Putting the "A" in AP: The Effect of Advanced Placement State Policies on Student Participation and Performance[*]

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Abstract

Advanced courses prepare high school students for college material and the associated exams provide a low cost way to earn college credit. The College Board's Advanced Placement (AP) program is the most common in the United States, with about 40 percent of graduating seniors taking at least one AP exam in recent years. However, these opportunities are not equal across high school students due to variation in school offerings and potentially limiting exam fees. We examine the effects of two state-level policies designed to provide greater access to this program: the first mandates a minimum number of AP courses to be offered in each high school and the second waives exam fees for all students for at least one exam. Our event study and two-way fixed effect estimates suggest that that mandating the provision of AP courses raises the percent of high school graduates taking AP exams by 4 to 5 percentage points, while exam fee waivers increase participation by about 1.5 percentage points. At the same time, pass rates fell after implementation of the two policies, indicating that marginal exam takers are less proficient on the exams. We find both policies have minimal effects on the percent of graduates who passed at least one AP exam or on the number of passing exams per high school student.

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1   Introduction

Higher education has long been seen as a lever for improving economic inequality, as the returns to college are an important source of variation in lifetime earnings. This potential is limited, however, if students' economic or educational environments during high school curtail their opportunities for higher education. College costs are a commonly cited barrier for low-income students, with inflation adjusted tuition and fees at four-year public institutions more than doubling from 2000 through 2022. But as Dickert-Conlin and Rubinstein (2007) note, academic preparation is a second important barrier, as "income and socioeconomic status are also highly correlated with levels of preparation for college." Lower levels of college preparation can also lead to longer time to degree, increasing both the direct and opportunity costs of college for less prepared students.

One way high schools have addressed both preparation and cost issues is through advanced courses in high school. The College Board's Advanced Placement (AP) program is the most widespread of these programs, offering a standardized curriculum designed to mimic introductory college-level courses. The accompanying exams are optional, but high school students can earn college credit if their exam score is above the college or university designated threshold (typically a score of 3 or higher).[1] The price of an exam ($96 in 2022) is much lower than the typical cost of the equivalent college course. Smith, Hurwitz and Avery (2017) estimate that the potential savings associated with passing an AP exam is nearly $1,000 in the first year of college – a 10% reduction in the average cost for a year of college tuition. Further, AP course grades are often weighted more heavily in high school GPAs (Gollub et al. 2002; Geiser and Santelices 2004; Kolluri 2018), and high school GPAs, class ranks, and AP exam scores, further affect costs through admissions, scholarships, and merit aid.[2] The college level skills taught in high school may also enable former AP students

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[1] All AP exams are taken in the first two weeks of May. While AP exams are often seen as the "end goal" for most AP courses, students may enroll in AP courses without taking the AP exam. AP courses count towards high school graduation credit requirements regardless of exam taking in all states except North Carolina, where the exam is required for high school credit.

[2] Since course curriculum is designed to be universal, AP experience and performance conveys (in theory)

to complete more credits per semester in college, to take fewer repeat or remedial classes, and to decide on a major more quickly.

Not all students have these opportunities, as high schools vary in their AP course offerings. Prior research suggests that AP courses are more commonly offered in schools in urban areas (Gagnon and Mattingly, 2016), in districts with many high-achieving students (Iatarola, Conger and Long, 2011), and in areas where students are more likely to attend college (Dutkowsky, Evensky and Edmonds, 2009). Schools in rural areas, or with many low income, Black, or Hispanic students are less likely to offer AP courses(Klopfenstein, 2004).

Over the past several decades, a number of states have attempted to reduce these discrepancies in access by mandating that all districts or all schools in the state offer AP courses. A second set of states fully fund exam fees for all students in the state for at least one exam. Did these policies increase the number of students who potentially earned college credit while in high school? In this paper, we examine the effects of state AP course mandates and universal AP exam fee waivers on the percentage of high school students taking and passing AP exams.[3] We also examine the effects of these policies by race to see if groups with historically lower participation rates are deferentially affected. We use an event study design and difference-in-differences strategy, using the differential timing of policy passage and the states without policies to represent the counterfactual.

For states that mandate AP course offerings, there is an average 4-5 percentage point increase in the percent of high school graduates who took at least one AP exam over the course of their high school career – a sizeable effect relative to the period average of 24 percent of high school graduates who took at least one exam. The effect of fee waivers is also positive although about half as large. Fee waivers also increase the intensity of AP exam participation, significantly increasing both the fraction of students taking exams in a given year and the number of exams taken per student. While most racial or ethnic subgroups

more information about a student's abilities than experience in non-standardized courses do Klopfenstein (2004).

[3] While we do not have data on AP course enrollment, as noted, college credits are obtained only through passing scores.

show increases in participation, the effects relative to the mean are largest for Black students.

Does this increased exam taking lead to more exams scoring high enough to earn college credit? Implementing the two policies reduces exam pass rates by about 4 percentage points on average, implying that the marginal exams induced by the policies tend to scoring below the usual cutoff for college credit. Event studies show generally positive effects on the percentage of high school graduates with at least one passing exam, but the TWFE results show no significant increases in passing exams when including state specific time trends.

Additional specifications add nuance and detail to these findings. Callaway and Sant'Anna (2021) estimates of heterogeneous impacts across states show much larger effects in states with stronger policies. Specifications that separate district and school mandates indicate that school level mandates drive the results. The results are similar when controlling for policies that allow for dual college enrollment course options as an alternative, further suggesting that the effects are specific to the AP policies and not state attitudes towards advanced course preparation in general.

2 Policy Background

Advanced coursework options have expanded rapidly in the United States. These programs include Advanced Placement (AP), International Baccalaureate (IB), Cambridge International Exam (CIE), and dual enrollment or concurrent enrollment programs that award both college and high school credits for a single course. The AP program is the most widespread of these programs in the United States.

Data on AP course availability by high school is not publicly available, but the AP program does report the number of schools with at least one enrolled student who took an exam. Figure 1 shows the rise in the percentage of high schools with exam-taking students. In 2000, less 60 percent of high schools had students who took an AP exam.[4] By 2018-19, the

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[4]The steep rise from 2014 to 2015 is partly due to reporting changes. Students can take subject exams even if they are not administered at their school. If a student enrolled in High School A took a subject exam

College Board reported exam-taking students at 87 percent of high schools – almost 22,000 schools of the more than 26,000 total.[5] Student level participation also increased rapidly. Figure 2 shows the rise in the percentage of public high school graduates and students taking at least one AP exam. In 2000, 15 percent of the graduating class of public school students took at least one AP exam, rising to nearly 40 percent in 2019.

Participation across subject areas and demographic groups remains uneven. Although 87 percent of schools reported an exam-taking student, in the two most popular subjects – AB Calculus and English Literature – less than half of high schools had at least one student who took the respective exam. The implication is that either many schools offer only one AP course (say, either AB Calculus or English Literature) or that many schools reporting AP exam-taking students did not offer the coursework and exams at their own school site and that those students took the exams independently. Figure 3 shows that while more than 40 percent of Asian high schools students took AP exams in 2018-19, the rate was less than half of that for White and Hispanic students, and less than 10 percent of Black high school students took exams. Fazlul, Jones and Smith (2021) show that part of this disparity is related to lower exam-taking rates of Black and Hispanic students who enroll in AP courses, perhaps due to exam fees.

The potential ramifications of these discrepancies are underscored by a growing body of literature finding that advanced coursework in high school affects post-secondary outcomes. Using raw score data from the College Board, Smith, Hurwitz and Avery (2017) find that AP credit increases college graduation: students who barely obtain a passing score are more likely to graduate than students who just miss the cutoff for a passing score. Similarly, Evans (2019) finds AP credits are associated with reduced time to degree and double majors. Further, subject access and exam performance affects college choices. Conger et al. (2021) shows that course access increases the likelihood of choosing a STEM major, and Gurantz

(2021) finds that majoring in STEM is positively related to having passed an STEM AP exam. However, Owens (2023) concludes that a marginal increase in the number of AP courses a school offers only have positive (and small) effects for the most able students.

We examine two policies designed to increase access to the AP program: course mandates and fee waivers. In 1985, South Carolina was the first state to mandate the provision of AP courses in all high schools. Table 1 shows that several other states enacted similar mandates between 2005 and 2013 at either the school or district level. The policies vary in their details, with some requiring a minimum number of AP classes (e.g., Arkansas and Louisiana) and others requiring specific subjects (e.g., Indiana). For example, Louisiana's policy states "Each high school shall provide students access to at least one advanced placement (AP) or international baccalaureate (IB) courses in each of four content areas and one additional AP or IB course" in order to "provide students with more opportunities to take rigorous courses that have been shown to increase students' chances of succeeding in college."[6] As Table 1 shows, a number of other states have more general advanced course mandates, which may include AP, IB, CIE programs, as well as dual enrollment courses.[7] These broader policies are explored in the extensions to the main analysis.

