890 school-subject areas treated. The primary analysis is conducted at the student subject-area level, observing each student once in a subject-area per year (the outcome is based on the average proportion of upper-income students across classrooms in a subject-area).

To identify β_t 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 upper-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 quality, but acknowledge the potential for other unobserved confounding factors.

A concern with the traditional difference-in-difference design with variation in treatment timing is that treatment effects may be gradual and heterogeneous and so are not good 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 subject areas as the comparison group (stacked DID estimator). I then take the weighted average of those estimates.[9] This is an application of the DiD corrections suggested by Callaway and Sant'Anna (2021).

Table 9.2 summarizes the demographics of students in grades 11 and 12 within treated and control school subjects. The treated subjects enroll, on average, more students than control subjects (99 vs. 43 students), and they have a slightly higher proportion of upper-income students (26.0% vs. 24.5%).[10] The DiD identification strategy does not require treated and control school subjects to be identical, but rather that, in the absence of AP course addition, they would have exhibited similar trends.

5 Main Results

After the initial addition of an AP course, the number of AP courses in the subject area grows, reaching approximately 1.4 courses by the fourth year, as shown in Figure 1. 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 roughly 6 percentage points. Figure 2 illustrates the effect of the AP course addition on AP enrollment rates over time. Students with higher eighth-grade reading test scores are more likely to enroll in AP courses overall. As shown in Figure 4(a), lower-income students who scored in the bottom and top quintile of the grade 8 reading test are 3.8 and 10.6 percentage points more likely to enroll in an AP course following the addition of an AP course in the subject area.

[9]For now 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. In the future I will instead weight the estimates by the number of observations only.

[10]The student demographics in treated school subjects are based on years prior to treatment. The number of students served is based on the full sample of years 2011 to 2022 for both treated and control school subjects. A school can have both treated and control subjects.

The results indicate that adding an AP course raises 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. This increase in exposure unfolds gradually, stabilizing around the fourth year—coinciding with the stabilization of AP course offerings, as shown in Figure 2. The addition of an AP course raised the average proportion of higher-income classmates of lower-income students by 1.4 percentage points ($p < 0.001$). The increase in share of upper-income classmates following the addition of an AP course appears similar across students with different test scores, as shown in Figure 4(b) and Table 9.5.

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 5.

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. It is possible that AP courses are introduced alongside other changes—–such as a new principal or the arrival of an experienced teacher—that could also affect outcomes.[11] To address this concern, I include teacher-school-subject fixed effects to isolate the impact of AP course additions while accounting for teacher influence. The estimates remain consistent, though slightly smaller, with the inclusion of teacher fixed effects: following the addition of an AP course, lower-income students experience an increase of 1.1 percentage points ($p < 0.01$) in the share of upper-income peers. The continued positive impact of AP courses on the share of upper-income students, even when controlling for teacher effects, suggests that the estimates are not solely driven by changes in teacher quality.

6 Mechanisms

The increase in exposure to upper-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 upper-income students participating in the subject area, and (2) a gap change, whereby income-based sorting within the subject increases. I define sorting as the difference between the average proportion of upper-income classmates in upper- relative to lower-income students' classrooms in a subject area.[12]

[11] Following the addition of an AP course, students are 12 percentage points less likely to be taught by a "new teacher". The first year a teacher joins a school they are concerned new to the school in the data.

[12] 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. Here I look at the difference

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 9.6 Model (2), consistent with a composition change. Additionally, there is evidence of an increase in income-based sorting within the subject: the gap in the proportion of upper-income classmates between upper- and lower-income students widens by 0.7 percentage points, as shown in Table 9.6 Model (1). This suggests that, although income sorting intensifies after adding an AP course, the increase in the share of upper-income students in the subject area helps to offset this effect, resulting in an overall increase in cross-income exposure.

The increase in the proportion of upper-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 area on the share of upper-income students in the entire school. The results, shown in Table 9.8, indicate that following the introduction of an AP course in a subject area, the proportion of upper-income students enrolled in the school increased by 1.4 percentage points. This suggests that the rise in exposure to upper-income peers may be driven, at least in part, by a growing share of upper-income students choosing to enroll in the school.

