Giving College Credit Where it is Due: Advanced Placement Exam Scores and College Outcomes

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ABSTRACT

We implement a regression discontinuity design using the continuous raw Advanced Placement (AP) exam scores, which are mapped into the observed 1-5 integer scores, for over 4.5 million students. Earning higher AP integer scores positively impacts college completion and subsequent exam taking. Specifically, attaining credit-granting integer scores increases the probability that a student will receive a bachelor's degree within four years by 1 to 2 percentage points per exam. We also find that receiving a score of 3 over a 2 on junior year AP exams causes students to take between 0.06 and 0.14 more AP exams senior year.

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1. Introduction

Stagnant completion rates and increasing time-to-degree (Bound, Lovenheim, and Turner, 2010; 2012) in a time of high unemployment, budgetary crises, and increasing federal grant aid (College Board, 2013a) have put colleges under increased public scrutiny. Inadequate preparation for college is one factor behind the criticisms of college completion, but it is not the only factor. Finishing a bachelor's degree on time generally requires a student to complete at least 120 credit hours within four years. To accomplish this, a student might take five courses per semester, spread over eight semesters. Timely completion requires students to fulfill the course-specific requirements of their chosen major, as well as any general education coursework necessary for the awarding of a bachelor's degree. For many students, neatly cobbling together a postsecondary curriculum that satisfies both graduation and major requirements within 120 credit hours is challenging. So difficult is this task that in 2011, 33 U.S. governors endorsed a report authored by the Complete College America organization that identified excessive college course taking as one of the five leading causes of the nation's college completion crisis.[1]

One potential way to ameliorate this problem is to give students the opportunity to earn college credit while still in high school, which is typically accomplished either through dual enrollment or Advanced Placement (AP) programs.[2] These widely accepted courses allow students to earn credit and placement towards college graduation and to bypass introductory courses while freeing up time to fulfill both major and general education requirements.[3] In

[1] Upon receiving bachelor's degrees, many students will have taken nearly 15 more credits than the minimum required for such a degree. Time is the Enemy (2011). College Completion America. Retrieved from http://www.completecollege.org/docs/Time_Is_the_Enemy_Summary.pdf.

[2] Other solutions exist, including student facing solutions (e.g. better preparation and college match) and college facing solutions (e.g. better professors, smaller classes, fewer requirements, and financial aid).

[3] As of 2012, nearly four-fifths of four-year public and private not-for-profit colleges had AP credit policies in place (IPEDS, 2012).

theory, students who take advantage of these colleges' AP credit and placement policies may have an increased likelihood of completing college within a reasonable time frame.

While taking an AP exam is a strong signal of academic ability, it is not a guarantee of postsecondary academic success. About 16 percent of AP exam-takers do not attend four-year postsecondary institutions and only about half of on-time enrollees (54 percent) complete bachelor's degrees within four years of high school graduation (see discussion of Table 1 below in Section 3). Thus, it is plausible to conduct empirical analyses to study the effect of success on an AP exam on such outcomes as completion of a bachelor's degree within four (or five or six) years of high school graduation. We believe that this paper is the first to identify the causal effect of receiving college credit while in high school on such outcomes.

To evaluate the impact of early receipt of college credit, we exploit previously unavailable data on the underlying AP exam continuous raw scores that map into the 1-5 integer (scaled) scores, where a 5 is the highest possible score.[4] Availability of continuous data lend themselves to a sharp regression discontinuity design whereby we compare nearly identical students, as demonstrated with both density tests and covariate balancing tests, just above and just below the thresholds of each scaled score as well just above and below the scores for which students would receive credit at their chosen postsecondary institutions. The student just above the threshold may receive the associated benefits resulting from earning a higher AP exam score, which may include improved college admissions outcomes, advanced placement, credit, completion, or even the psychological benefits of positive affirmation. We focus much of the discussion of results on Biology, Calculus AB, English Language and Composition, English Literature and Composition, U.S. Government and Politics, and U.S. History, the six largest

[4] According to the College Board, the 1-5 scores can be interpreted as follows in terms of college credit, respectively: no recommendation, possibly qualified, qualified, well qualified, and extremely well qualified.

volume AP exams. These six exams encompass the four major high school curricular strands of humanities, social sciences, natural sciences and mathematics.

Our first and primary result is that students who receive college credit on a single AP exam are approximately 1-2 percentage points more likely to receive a bachelor's degree within four years of high school graduation compared to students who do not receive college credit. However, we find little evidence that a similar effect exists on attaining a bachelor's degree within six years of high school graduation, implying that the receipt of college credit while still in high school improves time-to-degree, but not overall bachelor's attainment rates. We also find evidence that there are cumulative effects when students attain credit on multiple AP subject exams.

In addition to the main findings regarding bachelor's completion, this paper also shows the following results. First, there are no discernible effects of receiving higher AP exam scores on bachelor's attainment rates unless the scores coincide with college credit. For example, earning a 3 on an AP exam does not improve four-year bachelor's completion rates unless the student attends a college that offers credit for attaining a 3 on the exam. Second, higher exam scores (e.g. 3 over a 2) seem to have little impact on the colleges to which students send their SAT scores and enroll. However, we do find that higher AP exam scores attained during a student's junior year in high school increases the probability that she takes more AP exams in her senior year of high school. Third, we find few heterogeneous effects by parental income or education, race, and gender. Finally, we find that the effects of receiving college credit on four-year bachelor's completion are comparable in magnitude between students attending a college with a minimum credit-granting score of 3 and students attending a college with a minimum credit-granting score of 4. This provides evidence that the local average treatment effects identified through our regression discontinuity analyses apply to a set of students with a broad range of academic preparation.

The paper proceeds as follows. Section 2 summarizes the history of the Advanced Placement program and results of past research on the effects of the program. Section 3 describes our empirical hypotheses and the data we use to test them. Section 4 outlines the framework for our empirical methodology. Section 5 presents empirical results. Section 6 concludes.

2. Background and Literature Review

The AP program dates back to the 1950s and was born partially to remedy "conspicuous waste through unneeded repetition in the subjects of English (composition and literature), history, sciences and foreign languages" (Lacy, 2010, p.28). Originally concentrated in well-to-do high schools, the AP program underwent rapid expansion during the last quarter of the 20th century, and by the mid 1990's nearly half of U.S secondary schools offered AP coursework (Lacy, 2010). By the 2009-10 academic year, 71 percent of all U.S. public high schools had students participating in the AP program, and these schools enrolled 91 percent of public high school students (Theokas and Saaris, 2013).[5] AP participation rates have been steadily rising as well, from more than 660,000 in the 2004 high school graduation cohort to approximately 940,000 for the 2009 cohort.[6] Among US public and non-public high school graduates, the fraction taking an AP exam rose from 21 percent in 2004 to about 27 percent in 2009. These AP participants tend to be academically stronger than the typical college-aspiring students, with composite SAT (Math+Critical Reading) scores of approximately 1136 on the Math and Critical

[5] The College Board official statistics are slightly lower at around 60 percent. (See http://apcentral.collegeboard.com/apc/public/program/index.html)
[6] These numbers include both private and public school students as well as international students.

Reading sections, which corresponds to 71st percentile among the population of students from the 2004 thru 2009 cohorts who took the SAT.

The exact number of AP exams has varied over time, as some exams were retired due to low participation rates and new exams were introduced as a result of high student demand. In this research study, we consider 34 distinct subject exams, while focusing on the six most popular (See Appendix Table 1 for details on exams).

2.1. Scoring

As previously discussed, AP exams are scored on an integer scale of 1-5, where a score of 5 indicates that a student is "extremely well qualified" to receive college credit and a score of 3 suggests that the student is qualified to receive college credit. The minimum scaled score required for college credit varies by college and by AP exam subject. Across the students who take the six major exams, approximately 94 percent of the students attend a college that gives credit for the exams and conditional on giving credit, approximately 58 percent of students attend a college that require a 3; 38 percent require a 4; and 4 percent require a 5.[7]

Underlying this scaled score is a continuous raw score which is a composite of the student's performance on both the multiple choice and free response sections of the AP exams. This raw score is *never* observable to the student or college, and for a typical AP exam might range from 0 to about 150, though the range of raw scores within a scale score varies across subjects and also across years for a given subject. Raw scores are collapsed into scaled integer scores using the modified Angoff method (Angoff, 1971), and since the cut points are determined after grading is completed, raters are unable to manipulate student scores by assigning them just enough credit to get a score of 3 (for example).

[7] More details on the distribution of policies in the data can be found in Appendix Table 1 and college-specific policies are maintained at https://apscore.collegeboard.org/creditandplacement/search-credit-policies.

2.2. Literature Review

A series of previous studies demonstrate a strong positive correlation between AP participation, AP exam scores and subsequent academic performance across a range of measures including college attendance (Chajewski, Mattern, and Shaw, 2012) and success in subject performance (Patterson and Ewing, 2013), overall performance (Shaw, Mattern, and Marini, 2012), and college completion (Morgan and Klaric, 2007; Dougherty, Mellor, and Jian, 2008; Hargrove, Godin, and Dodd, 2008 ; Mattern, Marini and Shaw, 2013).[8] These studies show that AP is a useful tool in identifying students who demonstrate potential for earning college credit/placement. Though many of these studies convincingly demonstrate the predictive power of AP exams, even after controlling for extensive sets of covariates, they do not estimate the causal effects of taking an AP exam or achieving certain scores.

There have been some promising efforts to address the lingering causal research questions. For example, Jackson (2010) shows that students who are paid to take and perform well on AP exams are more likely to have higher SAT scores and enroll in college. While Jackson convincingly addresses the effect of AP course participation in Texas, he is unable to disentangle the effects of achieving relatively higher AP exam scores beyond traditional methods of controlling for observables. Similarly, other papers use a selection on observables design but they note that any unobservable that is correlated with AP exam score may confound the estimates (e.g. Murphy and Dodd, 2009; Long, Conger, and Iatorala, 2012).[9] Our paper is the first study to isolate the causal impacts of achieving certain benchmark AP exam scores on student outcomes for those who have taken the exams.

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[8] There is a similar line of research on dual enrollment. For example, see Karp et al. (2007).

[9] There are currently some randomized AP evaluations underway, which will be very informative, but they are limited in their scope of exams and populations (Conger, Long, and McGhee, 2014).

3. Data, Descriptive Statistics, and Empirical Hypotheses

This paper uses student-level data from the 2004-09 graduating high school cohorts collected from two main sources, College Board (CB) data on AP examinees and National Student Clearinghouse (NSC) data. CB maintains a database of all students who take at least one AP exam. This database contains not only the students' AP exam scores on the 1-5 integer scale, but their underlying continuous scores on most exams taken between 2004 and 2009. From these two pieces of information, we identify the exact continuous scores that sharply form the boundaries of the scaled scores.[10] In addition to student performance on each AP exam, the CB data also contain a host of student demographic information, such as a student's gender, race/ethnicity, and parental income.[11]

CB data are merged with the NSC data. As of 2014, over 3,600 postsecondary institutions participate in NSC, which collects postsecondary enrollment information on more than 98 percent of students enrolled in U.S. postsecondary institutions. Though, data privacy laws and imperfect matching may mean that the actual coverage is a bit lower (Dynarski, Hemelt and Hyman, 2015). Data from the NSC allow us to track a student's postsecondary trajectory including enrollment and degree completion through 2013. Thus, we are able to track the 2009 cohort of high school graduates through four years of college enrollment and to track earlier cohorts of high school graduates for at least five years after high school graduation. As a simple measure of four-year college quality, we append to our data the average standardized test scores

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[10] Data on raw scores are available only for exams taken during the 2003-04 school year or later. Therefore some AP test takers, particularly in the 2004 and 2005 cohorts, will not have raw scores that can be mapped to their scaled scores. Any exam without an accompanying raw score is removed from our analyses,

[11] Parental education and income are collected on the SAT registration forms, and so some AP test takers who did not participate in the SAT will have missing demographic information. Even among SAT participants, some students fail to respond to these questions.

(ACT and SAT) of incoming students reported to the Integrated Postsecondary Education Data System (IPEDS).[12]

Finally, we merge data on AP credit-granting policies to the colleges at which students enroll. These data come from the College Board administered Annual Survey of Colleges (ASC), which is administered annually to nearly 4,000 colleges. In 2005, the ASC collected information on the minimum AP exam scores on 34 exams for which colleges award credit.[13] Historically, college-level AP policies change very little from one year to the next. Therefore, we match the 2005 college-level policies to postsecondary institutions attended by the 2004-2009 high school graduation cohorts with the data-informed assumption that any noise such matching introduces is likely to be minimal.

3.1 Summary Statistics

We present summary statistics on all students appearing in our sample in Table 1, as well as students participating in the six most-represented AP exams in our sample. The first set of columns show that females constitute the majority of AP examinees and that slightly less than two-thirds of sampled students identified as white. Panel B of Table 1 shows the distribution of AP exam scores among the sampled students. On average, the sampled students took 2.64 AP exams for which we had the underlying raw scores and received 0.48 (18 percent) scores of 1; 0.59 (22 percent) scores of 2; 0.67 (25 percent) scores of 3; 0.53 (20 percent) scores of 4; and 0.37 (15 percent) scores of 5.[14] Most - 84 percent - of these students ultimately attend a four-year

[12] To estimate average composite SAT scores, we add the 25th and 75th percentiles of the Math and Critical Reading sections, as reported by IPEDS, and divide by 2. For colleges that only report ACT scores to IPEDS, we use an SAT conversion table found at http://research.collegeboard.org/sites/default/files/publications/2012/7/researchnote-2009-40-act-sat-concordance-tables.pdf

[13] There exists no data on minimum scores for Chinese, Italian Language and Culture, and Japanese Language and Culture.

[14] This estimate includes only the sampled exams for which there existed raw scores. Exams taken prior to 2004 are excluded, therefore some students (particularly in the 2004 and 2005 HS cohorts) will have taken more AP exams

postsecondary institution and 54 percent of students who first enroll in a four-year institution on-time obtained bachelor's degrees within four years of high school graduation.

<<Insert Table 1>>

Demographically, participants in the six most popular AP exams mirror the typical AP examinee, an exception being Calculus AB where slightly more than half of participants are male. Some of these APs exhibit sharp differences from each other in their scoring distributions. For example, there is unusual variation in the scaled integer scores on the Calculus AP exam – nearly half of students receive the lowest or highest scores of 1 and 5 (25 percent and 21 percent of Calculus AB participants receive scores of 1 and 5 respectively) whereas only about one-sixth of exam-takers receive these extreme scores on the English Literature exam (9 percent and 7 percent of English Literature participants).

Academically, participants in these six primary subject exams appear to be stronger than all AP exam-takers, with about 90 percent of participants enrolling at a four-year college. For these six subjects, the four and six year bachelor's completion rates among on-time four-year enrollees are about 60 percent and 80 percent, respectively. As we show in Section 5, these overall completion rates are nearly identical to those of the marginal students, whose raw scores place them on the cusp of receiving AP credit.

3.2 Empirical Hypotheses

We use the summary statistics from Table 1 to direct our choice of empirical hypotheses for this paper. As we describe in more detail in Section 4, our analysis is based on a regression discontinuity approach, comparing students with raw scores just above and below the threshold for scores in the 1 through 5 range on a given AP exam. We wish to focus on comparisons of

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than indicated in our sample. Folding back in exams with no accompanying raw scores, we find that the typical AP taker in the 2004-2009 HS cohorts took an average of 2.79 AP exams by high school graduation.

students with similar raw scores on a given exam, where those just above a particular threshold qualify for college credit and those just below that threshold do not qualify for college credit.

Our first hypothesis is simply that students will be attracted to colleges that offer credit for the particular scores that they achieve. Though students who take more than one exam may face diluted incentives with regard to their score on a particular exam, this incentive would still apply (to some degree) for each and every AP exam that they take.

(H1) Students will be more likely to attend colleges that provide credit for the AP exam scores that they receive.

This hypothesis is also important to the econometric approach of our subsequent analyses. If students systematically vary their choice of colleges based on the combination of their AP exam scores and credit policies of colleges, then we would have to regard the choice of college as endogenous. In this scenario, we might conflate effects from college quality with the effects of receiving credit.

However, we also note that 11th grade AP exam-takers likely have much more ability to adjust their college plans after learning their exam scores than do 12th grade AP exam-takers. Most students who take an AP exam as high school seniors will have graduated from high school, selected a four-year college and paid a deposit to that college by the time that they receive their scores in the middle of the summer. At this time, it is too late to apply to additional four-year colleges, for colleges to change admission decisions from the past spring, or for students to enroll at a college after previously rejecting its offer of admission.

Since Table 1 indicates that completion of a bachelor's degree (especially within four years of high school graduation) is quite uncertain for this population of students, it seems appropriate to focus on degree completion as an outcome of interest. Each AP credit that counts towards requirements for college graduation may enable a student to reduce her course load and still graduate on time in four years. Hypothesis (H2) concerns this direct effect:

(H2) Achieving an AP exam score that counts for college credit promotes the completion of postsecondary degrees.

Hypothesis (H2) is silent on the mechanism behind credit promoting completion. For example, students may face a reduced course load or they may have the same course load, but a different composition of courses.

There are several additional channels by which an increase in AP exam score could promote postsecondary educational attainment. Each of these channels corresponds to a distinct empirical hypothesis, which we enumerate below.

(H3) Achieving a relatively high AP exam score provides a psychological boost to students and thus promotes their subsequent academic performance.

In recent years, it has become increasingly popular for students to take AP exams prior to the senior year of high school. Success on an AP exam prior to the senior year can affect future performance in several additional ways.

(H4) Achieving a relatively high AP exam score prior to the senior year of high school may encourage students to continue taking advanced courses and AP exams in subsequent years in high school.

One factor opposing hypothesis (H4) is that students typically select high school courses in the late winter or early spring for the following school year. Once again, since this predates the scoring of that year's AP exams for junior exam-takers, it may not be feasible in all cases for a student to change enrollment in AP courses for the next year after receiving AP exam scores for the previous school year.

(H5) Achieving certain AP exam scores prior to the senior year of high school may promote future enrollment at selective colleges.

(H5a) Achieving an AP exam score prior to the senior year of high school may encourage students to adopt more ambitious strategies in the college application process, thereby making them more likely to apply to more selective colleges than they would have otherwise.

(H5b) Achieving an AP exam score prior to the senior year of high school may improve the chances of admission to a particular selective college, conditional on applying to that college.

Several of these hypotheses, and in particular (H5a), may be especially pertinent for low-income students. Hoxby and Avery (2013) find that high achieving low-income high school students are quite unlikely to apply to selective colleges. Further, Pallais (2013) concludes that the application choices of low-income students are highly sensitive to small changes in the cost of sending ACT scores to colleges. So it is natural to hypothesize that the college application choices of talented low-income students may also be strongly influenced by a marginal change in scaled score on a particular AP exam.

Hypotheses (H1) to (H5), which consider college choice, clearly overlap to some degree. Fortunately, because we have information on (1) AP credit policies at each college; (2) AP exam participation and scores for each student all through high school; (3) the set of colleges where each student sends SAT scores; (4) college enrollment and completion for each student, we can conduct a series of empirical tests that disentangle this overlap and enable us to evaluate each hypothesis separately.

4. Empirical Methodology

4.1. Unidimensional Framework

For our first set of analyses, we examine the effect of a marginal change in score on a single AP exam on future outcomes. Each student i on AP exam j receives a continuous score C_{ij}. This continuous score maps into the scaled score, T_{ij} as follows:

$$T_{ij} = \begin{cases} 1 \text{ if } C_{ij} < t_j^2 \\ 2 \text{ if } t_j^2 \leq C_{ij} < t_j^3 \\ 3 \text{ if } t_j^3 \leq C_{ij} < t_j^4 \\ 4 \text{ if } t_j^4 \leq C_{ij} < t_j^5 \\ 5 \text{ if } t_j^5 \leq C_{ij} \end{cases}$$

where t_j^n are the thresholds for each scaled score *n* on exam *j*. For each value of $n \in \{2,3,4,5\}$, we create two variables. The first is the forcing variable:

$$Dist_{ijn} = C_{ij} - t_j^n$$

which captures how far student *i*'s score on exam *j* is from threshold *n*. A $Dist_{ijn} \geq 0$ implies that the student has a scaled scores of at least an *n*. This leads to the second variable for each value of *n*, the dichotomous threshold variable:

$$Threshold_{ijn} = \begin{cases} 1 \text{ if } Dist_{ijn} \geq 0 \\ 0 \text{ if } Dist_{ijn} < 0 \end{cases}$$

After generating these variables, our basic empirical framework is shown by the standard regression discontinuity equation presented in equation (1), where X_{ij} is a vector of fixed effects for the student's year of high school graduation and the high school year in which they participated in AP exam *j*

$$Outcome_{ijn} = \alpha_0^n + \alpha_1^n Threshold_{ijn} + \alpha_2^n Dist_{ijn} + \alpha_3^n Threshold_{ijn} \times Dist_{ijn} + X_{ij} + \varepsilon_{ijn} \quad (1)$$

We are primarily interested in the estimate of α_1^n, which is the coefficient on $Threshold_{ijn}$ that represents the discontinuous effect of being above the AP scaled *n* threshold on the outcome of interest. In practice, we separately estimate the effects of each scaled threshold. We also define the forcing variable to represent the distance between the student's raw AP exam score in subject *j* and the score above which the student would have been eligible to receive credit at her chosen college. In these analyses, we separately consider exams taken at any point prior to high school graduation as well as exams taken only during the student's junior or senior years of high school.