Our specific focus is on how these broad based AP course mandates affect the fraction of students taking the exams and scoring high enough to receive college credit. Previous research has examined the effect of AP course expansions in narrower contexts. Jackson (2010) and Jackson (2014) studied the Advanced Placement Incentive Program (APIP), which provided monetary incentives for underprivileged students in Texas to take and pass AP exams. The program significantly reduced (but did not eliminate) the cost of exams for all students.[8] The program increased the number of students taking AP courses, with

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[6]Lousiana's statue is found here. Note that some mandates require either AP *or* IB courses, but in practice, less than 5 percent of high schools in the US offer the IB program. For more information, see IB Programme 2016.

[7]Dual enrollment courses are typically offered at local community colleges and allow students to take college courses while still in high school.

[8]Importantly, students not only had to pass an AP exam, they also had to attend the corresponding AP course as well.

the largest increases among Black and Hispanic students. However, the targeted schools in this expansion were provided with substantial supports and resources that go beyond the typical statewide mandates we analyze in this study. These studies showed that pass rates on AP exams were significantly boosted by funds for teacher training, pre-AP curriculum coordination, and cash incentives to teachers and students for passing scores, suggesting that many students who might pass exams will not in the absence of these kinds of supports.

Other studies have identified more muted effects. Owens (2023) found that when high schools in Michigan offered an additional AP course, AP enrollment only increased by 10 students, but these expansions could also have been for less popular courses at schools already offering core subject rather than the introduction of AP classes at previously non-participating schools. Conger et al. (2021) recruited 23 schools that had previously not offered AP science courses and randomly assigned eligible students to receive enrollment offers. They find that treated students were significantly more likely to enroll in AP science courses, consistent with a growing literature on the effects of "nudges" into advanced course curriculum (i.e., Austin et al. 2022, Daly 2019). However, only 6 percent of the enrolled students took the corresponding exam and scored high enough to receive college credit. Furthermore, rather than expanding access to selective colleges, the policy had the opposite effect, as treatment group students were significantly less likely to enroll in selective college than were control group students (Conger, Long and McGhee 2023). Conger et al. (2021) also found that the course-takers reported higher levels of stress and lower confidence in their ability to succeed in college science.

Part of the reason exam take up rates may be low is that high exam fees may dissuade students. The second policy we consider waives exam fees for at least one exam for all students. Table 2 lists states that have provisions to pay exam fees for all students, with variation in how many exams fees are waived. Four of the eleven states also have course mandates.

Universal fee waivers might have minimal effects if credit constrained students already

had access to other mechanisms to reduce the fees. The AP program does partially subsidizes exam fees for low income students. The subsidies, paid for jointly by both schools and the College Board, reduce the cost of an exam by about 40 percent, resulting in an exam fee of $53 in 2022. The federal No Child Left Behind act in 2002 also provided the option for states to apply for federal grants for need-based fee waivers, and 35 states received grants. These funds were no longer available after the Every Student Succeeds Act of 2015, although some districts continued to fund some low-income students.

To our knowledge, only Fazlul, Jones and Smith (2021) examines an AP fee waiver policy, finding that individual district programs in Georgia that pay for exams increased exam taking of low-income students. Other related literature looks at cost reductions for college entrance exams like the SAT or ACT. Several studies examine the impact of policies that pay for additional "score sends" to colleges (e.g., Hurwitz et al. 2017; Pallais 2015) and find positive effects on the college choices of students, particularly for lower-income students. Hyman (2017) and Dettling, Goodman and Smith (2018) examine state policies that waive exam fees for the SAT or ACT college entrance exams, finding increases in the numbers of low income students with college ready scores and an overall increase in college enrollment. Dettling, Goodman and Smith (2018) notes that the increase in enrollment could come from eliminating the fee, but it also could reflect greater convenience from taking tests during normal school hours or a reduction in the logistics of applying to college. Importantly, many states also required all students to take ACT or SAT. These considerations would not necessarily apply to the AP fee waiver policies.

3 Data

The primary data come from College Board reports of yearly state-level exams taken between 2000 to 2019. We exclude the 2020 and later exams as COVID significantly affected the landscape of exam taking.[9]   These data include the number of public school graduating

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[9]As of 2021, the College Board no longer reports exam taking by race.

seniors who took at least one exam over the course of their high school career and the number of public school graduating seniors who scored a 3 or higher on at least one exam (the typical threshold for college credit). The data for graduating seniors is not available by race or for participation in specific subjects, nor does it provide the cumulative number of exams taken by individual students. Instead, we use the number of candidates (i.e., students who took at least one AP exam) and AP exams in each individual year to estimate effects on the number of exams taken by candidates and for results by racial subgroups and by subject.[10]

State policy variables are constructed from state legislative documents, with the Education Commission of the States report on AP policies in 2016 as an initial starting point (Zinth 2016). We match AP program polices to the exam year in which the policy takes effect. For example, a policy that is effective starting in September 2014 would be first identified with the exams administered in May 2015. The coding of state policies is provided in Tables 1 and 2 with more details in Appendix Tables A1 and A2.

Additional time-varying state control variables include public school expenditures per pupil, average teacher salaries, the level of urbanization, median household income, the unemployment rate, and high school enrollment for each racial and ethnic subgroup.[11] Regression analyses are performed on balanced panels containing all states plus the District of Columbia (DC).[12]

Table 3 and Table 4 report the average characteristics of states that never passed these policies in the first column and states that ever passed a specified policy in the second column. These characteristics are measured in 2000 at the start of the panel and in 2019 at the end of the panel. Many of the mean characteristics are similar across adopting and

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[10]Data is available on the number of public high school graduating seniors from 2000 through 2019. Data on the number of candidates and exams in each individual year is only available from 2001 through 2019. We include data from 2000 when available. Results are consistent when we exclude data from 2000 on the number of public high school graduating seniors taking and/or passing AP exams.

[11]In 2000, Idaho and New Jersey data did not meet NCES reporting standards and were excluded from the NCES data collection. We imputed the values in these states using a backward linear prediction from the subsequent three years. Results are similar if these instances are excluded from the set of controls.

[12]For brevity, we refer to states throughout inclusive of DC.

non-adopting states, including the number of students enrolled in high school, the number of high schools (and therefore the average high school size), average teacher salaries, and the percentage rural. The primary statistically significant differences are that states with AP course mandates and/or fee waivers have a higher fraction of Black students and lower household incomes.

Figure 4 provides an initial look at the raw data for AP participation in adopting and non-adopting states over time. The figures plot the percentage of public high school graduates who took at least one AP exam. Each row in the figure is an individual state and each dot is an annual observation. Blue dots indicate periods without a given policy in effect. The panel on the left has red dots for the observations where an AP course mandate was in effect, the panel on the right has red dots for the observations with universal exam fee waivers. The figures are arranged with states with the highest average rates overall at the top and the lowest at the bottom. Note that because South Carolina had a course mandate the entire period, all of its observations are red dots.

The figures point to several patterns. First, the states that adopted these policies had initial test participation rates that ranged throughout the distribution; the policies were not more common in either the highest or the lowest participating states. Second, policy adoption is correlated with higher participation: in nearly every case, the red dots are to the right of the blue dots. While this is likely partly due to rising rates in all states over time, it is also apparent that policy adoption is associated with particularly rapid increases in participation rates in a number of states.

4 Empirical Strategy

We estimate the average impact of AP program policies on students' participation in and performance on AP exams, with both an event study and difference-in-difference frameworks, exploiting the timing of policy changes across states. The baseline difference-in-difference

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estimating equation is:

$$Y_{st} = \psi + \alpha \text{ AP Mandate}_{st} + \beta \text{ AP Funding}_{st} + \pi\mathbf{X}_{st} + \theta_t + \lambda_s + \nu_s t + \epsilon_{st} \quad (1)$$

where s indexes states and t indexes years. The indicator variables, $AP\ Mandate_{st}$ and $AP\ Funding_{st}$, indicate whether a state has an AP course mandate or AP fee waiver policy in operation in time t. $\mathbf{X}_{st}$ is a vector of time-varying state-level characteristics that may affect the outcome, including the percentage of high schools located in rural areas, the racial composition of public high schools, average teacher salary, state school expenditures per pupil, median household income, and state unemployment rates.

The analysis first examines impacts on both the extensive margin of participation (measured as the percentage high school graduates taking at least one AP exam over the course of their high school career), as well as the intensive margin (the fraction of students who were AP candidates in any given year and the number of exams taken per 100 high school students). Second, we examine pass rates, the percent of high school graduates who pass at least one AP exam over their high school career, and the number of passing exams per 100 high school students. Where the outcome variables are measured as percentages, average marginal effects are estimated using a fractional Probit model as recommended by Wooldridge (2023).