One concern is that the observed increase in lower-income students' exposure to upper-income peers might result from a decline in the proportion of lower-income students enrolling in the subject area—i.e., upper-income students simply replacing lower-income students. However, I find no evidence of a decrease in lower-income student participation in the subject area following the addition of an AP course, as shown in Table 9.6, Model (3). Instead, it appears that higher-income students are replacing middle-income students, as the share of middle-income students in the subject area decreases by 1.4 percentage points after an AP course is added (Table 9.6, Model (4)). Additionally, the data suggest that the addition of an AP course increases the total number of students across income groups enrolled in the subject area, as shown in Table 9.7.

Adding an AP course appears to increase the total number of sections offered in the school subject area, as shown in Figure 8. This increase suggests that the AP course addition is not simply a rebranding of an existing section. However, it also raises the possibility that the change in exposure to upper-income students is driven by the increased number of sections and course options in the subject, rather than by the AP course's specific characteristics. To address this, future iterations of this study will compare the impact of AP course additions to that of other types of courses. Additionally, I will use simulation exercises to assess

in peer composition and do not include students' own income status.

how the increase in section numbers affects cross-income exposure, holding student composition constant.

7 Discussion and Conclusion

The strong link between exposure to higher-income peers and improved long-term outcomes, as documented in Chetty et al. (2022) and supported by the findings here, raises an important question: can school policies actively enhance such exposure? One feasible and commonly implemented policy lever is course offering. In high schools, where cross-income exposure is often greater due to larger and more diverse student bodies, course offerings—particularly AP courses—may serve as a meaningful tool for fostering economic diversity within classrooms.

This study examined the impact of adding AP courses in a specific subject area, finding that, following the introduction of an AP course, lower-income students experienced greater exposure to higher-income peers. The increase in exposure appears to result primarily from changes in student composition within the subject area, which counterbalance the heightened income-based sorting observed with AP course additions. Notably, the increase in cross-income exposure is concentrated in three subject areas: science, foreign language, and fine arts. Future research should explore the underlying reasons for this variation across subjects, as certain subjects may have unique characteristics or prerequisites that influence student enrollment patterns and the potential for mixed-income exposure.

A key limitation of this analysis is the possibility that other concurrent changes in the school or subject area could be contributing to the observed increase in exposure to higher-income peers. For example, the introduction of an AP course might coincide with improvements in school resources, teaching staff, or administrative changes that could independently affect classroom composition. Although pre-trend tests and the similarly positive impact when including teacher fixed effects provide some reassurance, future work could examine whether observable changes, such as funding shifts, systematically align with AP course additions and potentially drive the results.

In conclusion, the addition of AP courses in specific subject areas appears to be a viable approach for enhancing cross-income exposure in high schools, with potential implications for both educational equity and long-term economic outcomes. Future research should continue to investigate how school policies related to course offerings can be leveraged to maximize diversity and support positive student trajectories across socioeconomic backgrounds.

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9 Main Tables and Figures

Table 9.1: 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 9.2: Student Demographics by Subject-Area Treatment Status

Variable	Control	Treated
Higher-Income Students	.258	.27
	(.438)	(.444)
Lower-Income Students	.262	.311
	(.44)	(.463)
Hispanic Students	.389	.464
	(.488)	(.499)
Black Students	.096	.129
	(.295)	(.335)
White Students	.506	.385
	(.5)	(.487)
ESL Students	.034	.038
	(.181)	(.192)
Std. Reading Score G8	.175	.145
	(.791)	(.808)
Std. Math Score G8	.144	.138
	(.909)	(.922)
Missing Reading Score G8	.087	.091
	(.282)	(.288)
Missing Math Score G8	.092	.095
	(.289)	(.293)
Number of Students	576058	574738
Number of School Subject-Areas	3745	890
Number of Schools	1138	578