The dependent variable in equation (1) is often an indicator variable for an outcome at each threshold *n*. In order to capture trends in the forcing variable that exist on either side of the boundary, we fit a local linear regression with a triangular kernel. The triangular kernel puts more weight on the observations closest to the threshold. In all regressions, we estimate the optimal bandwidth using the method suggested by Imbens and Kalyanaram (IK) (2012).[15]

As with any regression discontinuity design, students just below an AP scaled threshold are expected to have identical college and degree aspirations compared to students at or just above the AP scaled threshold. Researchers who use test cut scores as forcing variables in regression discontinuity designs often worry about score manipulation as a potential source of bias (Schochet et al., 2010). Score manipulation might occur if students know exactly how many questions they need to answer correctly in order to receive a certain score. Since students are neither informed of how the exams are scored nor are they provided with their own raw scores, manipulation would be impossible in this context. Nevertheless, we address and discount this threat by showing that the density of scores is continuous in the vicinity of the thresholds through

[15] We test the sensitivity to bandwidth and kernel choices and find no measurable differences. These robustness tests are presented in Appendix Table 2. We obtain the IK-estimated optimal bandwidth using software designed by Calonico, Cattaneo, and Titiunik (2014).

density tests in the spirit of McCrary (2008). Second, we run covariate balancing tests with similar specifications to equation (1), but using a covariate as the outcome. This allows us to confirm that students just below the thresholds are observationally similar to students just above the thresholds.

4.2. Multidimensional Framework

The parameter estimate, α_1^n,, in equation (1) allows us to estimate the discontinuous jump in the outcome measure from achieving *one* additional credit-granting AP exam score. For the typical AP exam-taker, this parameter estimate likely understates the true impact of the AP program in which many students receive more than just one credit-granting AP score. This is because more than 62 percent of AP exam-takers from the 2004 thru 2009 high school graduation cohorts took more than one examination and 36 percent received a 3 or higher on more than one examination. The unidimensional RD analytic framework fails to reveal the impact of receiving two or more credit-granting AP exam scores on this paper's outcomes, the effects of which may or may not be additive. To explore the impacts of receiving multiple AP credit-granting scores, we first adopt the analytic framework established by Papay, Murnane, and Willett (2011) in which equation (1) is expanded to include multiple forcing variables, boundaries and interactions as in the two-dimensional example shown by EQ(2). The sum of parameters α_1^n, α_4^n and α_8^n in EQ(2) below represent the impact of receiving two additional credit-granting scores on tests *J* and *K*.

$$
\begin{aligned}
Outcome_{ijn} &= \alpha_0^n + \alpha_1^n Threshold_{iJn} + \alpha_2^n Dist_{iJn} + \alpha_3^n Threshold_{iJn} \times Dist_{iJn} + \\
&+ \alpha_4^n Threshold_{iKn} + \alpha_5^n Dist_{iKn} + \alpha_6^n Threshold_{iKn} \times Dist_{iKn} + \alpha_7^n Dist_{iJn} \times Dist_{iKn} + \\
&\alpha_8^n Threshold_{iJn} \times Threshold_{iKn} + \alpha_9^n Threshold_{iJn} \times Dist_{iKn} + \alpha_{10}^n Threshold_{iKn} \times Dist_{iJn} + \\
&\alpha_{11}^n Threshold_{iKn} \times Dist_{iJn} \times Dist_{iKn} + \alpha_{12}^n Threshold_{iJn} \times Dist_{iJn} \times Dist_{iKn} + \\
&\alpha_{13}^n Threshold_{iJn} \times Threshold_{iKn} \times Dist_{iJn} + \alpha_{14}^n Threshold_{iJn} \times Threshold_{iKn} \times Dist_{iKn} + \\
&\alpha_{15}^n Threshold_{iJn} \times Threshold_{iKn} \times Dist_{iJn} \times Dist_{iKn} + X_{ij} + \varepsilon_{ijn}
\end{aligned}
\tag{2}
$$

Using pairings of the six most commonly taken AP exams in our data set, we fit equation (2) to examine the impact of receiving two additional credit-granting scores on bachelor's degree completion. An obvious limitation of this methodology is the notable reduction in sample size that comes along with restricting observations to certain narrow bandwidths on multiple subjects. When considered collectively, however, we show that this approach can provide strong suggestive evidence that the impacts of receiving multiple credit-granting scores are cumulative.

4.3. Marginal Analyses

The previously described analytic strategies do not account for the fact that many sampled students will have taken and received credit-granting scores on other AP exams. Equation 1 allows us to estimate the impact of receiving a credit-granting score on AP Biology (for example), not the impact of only receiving a credit-granting score in Biology and no other exams. Similarly, Equation 2 allows us to estimate the impact of receiving an additional two credit-granting scores, not the impact of receiving only two credit-granting scores.

In these analyses, we test whether the first AP credit-granting score confers students with larger advantages, in terms of outcomes, compared to each additional credit-granting score. To test this, we modify equation (1) so that the forcing variable indicates how close the student was to receiving *X*+1 credit-granting AP exam scores over *X* credit-granting AP exam scores. For each marginal analysis, we restrict the sample only to those students who received either X or X+1 credit-granting AP exam scores. We then re-define the forcing variable as the minimum distance to 0 among all negative subject-specific distances to the credit-granting threshold for students with X credit-granting AP exam scores and the minimum distance to 0 among all positive subject-specific distances to the credit-granting threshold for students with X+1 credit-granting AP exam scores. We continue to control for cohort, subject and school grade fixed effects. To provide a concrete example, consider the marginal analyses performed at the 2/3 margin, where scores of 3 always represent the minimum credit-granting scores. Student A received two credit-granting AP scores on four AP exams, with forcing variable values of {-3.44, -2.45, 0.56, 2.45}. Student B received three credit-granting AP scores on four AP exams, with forcing variable values of {-2.55, 0.96, 4.56, 5.46}. In the analyses addressing the impact of earning three credit-granting scores over two credit-granting scores, Student A would be assigned a forcing variable value of -2.45 and Student B would be assigned a forcing variable value of 0.96.

4.4. Outcomes Considered

To test our empirical hypotheses (H1) through (H5), we consider several outcomes. In reverse chronological order, the hypotheses range from college completion (H2), to college enrollment (H1, H5), to college applications (H5a), to high school course and exam taking (H4). Consequently, we consider three distinct sets of outcomes in our empirical analysis as listed below:

- College Completion Outcomes:[16]
    - Attains a Bachelor's Degree in Four Years

[16] We include students who earn bachelor's degrees through August four and six years beyond high school graduation.

- Attains a Bachelor's Degree in Six Years

- College Application and Enrollment Outcomes:
  - Number of SAT Score Sends (proxy for application)
  - Attends a Four-Year College First (on-time[17])
  - Mean SAT of First College Attended (four-year colleges only)

- Subsequent AP Exam Taking and Performance for Junior Year AP exam-takers:
  - Total AP Exams Taken Senior Year
  - Total Scores of 3 or Higher Senior Year
  - Total Scores of 4 or Higher Senior Year

While we believe that it is mechanically (nearly) impossible for the result of an AP exam taken by a high school senior to influence that student's choice of college applications and enrollment choices for the following fall, we still perform analyses of these outcome variables to verify that conjecture. However, since students do not take AP exams after graduating from high school, our analysis for the third set of outcome variables – AP exam taking in subsequent academic years – is limited to students who complete an AP exam in one year and then return to high school the following year. Technically, we could perform analyses for AP exams results in all grades prior to the senior year of high school, but since it is relatively rare for 9th and 10th graders to take an AP exam, we limit our attention in this particular set of analyses to only high school juniors.

5. Results

5.1. Density and Covariate Balancing Tests

[17] In this paper, we refer to on-time as beginning at a four-year college within 180 days of high school graduation.

To validate our regression discontinuity approach, we first verify that there are no discontinuities in the density of student raw scores across each of the four scaled boundaries for the AP subject exams that we study. In these density tests, we collapse observations into one raw score point bins, by cohort and high school year in which exam was taken. Counts are then regressed on distance from threshold, an indicator variable for whether the raw score is above the specified threshold, an interaction of these two terms, and dummy variables for high school graduation cohort and examination year.

In most RD settings, this type of density test might be performed to detect the presence of score manipulation. However, since the AP scoring rubric is unpublicized, no students would realistically be able to game the system in this manner. An alternative source of density discontinuity might originate from the placement of score boundaries, by the scorers, at points along the raw score distribution that represent particularly sharp breaks in student ability. The parameter estimates in Table 2 confirm that density is smooth across each of the four scaled thresholds. After collapsing observations into bins encompassing one raw score point, by subject, high school graduation cohort and year in which exam was taken, we show that discontinuities in density are small and imprecisely estimated. Moreover, positive and negative coefficients are both well-represented in this table and none are statistically significant at the 0.05 level, further supporting the argument that estimated discontinuities in density simply reflect noise. For example, the upper leftmost coefficient shows a discontinuity of just 11 students across the bins flanking the 1/2 threshold in biology. At the 3/4 threshold in biology, a discontinuity of 11 students also exists, but it is opposite in sign.

<<Insert Table 2>>

To test hypothesis (H1), about whether students choose colleges with AP credit policies that favor them (given the AP exam scores they have achieved), we look for a discontinuity in enrollment choices at each threshold in AP exam raw score. Figure 1 presents a histogram of the differences between students' raw AP exam scores and the colleges' qualifying AP exam scores, across all exams taken by on-time four-year college-going students for all AP exams (top panel) and for exams taken during a student's junior year (bottom panel), before which a college decision has been formalized. Visually, no discontinuities exist, suggesting that students are not sorting into colleges based on those colleges' credit/placement policies.

Table 3 presents the results of tests for discontinuities in density of observations and covariate imbalance at the college-policy thresholds for the six most popular AP exams. The first column shows results of density tests for each exam. There exists no clear evidence of discontinuities in density in the number of students at the credit-granting thresholds. The remaining columns show the results of covariate balancing tests. Only three out of sixty covariate balancing tests show discontinuities that reach statistical significance at the 0.05 level, which is what one might expect by random chance. These null results are confirmed visually in Figure 2, which clearly demonstrates the smoothness of key covariates around the thresholds. This provides evidence against hypothesis (H1). That is, students are not choosing their colleges based on the favorability of the colleges' credit-granting policies in relation to their AP exam scores.

<<Insert Figure 1, 2, Table 3>>

5.2 AP Exam Scores and Bachelor's Degree

As a precursor to our analysis of the individual hypotheses (H2) to (H5), we assess the overall effect of an increase in AP exam score, in particular from just below to just above the threshold for college credit. This formulation combines all of the different channels by which an increase in AP exam scores influences the time to completing a BA degree.

Figure 3 presents the parameter estimates and t-statistics for regression discontinuity tests for each of the 34 different AP exams for all students and completion of a BA degree within four, five and six years of high school graduation as dependent variables. For each student, we compute the distance in raw score to the threshold required for credit at the college where this student first enrolled after high school graduation. In many cases, we use the distance to the 2/3 scaled score cutoff as the distance to the threshold, but since the credit policies for each exam vary to some degree across colleges and within colleges, we use different scaled score cutoffs for some students. Here, we rely on the results of our earlier analysis of (H1) to justify the use of this "distance to credit threshold" value as an independent variable in a regression discontinuity specification, since that analysis indicates that students do not appear to change colleges in response to a score just above or below a score threshold (i.e. near a value of 0 for the "Distance to Threshold" measure).

<<Insert Figure 3>>

The top left panel of Figure 3 presents t-statistics and the top right panel of Figure 3 presents coefficient estimates for exams with completion of BA degree within four years of high school graduation as the dependent variable. The effect of meeting the college's credit/placement guidelines is estimated to be positive in 26 of 34 cases, typically with a magnitude of an increase on the order of 1 to 2 percentage points in probability of graduation in four years. Since the sample sizes for most exams are quite large, we find that more than half (14 of 26) of the positive coefficients, but none of the negative coefficients on achieving the credit threshold are significant at the 0.05 level. When we restrict analysis to the 19 subjects with more than 100,000 observations, we find that an even larger proportion of exams - 12 out of 19 – yield positive and statistically significant coefficient estimates.

The middle and bottom panels of Figure 3 show the results with BA degree completion within five and six years, respectively, as the dependent variable. These results provide suggestive evidence that both the magnitudes and statistical significance of the parameter estimates fade over time. That is, meeting the threshold for college credit on an AP exam appears to reduce the expected time to completion of a BA degree, but also does not appear to increase the long-run probability of completing a BA degree. This may reflect the difference in baseline four-year and six-year graduation rates. For the six major AP exams on which we focus this paper, students just shy of the credit-granting thresholds have four-year BA completion rates of about 60 percent and six-year completion rates of more than 80 percent. Since such a large percentage of these students complete BA degrees within six years of high school graduation, the benefit of an additional AP exam credit may have little influence on the long-run outcomes of those who would not otherwise complete a BA degree within six years.

Before turning our attention exclusively to the six AP exams that are most commonly taken, we pool all exams together to estimate the bachelor's completion impacts of earning scores of 3, 4 and the minimum credit-granting AP score at the college to which the student matriculates. Figures 4a and 4b show graphically discontinuities on the order of about 1 percentage point in four-year bachelor's completion for both the pooled sample of 34 exams and the pooled sample of 6 focal exams. Discontinuities in six-year BA completion are smaller and more challenging to detect visually.

Table 4 presents results from pooled sample regressions at the 2/3 and 3/4 score thresholds. As Equation 1 states, we control for the fixed effects of high school graduation cohort, high school year in which the exams were taken, as well as fixed effects for exam subject. Panels A and B show results for all 34 AP subjects and Panels C and D does so for the six popular subjects that we highlight throughout the rest of the paper.

As shown in Panel A, we estimate a 0.7 percentage point jump in the probability of four-year BA completion resulting from receiving an AP score of 3 over 2 (column 1, row 1), over and above the 56.4 percent four-year BA completion rate of students who just missed a score of a 3. However, we then separate students by the minimum credit-granting score of the college they attend. For example, a student who earned a score of 3 on AP Biology and attended Florida State University, where the minimum credit-granting score is 3, would be grouped into the credit-granting analytic sample at the 2/3 margin (Table 4, Column 2). If that student were to instead have attended Pennsylvania State University, where the minimum credit-granting score for AP Biology is 4, she would have been grouped into the non-credit-granting sample at the 2/3 margin (Table 4, Column 3). The students who attend a college that gives credit for their scores experiences a 1.1 percentage point jump in four-year bachelor's completion while the other students only experiences a 0.4 percentage point jump, which is not significant at the 0.05 level. These results suggest that the credit-granting policies are the main driver of the bachelor's degree completion estimates (H2*)*, rather than psychological boosts from achieving higher scores (H3*)* or shifts in the quality of college in which a student enrolls (H5)

As shown in the next three columns of the top panel of Table 4, we estimate similar, but slightly smaller effects for pooled sample regressions fit at the 3/4 score threshold. Once again, these estimated effects are larger for the subset of students who attend colleges requiring the higher score at this score threshold for college credit. This demonstrates that effects of credit-granting policies on bachelor's completion are not confined only to the more academically modest students whose AP scores are proximal to the 2/3 thresholds. Finally, the last column represents the estimate that corresponds to Figure 4a, where students are assigned a forcing variable equal to the distance from the minimum credit-granting policy at the college they attend. The coefficient in the last column of Panel A suggests that students who attain the minimum score for receipt of college credit on their campuses experience a one percentage point increase in the probability of graduating in four-years.

As shown in Panel B of Table 4, we estimate much smaller effects for an increase in AP exam score in pooled regressions with six-year bachelor's degree attainment as the outcome. Specifically, we estimate a 0.4 percentage point increase in the probability of six-year bachelor's completion resulting from receiving an AP score of 4 over 3 for students attending a college requiring a score of 4 for credit, and this estimate is statistically significant at the 0.05 level. By contrast, the estimated coefficients at the 2/3 score threshold are close to zero in these specifications and none of them are statistically significant at the 0.10 level.

Comparing the top and bottom panels in Table 4, we find similar results when we pool all 34 AP tests or restrict attention to the six focal AP tests. In each case, we find a significant increase in four-year graduation rates due to earning higher AP scores at the 2/3 and 3/4 thresholds, primarily when that score coincides with the minimum credit-granting score at the college they attend. However, we find much smaller effects on six-year graduation rates from earning higher AP scores, where these effects are concentrated at the 3/4 score threshold.

<<Insert Table 4, Figure 4a, b>>

Next, we proceed to subject specific regression discontinuity analyses for the six most commonly taken AP exams in Figure 3. Tables 5 and 6 present the formal estimates for four- and six-year bachelor's degree completion rates As shown in the right most column of Table 5, the effect of exceeding the credit threshold on four-year graduation is statistically significant at the

.05 level for five of these six AP exams. For Calculus AB, earning a credit-granting AP score increases the probability of four-year bachelor's completion by 1.6 percentage points. The discontinuities found in column 7 (the right-most column) of Table 5 are presented visually in Figure 5. By contrast, as shown in the right most column of Table 6, the effect of exceeding the credit-granting threshold on six-year bachelor's completion is only statistically significant at the .05 level for two of these six exams. Further, on an exam-by-exam basis, the magnitudes of the coefficient estimates are smaller for six-year graduation than for four-year graduation.[18]

<<Insert Figure 5, Tables 5 and 6>>

In Appendix Figures 1 and 2, we show that the four-year bachelor's degree completion estimates in Table 5 are robust to a wide range of bandwidths and to the functional form of the forcing variable. Linear regression with a triangular kernel and the incorporation of a quadratic polynomial with a rectangular kernel both show that the lower bound of the 95 percent confidence interval tends to rest comfortably above zero for all subjects, except for AP Biology, an exam which has been altered substantially since the sampled cohorts entered college. Therefore, we caution that results for biology shown in this paper may not reflect impacts from earning a credit-granting score on the current version of the exam. It is also important to highlight that the 1 to 2 percentage point estimate magnitudes conveyed in Figure 5 and Table 5 may actually slightly understate the discontinuities, as the point estimates tend to shrink from the smaller bandwidths to the larger, optimal bandwidths.

Columns 1 and 4 of Tables 5 and 6 repeat these analyses for all students with raw scores near the cutoff for scaled scores of 2 versus 3 and separately near the cutoff for scaled scores of 3

[18] These estimates are robust to inclusion of college fixed effects, which should allay any lingering concerns about the effect being driven by college choice.

versus 4.[19] These coefficient estimates, especially those in Column 1 (for the 2/3 scaled score cutoff) are broadly similar to the estimates for the "Distance to Cutoff" specification in Column 7 of Tables 4 and 5, suggesting that receiving higher AP exam scores improves on-time bachelor's completion by 1 to 2 percentage points.

As in Table 4, to distinguish hypotheses (H2) and (H3), which consider the direct effect of credit receipt versus the psychological boost of a higher AP exam score, we compute separate analyses at each scaled score threshold for (A) students attending colleges that use this threshold as the minimum for college credit and (B) students attending colleges that do not use this threshold as the minimum for college credit or reported no credit-granting policies. As shown in Columns 2-3 and 5-6 of Table 5, we estimate that receiving an AP exam score of a 3 over a 2 results in a statistically significant increase in the probability of four-year bachelor's degree completion of 1 to 2 percentage points, but only when that score of 3 is high enough for the student to earn credit. Similarly, we find that achieving a score of 4 over a 3 enhances the student's probability of completing a bachelor's degree in four years only when 4 is the minimum credit-granting score.[20]

To refine this assessment, we restrict the sample to high school seniors taking AP exams and repeat these same specifications for four of the six popular exams studied in Table 5, excluding English Composition and U.S. History, which are relatively rarely taken by high school seniors. We note that high school seniors have already selected a college by the time that

[19] Only students who enroll in four-year colleges as first-time on-time students are included in these analyses.
[20] The obvious exception to this pattern is AP Biology, for which exceeding a certain AP threshold contributes to an improved bachelor's degree completion probability only when the threshold *does not* translate into a difference in whether the student is eligible for college credit. It is not possible to explain this bewildering finding with the existing data. However, in 2012, the College Board substantially re-designed the AP Biology exam, so it is possible that the results presented in this paper will not be applicable to the more recent cohorts of AP Biology test takers.

they receive their scores, so should not be subject to the effects described in hypotheses (H1), (H4) and (H5), which consider college choice.

Table 7 shows the results of restricting the sample to senior year exams only. We find positive and statistically significant effects (at the .10 level) on bachelor's completion for three of the four subjects at the 2/3 scaled score cutoff (column 2) and also at the 3/4 scaled score cutoff (column 5) for students attending colleges that use these separate cutoffs as the thresholds for college credit. By contrast, we only find one statistically significant coefficient among the eight exams (four exams at the 2/3 scaled score cutoff and four more exams at the 3/4 scaled score cutoff) for gains in exam scores that do not correspond to a course credit threshold at the colleges where the students enrolled (columns 3 and 6).[21] Taken together, these results weigh in favor of the direct effect of college credit receipt in hypothesis (H2) over the psychological boosts associated with relatively higher AP exam scores in hypothesis (H3). Moreover, since the results in Table 7 parallel so closely those shown in Table 4, we can discount college choice as a driver of this paper's main bachelor's degree findings.