The state fixed effects (λ_s) control for any permanent differences between states such as overall attitudes towards college, while the year fixed effects (θ_t) capture any time-varying shocks common to all states such as changes in the difficulty of AP exams. To account for any potential correlation of error terms within a state over time, we cluster our standard errors at the state level (Bertrand, Duflo and Mullainathan 2004; Abadie et al. 2022).

Equation 1 relies on a two-way fixed effects (TWFE) approach that compares the changes in outcomes of states with AP program policies to changes in states that have yet to implement a policy, have already implemented, or never enact an AP program policy. In such

models, the main identifying assumption for causality is that, conditional on the control variables used, states that have not yet or never will enact an AP program policy serve as a valid counterfactual group for states that have already implemented the policy. This implies that the evolution of the outcomes in the "control" states should parallel the evolution of the outcomes in the "treated" states were they not to have been treated. In other words, the average differences between policy and non-policy states would have remained constant over time. Although the parallel trends assumption is fundamentally untestable since the potential outcomes for treated states in the absence of treatment are never observed, we explore the plausibility of this assumption in several ways.

The parallel trend assumption implies that there are no other unobserved changes in states that occur at the same time as the policy changes. To provide support for this assumption, the previous section compared the average observed characteristics of states that eventually adopt or never adopt the policies in the initial year to confirm that adopting and non-adopting states were not fundamentally different in observable ways. If they had differed, this might have suggested large unobservable differences as well. To further account for any state differences, we report results both with and without the control variables to account for demographic and school funding changes. If including control variables changes the results in substantive ways, this suggests that the policy implementation differs by state attributes, which undermines a causal interpretation. We also report results from specifications that include state specific time-trends, $(\nu_s t)$ to capture any underlying differences in state trends between treatment and control states. The final section of the analysis also reports additional estimates that include a set of other related state policies that might be similarly related to different trends in AP exam taking or might reflect unobserved state attributes that led to policy adoption.

An alternative approach is to use an event study framework to ascertain whether there is evidence of preexisting trends prior to policy enactment. A simple representation of this estimating equation is:

$$Y_{st} = \sum_{\substack{\tau=-4 \\ \tau \neq -1}}^{4} \alpha_\tau \text{ AP Mandate}_{s\tau} + \sum_{\substack{\tau=-4 \\ \tau \neq -1}}^{4} \beta_\tau \text{ AP Fee Waiver}_{s\tau} + \pi \mathbf{X}_{st} + \theta_t + \lambda_s + \epsilon_{st} \qquad (2)$$

where all variables are defined as in in Equation (1), but here α_τ and β_τ are vectors of coefficients for individual years prior to and subsequent to a policy change. The omitted year, $\tau = -1$, corresponds to the year prior to a state enacting an AP policy. Thus, $\tau = 0$ corresponds to the first year a state policy is in effect. The α_τ and β_τ trace out the outcome of interest for states that eventually enact an AP program policy relative. If the pre-treatment α_τ and β_τ terms indicate the existence of a trend in the years prior to the policy enactment, this casts significant doubt on the plausibility of the parallel trend assumption. This approach also allows us to examine whether there are any anticipatory effects, for example from the announcement of a policy to take effect at a later date.

The recent literature on two-way fixed effect (TWFE) models shows that variation in treatment timing can bias estimates of the treatment effect if the counterfactual group relies on the comparison between early treated states and late treated states (Callaway and Sant'Anna 2021; De Chaisemartin and d'Haultfoeuille 2020; Goodman-Bacon 2021). To account for this, we report the alternative event study specifications proposed by Callaway and Sant'Anna (2021), where the comparison of treated states is restricted to only states that never pass an AP program policy or are not yet treated.[13] These also track the evolution of the outcomes before and after the policy enactment. The Callaway and Sant'Anna (2021) event study approach also explicitly accounts for heterogeneity in the effects of the policy across states as well as the heterogeneity across time. This is particularly useful in this case, as we can examine whether the larger effects appear in states with more stringent policies. Given the small number of treatment states and changes within states in policy features over time, we do not attempt to also explicitly model specific program features other than

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[13]Results are consistent when using a comparison group that consists of only non-treated states.

school vs district mandates. Instead, we use the Callaway and Sant'Anna (2021) estimates for specific states as a check on the plausibility of the results.

5 Results

5.1 Baseline Results: Event Study and Two-Way Fixed Effects

Table 5 presents the baseline two-way fixed effect estimates of the effect of the two state AP policies on the percentage of public high school graduates in a state who took at least one AP exam during high school. While we cannot examine student enrollment in AP classes, this outcome indicates the fraction who potentially could earn college credit. The results in Column (1) (excluding control variables) and (2) (with controls included) are nearly identical, with course mandates associated with 8 percentage points more graduates taking exams. The similarity of the estimates in Columns (1) and (2) suggests that the observed state characteristics are not associated with passage of a law. Column (3) reports results with state specific time trends included. Once these trends are included, the estimated marginal effect of the course mandate is about half as large, with a 4-5 percentage point increase in participation. This is still a sizeable effect, given that on average over the period, 24 percent of graduating seniors took at least one AP exam. Fee waiver policies have smaller effects, increasing the percentage of exam takers by about 1.5 percentage points.[14]

The corresponding event study specifications for the percentage of graduates who took at least one AP exam are shown in Figure 5. The top panel plots coefficient estimates of the effect of an eventual AP course mandate policy in the years prior to and after passage; the bottom panel repeats this for the AP fee waiver funding policy coefficients.[15] The event study results show that the leading years generally have coefficients that are not statistically

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[14]The pattern of results was also similar when we included the two policies one at time, as well as when we include an indicator for states that adopted both policies. These results are included in the online supplemental tables.

[15]Note that leads and lags of both policies are included in each regression.

different from zero, although the mandate states do exhibit an upward trend in the pre-policy period. This is consistent with the difference in the results in Table 5 for the specifications with and without state specific time trends. The average effect in the post treatment period is consistent with the TWFE estimates, with about a 5 percent point increase in the percentage of seniors who took an exam with a course mandate, but a smaller increase from the fee waivers. The fee waiver event study figures show less evidence of trends in the years leading up to policy implementation.

Figure 6 displays estimates from the methodology proposed by Callaway and Sant'Anna (2021) for individual treated states (again excluding South Carolina as they were treated throughout the entire period). The pattern of state specific effects in this figure appears to be related to the strength of the individual state policies. The mandate states with the largest effects – Louisiana, the District of Columbia, and Arkansas – all require schools to offer 4 or more AP classes. Indiana (with a smaller estimated coefficient) only requires two courses be offered. West Virginia allows schools to meet the requirement through providing access to online programming, which may be less effective than an in-person cohort. Fee waiver effects are more uniform across states, with the smallest effects in Idaho and Georgia. Both enacted their fee waiver policies close to the end of the panel, and Idaho's law provides a set amount of funding to use towards fees rather than a set number of exam fees that can be waived. Georgia also has a negligible estimated effect, and the state policy only provides funding for students to take one STEM exam. [16]

In addition to these impacts on the extensive margin, do students participate more intensively as well, taking more AP exams across years or more exams at a time? Panel A of Table 6 reports the average marginal effect on the ratio of AP candidates to the number of public high school students in a given year. This fraction will be higher if either more unique students participate or if students take exams in multiple high school years. Excluding time trends, the mandate is estimated to have a 3 percentage point increase in

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[16]Online supplemental materials include the overall CS event study figures.

overall participation, but with time trends this effect is no longer statistically significant. However, AP funding policies are significantly associated with higher annual participation rates. Panel B reports results for the average number of exams taken per 100 high school students. Both policies have positive effects, with funding policies associated with about 2 more exams taken per 100 students, relative to the sample mean of about 20 exams per 100 students. The coefficient estimates for the AP mandates are less precisely estimated and are generally not statistically significant. Together, the results imply that the mandates increase the likelihood any given student will take an AP exam, but state policies that pay exam fees have a stronger relationship with taking more exams across more years of high school and more exams in a given year.

Does this increase in participation translate into more individual students receiving college credit, and/or more college credits per student? Panel A of Table 7 reports the estimated effects on the fraction of graduating public high school students who scored a 3 or higher on at least one AP exam, and Panel B shows the number of exams scoring a 3 or higher per 100 students in a given year. Columns (1) and (2) show that course mandates are associated with about a 2.5 percent increase in the percentage of students who pass at least one exam, but neither panel shows consistent impacts of either funding or mandates once state specific time trends are included (Column 3). The event study specifications in Figure 7 show modest positive effects. The estimates using the methodology proposed by Callaway and Sant'Anna (2021) for individual states are reported in online supplemental material 8.

Although more students participated in the AP exams, it appears that the marginal participants were less likely to pass exams, leading to minimal impacts on the number of passing exams. This is consistent with the results for exam pass rates. In Table 8 shows that both fee waiver policies and course mandates reduced pass rates, with the clearest effects stemming from the fee waivers, which were the policy to have the largest impacts on the intensive margin. The lower pass rates could be consistent with a pattern where low-performing students are more likely to take the exams when the state is bearing the exam

fee costs.