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

Table 9.3: School Course Offering and Demographic: By Subject Area

Subject	N. Courses	N. Classrooms	N. Stud	Prop HI	N. Schls
All					
Control	4.325	16.301	43.13	.245	1138
	(3.997)	(19.082)	(62.151)	(.191)	
Treated	6.561	31.658	98.543	.26	578
	(6.867)	(35.997)	(113.048)	(.219)	
English Language Arts					
Control	5.403	24.756	74.691	.242	381
	(2.397)	(23.552)	(107.549)	(.188)	
Treated	7.564	41.719	155.881	.238	73
	(4.141)	(34.467)	(179.228)	(.194)	
Math					
Control	4.324	16.555	53.409	.212	293
	(1.388)	(14.712)	(71.242)	(.184)	
Treated	4.569	24.016	90.889	.264	81
	(1.341)	(19.073)	(83.25)	(.206)	
Science					
Control	3.183	12.754	44.377	.221	384
	(1.201)	(12.02)	(59.634)	(.17)	
Treated	3.945	25.651	110.913	.25	124
	(1.458)	(24.704)	(116.865)	(.207)	
Social Studies					
Control	5.559	21.699	64.539	.252	417
	(1.587)	(16.201)	(55.559)	(.171)	
Treated	6.294	35.667	116.983	.265	100
	(1.67)	(28.68)	(93.811)	(.203)	
Foreign Language					
Control	2.824	12.55	30.858	.269	734
	(1.252)	(9.378)	(33.751)	(.171)	
Treated	5.305	32.936	96.388	.274	128
	(6.074)	(35.05)	(103.243)	(.214)	
Fine Arts					
Control	7.786	25.802	51.967	.233	793
	(6.659)	(27.87)	(64.253)	(.168)	
Treated	13.55	53.751	129.263	.243	208
	(9.694)	(48.291)	(119.333)	(.206)	
Technology Applications					
Control	1.456	4.233	12.924	.257	743
	(.709)	(3.824)	(22.668)	(.247)	
Treated	1.712	5.917	24.353	.284	176
	(.82)	(5.624)	(31.903)	(.264)	

Notes. This table summarizes the number of subject areas in each group: treatment and control. It summarizes the number of courses, classrooms and students on average, in a given year for students who enroll in each subject area. For treated subject-areas the average is based on pre-treatment years.

Table 9.4: Impact of Addition AP Course on AP Course Enrollment and Classroom Composition

	(1) AP Enrollment	(2) Proportion Upper-Income	(3) Total Upper-Income	(4) Total Students
Lower-Income Students				
Post AP Course Addition	0.0579	0.0138	0.177	0.281
	(0.00632)	(0.00306)	(0.156)	(0.621)
N Clusters	1320	1320	1320	1320
Upper-Income Students				
Post AP Course Addition	0.0609	0.00918	-0.0473	-0.321
	(0.00395)	(0.00415)	(0.420)	(1.083)
N Clusters	1276	1276	1276	1276

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 area. The estimates are based on coefficient $beta_t$ from equation 1 for each income group, but the outcome varies across models. Model (1) captures the impact on the likelihood of enrolling in an AP course. Model (2) captures the impact on a students' share of total classmates in a subject-area who are upper-income. Model (3) captures the impact on the total number of upper-income classmates in a subject area. Model (4) captures the impact on the total number of classmates a student has across courses taken that year in the subject-area. Standard errors in parentheses are clustered at the school-level.

Table 9.5: Impact of Addition AP Course on Lower-Income Students: By Test-Score

	(1) Q1: Bottom Test-Score	(2) Q2	(3) Q3	(4) Q4	(5) Q5: Top Test-Score
AP Course Enrollment					
Post AP Course Addition	0.0382	0.0468	0.0645	0.0844	0.106
	(0.00591)	(0.00526)	(0.00679)	(0.00878)	(0.0109)
N Clusters	1259	1245	1250	1238	1200
Proportion Upper-Income Classmates					
Post AP Course Addition	0.0128	0.0127	0.0171	0.0189	0.0112
	(0.00294)	(0.00310)	(0.00353)	(0.00368)	(0.00344)
N Clusters	1259	1245	1250	1238	1200

The table captures the impact of the addition of an AP course on students' AP course enrollment and share of higher-income classmates on lower-income students. Lower-income students are split into five subgroups based on the distribution of grade 8 reading test-scores. Students are placed in quartiles based on the distribution of all student test-scores independent of income. Standard errors in parentheses are clustered at the school-level.