<<Insert Table 7>>

5.3 Impacts on Subsequent AP Exam Taking for High School Juniors

To test whether early success on AP exams encourages more advanced course work and success, hypothesis (H4), we perform regression discontinuity tests for junior year exam-takers using dependent variables based on senior year AP exam taking and scores. Since most AP exam-takers will not have selected a college in their junior year, we use the same threshold – either the 2/3 or 3/4 scaled score cutoff – regardless of the credit policies at the first college where each student enrolled after high school graduation. Figure 6 graphs the average number of

[21] In support, we also do not find completion effects on the 1/2 or 4/5 scaled score cutoffs, where credit is less likely to be at stake. See Appendix Table 6 for the estimates.

senior year AP exams taken and the average number of scores of 3 or higher in senior year exams by distance from the 2/3 threshold on each junior year exam.[22] We find discontinuities on the order of about 0.10 senior year exams taken and 0.05 exams passed for all subjects except for Calculus AB. But students who take the Calculus AB exam as juniors are probably unusually accelerated, even within the population of those taking at least one AP exam as a high school junior, and may have received sufficient academic affirmation in prior courses that an additional signal of academic aptitude (in the form of an AP exam score) has little additional effect on them.

Table 8 presents numerical estimates of the marginal effect of an increase scaled junior year AP exam score on each of the six most popular AP exams on senior year AP exam taking and performance. Consistent with the results of Figure 6, we find that an increase in scaled score from 2 to 3 increases the number of AP exams taken in the senior year; these predicted increases are statistically significant at the .05 level for five of the six exams and at the .10 level for the remaining exam, Calculus AB (column 4). The largest effect, found for AP English Language and Composition, suggests that students who just receive a scaled score of 3 junior year take approximately 0.14 more AP exams senior year. Across the other boundaries, there exist some positive, statistically significant increases in senior year AP exam taking. For example, three out of six of the parameter estimates in column 1 of Table 8 are significant at the 0.05 level. This provides suggestive evidence that even receiving a signal that a student is "possibly qualified" (AP exam score=2) rather than "no recommendation" (AP exam score=1) induces an increase in senior year AP exam taking.

<<Insert Figure 6, Insert Table 8>>

[22] We cannot observe AP course taking, only exam taking.

These results provide support for hypothesis (H4). Yet, a back of the envelope calculation suggests that while success on an AP exam as a high school junior is predicted to induce additional AP exam participation as a high school senior, this additional exam taking as a senior is likely to have only a second-order effect on postsecondary success. For example, Table 8 (column 5) suggests that an increase in scaled score from 2 to 3 increases the number of scores of 3 or higher on senior year exams by at most 0.09. But since the estimates from Table 7 suggest that each additional score of 3 or higher as a high school senior increases the probability of on-time completion of a BA degree at most by 2.4 percentage points, an increase of 0.09 AP credit-granting scores would translate into an extremely small effect on time to completion of a BA degree.

5.4 Score-Sending and College Choice

To test hypotheses (H5a) and (H5b), which consider college application and admission, we first assess the effects of achieving certain AP exam scores on the student's college search process and whether or not the student enrolls at a more selective college. We rely on the number of SAT Score Sends as a crude proxy for number of applications.[23] A discontinuity in this metric would strongly suggest that achieving certain AP exam scores alters the number of college applications submitted. Since high school seniors send SAT scores to colleges before they take AP exams, estimates for exams taken senior year serve as placebo tests for junior year estimates.

The first six columns of Table 9 show that achieving a score of 3 over 2 or a score of 4 over 3 on AP exams taken during a student's junior year of high school tend not to impact SAT score sending. Among the 12 parameter estimates presented for junior year SAT test takers, only one (English Language and Composition at the 2/3 boundary) is statistically significant. The

[23] Not all score sends materialize in college applications. Moreover, a small number of SAT score sends may involve scores sent to scholarship organizations, like the National Merit Scholarship Corporation, rather than colleges.

magnitude of this parameter estimate indicates that receiving a score of 3 on AP English Language and Composition causes the student to send 0.105 (2.5 percent) more SAT scores to colleges. As expected, almost all (11 out of 12) placebo tests using SAT score sends of high school senior AP exam-takers are statistically indistinguishable from zero. In Appendix Table 7, we show little heterogeneity along the lines of parental income in shifting college application behavior as a result of achieving scores of 3 or 4.

In the last six columns of Table 9, we present regression discontinuity parameter estimates of the average SAT scores of colleges selected by first-time on-time four-year college enrollees. Restricting analyses to AP exam scores on the six most popular AP exams for high school juniors, we find only one statistically significant (positive) effect at the 2/3 scaled score cutoff and one statistically significant (positive) effect at the 3/4 scaled score cutoff. Similarly, we find essentially no effect of AP exam scores on enrollment in four-year colleges (results shown in Appendix Table 9). This is most likely because the baseline four-year college-going rates among students participating in AP exams is already quite high.

To determine whether application composition was altered by AP exam scores, we calculate the mean, maxima and minima of the institutional average SAT scores among the sets of colleges to which students submitted their own SAT scores. We test for discontinuities in these metrics at both the 2/3 and 3/4 boundaries among the six major exams taken junior year. Of the 36 discontinuity parameter estimates, only three are statistically significant at the 0.05 level. Since college choice appears unaffected by the receipt of higher AP scores, it is unsurprising that college application behavior also appears unaffected by these higher scores.[24]

[24] Results not presented in paper. Please contact the authors for more details.

Overall, these results do not support hypotheses (H5a) or (H5b) in that there are no measurable changes in students' score sends or attending college after achieving a relatively high AP exam score.

<<Insert Table 9>>

5.5 Multidimensional RD Impacts

In Figure 7, we show the distribution of point estimates associated with achieving credit-granting scores on the 15 pairings of the six commonly taken AP exams. These pairings include all possible two-exam combinations of the six AP exams in Tables 5 and 6. The estimates can be thought of as the effect of getting college credit on two exams, relative to zero exams.

Although power is diminished by constraining the models to include only those students fairly close to the credit-granting boundaries on two exams, the pattern is clear. When the outcome of interest is bachelor's degree completion in four years (Panels A and B), the parameter estimates are mostly positive. In fact, at a bandwidth of 20, only one of the 15 multidimensional parameter estimates in Panel B is negative, and the magnitude of this one parameter estimate is only -0.4 percentage points. Expanding the time to bachelor's degree completion from four years to six years results in a more equally distributed number of positive and negative parameter estimates (Panels C and D).

On average, the magnitudes of the four-year bachelor's completion parameter estimates in Panels A and B are about twice as large as the unidimensional point estimates presented in Table 4. When observations are restricted only to those within 10 raw points of the credit-granting boundary, the average impact of receiving an additional two credit-granting scores across all 15 pairings is 3.2 percentage points. When the bandwidth is expanded to +/- 20 raw points, the average impact on four-year bachelor's completion is 2.7 percentage points.

<<Insert Figure 7>>

Despite the fact that, in the unidimensional RD framework, we were unable to detect a boost in four-year bachelor's degree completion from receiving a credit-granting score in AP Biology, our analysis in the multidimensional RD framework suggests that when paired with other AP examinations, success on AP Biology substantially increases four-year bachelor's completion rates. In fact, some of the largest estimates shown in the histogram Figure 6 (panels A and B) are for AP Biology pairings. When the bandwidth is +/-10 raw points, receiving/ a credit-granting score on AP Biology and AP US Government, AP Biology and AP English Language and Composition and AP Biology and AP US History increases the probability of receiving a bachelor's degree in four years by 9.4 pp, 8.0 pp and 5.0 pp respectively. The corresponding percentages when the bandwidth is expanded to +/- 20 raw points are 2.5 pp, 5.1 pp and 4.0 pp. Also notable is the pairing of Calculus AB and English Language and Composition, credit eligibility on both of which leads to the largest point estimates on four-year bachelor's degree completion for both bandwidths among all 15 pairings (10.1 pp at a bandwidth of +/- 10 raw points and 5.4 pp at a bandwidth of +/-20 raw points).

Though the data do not allow us to conclude definitively why earning a credit-granting score on both biology and another subject yield such large point estimates, one possibility is that these pairings allow students to satisfy simultaneously curricular requirements in both sciences and humanities or social sciences. Completing two distinct sets of educational requirements, rather than just one, may allow students the flexibility to properly structure their course-taking in a manner conducive for on-time bachelor's completion. An entirely distinct mechanism which might explain this finding involves the relationship between the receipt of credit-granting AP scores and what students actually study in college. If students who take AP Biology are inclined to study STEM fields in college, receiving a credit-granting score in a non-science field might instead divert them into humanities and social sciences- fields where students, on average, may face fewer credit-hour requirements to obtain their degrees (Johnson et al., 2012).

5.6 Marginal Impacts

In this section of results, we address whether the impact of receiving an additional credit-granting AP exam score on bachelor's degree completion depends on the number of credit-granting scores that the student had already amassed. These analyses differ from all previous analyses in that we do not discern between the 34 AP subjects for which we have college-specific AP credit-granting score minima. Table 10 shows the impact of bachelor's degree completion probability driven by each incremental increase in the number of credit-granting AP exam scores earned. Students who have met the credit-granting threshold on just one AP exam are 1.2 percentage points more likely to have earned a bachelor's degree within four years than students who just missed earning a credit-granting AP exam score. Transitioning from one credit-granting AP exam score to two results in an additional 0.8 percentage point boost in four-year bachelor's degree completion. Progression from four to five credit-granting AP exam scores yields increases in four-year and six-year bachelor's degree completion probabilities of 1.2 and 0.9 percentage points, respectively.

<<Insert Table 10>>

Parameter estimates in Table 10 can be used to draw inferences about the cumulative impacts of achieving credit-granting scores on AP exams. For example, the parameter estimates in Column 1 suggest that students who earn credit-granting scores on two AP exams could experience a 2.0 percentage point bump in four-year bachelor's degree completion probability attributable to those credit-granting scores. This 2.0 percentage point bump is calculated as the sum of the first two parameter estimates (1.2 and 0.8 percentage points) in Column 1 and is roughly equal to the multidimensional estimates on the passing of two AP exams presented in Section *5.5*. The consistently positive, though imprecisely estimated, parameter estimates in Column 1 reveal that the marginal benefits of earning additional credit-granting AP exam scores continues to increase four-year bachelor's degree completion rates beyond the first two passing scores. Addition of the first five parameter estimates in Column 1 suggests that one college semester's worth of AP credits may increase four-year bachelor's degree completion rates by nearly 4 percentage points, assuming a standard semester course-load of five courses (approximately 15 credit hours). For the high school graduation cohort of 2014, an estimated 100,000 or more students will have earned at least five AP credit-granting scores, contributing to the expected 70%- 75% on-time BA completion rate of these students.[25]

5.7 Heterogeneous Effects

We hypothesized that the effects of AP exam scores on college choices and college completion might be unusually pronounced for students from low-income families. To test this hypothesis, we repeat the analysis from Tables 5 and 6 for subgroups of students based on self-reported family income. The results, as shown in Table 11, are consistent with the earlier findings, which suggest that AP credit-granting policies have an effect on four-year bachelor's degree completion rates, but much less, if any effect, upon six-year bachelor degree completion rates. However, we see no obvious patterns across family income in RD estimates for four-year and six-year completion of bachelor's degrees. Since our measure of family income is based on student self-report, which is likely to be fairly noisy, we do not regard the coefficients in Table 11 as precise estimates of heterogeneous effects as a function of family income. Nevertheless, if

[25] These bounds are estimated by the number of students who received 5 or more scores of 3 (174,000) and 5 or more scores of 4 on all AP exams (90,000).

the effects of AP credit policies are concentrated in students from families with relatively low incomes, we would still expect to see conspicuous patterns by income in Table 11. Since this is not the case, we tentatively rule out the hypothesis that AP credit is unusually important for students from low-income families.

<<Insert Table 11>>

We also test for heterogeneous effects by race, gender and parental education and also find no obvious differences. Estimates for some underrepresented groups, such as Black and Hispanic students, as well as students whose parents never obtained high school diplomas, are particularly noisy due to small sample sizes. Therefore, the inability to confirm any expected patterns by race or parental education may result from small sample sizes, rather than the actual absence of these patterns. Results are reported in Appendix Table 8.

6. Discussion and Conclusion

In this study, we find evidence that attaining a relatively high AP exam score yields a significant increase in the probability of completing a bachelor's degree within four years of high school graduation. For high school seniors, we attribute most of this effect to the direct effect of an AP credit towards college graduation requirements (empirical hypothesis (H2)), since we find little to no effect on bachelor's degree completion from an increase in AP exam scores for high school seniors when those increases in scores do not coincide with credit/no-credit threshold at the college attended by that student. Thus we rule out empirical hypothesis (H3), which suggests that a marginal increase in AP exam score improves postsecondary outcomes by providing a psychological boost to students.

We also find evidence that earning scores of 3 or higher on AP exams for high school juniors induces increased participation and success on AP exams (empirical hypothesis (H4)) in the senior year of high school. However, this increase is still of relatively small magnitude – e.g. an improvement in AP exam score from 2 to 3 or 3 to 4 predicts an increase of approximately 0.1 additional AP exams taken as a high school senior – and is only predicted to produce second-order effects on time to bachelor's degree completion. While students with higher AP exam scores tend to enroll in more selective four-year colleges, we find little causal evidence that the AP exam scores themselves radically shift whether or not a student enrolls at a four-year college or the type of college chosen, as measured by average college-level SAT scores (empirical hypothesis (H1) and (H5)). In particular, it does not appear that an increase in AP exam score for a high school junior alters the colleges to which she sends SAT scores. Given this pattern of results, we also attribute the significant increase in the probability of completing a bachelor's degree within four years of high school graduation that we observe for high school juniors to the direct effect of an AP credit towards college graduation requirements (empirical hypothesis (H2)).

Additionally, our estimates on the effect of receiving a credit-granting score on four-year graduation rates are similar on the 2/3 boundary and the 3/4 boundary. Typically in a regression discontinuity design, researchers have one discontinuity to exploit and the estimated treatment effect is localized. In this analysis, there is evidence that the treatment effect is fairly constant, at least on the 3 to 4 range.

We believe that these findings have positive implications for colleges and students. From the perspective of postsecondary institutions, awarding AP credit and/or placement may serve as a useful tool for increasing the percentage of students who complete bachelor's degrees in four years. By awarding college credit and advanced placement to successful AP examinees, postsecondary institutions can free students from unnecessary curricular repetition while simultaneously responding to the issues of overcrowding of introductory courses in the nation's larger university systems (Moltz, 2009; Murphy, 2013).[26] Finally, in light of the federal government's recent push for the implementation of a college ratings system, as well as the almost certain inclusion of college completion as a part of that ratings system, rewarding successful AP students with early college credit may be a strategic approach to boost on-time BA completion, and consequently, the institution's rating. [27]

For students, AP exams can reduce the total costs associated with a postsecondary education. During the 2014-2015 academic year, the typical student attending a four-year public college faced published tuition and fees of $9,139(Baum and Ma, 2014). Assuming that a typical student completes 30 credits per year, savings from earning credit on one AP exam has the potential to save that student an estimated $914 in costs for colleges that charge tuition per credit, ten times larger than the actual $91 cost of an AP exam.[28] Further, our finding that each AP course credit increases the probability of completing a bachelor's degree on-time in four years from high school graduation translates into additional expected financial benefits due to (1) reduced tuition costs at colleges that charge by semester rather than by credit and (2) increased wages and career benefits due to potential earlier entry into the labor market.

Importantly, the estimates in this paper may represent a lower-bound on the total potential effects of the AP program. Some students qualified to benefit from sharing AP exam results with their chosen colleges may have instead withheld these scores or colleges may have additional restrictions on the credit policies (e.g. maximum number of AP credits). If colleges

[26] Evans (2013) explores this question using a selection on observables identification strategy.
[27] See the Department of Education's request for ratings feedback. http://www.ed.gov/news/press-releases/public-feedback-college-ratings-framework
[28] We assume that the student is awarded 3 credits for a passing score and pricing is linear with respect to credits. Depending on the AP exam and the institution, the student might actually receive more than 3 credits for a passing score, meaning that the $914 figure probably represents an underestimate.

were to relax criteria capping the number of AP credits, the effects on bachelor's degree completion might be even larger than those presented in this paper.

Finally, we are unable to offer any commentary on the cumulative effects of taking an AP course and earning credit on the associated AP exam. Because our estimation strategy relies on the comparison of two sets of students- those who barely achieved a credit-granting score and those who barely missed a credit-granting score-, we are unable to determine how the content of the AP course influences bachelor's degree completion, which is necessary to fully determine the costs and benefits of the AP program. Moreover, the analytic strategy employed in this study prevents us from making any strong conclusions about the contribution of human capital gains towards college completion. It is entirely plausible that the knowledge and skills acquired in AP courses, which should be roughly equivalent on both sides of credit-granting thresholds, influences college completion more profoundly than establishment of credit-granting policies.

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Table 1: Summary Statistics

	All AP Exam Takers			Biology			Calculus AB			English Lang. & Comp.			English Literature			US Government			US History		
	N (1000s)	Mean	Std. Dev	N (1000s)	Mean	Std. Dev	N (1000s)	Mean	Std. Dev	N (1000s)	Mean	Std. Dev	N (1000s)	Mean	Std. Dev	N (1000s)	Mean	Std. Dev	N (1000s)	Mean	Std. Dev
(A) Demographics																					
Male	4,528	0.44	0.50	691	0.41	0.49	1,120	0.51	0.50	1,229	0.37	0.48	1,641	0.36	0.48	847	0.47	0.50	1,438	0.45	0.50
White	4,528	0.64	0.48	691	0.63	0.48	1,120	0.67	0.47	1,229	0.64	0.48	1,641	0.67	0.47	847	0.64	0.48	1,438	0.67	0.47
Black	4,528	0.07	0.26	691	0.06	0.24	1,120	0.05	0.21	1,229	0.07	0.26	1,641	0.07	0.26	847	0.06	0.24	1,438	0.06	0.24
Hispanic	4,528	0.13	0.34	691	0.08	0.28	1,120	0.09	0.28	1,229	0.13	0.33	1,641	0.11	0.31	847	0.12	0.33	1,438	0.11	0.31
Asian	4,528	0.11	0.31	691	0.18	0.39	1,120	0.16	0.36	1,229	0.11	0.32	1,641	0.10	0.31	847	0.13	0.33	1,438	0.12	0.32
Parental education - HS dropout	4,528	0.08	0.28	691	0.07	0.26	1,120	0.08	0.27	1,229	0.08	0.28	1,641	0.08	0.27	847	0.08	0.28	1,438	0.08	0.27
Parental education - HS graduate	4,528	0.14	0.34	691	0.13	0.34	1,120	0.13	0.33	1,229	0.14	0.35	1,641	0.14	0.34	847	0.14	0.35	1,438	0.14	0.35
Parental education - BA or higher	4,528	0.43	0.50	691	0.50	0.50	1,120	0.49	0.50	1,229	0.49	0.50	1,641	0.48	0.50	847	0.52	0.50	1,438	0.51	0.50
Low income (< $50,000)	4,528	0.14	0.35	691	0.13	0.34	1,120	0.13	0.34	1,229	0.15	0.35	1,641	0.14	0.35	847	0.15	0.35	1,438	0.14	0.34
Middle income ($50,000-$100,000)	4,528	0.17	0.38	691	0.18	0.39	1,120	0.19	0.39	1,229	0.19	0.40	1,641	0.19	0.39	847	0.19	0.40	1,438	0.19	0.39
High income (> $100,000)	4,528	0.15	0.36	691	0.18	0.38	1,120	0.17	0.38	1,229	0.18	0.38	1,641	0.17	0.37	847	0.19	0.39	1,438	0.18	0.39
(B) Test scores																					
Received AP Score = 1	4,528	0.48	0.82	691	0.21	0.41	1,120	0.25	0.43	1,229	0.11	0.31	1,641	0.09	0.28	847	0.18	0.38	1,438	0.22	0.41
Received AP Score = 2	4,528	0.59	0.83	691	0.21	0.41	1,120	0.16	0.37	1,229	0.32	0.47	1,641	0.30	0.46	847	0.29	0.46	1,438	0.26	0.44
Received AP Score = 3	4,528	0.67	0.95	691	0.20	0.40	1,120	0.19	0.39	1,229	0.32	0.47	1,641	0.33	0.47	847	0.27	0.44	1,438	0.22	0.42
Received AP Score = 4	4,528	0.53	0.96	691	0.19	0.39	1,120	0.20	0.40	1,229	0.18	0.38	1,641	0.21	0.41	847	0.17	0.38	1,438	0.20	0.40
Received AP Score = 5	4,528	0.37	1.02	691	0.18	0.39	1,120	0.21	0.41	1,229	0.08	0.28	1,641	0.07	0.26	847	0.09	0.28	1,438	0.10	0.30
(C) College outcomes																					
Attends Four-Year	4,528	0.84	0.37	691	0.90	0.30	1,120	0.91	0.29	1,229	0.88	0.33	1,641	0.89	0.31	847	0.90	0.30	1,438	0.89	0.31
Attends Four-Year First On-Time	4,528	0.71	0.45	691	0.80	0.40	1,120	0.81	0.39	1,229	0.76	0.43	1,641	0.79	0.41	847	0.80	0.40	1,438	0.78	0.42
Mean SAT of First College	3,113	1158	125	540	1195	131	887	1192	123	908	1174	129	1,254	1177	129	659	1182	124	1,088	1182	129
Bachelors in Four Years	3,220	0.54	0.50	554	0.61	0.49	910	0.59	0.49	934	0.58	0.49	1,292	0.59	0.49	674	0.59	0.49	1,120	0.59	0.49
Bachelors in Five Years	2,583	0.73	0.45	438	0.78	0.42	737	0.78	0.42	715	0.76	0.43	1,048	0.76	0.43	535	0.77	0.42	869	0.77	0.42
Bachelors in Six Years	1,965	0.78	0.42	325	0.82	0.39	567	0.82	0.39	513	0.80	0.40	810	0.80	0.40	401	0.81	0.39	628	0.81	0.39

Notes: The unit of observation is a student. Means and standard deviations are calculated using the raw AP scores. Because raw AP score data were unavailable before 2004, some sampled students, particularly for earlier high school graduation cohorts, will have participated in more AP exams than their raw scores would suggest. Bachelor's completion rates are calculated for students starting at four-year colleges within 180 days of high school graduation. Only students from the 2004-2007 and 2004-2008 cohorts considered in the six-year bachelor's completion rates and five-year bachelor's completion rates, respectively. All mean values for test score distributions add up to 1, except for those in column 2, which add up to the number of AP exams taken by the typical sampled student.