5.2 Variation in policy impacts across racial and ethnic groups

As noted in the Introduction, AP participation varies widely across income and racial and ethnic groups. The results thus far suggest that both limited offerings at the school level and exam fees may be barriers to participation. The College Board data does not include information about students' family incomes but reports do include separate results for major racial and ethnic groups.[17] Table 9 reports effects on the percentage of all high schools students taking AP exams in a given year and the number of exams taken per 100 students of the major racial and ethnic groups.[18]

The results indicate several general patterns. First, AP course mandates led to fairly similar increases in the percentage of high school students taking exams, ranging from a 2 to 3 percentage point increase when estimated without state specific time trends, and about 2 percentage points when including these trends. This percentage point increase is relative to much more variation in the mean participation rates in the AP program across these demographic groups. The average participation for Black students was about 4 percent during this period, and so the two percentage point increase represents a nearly 50 percent increase relative to the mean. In contrast, the 3.6 percentage point rise in participation for Asian students is about 16 percent of the mean for this group. Course mandates also increased the number of exams taken for students of all racial and ethnic groups.

Fee waiver policies increased the percentage of Asian and White students taking exams, and the largest effect on the number of exams per student was for Asian and White students. This result may appear surprising, given the relatively higher family incomes of these groups. However, given the availability of partial fee waivers for low-income students, the impact of universal waivers reflects the higher uptake among more affluent students when fee waiver

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[17]Racial/ethnic groups are reported by the student but the classification system changed in 2015. For the sake of comparison across years, data is pooled based on the classification set forth by the NCES.

[18]Separate results for high school graduates by racial or ethnic group are not provided.

policies are universal. As in the aggregate, we find no systematic effects on the number of passing exams per 100 students for specific racial or ethnic groups (reported in online supplemental tables).

5.3   Comparison with alternative policies

To this point, we have focused on policies that are clearly defined, consistent across states, and adopted by several states at different points in time. However, there is a continuum in terms of state policy intensity. This means that the "treated" states can have tighter or looser constraints, and the "control" states may have other policies that might also increase AP exam taking. We consider three such policy variants here: mandates that bind on either the school or district level, advanced course mandates can be met with non-AP courses, and states that had both a mandate and fee waiver policy in place at the same time. These policies are interesting in their own right. Additionally, examining a range of policies allows us to further probe for the potential endogeneity of policy introduction. If enacting some kind of advanced course policy is mostly reflective of state preferences for college or of overall interest in the AP program, we might expect to see similar effects for various policies regardless of the details.

First, consider the level of the mandate. In the preceding analysis, the policy indicator was equal to one only for states with school level mandates, but reported in 1, a number of additional states have mandates at the district level. The estimates reported in column 2 of Table 10 show, not surprisingly, that the effects on both candidates and the number of exams per 100 students is much larger in states where AP courses are required in each high school than in states where the requirement is at the district level. District level policies have no significant effect in these specifications.

Next, we consider the effects of other state advanced course mandates as a way to check whether our results may be driven by policy endogeneity. The College Board AP exams are not the only options for receiving college credit in high school. The International Bac-

calaureate and the Cambridge International are less common advanced course programs but their exams are accepted by most colleges and universities. Most states allow these as alternative ways to satisfy the AP course mandate. Because these programs are relatively small compared to the AP program, we included states that allowed for these options in our classification of mandate states in the preceding analysis.

The more common alternative for receiving college credit in high school is a dual enrollment program where students earn college and high school credit for courses taken in conjunction with a partnering institution (typically a local community college). In several states, the advanced course mandates allows for a dual enrollment programs to meet the requirement. If these broader policies also affect the AP exam taking, it raises the concern that the changes in exam taking are driven by whatever state factors influence policy adoption, rather than reflecting a causal effect of the AP specific policies. Column 3 of Table 10 repeats the main specifications with an additional policy indicator for states that include dual enrollment options. Reassuringly, we find that these more general mandates do not substantively affect the coefficients on the mandate or fee waiver policies, and that the broader advanced course options have no significant impact on AP participation.

6   Conclusion

From the early 2000s through 2019, participation in the College Board's Advanced Placement program expanded rapidly. By the end of the period, nearly 40 percent of all high school graduating seniors were taking at least one AP exam at some point during high school. Students who score high enough on the exams can earn college credit, which previous research has found can reduce college costs, improve the selectivity of the institution attended, and influences college major choices. However, concerns have been raised about whether all high school students have equal access to these opportunities, particularly because high schools vary in their offerings and fees may dissuade exam taking.

A number of states and the District of Columbia have passed legislation to address this issue, either by requiring that AP courses be offered or by waiving AP exam fees for one or more exams for all students (or both). Federal legislation that would expand course access has also been introduced, although as of 2023 Congress had not yet passed the proposed bills [19]

This study examines the impact of mandating a specific number of AP courses and universal exam fee waivers. Outcomes include the percentage of graduating seniors in public schools who took at least one exam during high school, the number of exams per 100 students, and on passing exam scores. The analysis uses the differential timing of policy adoption in both difference-in-difference and event study approaches.

The most conservative estimates show that course mandates increased the percentage of graduating seniors who took at least one AP exam at some point during high school by 4 to 5 percentage points. This is a substantial increase compared to the average of 24 percent participation during the sample period. Fee waivers increased participation by 1 to 2 percentage points, but had larger effects than the mandates at the intensive margin (the number of exams per high school student and the fraction of students taking exams annually). Results are robust to several different estimation approaches and are largely unaffected by including other policy indicators for related (but less stringent) policies. All racial and ethnic subgroups show positive effects of the course mandates, with the largest percentage point increases for White and Asian students. However, the participation increase relative to the mean is largest for Black students. Universal fee waivers have larger affects on White and Asian students, who on average come from families with higher household income. The smaller effects of fee waivers for Black and Hispanic students could be due to the College Board policy of reducing exam fees for low-income students.

In spite of the increases in exam taking, the two policies have minimal effects on the percentage of graduating students who passed at least one AP exam or on the number of

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[19] The "Advanced Coursework Equity Act" has been proposed in several sessions, most recently in November of 2023. The text of the bill can be found here.

passing exams per 100 students. Both policies reduce the overall exam pass rate, implying that most of the higher scoring students were already taking exams prior to mandates or the universal fee waivers.

It is worth noting that such policies may have other benefits or costs. To the degree that advanced coursework improves student learning independent of exam performance, as found in Conger et al. (2021), our findings understate potential benefits of expanded AP courses. Arce-Trigatti (2018) also finds the Arkansas policy increased high school graduation rates in affected schools, although impacts were also related to across-school sorting. However, it is worth noting the other potential costs. AP courses have been found to displace offerings like career and technical education (Arce-Trigatti 2018), and marginal participants have been found to experience negative effects on grades in other classes, confidence, stress, and other class grades (Conger et al. 2021).

Research on more intensive and targeted interventions has found that the number of students with passing AP exam scores can increase when additional resources and incentives are provided to both teachers and students (Jackson 2010). Our study suggests that without these supports, broad based policies that simply require schools to offer more AP courses or to waive exam fees will not lead more students to earn college credit, while imposing financial costs on states.

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Tables

Table 1: Classification of State Policies Mandating Advanced Courses – Includes Policies Related to AP, IB, and Dual Enrollment/Credit and Other Programs

State/District	All High Schools Must Offer AP Courses	All Districts Must Offer AP Courses	All High Schools Must Offer AP/IB/Cambridge Courses	All Districts Must Offer AP/IB/Cambridge Courses	All High Schools Must Offer Advanced Courses (AP/IB and/or Dual Credit/Enrollment)	All Districts Must Offer Advanced Courses (AP/IB an/or Dual Credit/Enrollment)
Arkansas	2005					
Connecticut						2011
District of Columbia	2011					
Florida					2013	
Idaho					2009	
Indiana	2006					
Iowa		2008				
Kentucky						2009
Louisiana			2013			
Mississippi						2008
North Carolina				2013		
North Dakota					2011	
Ohio						2008
Oregon						2015
South Carolina	1984					
Texas						2008
Virginia					1997	
West Virginia			2009			
AP Mandate	Yes	No	Yes	No	No	No
Advanced Course Mandate	Yes	Yes	Yes	Yes	Yes	Yes

Note – The table reports the classification of state-level policies mandating the provision of advanced courses. This table is adapted from Table 1 in Klopfenstein and Thomas (2009). The year listed in the table above indicates when a state and/or district's policy (if applicable) first impacts AP test-taking in that state and/or district.