Table 9.6: Impact of AP Course Addition on Subject-Area Composition

	(1) Income Sorting	(2) Proportion Upper-Income	(3) Proportion Lower-Income	(4) Proportion Middle-Income
Post AP Course Addition	0.00723	0.0159	-0.00185	-0.0140
	(0.00211)	(0.00339)	(0.00551)	(0.00564)
Mean	0.025	0.122	0.450	0.428
N Clusters	1281	1320	1320	1320

The table captures the impact of the addition of an AP course on the subject area composition. The reported mean is based on the outcome mean at $t-1$ for treated subject areas. All outcomes are based on the average in a given year in the school subject area weighted by the number of lower income students enrolled. In Model (1) the outcome is the difference between upper- and lower-income students in the share of upper-income classmates in a subject area. Model (2)-(4) capture the impact on the proportion of upper-, lower- and middle-income students enrolled in the subject area (each student is counted once). Standard errors in parentheses are clustered at the school-level.

Table 9.7: Impact of AP Course Addition on Number of Students Enrolled in Subject Area

	(1) Total Students	(2) Total Upper-Income	(3) Total Lower-Income	(4) Total Middle-Income
Post AP Course Addition	200.34	16.96	86.37	97.01
	(40.568)	(9.890)	(19.978)	(25.113)
Mean	1360.822	170.964	612.769	577.089
N Clusters	1320	1320	1320	1320

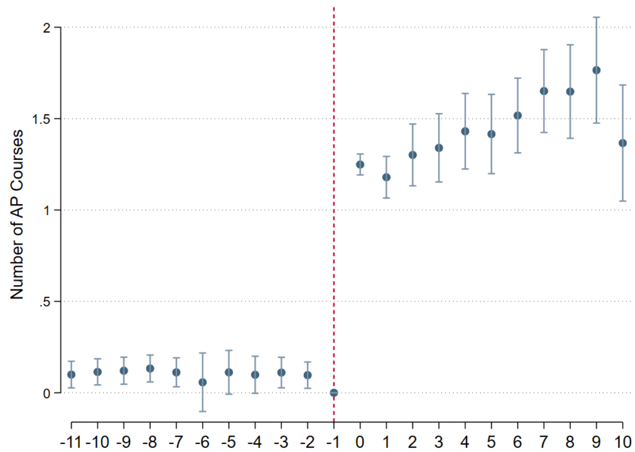
The table captures the impact of the addition of an AP course on the number of student enrollments in the subject area. The reported mean is based on the outcome mean at $t-1$ for treated subject areas. All outcomes are based on the average in a given year in the school subject area weighted by the number of lower income students enrolled. Models (1)-(4) capture the impact on the total number of enrollments of any student, upper-, lower- and middle-income students, respectively. A student is enrolled on average in two courses in a subject area in a given year. Standard errors in parentheses are clustered at the school-level.

Table 9.8: Impact of AP Course Addition on School Composition

	(1) Proportion Upper-Income	(2) Proportion Lower-Income	(3) Proportion Middle-Income
Post AP Course Addition	0.0141	-0.000784	-0.0133
	(0.00312)	(0.00511)	(0.00528)
Mean	0.122	0.452	0.426
N Clusters	1320	1320	1320

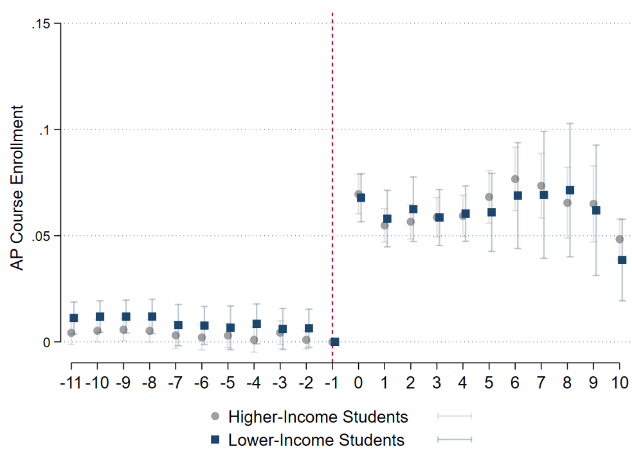
The table captures the impact of the addition of an AP course on the subject area composition. Estimates are weighted by the number of students enrolled. The reported mean is based on the outcome mean at $t-1$ for treated subject areas. All outcomes are based on the proportion of total students enrolled in each income group in a given year in the school weighted by the number of lower income students enrolled. Unlike in table 9.6 where the outcome is the proportion of students in a school subject area, in this table the outcome is the proportion of total students (G9-12) enrolled in a school.