Table 2: Density Tests at the Integer Thresholds

	Threshold:			
	1/2	2/3	3/4	4/5
(A) Biology (BW=32.164)				
Above threshold	11.035	1.594	-10.560	-0.959
	(11.452)	(7.014)	(7.717)	(6.448)
Mean below threshold	357.000	451.167	444.333	328.833
N	946	693	644	905
(B) Calculcus AB (BW=15.844)				
Above threshold	19.102	-4.048	-0.115	-3.387
	(27.473)	(27.408)	(18.193)	(14.364)
Mean below threshold	871.600	928.000	945.063	720.722
N	453	439	492	548
(C) English Language and Composition (BW=26.038)				
Above threshold	31.841	15.184	-54.706	-65.623
	(32.598)	(55.520)	(65.032)	(62.940)
Mean below threshold	497.438	1144.667	1122.250	599.933
N	831	760	592	657
(D) English Literature (BW=17.631)				
Above threshold	-14.147	103.702	-61.633	0.758
	(44.152)	(109.695)	(118.552)	(113.241)
Mean below threshold	546.063	1457.500	1786.733	817.067
N	544	555	545	508
(E) US Government (BW=26.225)				
Above threshold	12.333	-1.138	-12.610	-61.168*
	(16.785)	(14.563)	(23.024)	(34.259)
Mean below threshold	425.056	694.333	699.444	588.545
N	889	769	596	697
(F) US History (BW=33.363)				
Above threshold	28.753	-6.949	-6.435	-31.386
	(30.066)	(25.684)	(24.619)	(23.976)
Mean below threshold	747.000	1045.000	896.444	551.647
N	956	723	713	929

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All regressions use triangular kernels with fixed effects for cohort and high school year in which exam was taken. In these density tests, observations are collapsed into 1 raw score point bins, by cohort and high school year in which exam was taken. These counts are then regressed on distance from threshold, an indicator variable for whether the raw score is above the specified threshold, an interaction of these two terms, and dummy variables for high school graduation cohort and examination year. The means below the thresholds represent the mean number of observations within the high school cohort by exam year categories within 1 raw score point below the specified threshold . Optimal bandwidths are selected using the outcome, bachelor's degree within four years.

Table 3: Density and Covariate Balance Tests at the College Credit Policy Boundaries

	(1) Number of observations	(2) Male	(3) Black	(4) Hispanic	(5) Asian	(6) Parent HS dropout	(7) Parent HS graduate	(8) Parent BA or more	(9) < $50K	(10) $50K-$100K	(11) > $100K
(A) Biology (BW=32.164)											
Above threshold	6.363	-0.003	0.003**	0.001	-0.001	0.001	-0.000	-0.004	0.001	-0.005*	-0.003
	(5.165)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
Mean below threshold	382	0.408	0.040	0.060	0.166	0.058	0.131	0.553	0.118	0.190	0.206
N	1,152	388,247	388,247	388,247	388,247	388,247	388,247	388,247	388,247	388,247	388,247
(B) Calculcus AB (BW=15.844)											
Above threshold	2.140	-0.001	0.002*	-0.001	-0.001	-0.002	0.001	-0.007*	-0.000	-0.004	-0.002
	(18.695)	(0.004)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)	(0.003)	(0.003)
Mean below threshold	762	0.499	0.034	0.067	0.137	0.067	0.125	0.529	0.119	0.199	0.192
N	523	375,973	375,973	375,973	375,973	375,973	375,973	375,973	375,973	375,973	375,973
(C) English Language and Composition (BW=26.038)											
Above threshold	23.846	0.004*	-0.001	0.002	0.003*	-0.000	0.002	-0.001	0.001	-0.002	0.002
	(41.214)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mean below threshold	1,079	0.360	0.048	0.090	0.110	0.062	0.140	0.565	0.121	0.209	0.209
N	818	659,539	659,539	659,539	659,539	659,539	659,539	659,539	659,539	659,539	659,539
(D) English Literature (BW=17.631)											
Above threshold	37.952	-0.006***	-0.001	0.002*	0.003*	0.003**	0.002	-0.003	0.002	-0.001	0.001
	(72.872)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mean below threshold	1,429	0.365	0.042	0.073	0.107	0.056	0.130	0.550	0.118	0.206	0.189
N	551	719,422	719,422	719,422	719,422	719,422	719,422	719,422	719,422	719,422	719,422
(E) US Government (BW=26.225)											
Above threshold	13.775	-0.003	0.000	0.001	0.003	0.000	0.001	-0.001	-0.002	-0.003	-0.000
	(12.557)	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Mean below threshold	589	0.487	0.038	0.080	0.122	0.057	0.121	0.587	0.113	0.207	0.223
N	934	451,325	451,325	451,325	451,325	451,325	451,325	451,325	451,325	451,325	451,325
(F) US History (BW=33.363)											
Above threshold	-2.176	0.000	0.001	0.001	0.002	0.000	-0.002	-0.001	0.002	-0.003	-0.000
	(19.152)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Mean below threshold	836	0.460	0.041	0.068	0.120	0.056	0.127	0.579	0.112	0.205	0.217
N	1,162	812,279	812,279	812,279	812,279	812,279	812,279	812,279	812,279	812,279	812,279

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). Only includes students who enrolled in four-year colleges within 180 days of HS graduation. All regressions use triangular kernels with fixed effects for cohort and high school year in which exam was taken. In the density tests peformed in Column 1, observations are collapsed into 1 raw score point bins, by cohort and high school year in which exam was taken. These counts are then regressed on distance from threshold, an indicator variable for whether the raw score is above the specified threshold, an interaction of these two terms, and dummy variables for high school graduation cohort and examination year. Similar regressions are performed to check covariate balance and raw scores are not collapsed in columns 2-11. The means below the thresholds represent the mean covariate values within 1 point of the boundary. Optimal bandwidths are selected using the outcome, bachelor's degree within four years.

Table 4: Impact of AP College Credit on Bachelor's Attainment Within 4 and 6 Years of High School Completion

	Students near 2/3 Threshold			Students near 3/4 Threshold			Min. Credit-Granting Score of College Attended
	Students with AP scores of 2 and 3	Attends college with min. credit score=3	Attends college with min. credit score≠3	Students with AP scores of 3 and 4	Attends college with min. credit score=4	Attends college with min. credit score≠4	All students near credit-granting threshold
	(A) All 34 AP Subjects, Outcome = BA within 4 years of high school graduation						
Above threshold	0.007***	0.011***	0.004*	0.005***	0.008***	0.004*	0.010***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.564	0.51	0.64	0.65	0.73	0.61	0.610
Bandwidth	8.855	14.017	9.536	7.156	9.946	7.434	17.788
N	2,283,678	1,871,284	1,095,568	1,923,429	983,921	1,254,305	4,307,202
	(B) All 34 AP Subjects, Outcome = BA within 6 years of high school graduation						
Above threshold	0.002	0.002	0.000	0.003**	0.004**	0.002	0.004***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.806	0.780	0.838	0.850	0.883	0.830	0.827
Bandwidth	13.812	21.338	13.962	9.837	14.538	9.528	15.264
N	1,954,101	1,377,950	880,544	1,517,355	803,617	917,132	2,206,377
	(C) 6 Focal AP Subjects, Outcome = BA within 4 years of high school graduation						
Above threshold	0.008***	0.013***	0.003	0.008***	0.009***	0.006***	0.010***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.557	0.500	0.640	0.658	0.727	0.613	0.604
Bandwidth	9.324	10.839	10.867	9.429	12.088	12.455	17.480
N	1,453,006	985,028	696,890	1,497,546	738,417	1,179,327	2,671,184
	(D) 6 Focal AP Subjects, Outcome = BA within 6 years of high school graduation						
Above threshold	0.001	0.002	-0.001	0.004***	0.005**	0.003*	0.002*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.802	0.777	0.838	0.851	0.879	0.832	0.822
Bandwidth	13.531	13.972	15.627	8.857	9.218	12.252	24.092
N	1,226,389	729,490	580,369	832,633	341,183	689,913	2,046,884

Notes: Heteroskedastic robust standard errors clustered by student in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. The 34 AP subjects are listed in Appendix Table 1. The 6 major AP subjects include: Biology, Calculus AB, English Language and Composition, English Literature, US Government and U.S. History. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. The first six columns in the table focus on the 2/3 and 3/4 thresholds, while the final column shows discontinuities along the AP threshold that corresponds to the minimum credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the threshold, the interaction of distance and Above threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects, fixed effects for AP subject and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Bachelor's outcomes include students who received bachelor's degrees from four-year colleges within four and six years of graduating from high school. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Table 5: Impact of AP College Credit on Bachelor's Attainment Within 4 Years of High School Completion

	Students near 2/3 Threshold			Students near 3/4 Threshold			Min. Credit-Granting Score of College Attended
	Students with AP scores of 2 and 3	Attends college with min. credit score=3	Attends college with min. credit score≠3	Students with AP scores of 3 and 4	Attends college with min. credit score=4	Attends college with min. credit score≠4	All students near credit-granting threshold
(A) Biology							
Above threshold	0.008*	0.005	0.015*	0.007	-0.003	0.012**	0.002
	(0.005)	(0.006)	(0.008)	(0.005)	(0.007)	(0.006)	(0.003)
Mean below threshold	0.58	0.53	0.65	0.65	0.72	0.60	0.62
Bandwidth	15.880	19.047	12.301	13.074	13.489	16.189	32.164
N	197,284	123,736	71,204	175,659	72,979	123,634	389,484
(B) Calculus AB							
Above threshold	0.013***	0.021***	0.001	0.008**	0.022***	0.004	0.016***
	(0.004)	(0.005)	(0.006)	(0.003)	(0.007)	(0.004)	(0.003)
Mean below threshold	0.56	0.51	0.65	0.61	0.68	0.58	0.57
Bandwidth	11.644	10.461	21.561	15.669	10.624	16.199	15.844
N	276,434	160,635	113,595	352,152	80,512	247,295	372,552
(C) Eng. Lang. and Comp.							
Above threshold	0.009***	0.014***	0.005	0.002	-0.001	0.002	0.010***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Mean below threshold	0.54	0.49	0.63	0.67	0.75	0.63	0.59
Bandwidth	19.766	18.993	29.980	18.899	19.753	21.104	26.038
N	530,131	314,791	226,399	485,720	178,872	322,524	660,439
(D) Eng. Literature							
Above threshold	0.007***	0.012***	0.003	0.007**	0.009**	0.006	0.007***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Mean below threshold	0.55	0.49	0.63	0.67	0.73	0.63	0.62
Bandwidth	16.616	17.210	19.570	12.194	12.293	13.219	17.631
N	644,142	368,086	329,290	513,656	210,844	324,774	709,015
(E) US Government							
Above threshold	0.008**	0.010**	0.003	0.010**	0.014**	0.005	0.015***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)
Mean below threshold	0.57	0.51	0.66	0.67	0.74	0.62	0.61
Bandwidth	18.058	19.310	19.787	14.605	15.580	15.451	26.225
N	343,277	208,531	147,686	280,203	110,921	180,636	453,449
(F) US History							
Above threshold	0.007**	0.011**	0.001	0.009***	0.013***	0.006	0.011***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Mean below threshold	0.57	0.50	0.65	0.67	0.73	0.61	0.61
Bandwidth	14.588	15.417	17.347	18.200	18.560	19.743	33.363
N	415,961	236,589	224,620	476,594	222,091	265,366	818,015

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. The first six columns in the table focus on the 2/3 and 3/4 thresholds, while the final column shows discontinuities along the AP threshold that corresponds to the minimum credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Table 6: Impact of AP College Credit on Bachelor's Attainment Within 6 Years of High School Completion

	Students near 2/3 Threshold			Students near 3/4 Threshold			Min. Credit-Granting Score of College Attended
	Students with AP scores of 2 and 3	Attends college with min. credit score=3	Attends college with min. credit score≠3	Students with AP scores of 3 and 4	Attends college with min. credit score=4	Attends college with min. credit score≠4	All students near credit-granting threshold
(A) Biology							
Above threshold	-0.002	-0.006	0.002	-0.001	-0.018**	0.008	-0.007*
	(0.004)	(0.007)	(0.006)	(0.004)	(0.007)	(0.005)	(0.003)
Mean below threshold	0.81	0.79	0.84	0.84	0.87	0.82	0.83
Bandwidth	26.737	15.996	20.661	17.036	12.836	19.970	29.360
N	148,879	69,107	61,186	133,544	41,329	85,382	213,785
(B) Calculus AB							
Above threshold	-0.000	-0.003	0.003	0.005	0.017***	-0.000	0.003
	(0.003)	(0.005)	(0.006)	(0.003)	(0.006)	(0.004)	(0.003)
Mean below threshold	0.81	0.79	0.84	0.84	0.86	0.83	0.82
Bandwidth	21.052	12.363	11.339	13.837	12.073	17.611	24.993
N	201,745	116,463	60,553	208,303	56,252	155,877	350,108
(C) Eng. Lang. and Comp.							
Above threshold	0.002	0.006	-0.000	-0.005	-0.005	-0.005	0.002
	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.004)	(0.003)
Mean below threshold	0.80	0.77	0.84	0.86	0.89	0.84	0.82
Bandwidth	18.473	17.389	22.872	18.301	16.336	22.641	26.839
N	281,050	161,127	124,372	256,339	88,795	172,886	368,177
(D) Eng. Literature							
Above threshold	-0.001	0.001	-0.003	0.008***	0.010***	0.006	0.007***
	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Mean below threshold	0.80	0.78	0.82	0.85	0.87	0.83	0.82
Bandwidth	25.727	29.295	20.834	10.928	12.444	11.686	15.359
N	498,435	282,766	213,426	293,939	135,454	183,062	398,347
(E) US Government							
Above threshold	0.007	0.010*	0.002	0.004	0.004	0.005	0.007**
	(0.004)	(0.006)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)
Mean below threshold	0.81	0.78	0.85	0.86	0.89	0.84	0.82
Bandwidth	13.191	13.344	16.517	12.146	15.783	12.676	20.148
N	159,069	94,682	81,920	146,580	69,825	93,294	224,719
(F) US History							
Above threshold	-0.003	-0.005	-0.001	0.004	0.006	0.002	-0.002
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Mean below threshold	0.80	0.77	0.85	0.86	0.89	0.83	0.83
Bandwidth	18.040	23.234	19.429	20.691	14.704	26.076	52.565
N	280,877	167,812	135,872	286,535	105,242	154,531	565,346

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. The first six columns in the table focus on the 2/3 and 3/4 thresholds, while the final column shows discontinuities along the AP threshold that corresponds to the minimum credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Table 7: Impact of AP College Credit on Bachelor's Attainment Within 4 Years of High School Completion (Senior Exams Only)

	Students near 2/3 Threshold			Students near 3/4 Threshold			Min. Credit-Granting Score of College Attended
	Students with AP scores of 2 and 3	Attends college with min. credit score=3	Attends college with min. credit score≠3	Students with AP scores of 3 and 4	Attends college with min. credit score=4	Attends college with min. credit score≠4	Senior Year AP exam takers
(A) Biology							
Above threshold	0.005	0.003	0.013	0.012**	-0.003	0.022***	-0.001
	(0.006)	(0.008)	(0.009)	(0.006)	(0.008)	(0.008)	(0.004)
Mean below threshold	0.58	0.54	0.64	0.65	0.72	0.60	0.63
Bandwidth	17.571	20.088	13.059	17.122	25.306	16.989	30.985
N	125,206	71,667	47,455	123,209	54,646	70,768	222,466
(B) Calculus AB							
Above threshold	0.014***	0.024***	-0.001	0.008**	0.022***	0.004	0.019***
	(0.004)	(0.006)	(0.006)	(0.004)	(0.008)	(0.005)	(0.004)
Mean below threshold	0.56	0.51	0.65	0.61	0.68	0.58	0.57
Bandwidth	12.187	10.972	26.802	15.682	10.647	16.589	15.514
N	250,113	146,075	99,209	296,564	68,857	208,098	314,260
(C) Eng. Literature							
Above threshold	0.009***	0.014***	0.003	0.007**	0.008*	0.006	0.008***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Mean below threshold	0.55	0.49	0.63	0.67	0.73	0.63	0.62
Bandwidth	18.489	18.935	24.163	12.508	12.711	13.392	18.347
N	663,652	377,014	326,167	499,643	205,358	309,462	690,134
(D) US Government							
Above threshold	0.008**	0.009*	0.005	0.008**	0.012**	0.004	0.013***
	(0.004)	(0.005)	(0.006)	(0.004)	(0.006)	(0.005)	(0.003)
Mean below threshold	0.57	0.51	0.66	0.66	0.74	0.61	0.61
Bandwidth	19.920	20.534	20.585	15.621	15.662	16.007	25.959
N	314,330	189,821	127,919	256,456	95,171	164,835	394,874

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. The first six columns in the table focus on the 2/3 and 3/4 thresholds, while the final column shows discontinuities along the AP threshold that corresponds to the minimum credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Table 8: Impacts of Achieving Higher AP Scores Junior Year on Senior AP Test-Taking

	Students near 1/2 Threshold			Students near 2/3 Threshold			Students near 3/4 Threshold			Students near 4/5 Threshold		
	# Exams Sen. Year	# 3 + Scores Sen. Year	# 4 + Scores Sen. Year	# Exams Sen. Year	# 3 + Scores Sen. Year	# 4 + Scores Sen. Year	# Exams Sen. Year	# 3 + Scores Sen. Year	# 4 + Scores Sen. Year	# Exams Sen. Year	# 3 + Scores Sen. Year	# 4 + Scores Sen. Year
(A) Biology												
Above threshold	0.024	0.013	-0.003	0.084***	0.052**	0.016	0.034	0.024	0.007	0.010	0.018	0.015
	(0.024)	(0.016)	(0.009)	(0.023)	(0.021)	(0.015)	(0.022)	(0.021)	(0.017)	(0.023)	(0.021)	(0.021)
Mean below threshold	1.39	0.52	0.18	1.68	0.98	0.45	2.12	1.56	0.88	2.65	2.30	1.59
Bandwidth	16.697	14.100	13.884	14.532	11.162	9.360	17.624	14.069	13.261	22.501	24.687	19.901
N	63,586	55,359	54,722	77,557	62,245	52,345	93,632	78,834	74,963	87,001	89,184	83,834
(B) Calculus AB												
Above threshold	0.090***	0.048**	0.023	0.058*	0.013	0.005	0.005	0.002	0.014	0.057**	0.056**	0.070***
	(0.031)	(0.022)	(0.016)	(0.034)	(0.025)	(0.018)	(0.029)	(0.028)	(0.021)	(0.025)	(0.024)	(0.026)
Mean below threshold	1.64	0.79	0.34	1.93	1.20	0.57	2.27	1.71	0.95	2.60	2.25	1.58
Bandwidth	19.004	19.844	14.085	11.253	14.116	15.001	14.614	12.481	14.578	23.387	21.016	12.203
N	43,759	44,514	38,333	41,466	48,904	49,460	62,198	54,976	62,051	81,324	78,435	55,687
(C) Eng. Language and Comp.												
Above threshold	0.004	0.004	-0.000	0.143***	0.089***	0.025***	0.054***	0.039***	-0.004	0.020	0.027	0.037**
	(0.011)	(0.006)	(0.003)	(0.011)	(0.009)	(0.006)	(0.012)	(0.012)	(0.013)	(0.018)	(0.017)	(0.018)
Mean below threshold	1.18	0.16	0.06	1.72	0.88	0.34	2.47	1.95	1.16	2.96	2.64	2.03
Bandwidth	19.795	8.556	8.872	13.145	10.596	8.968	13.981	11.723	7.554	11.877	12.796	11.295
N	289,134	120,295	125,330	387,821	315,541	269,975	364,538	309,813	202,829	172,086	185,352	163,214
(D) Eng. Literature												
Above threshold	0.071**	0.008	0.013	0.106***	0.082***	0.025**	0.043	0.014	0.002	0.038	0.026	0.021
	(0.028)	(0.013)	(0.010)	(0.025)	(0.020)	(0.012)	(0.032)	(0.031)	(0.028)	(0.042)	(0.042)	(0.039)
Mean below threshold	0.79	0.11	0.03	1.13	0.66	0.31	1.65	1.35	0.91	2.02	1.85	1.46
Bandwidth	26.334	18.011	11.417	18.008	17.549	27.220	15.333	13.518	11.884	23.141	20.279	19.347
N	34,356	21,942	13,447	50,616	49,611	60,144	41,860	37,219	32,957	27,152	26,912	26,793
(E) US Government												
Above threshold	0.013	0.012	-0.015	0.075**	0.036	-0.001	-0.020	-0.004	-0.011	-0.015	-0.016	-0.008
	(0.032)	(0.023)	(0.011)	(0.030)	(0.025)	(0.019)	(0.042)	(0.038)	(0.032)	(0.047)	(0.052)	(0.054)
Mean below threshold	1.00	0.35	0.11	1.53	1.03	0.52	2.18	1.84	1.20	2.81	2.61	2.15
Bandwidth	23.714	15.898	22.161	19.989	21.958	21.042	12.167	13.598	15.059	20.918	14.172	12.105
N	28,085	19,216	26,547	38,340	39,612	39,178	24,750	27,176	29,270	19,824	17,577	15,626
(F) US History												
Above threshold	0.021***	-0.001	-0.005*	0.083***	0.035***	0.003	0.055***	0.055***	0.029***	0.031**	0.034**	0.033**
	(0.008)	(0.006)	(0.003)	(0.010)	(0.009)	(0.006)	(0.011)	(0.011)	(0.008)	(0.015)	(0.015)	(0.016)
Mean below threshold	1.38	0.45	0.15	1.81	1.09	0.48	2.36	1.81	1.04	2.96	2.66	2.01
Bandwidth	27.585	14.285	15.558	13.946	10.723	11.596	15.017	12.806	14.560	15.349	15.188	11.403
N	551,785	343,508	372,520	432,254	336,000	362,049	412,516	353,936	400,503	242,366	239,834	179,247