Table 2: Classification of State Funding Policies Policies Towards Advanced Placement (AP) Exams

State/District	State Funds All AP Exams	State Funds Some AP Exams	State Provides Funds For Students To Use on AP Exams	State Funds a Portion of All AP Exams
Arkansas	2005			
District of Columbia	2011			
Florida	2003			
Georgia		2018		
Idaho			2017	
Indiana		2006		
Kentucky	2009			
Minnesota				2006
North Carolina	2015			
North Dakota		2016		
Oklahoma				2016
Oregon				2014
South Carolina	1985			
Tennessee	2014			
Texas				2001
AP Funding Policy	Yes	Yes	Yes	No

Note – The table reports the classification of state-level policies providing funding for advanced placement (AP) exams. The year listed in the table above indicates when a state and/or district's policy (if applicable) first impacts AP test-taking in that state and/or district.

Table 3: Sample Summary Statistics of Control Variables, by eventual treatment status (mandate)

At baseline (2000)			
	Never Treated	Treated (Mandate)	Difference
Log State Expenditures by Student	8.82	8.82	-0.0071
Log Average Teacher Salary	10.6	10.5	0.043
Log Average Household Income	10.7	10.4	0.20***
% Rural Schools	0.31	0.27	0.036
Unemployment Rate	3.80	4.56	-0.76*
% Asian	0.044	0.012	0.032
% Black	0.12	0.33	-0.21***
% Hispanic	0.083	0.026	0.057
% White	0.74	0.61	0.13
At end of the period (2019)			
Log State Expenditures by Student	9.50	9.48	0.023
Log Average Teacher Salary	11.0	10.9	0.089
Log Average Household Income	11.2	11.0	0.11
% Rural Schools	0.30	0.26	0.037
Unemployment Rate	3.50	4.06	-0.56
% Asian	0.047	0.016	0.030
% Black	0.12	0.31	-0.19***
% Hispanic	0.18	0.098	0.084
% White	0.58	0.55	0.034
Observations	**n = 45**	**n = 6**	

Note – The table reports averages of each variable for states that do and do not implement an AP mandate policy at some point between 2000 and 2019. T-test for difference in means between the two groups (never treated and eventually treated) is included – *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 4: Sample Summary Statistics of Control Variables, by eventual treatment status (funding)

At baseline (2000)

	Never Treated	Treated (Funding)	Difference
Log State Expenditures by Student	8.84	8.73	0.11
Log Average Teacher Salary	10.6	10.5	0.051
Log Average Household Income	10.7	10.5	0.13**
% Rural Schools	0.30	0.32	-0.017
Unemployment Rate	3.87	3.94	-0.061
% Asian	0.048	0.014	0.034
% Black	0.11	0.25	-0.14***
% Hispanic	0.086	0.043	0.043
% White	0.74	0.67	0.063

At end of the period (2019)

	Never Treated	Treated (Funding)	Difference
Log State Expenditures by Student	9.54	9.35	0.18*
Log Average Teacher Salary	11.0	10.9	0.097*
Log Average Household Income	11.2	11.1	0.11*
% Rural Schools	0.29	0.32	-0.030
Unemployment Rate	3.60	3.45	0.15
% Asian	0.049	0.023	0.026
% Black	0.12	0.24	-0.12**
% Hispanic	0.18	0.14	0.042
% White	0.58	0.56	0.021

| **Observations** | **n = 40** | **n = 11** | |

Note – The table reports averages of each variable for states that do and do not fund AP exams at some point between 2000 and 2019. T-test for difference in means between the two groups (never treated and eventually treated) is included – *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 5: The Effect of Advanced Placement (AP) Program Policies on the Percent of Public High School Graduates That Took At Least One AP Exam

	Outcome Variable: Percent of Public High School Graduates That Took At Least One AP Exam		
	(1)	(2)	(3)
	Outcome Variable Mean: [0.242]		
AP Mandate	0.080***	0.084***	0.045*
	(0.025)	(0.024)	(0.025)
AP Funding	0.011	0.012	0.017*
	(0.014)	(0.014)	(0.010)
Observations	1,020	1,020	1,020
States	51	51	51
Years	20	20	20
Time-Varying Controls:	No	Yes	Yes
State Time Trend:	No	No	Yes
Functional Form:	Probit	Probit	Probit

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the % of high school graduates that took at least one AP exam. State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 6: The Effect of Advanced Placement (AP) Program Policies on the Percent of High School Students That Took At Least One AP Exam and the Number of AP Exams Per 100 Public High School Students

Panel A: Percent of Public High School Students That Took At Least One AP Exam			
	(1)	(2)	(3)
Outcome Variable Mean: [0.089]			
AP Mandate	0.029***	0.029***	0.017
	(0.011)	(0.011)	(0.012)
AP Funding	0.009*	0.009*	0.013**
	(0.006)	(0.006)	(0.006)
Observations	969	969	969
States	51	51	51
Years	19	19	19
Time-Varying Controls:	No	Yes	Yes
State Time Trend:	No	No	Yes
Functional Form:	Probit	Probit	Probit
Panel B: Number of Exams Taken Per 100 Public High School Students			
	(1)	(2)	(3)
Outcome Variable Mean: [19.60]			
AP Mandate	2.372	2.789*	1.949
	(2.066)	(1.406)	(1.710)
AP Funding	2.917**	2.742**	2.056**
	(1.441)	(1.313)	(0.998)
Observations	969	969	969
States	51	51	51
Years	19	19	19
Time-Varying Controls:	No	Yes	Yes
State Time Trend:	No	No	Yes
Functional Form:	Linear	Linear	Linear

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the percent of public high school students that took at least one AP exam and the number of exams per 100 public high school students. State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 7: The Effect of Advanced Placement (AP) Program Policies on the Percent of Public High School Graduates Passing At Least One AP Exam and the Number of Passing Exams Per 100 Public High School Student

	(1)	(2)	(3)
Panel A: Percent of Public High School Graduates That Passed At Least One AP Exam			
Outcome Variable Mean: [0.143]			
AP Mandate	0.021**	0.025***	0.009
	(0.010)	(0.009)	(0.007)
AP Funding	-0.001	0.000	0.003
	(0.008)	(0.007)	(0.004)
Observations	1,020	1,020	1,020
States	51	51	51
Years	20	20	20
Time-Varying Controls:	No	Yes	Yes
State Time Trend:	No	No	Yes
Functional Form:	Probit	Probit	Probit
Panel B: Number of Passing Exams Per 100 Public High School Students			
	(1)	(2)	(3)
Outcome Variable Mean: [11.55]			
AP Mandate	-1.079	-0.666	0.000
	(0.769)	(0.647)	(0.429)
AP Funding	0.621	0.485	0.383
	(0.662)	(0.627)	(0.413)
Observations	969	969	969
States	51	51	51
Years	19	19	19
Time-Varying Controls:	No	Yes	Yes
State Time Trend:	No	No	Yes
Functional Form:	Linear	Linear	Linear

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the percent of public high school graduates passing at least one AP exam in high school and number of passing exams per 100 public high school students. State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 8: The Effect of Advanced Placement (AP) Program Policies on the Percent of Exams That Scored 3 or Higher

	Outcome Variable: Percent of Exams That Were Scored 3 or Higher		
	(1)	(2)	(3)
Outcome Variable Mean: [0.571]			
AP Mandate	-0.047	-0.053*	-0.031
	(0.030)	(0.028)	(0.031)
AP Funding	-0.005	-0.005	-0.037***
	(0.018)	(0.018)	(0.014)
Observations	969	969	969
States	51	51	51
Years	19	19	19
Time-Varying Controls:	No	Yes	Yes
State Time Trend:	No	No	Yes
Functional Form:	Probit	Probit	Probit

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the percent of AP exams scored 3 or higher. State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 9: The Effect of Advanced Placement (AP) Program Policies on the Percent of Students (by Race) Taking AP Exams and the Number of AP Exams Taken Per 100 Students (by Race)

	Panel A: Percent of Students (by Race) Taking AP Exams							
	(1) Asian	(2) Asian	(3) Black	(4) Black	(5) Hispanic	(6) Hispanic	(7) White	(8) White
Outcome Variable Mean:	[.228]		[.043]		[.066]		[.103]	
AP Mandate	0.036*	0.025**	0.020***	0.007	0.018*	0.001	0.031***	0.015
	(0.020)	(0.011)	(0.007)	(0.010)	(0.010)	(0.010)	(0.011)	(0.013)
AP Funding	0.005	0.021**	0.004	0.009*	-0.001	0.004	0.011*	0.015**
	(0.008)	(0.009)	(0.004)	(0.005)	(0.007)	(0.007)	(0.006)	(0.006)
Observations	969	969	969	969	969	969	969	969
Time-Varying Controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Time Trend:	No	Yes	No	Yes	No	Yes	No	Yes
Functional Form	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
	Panel B: Number of Exams Taken Per 100 Students (By Race)							
	(1) Asian	(2) Asian	(3) Black	(4) Black	(5) Hispanic	(6) Hispanic	(7) White	(8) White
Outcome Variable Mean:	[47.52]		[6.59]		[10.54]		[18.18]	
AP Mandate	7.028**	5.583*	2.197*	1.000	5.096**	1.600	5.659*	1.226
	(2.959)	(2.865)	(1.212)	(1.228)	(2.080)	(2.247)	(3.096)	(2.227)
AP Funding	6.674***	5.446**	1.436*	1.278	1.393	0.013	4.267**	2.931**
	(1.847)	(2.265)	(0.806)	(0.891)	(2.036)	(1.652)	(1.937)	(1.174)
Observations	969	969	969	969	969	969	969	969
Time-Varying Controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Time Trend:	No	Yes	No	Yes	No	Yes	No	Yes
Functional Form	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the percent of students taking AP exams (by race) and the number of exams per 100 students (by race). State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.