Figure 1: Impact of AP Course Addition on the Number of AP Courses Offered in Subject-Area



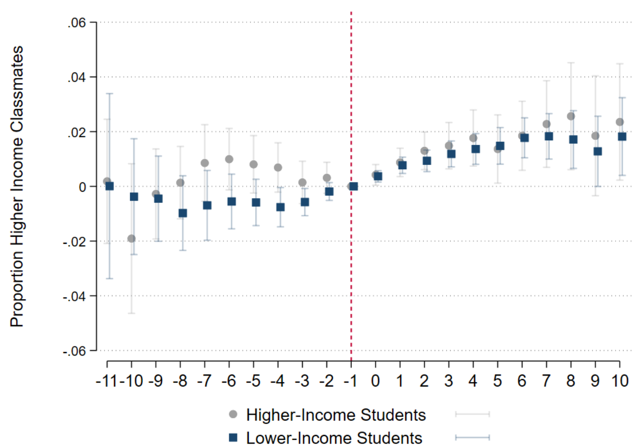
Notes: Plot captures the impact on the number of AP courses offered in a subject-area after an AP course is first added in $t = 0$. Average is weighted by the number of students enrolled. The 95% confidence is based on the standard errors of the coefficients from the regression, clustered at the school-level. The comparison school subject areas are those never treated.

Figure 2: Impact of AP Course Addition on the Likelihood of Enrolling in an AP Course



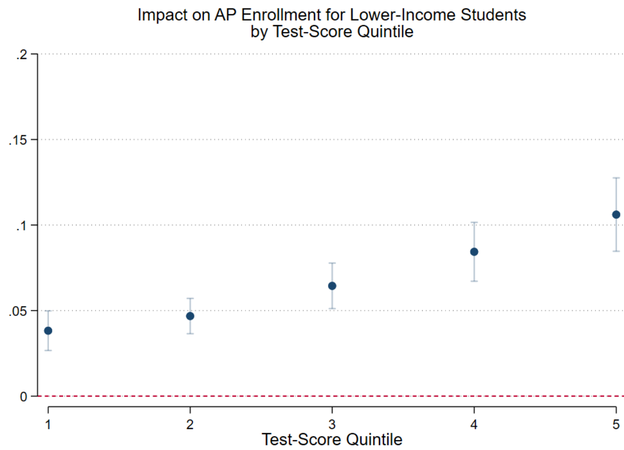
Notes: This event plot captures the impact of treatment on students' likelihood of enrolling in AP course. Plot is based on coefficients $beta_t$ from equation 1 for each income group with the outcome being a binary variable that takes on a value of 1 if a student is enrolled in any AP class in the subject area. 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 student subject-area enrollment. 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 3: Impact of AP Course Addition on Exposure to Higher-Income Students

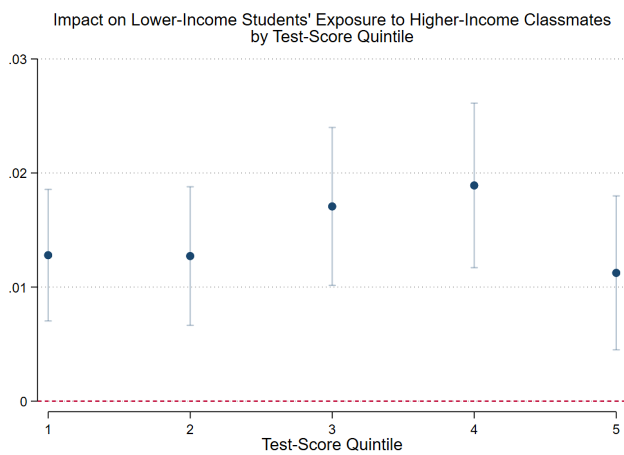


Notes: The event plot is similar to Figure 2 with the outcome being students' subject-area average proportion of higher-income classmates.