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in number AP exams taken during senior year (columns 1,4,7,10) and the number of scores of 3 or higher and the number of scores of 4 or higher (remaining columns) at the thresholds identified by the column headers. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold) and cohort fixed effects. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Table 9: Impacts of Achieving Higher AP Scores on SAT Score Sending and SAT (M+CR) Scores of First College Attended

	Impacts on SAT Score Sending						Average SAT Scores of Colleges (First-Time On-Time Students)					
	All HS Years		Junior Takers		Senior Takers		All HS Years		Junior Takers		Senior Takers	
Boundary	2/3	3/4	2/3	3/4	2/3	3/4	2/3	3/4	2/3	3/4	2/3	3/4
(A) Biology												
Above threshold	0.006	0.019	0.085	0.114*	-0.032	-0.018	0.747	0.064	3.641**	-0.170	-0.470	0.467
	(0.031)	(0.042)	(0.060)	(0.068)	(0.041)	(0.055)	(1.179)	(1.308)	(1.839)	(2.107)	(1.485)	(1.678)
Mean below threshold	4.543	5.192	4.701	5.529	4.434	4.929	1,168.84	1,204.20	1,166.22	1,209.34	1,168.71	1,199.85
Bandwidth	35.194	13.541	19.309	15.047	22.025	13.604	13.066	10.872	15.839	11.564	13.899	11.581
N	285,186	214,072	93,212	83,295	164,712	123,805	168,237	143,947	65,194	54,470	105,901	88,278
(B) Calculus AB												
Above threshold	-0.020	-0.014	-0.073	0.007	-0.022	-0.018	-1.072	-0.480	-2.249	-0.884	-1.219	-0.326
	(0.035)	(0.026)	(0.095)	(0.071)	(0.037)	(0.029)	(1.217)	(0.797)	(3.063)	(2.373)	(1.288)	(0.855)
Mean below threshold	4.436	4.833	4.987	5.488	4.351	4.714	1,177.47	1,199.79	1,191.79	1,219.22	1,175.39	1,195.99
Bandwidth	8.860	36.998	10.452	27.031	9.506	19.336	6.973	17.730	9.344	12.622	7.074	19.108
N	259,120	429,387	38,575	65,505	242,559	360,771	162,568	350,195	27,200	45,266	143,898	294,461
(C) Eng. Lang. and Comp.												
Above threshold	0.086***	0.023	0.105***	0.019	0.034	0.038	0.736	1.810**	0.853	2.494***	-1.096	-0.183
	(0.022)	(0.025)	(0.026)	(0.029)	(0.045)	(0.049)	(0.627)	(0.793)	(0.690)	(0.858)	(1.671)	(1.887)
Mean below threshold	3.892	5.135	4.000	5.389	3.366	4.219	1,146.19	1,204.38	1,147.35	1,208.38	1,139.68	1,187.74
Bandwidth	15.231	17.107	13.454	16.253	20.505	22.747	20.062	14.116	20.515	15.547	15.196	11.618
N	547,895	548,476	396,035	415,435	129,791	124,835	522,900	387,741	427,644	332,128	74,036	65,990
(D) Eng. Literature												
Above threshold	0.004	0.058***	0.026	0.056	-0.001	0.059***	0.937	-0.435	3.069	-1.333	0.726	-0.426
	(0.016)	(0.020)	(0.082)	(0.100)	(0.018)	(0.020)	(0.619)	(0.563)	(2.299)	(3.207)	(0.623)	(0.564)
Mean below threshold	4.088	4.99	3.843	5.273	4.102	4.973	1,152.11	1,203.33	1,165.61	1,238.43	1,151.24	1,201.22
Bandwidth	24.727	17.673	16.311	15.386	20.245	18.275	15.346	21.295	22.263	12.718	15.983	25.313
N	1,000,818	830,268	46,555	41,964	887,753	796,391	581,905	729,872	42,693	28,716	569,373	688,392
(E) US Government												
Above threshold	0.031	0.033	0.018	-0.037	0.032	0.018	1.254*	0.494	-1.047	-0.390	1.640**	0.485
	(0.025)	(0.037)	(0.082)	(0.119)	(0.026)	(0.036)	(0.738)	(1.159)	(2.369)	(3.383)	(0.798)	(1.146)
Mean below threshold	4.655	5.316	3.232	4.188	4.798	5.419	1,166.78	1,210.21	1,172.00	1,219.26	1,164.93	1,207.66
Bandwidth	23.200	10.724	23.001	12.565	28.196	13.073	22.581	9.003	29.968	12.928	21.729	10.537
N	458,928	253,654	40,161	25,424	416,966	263,416	362,886	183,143	32,928	21,802	315,299	186,085
(F) US History												
Above threshold	0.026	0.035	0.034	0.041	-0.084	-0.026	0.318	0.706	0.476	0.579	-4.103	2.841
	(0.025)	(0.025)	(0.027)	(0.029)	(0.077)	(0.103)	(0.724)	(0.744)	(0.681)	(0.832)	(3.140)	(3.049)
Mean below threshold	4.281	5.172	4.414	5.301	3.573	4.372	1,163.06	1,204.42	1,162.65	1,205.04	1,152.29	1,184.05
Bandwidth	13.524	18.564	13.423	15.242	20.144	15.402	15.114	17.163	20.239	15.672	11.899	15.906
N	484,016	570,072	416,703	418,452	48,213	35,172	418,976	446,124	448,537	355,465	23,565	28,680

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in number of SAT score sends (columns 1-6) and the average SAT scores among all matriculants at the four-year institutions where the students enrolled (columns 7-12). Columns labeled "Junior Takers" and "Senior Takers" include only the subset of exams taken by students during their junior and senior years of high school, respectively. Columns labled "All HS Years" include all exams taken by students at any point prior to college entry. Columns labeled "2/3" include students with exam scores near the 2/3 threshold, and columns labeled "3/4" include students with exam scores near the 3/4 threshold. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. Means below threshold represent the average value of the outcome within 1 raw point of the cut score. SAT score units include the sum of math and critical reading scores.

Table 10: Marginal Impacts of Earning an Additional Credit-Granting AP Score, Based on College Policy

	(1) Bachelors in 4 Years	(2) Bachelors in 6 Years		(3) Bachelors in 4 Years	(4) Bachelors in 6 Years
(A) 0 to 1 passes			(F) 5 to 6 passes		
Above threshold	0.012***	0.003	Above threshold	0.008	0.002
	(0.002)	(0.002)		(0.005)	(0.005)
Mean below threshold	0.508	0.772	Mean below threshold	0.717	0.896
Bandwidth	21.650	22.291	Bandwidth	21.562	29.820
N	1,138,045	679,406	N	78,702	40,387
(B) 1 to 2 passes			(G) 6 to7 passes		
Above threshold	0.008***	-0.001	Above threshold	0.009	-0.002
	(0.002)	(0.002)		(0.006)	(0.009)
Mean below threshold	0.583	0.826	Mean below threshold	0.738	0.899
Bandwidth	19.672	22.914	Bandwidth	35.190	10.928
N	551,024	328,313	N	48,202	16,361
(C) 2 to 3 passes			(H) 7 to 8 passes		
Above threshold	0.005	0.006**	Above threshold	0.005	0.021*
	(0.003)	(0.003)		(0.010)	(0.012)
Mean below threshold	0.642	0.850	Mean below threshold	0.746	0.886
Bandwidth	16.309	22.123	Bandwidth	17.310	11.187
N	305,496	183,690	N	22,988	8,675
(D) 3 to 4 passes			(I) 8 to 9 passes		
Above threshold	0.002	-0.001	Above threshold	0.002	0.004
	(0.004)	(0.003)		(0.015)	(0.015)
Mean below threshold	0.682	0.873	Mean below threshold	0.765	0.925
Bandwidth	15.020	26.231	Bandwidth	13.339	14.272
N	187,431	115,079	N	10,695	4,730
(E) 4 to 5 passes			(J) 9 to 10 passes		
Above threshold	0.012***	0.009**	Above threshold	0.007	-0.018
	(0.004)	(0.004)		(0.028)	(0.029)
Mean below threshold	0.705	0.880	Mean below threshold	0.726	0.905
Bandwidth	20.153	31.472	Bandwidth	7.753	8.160
N	129,495	70,672	N	3,803	1,601

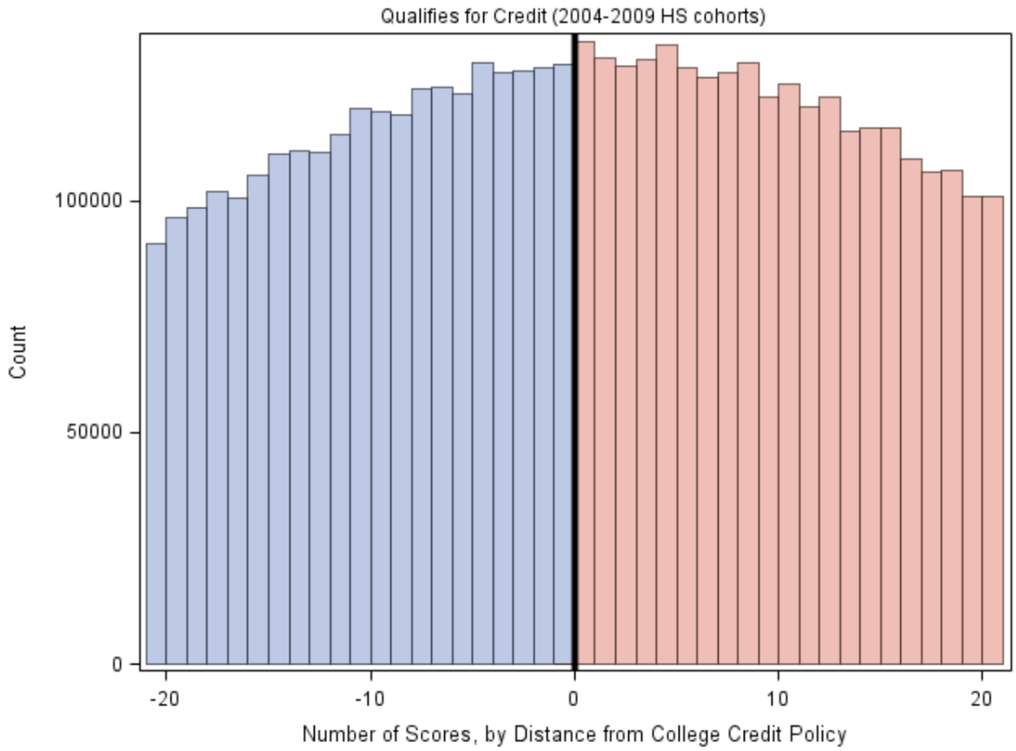
Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). Coefficients represent the discontinuity in the four-year bachelor's completion associated with the receipt of an additional credit-granting AP score. All regressions include the following controls: distance from the credit-granting threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort and AP subject by high school exam year fixed effects. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Table 11: Impacts on Bachelor's Attainment, by Parental Income

	Within 4 Years			Within 6 Years		
	< $50K	$50K-$100K	> $100K	< $50K	$50K-$100K	> $100K
(A) Biology						
Above threshold	0.004	0.006	-0.014*	-0.003	-0.007	-0.011*
	(0.009)	(0.007)	(0.007)	(0.010)	(0.007)	(0.007)
Mean below threshold	0.518	0.601	0.714	0.766	0.831	0.884
Bandwidth	38.587	37.667	27.198	35.938	36.918	32.430
N	53,341	84,613	68,103	32,734	51,891	42,651
(B) Calculcus AB						
Above threshold	-0.000	0.020***	-0.000	-0.005	-0.001	-0.001
	(0.009)	(0.007)	(0.007)	(0.009)	(0.006)	(0.006)
Mean below threshold	0.504	0.574	0.645	0.772	0.828	0.86
Bandwidth	22.639	20.571	19.142	21.440	22.823	27.374
N	61,666	93,685	85,461	39,066	66,891	67,377
(C) English Lang. and Comp.						
Above threshold	0.009	0.016***	0.012**	-0.002	0.013**	0.000
	(0.007)	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)
Mean below threshold	0.489	0.582	0.654	0.76	0.809	0.864
Bandwidth	31.712	33.996	32.701	36.805	29.214	31.742
N	93,462	157,462	152,554	59,428	85,477	77,379
(D) English Literature						
Above threshold	-0.002	0.008*	0.006	-0.003	0.001	0.003
	(0.006)	(0.005)	(0.004)	(0.006)	(0.004)	(0.004)
Mean below threshold	0.516	0.608	0.700	0.753	0.827	0.881
Bandwidth	30.894	26.533	25.234	31.893	27.399	29.175
N	126,758	190,632	175,664	86,216	127,443	111,075
(E) US Government						
Above threshold	0.020**	0.008	0.009	0.001	0.006	-0.003
	(0.008)	(0.006)	(0.006)	(0.009)	(0.005)	(0.005)
Mean below threshold	0.511	0.594	0.676	0.791	0.819	0.867
Bandwidth	30.845	30.652	25.893	29.062	39.872	47.860
N	59,465	101,483	99,817	36,856	71,648	70,972
(F) US History						
Above threshold	0.017**	-0.004	0.013***	0.002	0.002	0.004
	(0.007)	(0.005)	(0.004)	(0.007)	(0.004)	(0.004)
Mean below threshold	0.511	0.603	0.666	0.765	0.818	0.873
Bandwidth	32.713	26.460	35.832	32.045	44.742	44.637
N	93,149	143,161	178,539	56,648	116,740	104,771

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the credit-granting threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Figure 1: Distribution of Distances from College-Specific Credit-Granting Thresholds



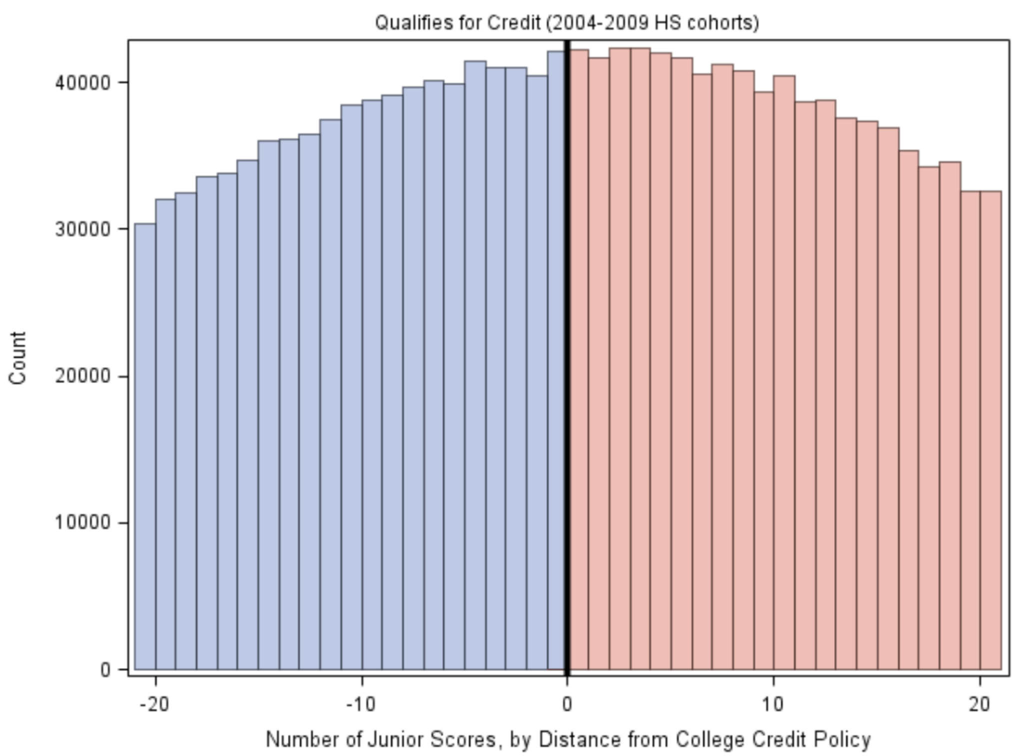


Figure 2: Covariate Balance

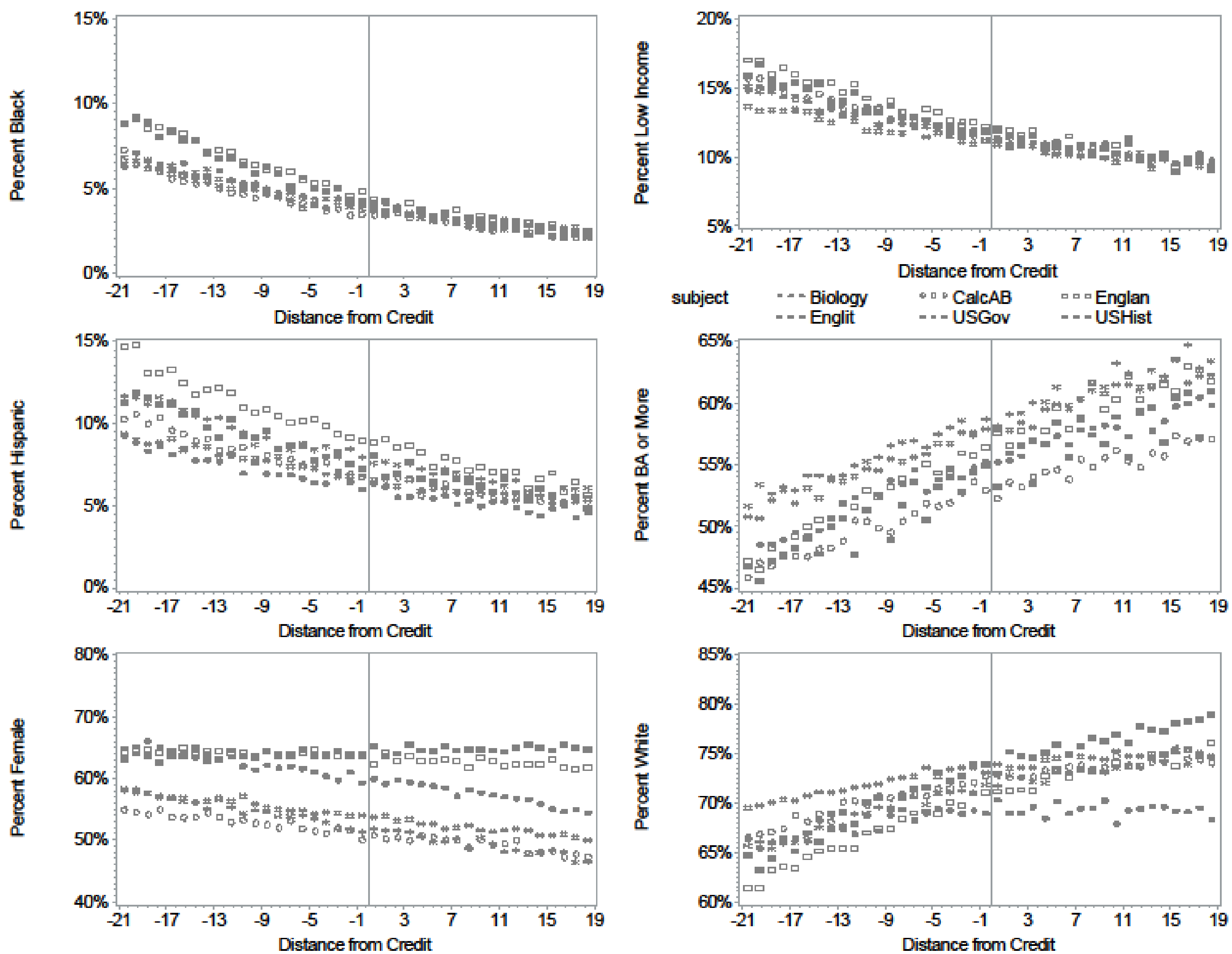


Figure 3: Parameter Estimates and T-Statistics Associated with Receiving a Credit-Granting AP Exam Score