Table 10: The Effect of Advanced Course Policies on the Percent of Public High School Graduates Who Took At Least One AP Exam

	Outcome Variable: Percent of Graduates Who Took At Least One AP Exam		
	(1)	(2)	(3)
	Outcome Variable Mean: [0.242]		
AP Mandate	0.045*		0.043*
	(0.025)		(0.025)
School-Level		0.045*	
		(0.025)	
District-Level		-0.007	
		(0.005)	
Adv. Course Mandates			0.002
			(0.006)
AP Funding	0.017*	0.017*	0.017*
	(0.010)	(0.010)	(0.010)
Observations	1,020	1,020	1,020
Time-Varying Controls:	Yes	Yes	Yes
State Time Trend:	Yes	Yes	Yes
Functional Form:	Probit	Probit	Probit

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the percent of public high school graduates taking at least one AP exam in high school. State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.
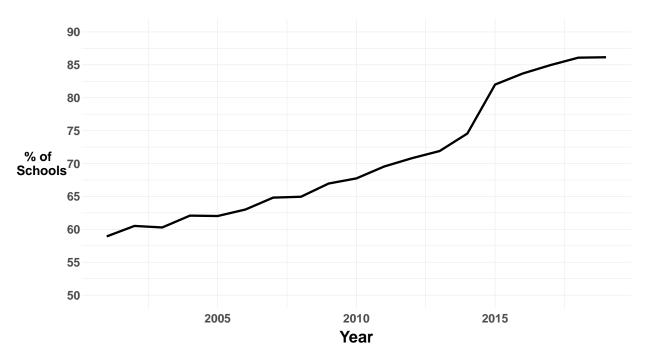
Figures

Figure 1: Percent of Secondary Schools With At Least One AP Exam-Taker

Note - The above figure displays the percent of secondary schools in the United States that report at least one Advanced Placement (AP) exam-taker from 2001 through 2019. The percent of secondary schools that report at least one AP exam-taker is found by dividing the number of public high schools reporting at least one AP exam-taker by the total number of public high schools. Data include all public schools from all 50 states plus the District of Columbia.

Figure 2: Percent of Public High School Students and Graduates Taking At Least One AP Exam

Note - The above figure displays the percent of public high school students and graduates that took at least one Advanced Placement (AP) from 2000 through 2019. Data on the percent of public high school students was not available for 2000. The percent of public high school students that took at least one AP exam in a given year is found by dividing the number of students that took at least one AP exam by the total number of public high school students. The percent of public high school graduates that took at least one AP exam is found by dividing the number of graduates that took at least one AP exam (during high school) by the total number of public high school graduates. Public students from all 50 states and the District of Columbia are included.
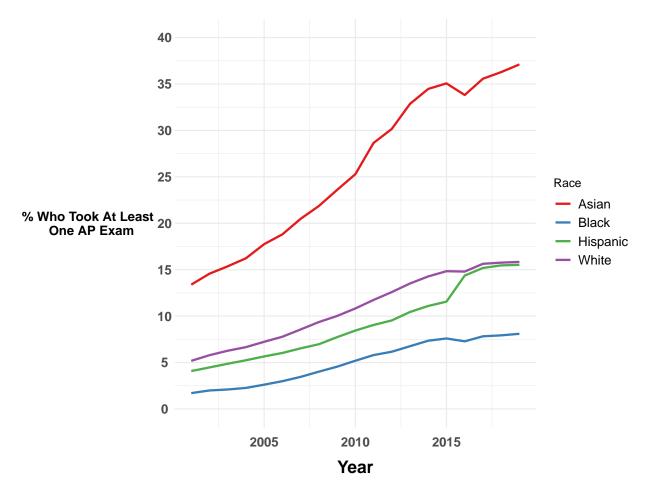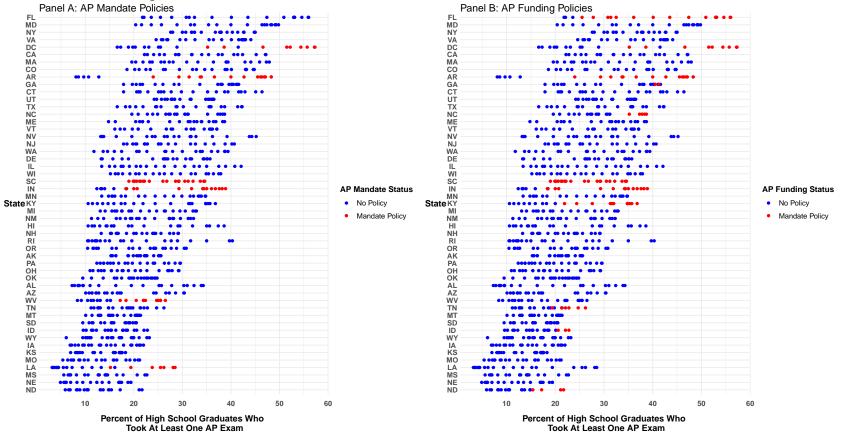
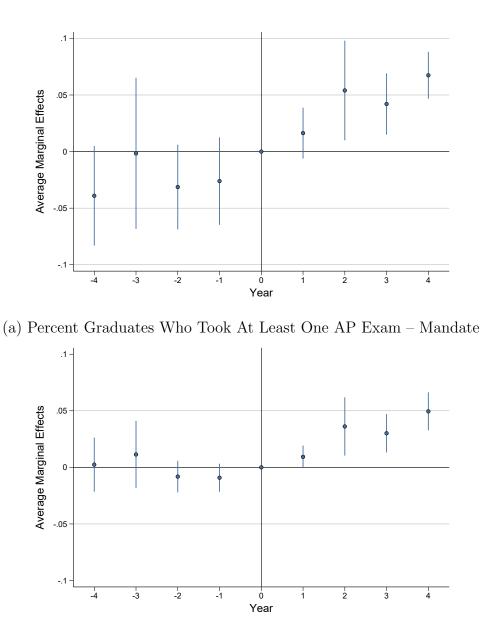Figure 3: Percent of Public High School Students (by Race) Taking At Least One AP Exam

Note - The above figure displays the percent of public high schools (by race) that took at least one Advanced Placement (AP) in a given year from 2001 through 2019. The percent of public high schools (by race) that took at least one AP exam in a given year is found by dividing the number of students that took at least one AP exam (by race) by the total number of public high school students (by race). Public students from all 50 states and the District of Columbia are included.

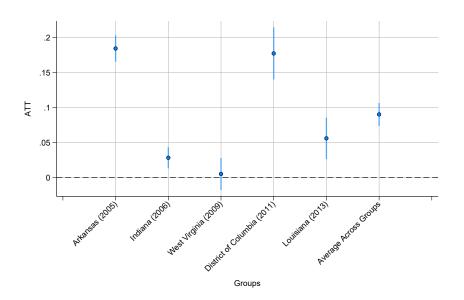Figure 4: Percent of High School Graduates Who Took At Least One AP Exam, by State, Year, and Policy Status

Note - The above figure displays the percent of public high school graduates who took at least one Advanced Placement (AP) exam over the course of their high school career by state and year from 2001 through 2019. The percent of public high school graduates who took at least one AP exam is found by dividing the total number of graduates who took at least one AP exam in a given state and year by the total number of public high school graduates in a given state and year. Public students from all 50 states and the District of Columbia are included.