Figure 4: Impact of AP Course Addition on Lower-Income Students by Student G8 Test-Score



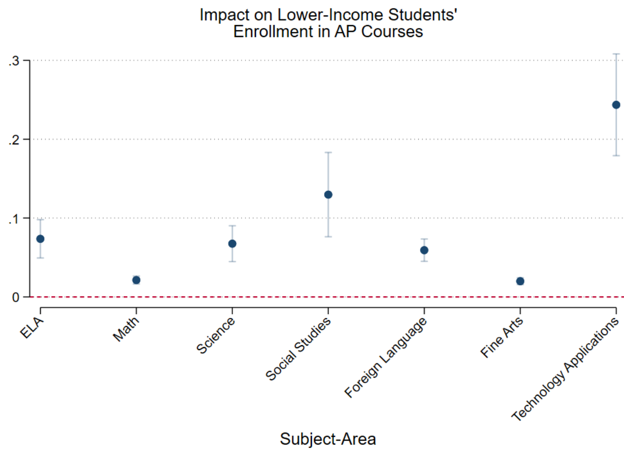
(a) Enrolled in AP Course



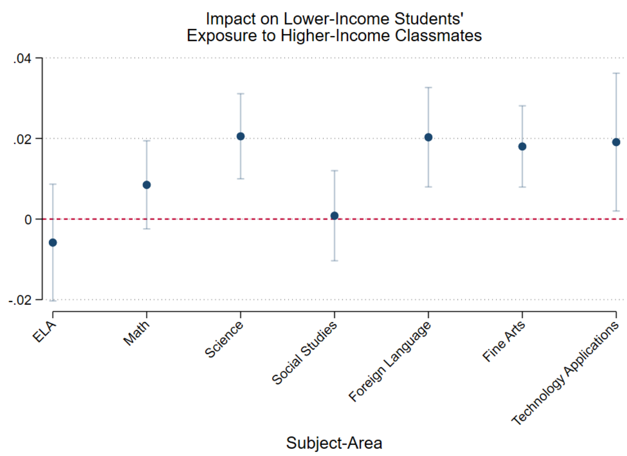
(b) Proportion Higher-Income students

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. Test-scores are based on grade 8 reading test-scores. Test-scores are missing for 8% of students.

Figure 5: Impact of AP Course Addition on Lower-Income Students by Subject-Area



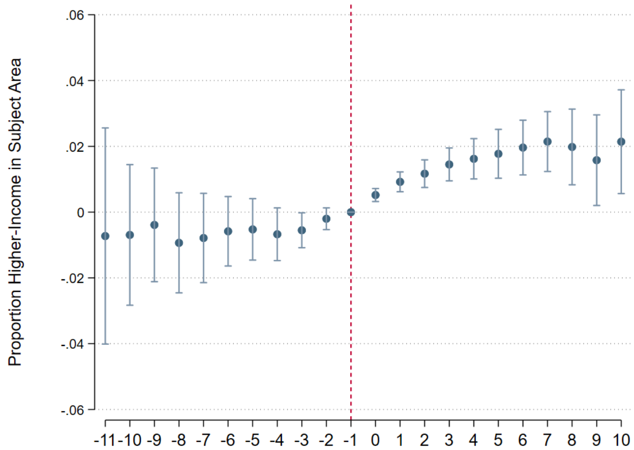
(a) Enrolled in AP Course



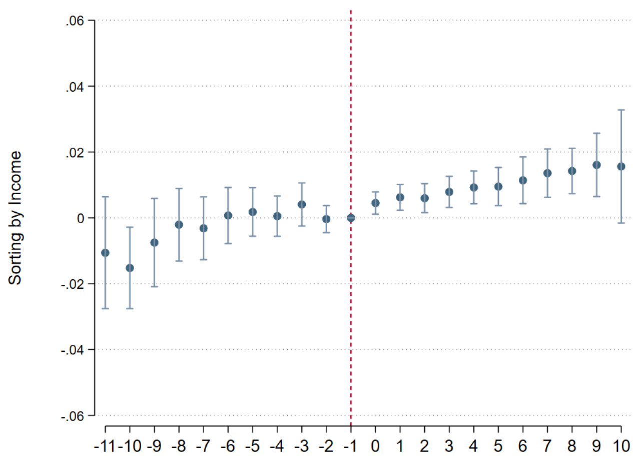
(b) Proportion Higher-Income students

Notes: The plots capture the overall average impact post-treatment for lower-income students in each 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.