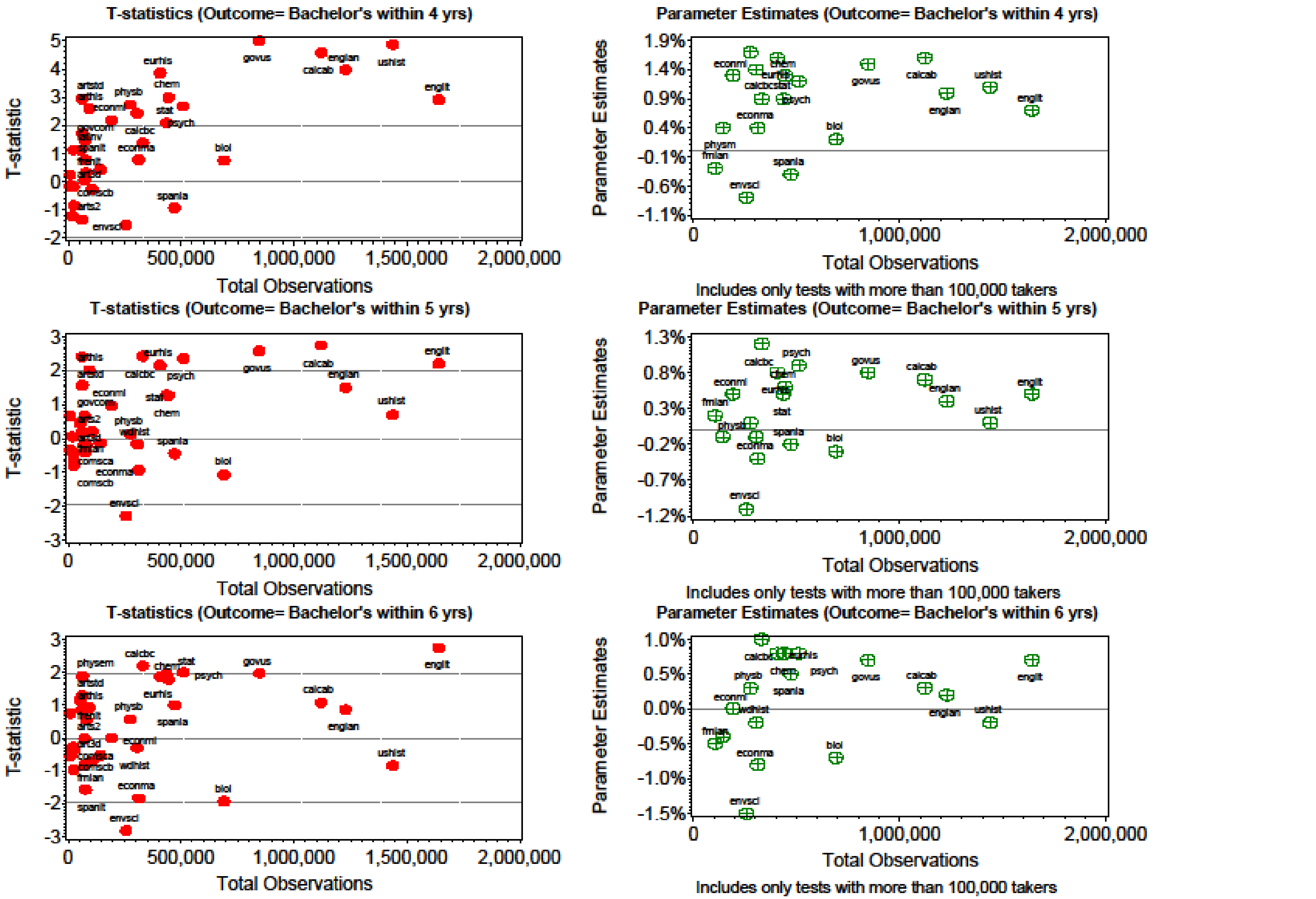


Figure 4a: Bachelor's Degree Attainment Rates (Pooled Sample of 34 Exams), by Distance from Credit-Granting Thresholds

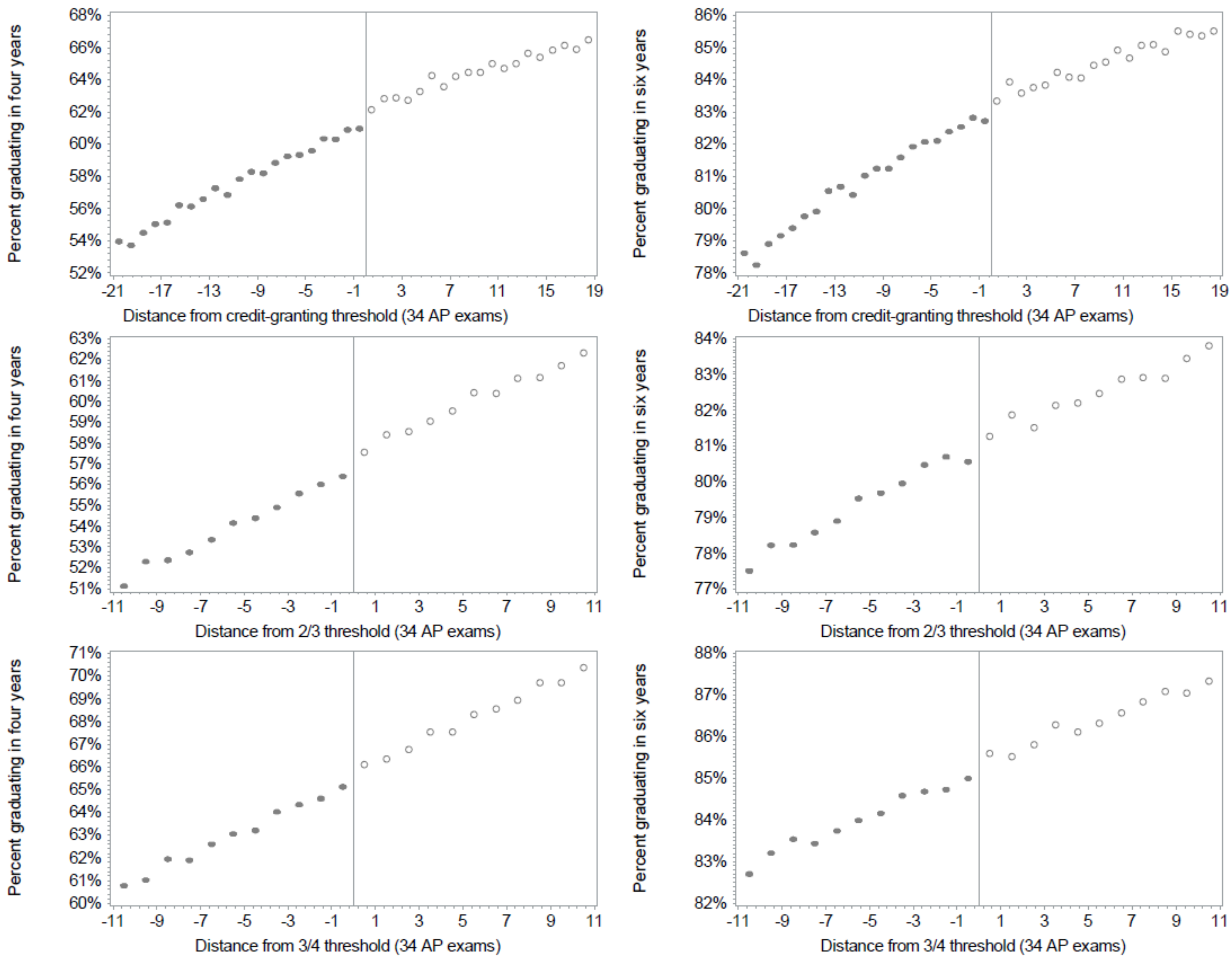


Figure 4b: Bachelor's Degree Attainment Rates (Pooled Sample of 6 Exams), by Distance from Credit-Granting Thresholds

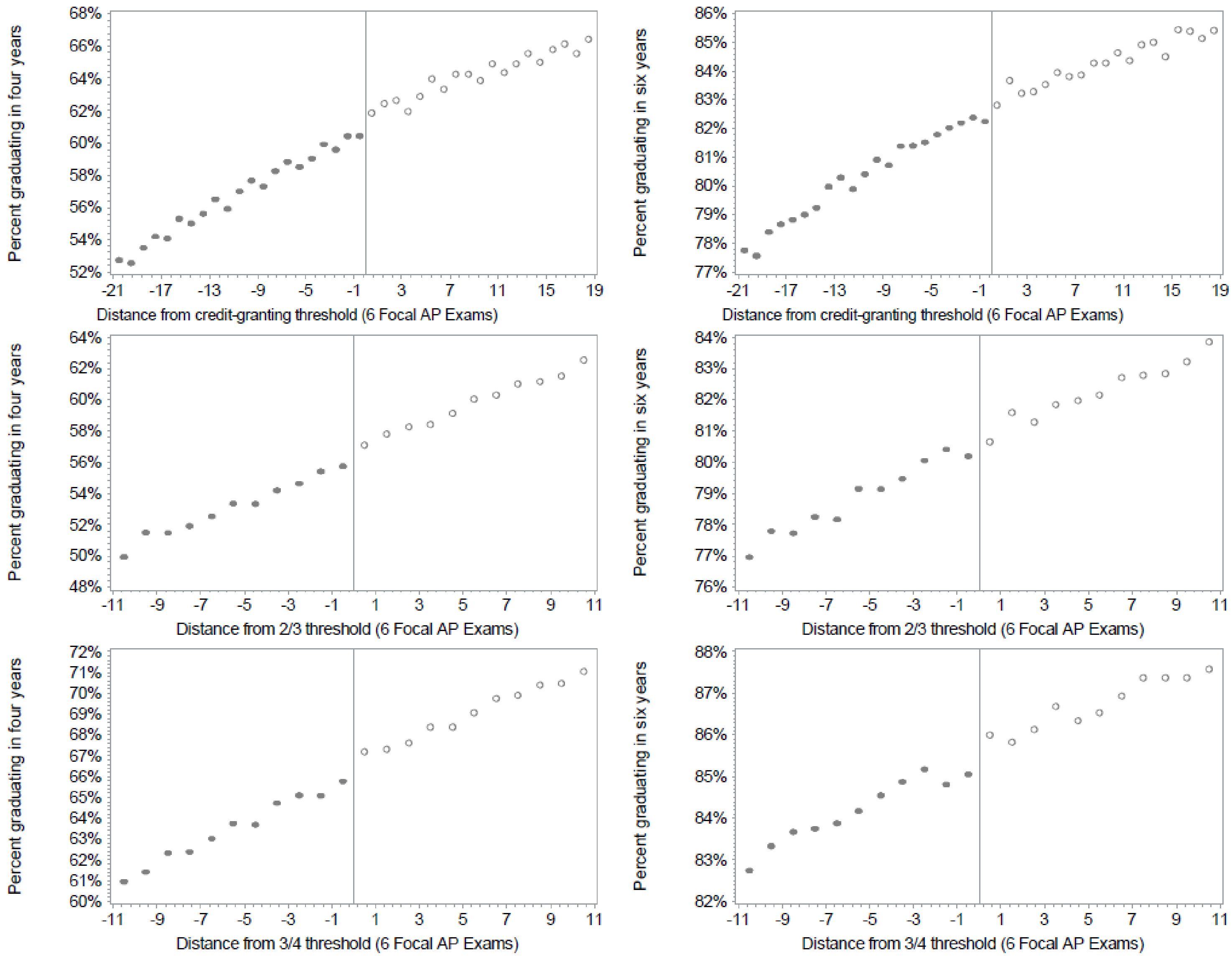


Figure 5: On-Time Bachelor's Degree Attainment Rates, by Distance from Credit-Granting Thresholds

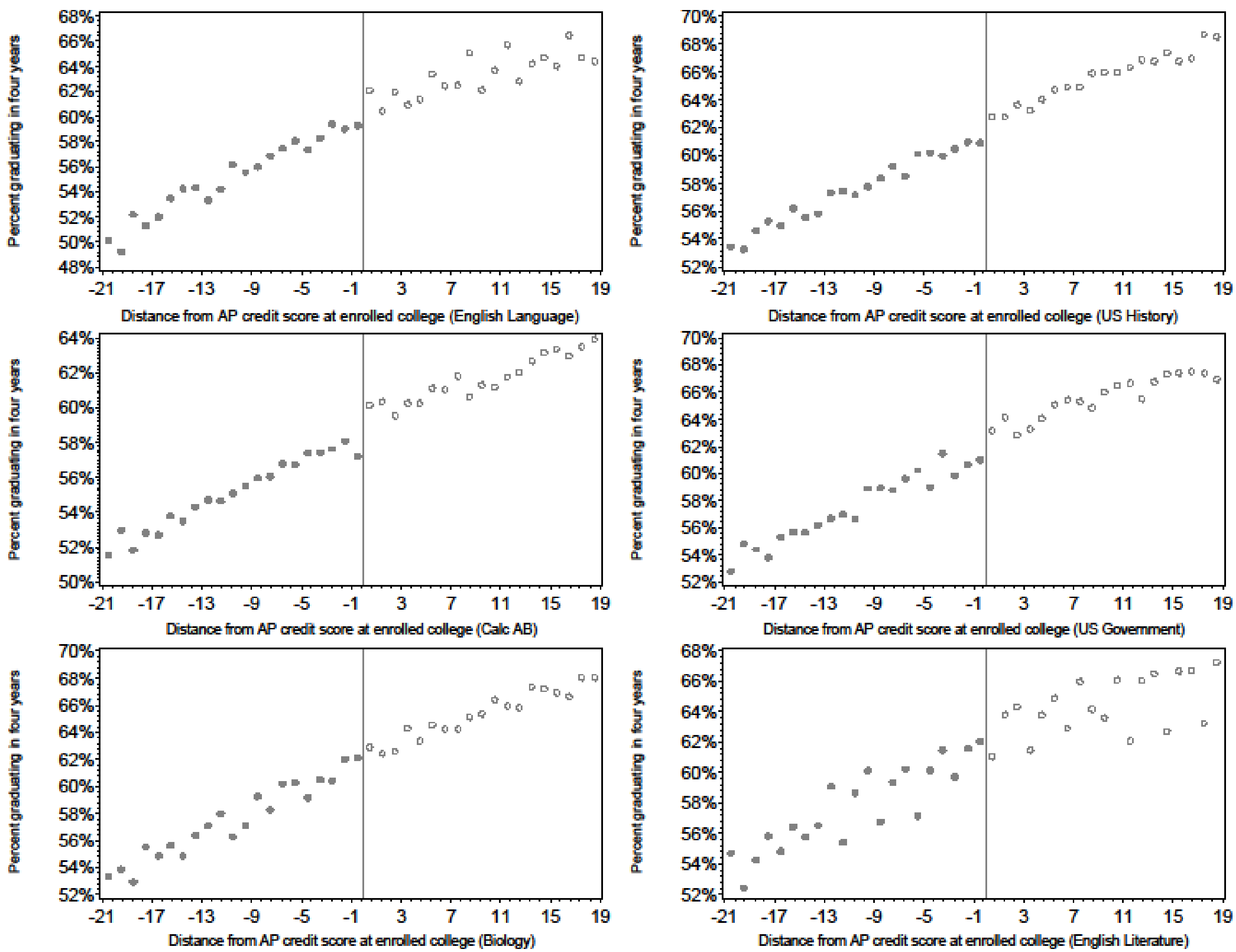
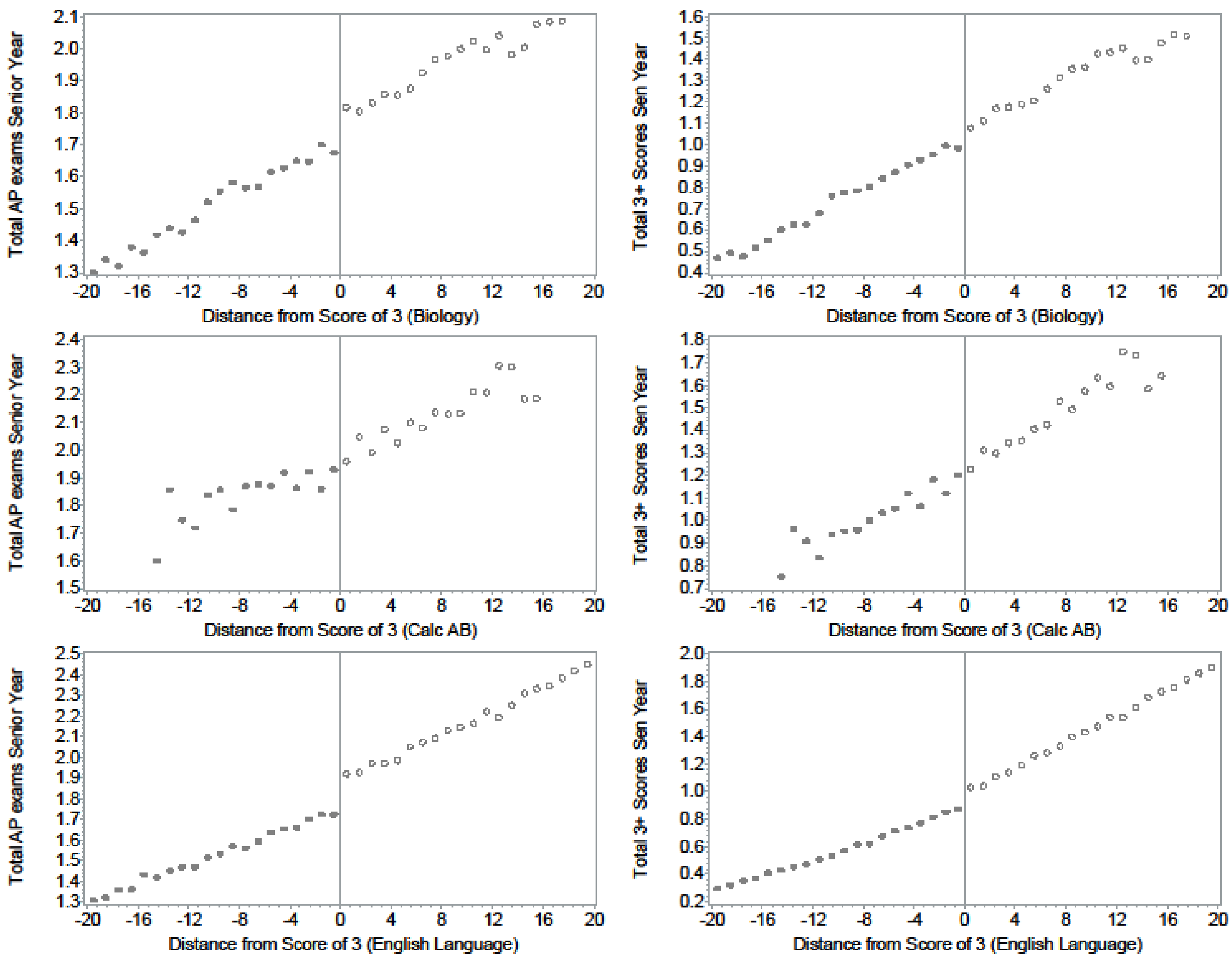


Figure 6: Senior Year AP Exams Taken and Scores of 3 or Higher on These Exams, by Distance from the 2/3 Threshold on Junior Exams