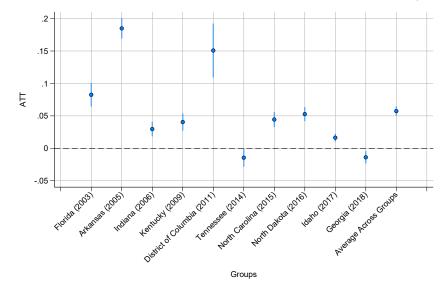(a) Percent Graduates Who Took At Least One AP Exam – Mandate

(a) Percent Graduates Who Took At Least One AP Exam – Funding

Figure 5: Event Study Estimates for the Percent of Graduates That Took At Least One AP Exam

Note - Each figure presents estimates of either the α_τ or β_τ coefficients in Equation (2). All regressions include state and year fixed effects as well as state-level control variables and state specific time-trends. Model is estimated using a fractional Probit specification. All standard errors are clustered at the state level.
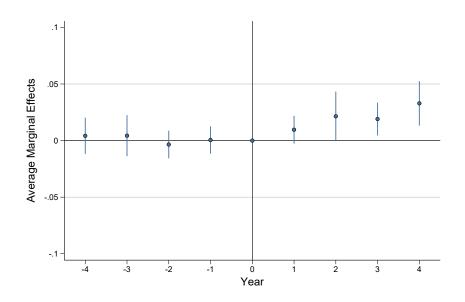
(a) Percent of Graduates Who Took At Least One AP Exam – Mandate (Dynamic Effects)
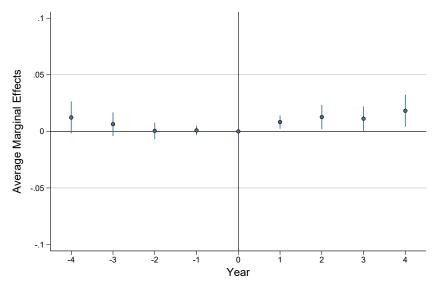

(b) Percent of Graduates Who Took At Least One AP Exam – Funding (Dynamic Effects)

Figure 6: Callaway and Sant'Ana (2021) Estimates for the Percent of Graduates Who Took At Least One AP Exam

Note - Each figure presents estimates using the alternative estimator proposed by Callaway and Sant'Anna (2021). All regressions include state and year-fixed effects as well as time-varying controls. All standard errors are clustered at the state level. Plots include all years in the sample period and include instances where the panel is unbalanced.

(a) Percent of Graduates Who Passed At Least One AP Exam – Mandate

(a) Percent of Graduates Who Passed At Least One AP Exam – Funding

Figure 7: Event Study Estimates for the Percent of Graduates That Passed At Least One AP Exam

Note - Each figure presents estimates of either the α_τ or β_τ coefficients in Equation (2). All regressions include state and year fixed effects as well as state-level control variables and state specific time-trends. Model is estimated using a fractional Probit specification. All standard errors are clustered at the state level.

Appendix A. Detailed Policy Descriptions and Sources

Table A1: Table of All State Policies Regarding Mandating Advanced Courses – Includes Policies Related to AP, IB, Dual Enrollment and Other Pathway Programs

State	Year	Citation	Description	Policy Coding
Arkansas	2005	Act 102 (2004)	All high schools must offer at least four AP courses. All districts must offer one AP course in each of four areas: English, math, science and social studies.	AP Mandate
Connecticut	2012	S.B. 438 (2009)	Each local and regional board of education must provide an advanced placement course program.	Advanced Course Mandate
District of Columbia	2011	Documentation from D.C. Public Schools	At least four AP courses are offered at each traditional high school. Starting in 2015, six AP courses must be offered in DC Public Schools.	AP Mandate
Florida	2012	Title XLVII, Chapt. 1003	Each high school must a combination of at least four courses in dual enrollment or AP including one courses each in English, math, science and social studies.	Advanced Course Mandate
Idaho	2009	IDAPA 08.02.03	All high schools must either offer "advanced opportunities" (defined as AP courses, dual credit courses, Tech Prep or IB programs), or provide opportunities for students to take courses at the postsecondary campus.	Advanced Course Mandate
Indiana	2006	H.B. 1347	Each high school must provide at least 2 AP and 2 dual credit course offerings. Additionally, each school corporation must provide AP science and math courses to qualified students.	AP Mandate
Iowa	2009	C.H. 1181, Sec. 51; 261E.	Districts must make AP courses available to their resident students through direct instruction on-site, collaboration with another school district, or via the online Iowa AP Academy	Advanced Course Mandate
Kentucky	2009	Statute 160.348	Each secondary school-based decision-making council shall offer a core curriculum of AP, IB, dual enrollment, or dual credit courses, using either or both on-site instruction or electronic instruction through the Kentucky Virtual High School or other on-line alternatives.	Advanced Course Mandate
Louisiana	2013	Title 28, Part CXV	Each high school must offer at least one AP course in each of four content areas, plus one additional AP course.	AP Mandate
Mississippi	2007	S.B. 2602	All districts must offer at least one AP course in English, math, science and social studies. Any public high school offering the International Baccalaureate Diploma Programme is exempt from the requirement to offer AP courses.	Advanced Course Mandate
North Carolina	2014	S.B. 402, Section 115C-83.4A	Local boards must ensure that all high school students have access to advanced courses (AP or IB) in language arts, math, science and social studies.	Advanced Course Mandate
North Dakota	2011	H.B. 1400	All high schools must offer one unit of an AP or dual credit course.	Advanced Course Mandate
Ohio	2008	S.B. 311	Each city, local, exempted village, and joint vocational school district and each chartered nonpublic high school shall provide students enrolled in grades nine through twelve with the opportunity to participate in a dual enrollment program. Dual enrollment programs may include (1) post-secondary enrollment, (2) advanced placement courses and (3) any similar program established pursuant to an agreement between a school district or chartered nonpublic high school and an institution of higher education.	Advanced Course Mandate
Oregon	2014	S.B. 254	All districts must offer accelerated college credit programs which include AP as well as dual credit, two-plus-two, and IB programs. Districts must provide students in grades 9-12 with accelerated college credit programs in English, math, and science, or ensure students in grades 9-12 have online access to accelerated college credit programs, including those related to English, math and science.	Advanced Course Mandate
South Carolina	1984	Act 512	State board policy requires all schools serving grades 11 and 12 to offer 1 AP course(s).	AP Mandate
Texas	2008	H.B. 3485	All districts are required to offer students the opportunity to earn at least 12 semester credit hours of college credit in high school, via AP, IB, dual credit, or post-secondary programs.	Advanced Course Mandate
Virginia	1997	8VAC20-131-100	All high schools must offer at least 3 AP, IB or Cambridge courses, college-level courses for degree credit, or any combination thereof.	Advanced Course Mandate
West Virginia	2009	Revision to Policy 2510 (listed in Title 126, Series 42)	All high schools must offer at least 1 AP course each in English, math, science and social studies.	AP Mandate

Table A2: Table of State Policies Regarding Universal Funding of Advanced Placement Exams

State	Year	Citation	Description
Arkansas	2005	Act 102 (2004)	All AP Exam fees paid by the state. Student must take and complete corresponding AP course to qualify. Students may take unlimited exams as long as they meet the other requirements.
Florida	2003	S.B. 20E (2003)	". . . public secondary school students are exempt from payment of Advanced Placement exam fees, regardless of whether or not they obtain a passing score on the exam."
Georgia	2018	The Covington News The Atlanta Journal - Constitution	"This year Georgia will pay only for science, technology, engineering, or mathematics (STEM) related AP exams. It no longer will pay for AP exams in the arts, English, history, social science, or world languages and cultures. Lawmakers also opened up the opportunity to all students, that is, Georgia now will pay for one STEM-related AP exam for any public-school student regardless of the student's economic status."
Idaho	2017	H.B. 458 (2016)	Students attending public schools in Idaho will be eligible for four thousand one hundred twenty-five dollars ($4,125) to use toward overload courses, dual credits, college credit-bearing examinations and professional certificate examinations.
Indiana	2008	P.L. 20-2007, Sec. 4.	To pay the fees for each math or science advanced placement examination that is taken by a student who is: (a) enrolled in a public secondary school (b) a resident of Indiana. Priority shall be given to paying the fees for each math or science advanced placement examination that is taken by a student in grade 11 or 12.
Kentucky	2009	160.348 (2013)	Effective with the 2008-2009 school year and thereafter, students enrolled in AP or IB courses in the public schools shall have the cost of the examination paid by the Kentucky Department of education.
North Carolina	2014	G.S.115C-83.4A	". . . appropriating funds to pay for all AP, IB, and AICE exams for public school or charter school students who are enrolled in the corresponding AP/IB/AICE courses. This funding continues in the recurring budget."
North Dakota	2017	S.B. 2031 (2015)	For economically disadvantaged students, the state will cover the entire exam fee for up to 4 exams in English, math, science or computer science over the student's high school career. For non-economically disadvantaged students taking AP exams in these subjects, the state will cover the exam fee for the student's first qualifying exam, and will cover 50% of the exam fee for the following 3 qualifying exams over the student's high school career. These exam fee waivers extend to private school, Bureau of Indian Education, and home school students.
South Carolina	1985	Act 512	". . . an appropriation for the AP program has paid for AP tests taken by students and provided resource materials for both students and teachers."
Tennessee	2014	TN Code 49-6-4 (2013)	Public high school students enrolled In Advanced Placement courses shall not be required to pay any fee to take the AP examination.