Figure 6: Impact of the Addition of AP course on Subject Area Composition and Sorting by Income



(a) Proportion of Higher-Income Students



(b) Difference in Share of Higher-Income Peers Between Higher- and Lower-Income Students

Notes: Panel (a) outcome is the share of total classroom student enrollments in the subject area who are higher-income. Panel (b) outcome is the difference in the proportion of higher-income classmates in higher- relative to lower-income students' classrooms in a given year. Estimates are weighted by the number of lower-income students enrolled in the subject area in a given year. This number captures the change in the level of sorting by income between classrooms in a subject area across time. 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.

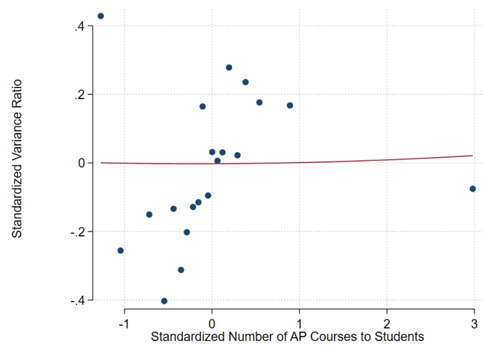
10 Appendix

Table 10.1: High School Student Demographics: 2019

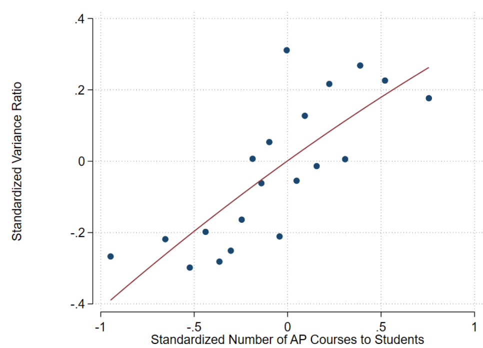
Variable	Mean
Black Students	.149
	(.356)
White Students	.305
	(.461)
Hispanic Students	.517
	(.5)
Title I School	.444
	(.497)
Free/Reduced Lunch Status (2019)	.542
	(.498)
Higher Income (Never on FRPL)	.253
	(.434)
Lower Income (Always on FRPL)	.28
	(.449)
Special Education	.089
	(.284)
Gifted Program	.096
	(.294)
English Language Learner	.158
	(.365)
Any Vocational Ed	.769
	(.421)
Enrolled in Charter School	.054
	(.225)
Number of Students	1542217

Notes. Table summarizes high school students' demographics 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.

Figure 7: Relationship between AP Courses to Students and Variance Ratio



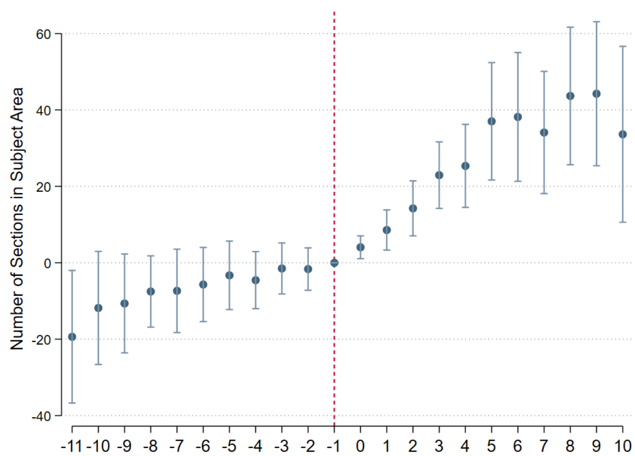
(a) Full Sample



(b) Excluding above 1 standard deviation AP courses to students and schools with no AP course offered

Notes: Based on 2019 high-school classroom enrollment data. Bins are based on grouping the x-values into 20 equal sized bins. It then computes the average y-variable value for that bin. Fitted line is weighted by the number of high-school students enrolled. Panel (a) plots the relationship between the number of AP courses to students and the full sample. Panel (b) limits the sample to schools offering at least one AP course, and below 1 standard deviations in terms of the number of AP courses they offer to students.

Figure 8: Number of Sections in Subject Area Post Treatment



Notes: These event plot capture the impact of treatment on the number of sections in subject-area. The outcome is weighted by the number of 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.