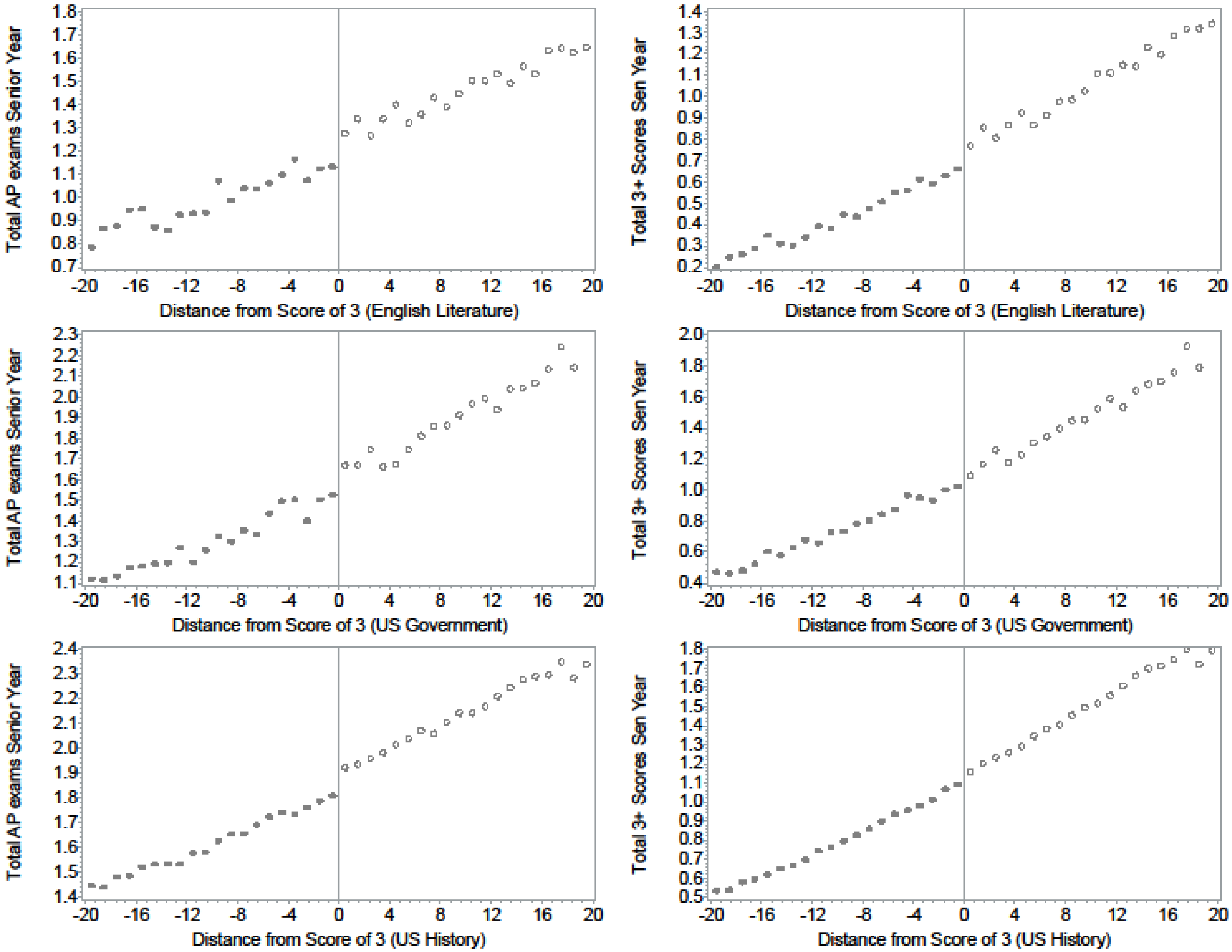
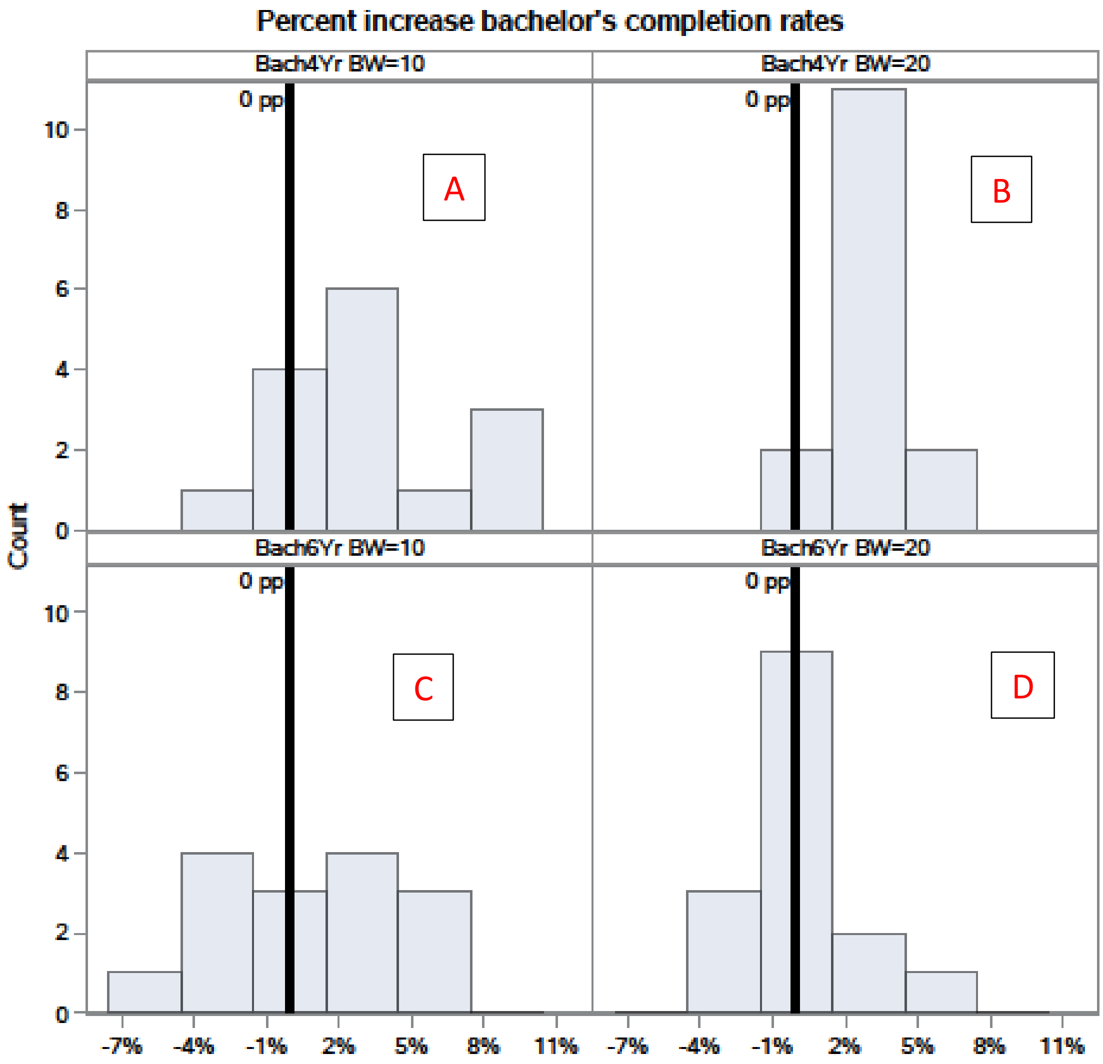

Total AP exams Senior Year
Distance from Score of 3 (English Literature)
Total 3+ Scores Sen Year
Distance from Score of 3 (English Literature)
Total AP exams Senior Year
Distance from Score of 3 (US Government)
Total 3+ Scores Sen Year
Distance from Score of 3 (US Government)
Total AP exams Senior Year
Distance from Score of 3 (US History)
Total 3+ Scores Sen Year
Distance from Score of 3 (US History)

Figure 7: Multidimensional RD Parameter Estimates



App. Table 1: Distribution of Credit-Granting Scores and Test Timing

AP subject	Total obs.	Pct. attending 4-yr colleges on-time	Pct enrolling at colleges with credit-granting policies	Percent distribution of minimum credit-granting AP scores				Percent distribution of high school years during which exam was taken			
				2	3	4	5	Fresh.	Soph.	Jun.	Sen.
Studio Art 3-D	10,622	61.8	34.4	0.0	61.2	31.1	7.7	0.0	0.9	10.5	88.5
Art History	94,143	75.2	90.2	0.0	55.9	35.7	8.4	0.1	6.3	27.6	66.0
Studio Art 2-D	62,215	61.7	38.3	0.0	59.3	33.0	7.7	0.0	0.9	11.8	87.2
Studio Art Drawing	61,579	61.6	72.8	0.0	60.3	34.0	5.7	0.0	1.1	14.2	84.7
Biology	690,772	80.2	95.8	0.1	55.1	39.4	5.3	0.4	6.4	34.4	58.8
Calculus AB	1,120,442	81.2	95.8	1.5	65.1	30.7	2.8	0.0	0.8	14.8	84.4
Calculus BC	330,823	86.0	95.5	6.3	60.7	28.5	4.6	0.1	1.2	18.0	80.7
Chemistry	444,396	81.4	95.2	0.0	56.2	38.1	5.7	0.0	4.1	48.5	47.3
Chinese	7,382	60.0						0.0	4.2	35.5	60.3
Computer Science A	72,446	75.2	83.7	0.0	50.6	40.9	8.5	0.6	11.6	35.9	51.9
Computer Science AB	25,564	81.4	90.0	1.4	44.0	49.5	5.2	0.3	8.8	36.0	54.8
Macroeconomics	313,155	80.2	91.9	0.0	49.8	42.6	7.6	0.0	0.7	7.8	91.5
Microeconomics	192,262	80.9	91.0	0.0	52.5	41.3	6.1	0.1	1.3	10.2	88.4
English Language & Comp.	1,228,818	76.0	93.3	0.0	60.3	34.9	4.8	0.0	1.0	79.5	19.5
English Literature & Comp.	1,641,172	78.7	94.9	0.0	53.3	39.2	7.5	0.0	0.1	5.9	94.0
Environmental Science	257,417	77.5	71.6	0.0	56.6	41.5	1.8	0.4	2.3	28.4	68.9
European History	406,442	79.4	94.5	0.0	49.3	47.0	3.7	0.3	42.3	16.7	40.8
French Literature	10,142	75.6	86.2	1.2	34.8	53.3	10.7	0.2	3.3	20.5	76.0
French Language and Culture	106,032	75.1	92.1	1.7	50.9	43.0	4.4	0.5	3.3	23.8	72.4
German Language and Culture	24,368	73.2	94.4	2.8	61.1	32.9	3.2	0.8	4.3	20.9	74.0
Comparative Gov.and Politics	74,051	80.5	84.6	0.0	52.2	43.9	3.9	0.1	5.1	14.1	80.7
US Gov and Politics	847,245	79.5	91.6	0.0	61.6	36.4	2.0	0.2	3.2	8.5	88.2
Human Geography	80,677	74.9	50.7	0.0	76.6	21.5	1.9	17.9	17.9	18.9	45.3
Italian Language and Culture	6,467	78.9						0.1	0.9	11.1	87.9
Japanese Lang. and Culture	3,949	64.7						0.0	2.1	20.1	77.9
Latin Literature	18,154	86.3	77.3	1.9	38.5	51.6	8.1	0.1	3.5	37.6	58.7
Latin Vergil	24,040	86.7	82.8	1.5	41.1	51.2	6.3	0.2	5.2	37.4	57.3
Music Theory	52,425	75.8	78.6	0.5	66.6	29.0	3.8	0.3	5.4	28.1	66.2
Physics B	276,199	80.9	89.7	0.0	56.3	34.7	9.0	0.1	1.4	31.4	67.1
Physics C: E&M	63,715	84.5	90.4	0.0	30.7	48.4	21.0	0.0	0.6	8.8	90.5
Physics C: Mechanics	142,707	83.8	93.8	0.0	38.3	48.3	13.4	0.0	0.5	10.8	88.7
Psychology	510,673	75.9	92.6	0.0	58.2	40.1	1.7	0.0	1.7	26.5	71.8
Spanish Language	472,437	61.4	93.8	1.3	63.9	29.3	5.5	1.3	8.8	33.8	56.1
Spanish Literature	76,242	50.1	86.5	0.1	62.3	32.0	5.6	0.4	4.8	26.5	68.2
Statistics	436,090	81.7	76.6	0.0	62.6	34.9	2.5	0.1	2.3	15.6	82.0
US History	1,438,063	77.9	94.8	0.0	52.7	44.3	3.0	0.0	5.9	86.8	7.3
World History	305,650	74.8	47.0	0.0	50.7	46.9	2.4	2.7	73.5	13.3	10.5

Notes: Includes AP exams taken by the 2004-2009 cohorts. On-time students are those who began at a four-year college within 180 days of HS graduation. In very rare instances, colleges indicated awarding credit for scores of 1. These cases are eliminated from our analyses.

Appendix Table 2 - Robustness Tests

	Cohorts 2004-2009								Cohorts 2004-2007							
	Rectangular Kernel				Triangular Kernel				Rectangular Kernel				Triangular Kernel			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Specification	**2/3**	**3/4**	**TOT**	**TOT**	**2/3**	**3/4**	**TOT**	**TOT**	**2/3**	**3/4**	**TOT**	**TOT**	**2/3**	**3/4**	**TOT**	**TOT**
	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years
(A) Biology																
Bandwidth = 5	0.001	0.010*	-0.003	-0.013*	0.004	0.009	0.002	-0.014*	0.010	0.013*	0.002	-0.013*	0.016**	0.012*	0.006	-0.014*
	(0.005)	(0.005)	(0.007)	(0.008)	(0.006)	(0.006)	(0.008)	(0.008)	(0.007)	(0.007)	(0.010)	(0.008)	(0.008)	(0.007)	(0.011)	(0.008)
Bandwidth =15	0.002	0.003	0.001	-0.007	0.002	0.005	0.002	-0.010**	0.002	0.004	-0.001	-0.007	0.003	0.006	0.001	-0.010**
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)	(0.006)	(0.005)
Bandwidth =25	-0.000	0.003	0.003	-0.006*	0.000	0.003	0.003	-0.006*	0.001	0.004	0.001	-0.006*	0.002	0.004	0.001	-0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)
Bandwidth =35	-0.000	0.003	0.002	-0.009***	0.000	0.003	0.002	-0.008**	0.001	0.004	-0.002	-0.009***	0.001	0.004	-0.001	-0.008**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)
(B) Calculus AB																
Bandwidth = 5	0.001	-0.005	0.025***	0.005	0.002	-0.001	0.027***	0.009	-0.001	-0.005	0.026***	0.005	0.002	-0.001	0.031***	0.009
	(0.004)	(0.004)	(0.006)	(0.006)	(0.004)	(0.004)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.005)	(0.008)	(0.006)
Bandwidth =15	-0.002	-0.002	0.013***	0.003	-0.001	-0.002	0.017***	0.003	-0.001	0.001	0.012***	0.003	-0.001	0.001	0.016***	0.003
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)
Bandwidth =25	-0.001	-0.001	0.010***	0.001	-0.001	-0.002	0.013***	0.003	-0.001	0.001	0.010***	0.001	-0.001	0.001	0.013***	0.003
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Bandwidth =35	-0.001	-0.001	0.004*	-0.006***	-0.001	-0.002	0.008***	-0.001	-0.001	0.001	0.005*	-0.006***	-0.001	0.001	0.010***	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
(C) English Language and Comp.																
Bandwidth = 5	0.003	-0.000	0.016***	0.009*	0.000	0.001	0.020***	0.012**	0.000	-0.002	0.016**	0.009*	-0.003	-0.004	0.018**	0.012**
	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)	(0.005)	(0.006)	(0.005)	(0.007)	(0.006)
Bandwidth =15	0.001	0.001	0.011***	0.003	0.002	0.001	0.011***	0.003	0.002	0.002	0.006	0.003	0.002	0.001	0.006	0.003
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Bandwidth =25	0.000	-0.002	0.009***	0.002	0.001	-0.001	0.010***	0.002	-0.000	-0.002	0.006*	0.002	0.001	-0.000	0.005	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Bandwidth =35	-0.000	-0.002	0.008***	-0.002	0.000	-0.001	0.009***	0.001	-0.002	-0.002	0.004	-0.002	-0.001	-0.001	0.005*	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)

Note: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). Columns 1,2,5,6,9,10, 13 and 14 represent the Intent-to-Treat estimates at the 2/3 and 3/4 cut score boundaries showing any discontinuities in the probability of enrolling in a four-year college within 180 days of HS graduation. The remaining columns represent the Treatment-on-Treated (TOT) estimates in which the forcing variable is defined as distance to the college-specific credit-granting AP scores among students enrolling at four-year institutions within 180 days of HS graduation.

Appendix Table 2 - Robustness Tests-*Continued*

	Cohorts 2004-2009								Cohorts 2004-2007							
	Rectangular Kernel				Triangular Kernel				Rectangular Kernel				Triangular Kernel			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Specification	**2/3**	**3/4**	**TOT**	**TOT**	**2/3**	**3/4**	**TOT**	**TOT**	**2/3**	**3/4**	**TOT**	**TOT**	**2/3**	**3/4**	**TOT**	**TOT**
	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years	4-Yr Coll On-time	4-Yr Coll On-time	BA in 4 Years	BA in 6 Years
(D) English Lit.																
Bandwidth = 5	0.009***	0.002	0.008*	0.010**	0.009**	0.005	0.001	0.004	0.009**	0.002	0.016***	0.010**	0.009*	0.004	0.011**	0.004
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)
Bandwidth =15	0.005***	0.002	0.009***	0.007***	0.006***	0.001	0.007**	0.007***	0.005**	0.003	0.017***	0.007***	0.006**	0.002	0.013***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
Bandwidth =25	0.004**	0.000	0.005***	0.001	0.005***	0.001	0.007***	0.004*	0.004*	0.000	0.008***	0.001	0.005**	0.001	0.011***	0.004*
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Bandwidth =35	0.002	0.000	0.002	-0.003	0.003**	0.001	0.005**	0.001	0.002	0.000	0.004*	-0.003	0.003*	0.001	0.008***	0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
(E) US Gov't																
Bandwidth = 5	0.004	0.001	0.020***	0.012**	0.001	0.002	0.022***	0.015**	0.001	-0.004	0.021***	0.012**	-0.001	-0.004	0.020**	0.015**
	(0.004)	(0.004)	(0.006)	(0.006)	(0.005)	(0.004)	(0.007)	(0.007)	(0.006)	(0.005)	(0.008)	(0.006)	(0.006)	(0.005)	(0.008)	(0.007)
Bandwidth =15	0.001	0.004	0.014***	0.006*	0.002	0.002	0.016***	0.008**	-0.002	0.002	0.012***	0.006*	-0.002	0.000	0.015***	0.008**
	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)
Bandwidth =25	0.000	0.004*	0.016***	0.005*	0.001	0.003	0.015***	0.006*	-0.004	0.002	0.015***	0.005*	-0.003	0.001	0.014***	0.006*
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Bandwidth =35	-0.000	0.004*	0.017***	0.004*	0.001	0.003	0.015***	0.005*	-0.005*	0.002	0.016***	0.004*	-0.004	0.001	0.015***	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
(F) US History																
Bandwidth = 5	0.004	-0.001	0.013***	0.001	0.004	0.002	0.013**	0.002	0.004	-0.002	0.019***	0.001	0.006	0.002	0.017**	0.002
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)
Bandwidth =15	0.001	-0.001	0.010***	0.000	0.002	-0.001	0.011***	0.001	0.001	-0.002	0.012***	0.000	0.002	-0.002	0.014***	0.001
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Bandwidth =25	0.001	0.000	0.011***	-0.000	0.001	-0.000	0.011***	-0.000	0.003	0.001	0.012***	-0.000	0.002	-0.001	0.013***	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
Bandwidth =35	0.001	0.000	0.009***	-0.001	0.001	-0.000	0.010***	-0.000	0.003	0.001	0.011***	-0.001	0.003	-0.000	0.013***	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)

Note: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). Columns 1,2,5,6,9,10, 13 and 14 represent the Intent-to-Treat estimates at the 2/3 and 3/4 cut score boundaries showing any discontinuities in the probability of enrolling in a four-year college within 180 days of HS graduation. The remaining columns represent the Treatment-on-Treated (TOT) estimates in which the forcing variable is defined as distance to the college-specific credit-granting AP scores among students enrolling at four-year institutions within 180 days of HS graduation.

Appendix Table 3: Impacts on Bachelor's Degree Completion Within Four and Six Years

AP subject	4-Yr	4-yr (SE)	6-Yr	6-Yr (SE)
Studio Art 3-D	-0.007	(0.044)	-0.024	(0.042)
Art History	0.028***	(0.011)	0.010	(0.011)
Studio Art 2-D	-0.022	(0.017)	0.016	(0.019)
Studio Art Drawing	0.042***	(0.014)	0.017	(0.014)
Biology	0.002	(0.003)	-0.007*	(0.003)
Calculus AB	0.016***	(0.003)	0.003	(0.003)
Calculus BC	0.009	(0.006)	0.010**	(0.005)
Chemistry	0.013***	(0.004)	0.008*	(0.004)
Computer Science A	0.001	(0.014)	-0.000	(0.013)
Computer Science AB	-0.016	(0.019)	-0.006	(0.016)
Macroeconomics	0.004	(0.005)	-0.008*	(0.004)
Microeconomics	0.013**	(0.006)	-0.000	(0.006)
English Language & Comp.	0.010***	(0.002)	0.002	(0.003)
English Literature & Comp.	0.007***	(0.002)	0.007***	(0.003)
Environmental Science	-0.008	(0.005)	-0.015**	(0.005)
European History	0.016***	(0.004)	0.008*	(0.004)
French Literature	0.005	(0.022)	0.017	(0.022)
French Language and Culture	-0.003	(0.010)	-0.005	(0.007)
German Language and Culture	-0.004	(0.021)	-0.016	(0.016)
Comparative Gov.and Politics	0.015	(0.010)	-0.007	(0.009)
US Gov and Politics	0.015***	(0.003)	0.007**	(0.003)
Human Geography	0.004	(0.014)	0.007	(0.013)
Latin Literature	-0.023	(0.019)	-0.007	(0.020)
Latin Vergil	0.017	(0.015)	-0.004	(0.014)
Music Theory	0.015	(0.014)	0.020	(0.017)
Physics B	0.017***	(0.006)	0.003	(0.006)
Physics C: E&M	0.019*	(0.011)	0.016*	(0.009)
Physics C: Mechanics	0.004	(0.008)	-0.004	(0.007)
Psychology	0.012***	(0.005)	0.008**	(0.004)
Spanish Language	-0.004	(0.005)	0.005	(0.005)
Spanish Literature	0.011	(0.015)	-0.030	(0.019)
Statistics	0.009**	(0.004)	0.008*	(0.004)
US History	0.011***	(0.002)	-0.002	(0.002)
World History	0.014**	(0.006)	-0.002	(0.008)

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the college-specific minimum credit-granting threshold. All regressions include the following controls: distance from the credit-granting threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation.