Course Mandate Policies:

- Arkansas

- Connecticut

- District of Columbia

- Florida

- Idaho

- Indiana

- Iowa

- Kentucky

- Louisiana

- Mississippi

- North Carolina

- North Dakota

- Ohio

- Oregon

- South Carolina
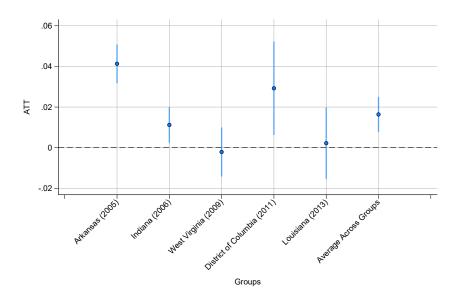
- Texas

- Virginia

- West Virginia

Funding Policies:

- Arkansas

- District of Columbia

- Florida

- Georgia

- Idaho

- Indiana

- Kentucky

- North Carolina

- North Dakota

- South Carolina
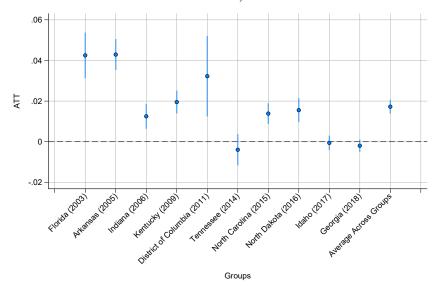
- Tennessee

Appendix B. Supplemental Tables and Figures

Table A3: The Effect of Advanced Placement Policies on the Percent of Public High School Graduates Who Took At Least One AP Exam (interacted policies)

	(1)	(2)	(3)	(4)
Outcome Variable: Percent of Graduates Who Took At Least One AP Exam				
Outcome Variable Mean: [0.242]				
AP Mandate	0.045*	0.056**		0.024***
	(0.025)	(0.028)		(0.006)
AP Funding	0.017*		0.030*	0.012
	(0.010)		(0.016)	(0.009)
AP Mandate × AP Funding				0.037
				(0.041)
Observations	1,020	1,020	1,020	1,020
Time-Varying Controls:	Yes	Yes	Yes	Yes
State Time Trend:	Yes	Yes	Yes	Yes
Functional Form:	Probit	Probit	Probit	Probit

Note – The table reports regression estimates of the effect of state-level Advanced Placement (AP) program policies in regard to funding and access on the percent of public high school graduates taking at least one AP exam in high school. State policies (both AP Mandate and AP Funding) are defined in Tables 1 and 2. Robust standard errors are in shown in parentheses. Standard errors are clustered on the state level. Regression includes state-level control variables when indicated. *, **, and ***, indicate statistical significance at the ten-, five-, and one-percent levels, respectively.
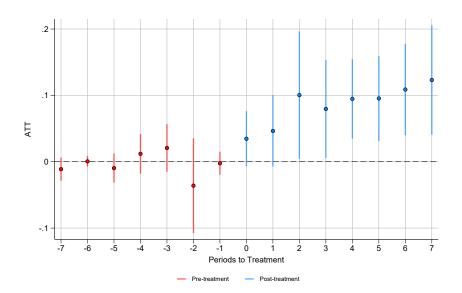
(a) Percent of Graduates Who Passed At Least One AP Exam – Mandate (Dynamic Effects)

(b) Percent of Graduates Who Passed At Least One AP Exam – Funding (Dynamic Effects)

Figure 8: Callaway and Sant'Ana (2021) Estimates for the Percent of Graduates Who Passed At Least One AP Exam

Note - Each figure presents estimates using the alternative estimator proposed by Callaway and Sant'Anna (2021). All regressions include state and year-fixed effects as well as time-varying controls. All standard errors are clustered at the state level. Plots include all years in the sample period and include instances where the panel is unbalanced.

(a) Percent of Graduates Who Took At Least One AP Exam – Mandate (Event Study)

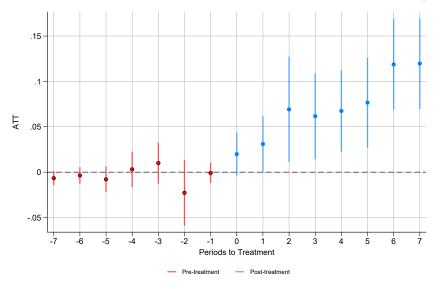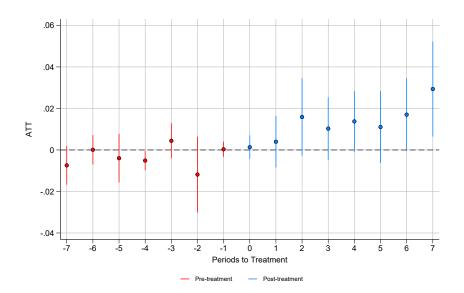
(b) Percent of Graduates Who Took At Least One AP Exam – Funding (Event Study)

Figure 9: Callaway and Sant'Ana (2021) Estimates for the Percent of Graduates Who Took At Least One AP Exam

Note - Each figure presents estimates using the alternative estimator proposed by Callaway and Sant'Anna (2021). All regressions include state and year-fixed effects as well as time-varying controls. All standard errors are clustered at the state level. Plots include all years in the sample period and include instances where the panel is unbalanced.

(a) Percent of Graduates Who Passed At Least One AP Exam – Mandate (Event Study)
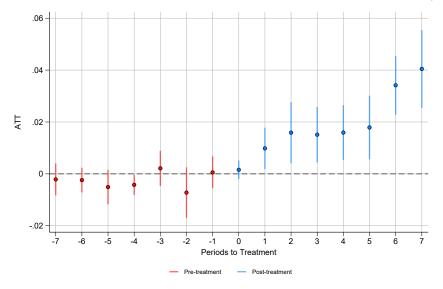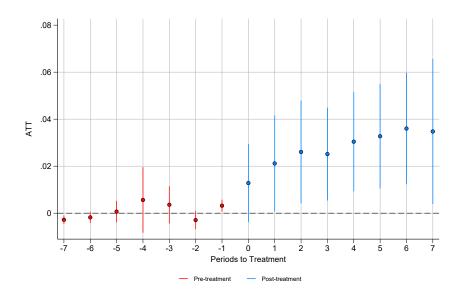

(b) Percent of Graduates Who Passed At Least One AP Exam – Funding (Event Study)

Figure 10: Callaway and Sant'Ana (2021) Estimates for the Percent of Graduates Who Passed At Least One AP Exam

Note - Each figure presents estimates using the alternative estimator proposed by Callaway and Sant'Anna (2021). All regressions include state and year-fixed effects as well as time-varying controls. All standard errors are clustered at the state level. Plots include all years in the sample period and include instances where the panel is unbalanced.

(b) Percent of Public High School Students Who Took At Least One AP Exam – Mandate (Event Study)

(b) Percent of Public High School Students Who Took At Least One AP Exam – Funding (Event Study)

Figure 11: Callaway and Sant'Ana (2021) Estimates for the Percent of Public High School Students Who Took At Least One AP Exam

Note - Each figure presents estimates using the alternative estimator proposed by Callaway and Sant'Anna (2021). All regressions include state and year-fixed effects as well as time-varying controls. All standard errors are clustered at the state level. Plots include all years in the sample period and include instances where the panel is unbalanced.

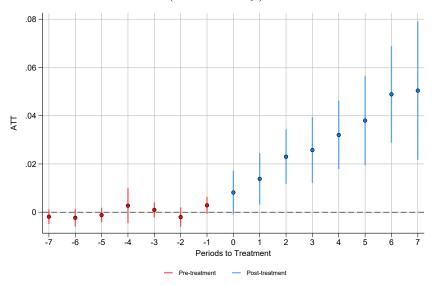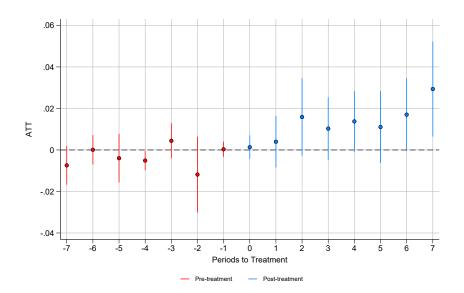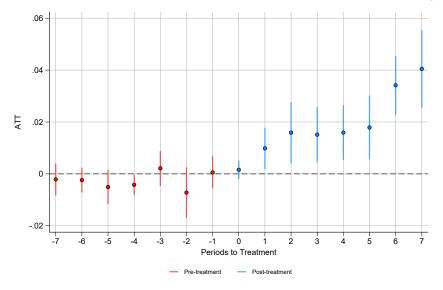(a) Percent of Graduates Who Passed At Least One AP Exam – Mandate (Event Study)

(b) Percent of Graduates Who Passed At Least One AP Exam – Funding (Event Study)

Figure 12: Callaway and Sant'Ana (2021) Estimates for the Percent of Graduates Who Passed At Least One AP Exam

Note - Each figure presents estimates using the alternative estimator proposed by Callaway and Sant'Anna (2021). All regressions include state and year-fixed effects as well as time-varying controls. All standard errors are clustered at the state level. Plots include all years in the sample period and include instances where the panel is unbalanced.