Appendix Table 4: Impact of AP College Credit on Bachelor's Attainment Within 5 Years of High School Completion

	Students near 2/3 Threshold			Students near 3/4 Threshold			Min. Credit-Granting Score of College Attended
	Students with AP scores of 2 and 3	Attends college with min. credit score=3	Attends college with min. credit score≠3	Students with AP scores of 3 and 4	Attends college with min. credit score=4	Attends college with min. credit score≠4	All students near credit-granting threshold
(A) Biology							
Above threshold	0.002	0.000	0.004	0.002	-0.010	0.010*	-0.003
	(0.004)	(0.005)	(0.007)	(0.004)	(0.007)	(0.005)	(0.003)
Mean below threshold	0.76	0.73	0.80	0.81	0.84	0.78	0.79
Bandwidth	20.582	24.334	15.499	15.149	11.644	18.308	33.343
N	184,442	109,675	67,765	159,275	50,821	109,749	315,983
(B) Calculus AB							
Above threshold	0.006*	0.007	0.005	0.005	0.018***	-0.000	0.007***
	(0.003)	(0.005)	(0.006)	(0.003)	(0.006)	(0.004)	(0.003)
Mean below threshold	0.76	0.73	0.81	0.80	0.83	0.79	0.77
Bandwidth	15.841	13.215	10.939	15.475	11.548	43.151	25.925
N	258,812	158,557	75,371	285,000	70,182	203,218	469,088
(C) Eng. Lang. and Comp.							
Above threshold	0.004	0.006*	0.001	-0.002	-0.004	-0.001	0.004
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Mean below threshold	0.75	0.72	0.80	0.83	0.87	0.80	0.78
Bandwidth	21.755	22.895	19.689	19.345	20.358	17.546	19.852
N	427,792	264,390	160,884	372,787	137,572	223,412	418,748
(D) Eng. Literature							
Above threshold	0.000	0.004	-0.004	0.005**	0.007**	0.004	0.005**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)
Mean below threshold	0.75	0.72	0.79	0.82	0.86	0.80	0.79
Bandwidth	19.021	22.983	19.651	11.962	12.688	13.195	14.503
N	588,285	350,912	270,215	405,555	177,822	263,723	492,789
(E) US Government							
Above threshold	0.008**	0.011**	0.003	0.001	0.005	-0.002	0.008**
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.003)
Mean below threshold	0.76	0.73	0.81	0.83	0.86	0.81	0.79
Bandwidth	14.358	13.900	19.311	12.293	18.388	11.759	21.668
N	226,680	128,528	118,716	193,750	96,035	114,974	312,942
(F) US History							
Above threshold	-0.002	-0.001	-0.004	0.005*	0.006	0.003	0.001
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Mean below threshold	0.76	0.71	0.81	0.83	0.87	0.79	0.79
Bandwidth	18.193	25.763	17.428	19.752	14.293	22.614	32.632
N	390,852	234,690	174,991	387,766	140,282	214,630	627,767

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. The first six columns in the table focus on the 2/3 and 3/4 thresholds, while the final column shows discontinuities along the AP threshold that corresponds to the minimum credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Appendix Table 5: Impact of AP College Credit on Bachelor's Attainment Within 3 Years of High School Completion

	Students near 2/3 Threshold			Students near 3/4 Threshold			Min. Credit-Granting Score of College Attended
	Students with AP scores of 2 and 3	Attends college with min. credit score=3	Attends college with min. credit score≠3	Students with AP scores of 3 and 4	Attends college with min. credit score=4	Attends college with min. credit score≠4	All students near credit-granting threshold
(A) Biology							
Above threshold	0.005***	0.007***	0.001	0.007***	0.010***	0.005**	0.006***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.017	0.020	0.012	0.025	0.017	0.031	0.019
Bandwidth	16.831	14.433	17.192	15.249	14.237	15.515	38.344
N	205,171	104,556	90,366	199,058	76,400	119,966	436,677
(B) Calculus AB							
Above threshold	0.005***	0.006***	0.003*	0.002**	0.004**	0.001	0.005***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Mean below threshold	0.014	0.015	0.010	0.019	0.012	0.023	0.015
Bandwidth	11.568	11.413	10.596	15.187	11.128	14.445	34.676
N	274,656	174,820	89,983	348,642	84,151	238,481	732,044
(C) Eng. Lang. and Comp.							
Above threshold	0.003***	0.004***	0.001	0.005***	0.004***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.019	0.021	0.014	0.029	0.023	0.034	0.021
Bandwidth	19.857	20.875	26.151	14.493	16.829	13.644	37.786
N	532,039	333,490	224,072	404,544	166,366	242,420	792,988
(D) Eng. Literature							
Above threshold	0.002***	0.005***	-0.001	0.004***	0.004***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean below threshold	0.016	0.018	0.014	0.026	0.02	0.03	0.018
Bandwidth	18.087	20.422	20.120	16.199	15.066	15.907	30.523
N	692,998	414,777	334,638	656,090	249,596	384,693	1,019,516
(E) US Government							
Above threshold	0.004***	0.004**	0.003**	0.007***	0.008***	0.005**	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Mean below threshold	0.020	0.023	0.015	0.031	0.023	0.035	0.023
Bandwidth	11.365	10.873	20.384	9.693	11.624	10.732	25.459
N	227,307	128,701	148,822	199,000	89,766	135,064	444,095
(F) US History							
Above threshold	0.004***	0.006***	0.001	0.004***	0.007***	0.001	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Mean below threshold	0.018	0.021	0.014	0.030	0.022	0.037	0.021
Bandwidth	16.355	17.841	16.759	15.724	16.229	16.584	23.717
N	462,927	268,360	218,369	421,714	200,749	238,251	640,026

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. The first six columns in the table focus on the 2/3 and 3/4 thresholds, while the final column shows discontinuities along the AP threshold that corresponds to the minimum credit-granting score at the college to which the student matriculated. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Appendix Table 6: Impact of AP College Credit on Average SAT Score of First College Attended and Bachelor's Attainment

	Average SAT Scores of First Colleges		Bachelor's Attainment within 4 Years		Bachelor's Attainment within 6 Years	
	Students near 1/2 Threshold	Students near 4/5 Threshold	Students near 1/2 Threshold	Students near 4/5 Threshold	Students near 1/2 Threshold	Students near 4/5 Threshold
(A) Biology						
Above threshold	-0.325	0.906	-0.010*	0.000	-0.009	0.003
	(1.268)	(1.095)	(0.006)	(0.004)	(0.007)	(0.005)
Mean below threshold	1129.766	1248.000	0.493	0.725	0.741	0.886
Bandwidth	15.124	23.365	15.178	23.364	17.238	13.921
N	135,627	197,672	140,266	201,051	84,179	86,535
(B) Calculus AB						
Above threshold	0.077	0.558	-0.002	0.002	-0.008*	-0.000
	(1.202)	(0.880)	(0.005)	(0.004)	(0.004)	(0.003)
Mean below threshold	1,156.88	1,225.59	0.516	0.662	0.788	0.864
Bandwidth	8.112	16.189	10.891	15.450	13.703	21.099
N	166,507	315,754	228,541	313,577	173,018	215,460
(C) Eng. Language and Comp.						
Above threshold	0.310	1.295	-0.006	0.004	-0.001	0.002
	(1.378)	(1.316)	(0.006)	(0.004)	(0.007)	(0.004)
Mean below threshold	1080.171	1257.172	0.330	0.748	0.646	0.893
Bandwidth	12.666	10.176	11.704	14.843	16.120	16.293
N	127,379	166,026	122,832	246,362	98,469	135,110
(D) Eng. Literature						
Above threshold	3.334***	1.562*	0.000	0.001	0.001	0.006**
	(1.170)	(0.848)	(0.005)	(0.003)	(0.007)	(0.003)
Mean below threshold	1,079.37	1,259.10	0.312	0.77	0.642	0.885
Bandwidth	16.754	22.527	12.379	14.176	13.686	19.104
N	206,672	388,802	152,294	315,296	103,862	248,215
(E) US Government						
Above threshold	1.297	1.994	0.004	-0.005	-0.002	0.014***
	(1.111)	(1.579)	(0.005)	(0.006)	(0.005)	(0.004)
Mean below threshold	1,120.65	1251.585	0.428	0.750	0.706	0.888
Bandwidth	17.026	8.047	18.423	8.285	35.505	16.146
N	183,396	106,236	204,833	110,958	172,641	106,014
(F) US History						
Above threshold	-0.661	2.090*	-0.002	0.004	-0.002	-0.004
	(0.817)	(1.174)	(0.003)	(0.003)	(0.004)	(0.003)
Mean below threshold	1120.396	1261.303	0.450	0.755	0.721	0.904
Bandwidth	16.805	13.106	24.433	27.016	21.317	21.049
N	319,261	205,587	443,264	362,216	227,993	192,674

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the AP exam score thresholds identified by the column headers. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation. Means below threshold represent the average value of the outcome within 1 raw point of the cut score. SAT score units include the sum of math and critical reading scores.

Appendix Table 7: Impacts on Number of SAT Score Sends among Junior AP Takers, by Parental Income

	Students near 2/3 Threshold			Students near 3/4 Threshold		
	< $50K	$50K-$100K	> $100K	< $50K	$50K-$100K	> $100K
(A) Biology						
Above threshold	-0.153	0.200	0.068	0.040	-0.077	0.045
	(0.149)	(0.138)	(0.138)	(0.155)	(0.138)	(0.162)
Mean below threshold	5.507	5.12	6.376	6.365	5.946	6.748
Bandwidth	18.804	12.342	19.055	40.894	13.276	12.159
N	11,746	13,570	17,114	10,269	14,462	14,893
(B) Calculcus AB						
Above threshold	-0.277	-0.233	0.216	0.149	0.103	-0.006
	(0.193)	(0.181)	(0.180)	(0.188)	(0.139)	(0.169)
Mean below threshold	6.015	5.664	6.188	6.066	5.729	6.838
Bandwidth	15.827	10.488	17.146	17.105	18.511	12.824
N	7,099	7,645	9,439	7,839	12,452	11,792
(C) English Language and Composition						
Above threshold	0.145**	0.034	0.030	0.068	0.065	0.002
	(0.061)	(0.039)	(0.047)	(0.080)	(0.054)	(0.051)
Mean below threshold	4.909	4.673	5.315	5.748	5.631	6.444
Bandwidth	14.573	22.957	26.880	17.152	16.441	24.038
N	61,990	125,119	109,080	45,318	86,710	106,593
(D) English Literature						
Above threshold	-0.119	0.177	-0.282	0.189	0.035	0.251
	(0.168)	(0.164)	(0.187)	(0.245)	(0.176)	(0.214)
Mean below threshold	4.959	4.526	5.972	5.853	5.196	6.498
Bandwidth	28.110	16.233	22.658	23.649	20.960	14.083
N	7,566	8,515	9,318	4,578	8,815	8,422
(E) US Government						
Above threshold	-0.028	-0.167	0.278	-0.156	-0.062	-0.461**
	(0.256)	(0.190)	(0.242)	(0.318)	(0.232)	(0.216)
Mean below threshold	4.617	4.862	5.269	5.351	5.318	6.134
Bandwidth	36.613	18.143	16.309	21.428	13.831	17.801
N	3,377	5,950	5,548	2,323	4,629	6,545
(F) US History						
Above threshold	0.002	-0.024	0.076	0.009	0.123**	0.026
	(0.053)	(0.057)	(0.054)	(0.081)	(0.053)	(0.065)
Mean below threshold	5.29	4.974	5.66	5.716	5.509	6.473
Bandwidth	23.805	11.020	17.124	14.955	16.309	12.750
N	82,526	72,983	100,407	44,013	91,835	78,468

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in number of SAT score sends at the 2/3 threshold and 3/4 thresholds. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Appendix Table 8: Heterogeneous Impacts of AP College Credit on Bachelor's Attainment Within 4 Years of High School Completion

	Female	Male	Asian	Black	Hispanic	White	Parent HS dropout	Parent HS graduate	Parent BA or more
(A) Biology									
Above threshold	-0.000	0.006	-0.004	-0.001	-0.018	0.007*	0.025*	0.006	-0.005
	(0.004)	(0.006)	(0.009)	(0.016)	(0.014)	(0.004)	(0.013)	(0.009)	(0.005)
Mean below threshold	0.676	0.541	0.61	0.522	0.564	0.637	0.511	0.557	0.675
Bandwidth	31.331	26.903	24.321	34.439	28.467	25.616	35.832	36.441	24.598
N	229,025	136,685	52,930	18,418	22,949	223,318	26,372	53,489	174,086
(B) Calculcus AB									
Above threshold	0.016***	0.013***	0.009	-0.017	0.007	0.017***	0.003	0.024***	0.011**
	(0.004)	(0.005)	(0.008)	(0.015)	(0.011)	(0.003)	(0.012)	(0.009)	(0.004)
Mean below threshold	0.658	0.486	0.527	0.481	0.484	0.594	0.504	0.516	0.625
Bandwidth	17.511	20.116	20.228	27.091	22.645	24.128	23.578	22.035	17.657
N	208,913	228,590	64,903	23,860	36,557	392,611	35,737	63,647	217,717
(C) English Lang. and Comp.									
Above threshold	0.012***	0.006	0.013*	0.021*	0.019**	0.008***	0.003	0.007	0.013***
	(0.003)	(0.004)	(0.007)	(0.010)	(0.008)	(0.003)	(0.009)	(0.006)	(0.003)
Mean below threshold	0.626	0.533	0.621	0.464	0.433	0.618	0.464	0.509	0.642
Bandwidth	28.066	25.390	31.637	36.215	32.757	33.478	36.719	34.003	27.655
N	436,483	238,358	84,518	43,348	72,528	523,912	53,487	104,721	383,090
(D) English Literature									
Above threshold	0.010***	0.001	0.006	0.006	0.008	0.007**	0.010	-0.002	0.010***
	(0.003)	(0.004)	(0.006)	(0.009)	(0.007)	(0.003)	(0.008)	(0.005)	(0.003)
Mean below threshold	0.646	0.576	0.619	0.503	0.502	0.643	0.534	0.544	0.673
Bandwidth	17.932	20.274	24.975	33.090	31.190	18.482	33.988	35.448	17.212
N	460,949	282,878	96,192	55,554	83,739	539,133	67,690	142,512	379,468
(E) US Government									
Above threshold	0.015***	0.014***	0.029***	0.026*	0.006	0.015***	0.008	0.017**	0.013***
	(0.004)	(0.005)	(0.009)	(0.013)	(0.011)	(0.004)	(0.012)	(0.008)	(0.004)
Mean below threshold	0.668	0.548	0.589	0.446	0.507	0.632	0.466	0.526	0.661
Bandwidth	26.454	24.754	24.654	40.630	27.629	23.138	28.386	33.852	25.628
N	237,921	209,244	54,265	26,208	39,122	295,868	29,174	67,829	260,587
(F) US History									
Above threshold	0.013***	0.009***	0.008	0.028**	-0.001	0.012***	-0.000	0.013**	0.007**
	(0.003)	(0.004)	(0.006)	(0.011)	(0.009)	(0.003)	(0.010)	(0.006)	(0.003)
Mean below threshold	0.669	0.538	0.634	0.482	0.533	0.623	0.523	0.526	0.66
Bandwidth	31.604	28.013	33.489	37.412	28.362	25.315	32.975	39.988	27.044
N	429,330	332,803	97,342	40,370	52,247	491,548	48,268	117,521	405,733

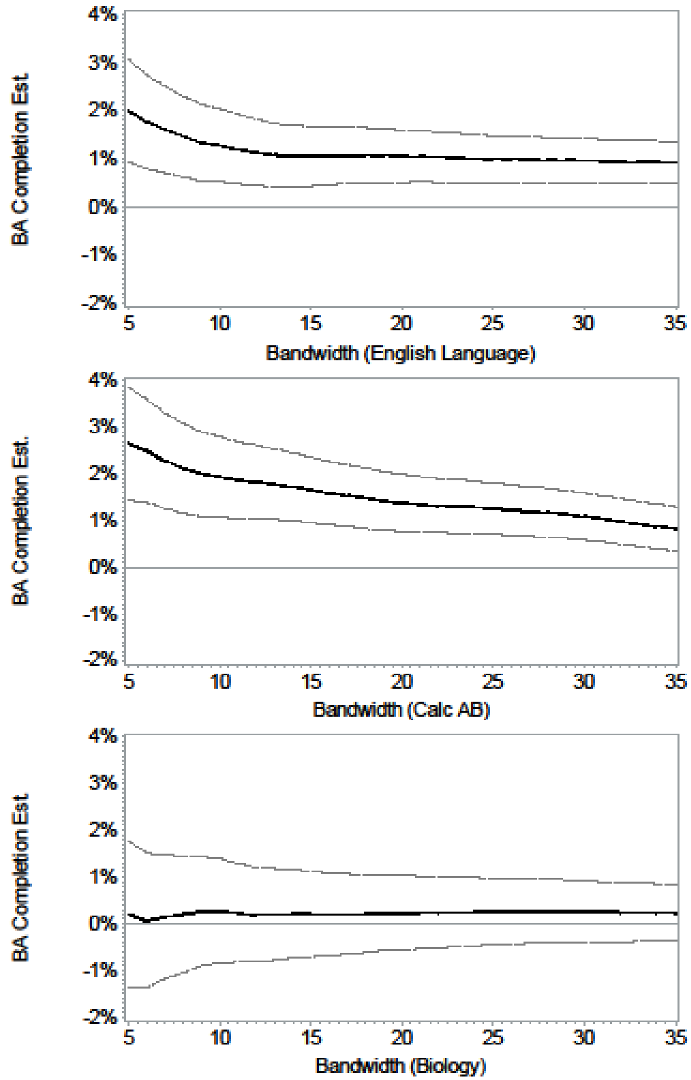
Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Coefficients represent the discontinuity in the outcome at the college-specific minimum credit-granting threshold. All regressions include the following controls: distance from the credit-granting threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. All students in the sample first attended a four-year college within 180 days of HS graduation.

Appendix Table 9: Impacts of Achieving Higher AP Scores on First-Time On-Time Four-Year College-Going

	All HS Years		Junior Takers		Senior Takers	
	Students near 2/3 Threshold	Students near 3/4 Threshold	Students near 2/3 Threshold	Students near 3/4 Threshold	Students near 2/3 Threshold	Students near 3/4 Threshold
(A) Biology						
Above threshold	0.001	0.005	0.008	0.005	-0.000	0.005
	(0.003)	(0.003)	(0.006)	(0.005)	(0.004)	(0.004)
Mean below threshold	0.813	0.847	0.81	0.849	0.816	0.849
Bandwidth	21.613	15.993	14.316	20.187	19.864	14.244
N	279,962	243,469	76,658	96,896	159,669	128,557
(B) Calculus AB						
Above threshold	-0.001	-0.002	-0.003	-0.003	-0.000	-0.001
	(0.003)	(0.002)	(0.007)	(0.006)	(0.003)	(0.002)
Mean below threshold	0.812	0.836	0.799	0.835	0.814	0.836
Bandwidth	13.883	24.572	18.162	18.609	12.809	33.783
N	380,295	429,387	49,820	65,505	318,697	360,771
(C) Eng. Lang. and Comp.						
Above threshold	0.002	0.001	0.004	-0.000	-0.004	0.005
	(0.002)	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)
Mean below threshold	0.77	0.846	0.771	0.851	0.767	0.831
Bandwidth	15.035	11.307	16.512	13.263	23.687	13.566
N	543,098	382,515	476,253	347,437	135,901	95,360
(D) Eng. Literature						
Above threshold	0.005***	0.001	0.031***	-0.002	0.004**	0.001
	(0.002)	(0.002)	(0.009)	(0.008)	(0.002)	(0.002)
Mean below threshold	0.792	0.849	0.782	0.845	0.793	0.85
Bandwidth	20.092	20.594	14.334	13.262	18.905	17.029
N	941,022	887,578	41,321	36,669	849,885	759,567
(E) US Government						
Above threshold	0.002	0.001	-0.005	0.007	0.002	-0.000
	(0.002)	(0.003)	(0.007)	(0.008)	(0.003)	(0.003)
Mean below threshold	0.815	0.866	0.825	0.871	0.814	0.867
Bandwidth	19.183	13.916	27.610	17.045	19.102	12.735
N	433,424	313,922	41,680	32,037	379,961	257,030
(F) US History						
Above threshold	0.002	-0.001	0.002	-0.001	0.006	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.008)	(0.007)
Mean below threshold	0.803	0.846	0.803	0.849	0.784	0.821
Bandwidth	18.022	20.176	20.373	18.657	18.898	34.032
N	627,448	590,469	579,167	493,396	46,624	43,494

Notes: Heteroskedastic robust standard errors in parentheses (*p<.10, **p<.05, *** p<.01). All coefficients and standard errors are from separate local linear regressions with the optimal IK bandwidth and a triangular kernel. Columns labeled "Junior Takers" and "Senior Takers" include only the subset of exams taken by students during their junior and senior years of high school, respectively. Columns labled "All HS Years" include all exams taken by students at any point prior to college entry. All regressions include the following controls: distance from the threshold, the interaction of distance and Above Threshold (a dummy variable for whether the student is above the specified threshold), cohort fixed effects and fixed effects for the high school year in which the exam was taken. Means below threshold represent the average value of the outcome within 1 raw point of the cut score.

Appendix Figure 1: On-Time Bachelor's Parameter Estimates and 95% Confidence Intervals Associated with Receiving a Credit-Granting AP Score (Triangular Kernel)



Appendix Figure 2: On-Time Bachelor's Parameter Estimates and 95% Confidence Intervals Associated with Receiving a Credit-Granting AP Score (Quadratic Polynomial)