

**POSTSECONDARY PREPARATION AND REMEDIATION:
EXAMINING THE EFFECT OF THE EARLY ASSESSMENT PROGRAM
AT CALIFORNIA STATE UNIVERSITY**

Jessica S. Howell
Department of Economics
California State University, Sacramento
jhowell@csus.edu

Michal Kurlaender
School of Education
University of California, Davis
mkurlaender@ucdavis.edu

Eric Grodsky
Department of Sociology
University of Minnesota
egrodsky@umn.edu

April 2009

Abstract. In this paper we investigate how participation in the Early Assessment Program, which provides California high school juniors with information about their academic readiness for college-level work at California State University campuses, affects their college going behavior and need for remediation in college. Using administrative records from California State University, Sacramento and the California Department of Education, we find that participation in the Early Assessment Program reduces the average student's probability of needing remediation at California State University by 6.2 percentage points in English and 4.3 percentage points in mathematics. Rather than discouraging poorly prepared students from applying to Sacramento State, EAP appears to lead students to increase their academic preparation while still in high school.

This project was supported with grants from the Institute of Education Sciences of the U.S. Department of Education, the Association for Institutional Research, and the CSUS Research and Creative Activity Awards Program. We thank the CSUS Office of Institutional Research and the California Department of Education for their assistance with the data. Opinions reflect those of the authors and do not necessarily reflect those of the granting agencies.

1. INTRODUCTION

College participation rates are at an all time high, with nearly three out of four high school students attending college. Despite increases in the share of high school graduates continuing on to college, college completion rates have remained relatively stagnant for the past several decades—around 66 percent for those who achieve at least 10 credits at a baccalaureate-granting institution and substantially less for the entire population of postsecondary entrants who aspire to a baccalaureate degree (Adelman, 2006; Turner, 2005). Moreover, graduation rates remain significantly lower for minorities and for those who come from poor or modest economic backgrounds than for white and relatively advantaged students (U.S. Department of Education, 2006).

In its recent review of the state of higher education in America, the Spellings Commission asserts that “[i]n an era when intellectual capital is increasingly prized, both for individuals and for the nation, postsecondary education has never been more important” (U.S. Department of Education, 2006). More recently, President Obama went even further in a speech on March 10, 2009, stating that “part of America’s education strategy is providing every American with a quality higher education.”¹ Despite the pressing need to ensure that more students obtain a postsecondary degree, we know surprisingly little about what leads to college readiness and degree completion.

Although several studies have demonstrated that many students are relatively uninformed about what it takes to succeed in college (Person, Rosenbaum, & Deil-Amen, 2006; Rosenbaum, 2001; Venezia, Kirst, & Antonio, 2003), the question of how we might effectively enrich the information on which students base their postsecondary decisions remains largely unexplored. In this paper we evaluate the extent to which an intervention designed to increase the quality of the information about academic preparedness available to high school students affects students’ decisions to apply to a public university and their need for remediation once enrolled.

The Early Assessment Program provides participating California high school juniors with information about their academic readiness for college-level work at California State University campuses. We ask: *Does providing high school juniors with*

¹ http://www.whitehouse.gov/the_press_office/Remarks-of-the-President-to-the-United-States-Hispanic-Chamber-of-Commerce/

early information about their academic preparation reduce their probability of requiring remediation in college? And, if so, what can we learn about the mechanism by which such an intervention influences remediation patterns at California State University?

The paper is organized as follows. Section two describes prior research on academic preparation for college, specifically students' expectations and the role of information, K-12 and higher education alignment, and the effect of college remediation on college persistence and degree completion. Section three describes the California Early Assessment Program. Section four describes the data and our methodological approach. In section five we present empirical results and then conduct robustness checks and tests for selection bias associated with the voluntary nature of the program. Section six discusses possible mechanisms of the impact of the intervention on changes in remediation rates at CSU. Finally, section seven concludes by offering several policy implications of our findings as well as avenues for future research.

2. PREVIOUS RESEARCH

Academic skills and preparation in high school are important determinants of college success (Horn & Kojaku, 2001; Kirst & Venezia, 2004). Two influential Department of Education analyses authored by Clifford Adelman, *Toolbox I* (1999) and *Toolbox Revisited* (2006), find that the intensity of a student's high school curriculum is the single best predictor of college graduation. Using High School and Beyond (HS&B) and National Educational Longitudinal Study (NELS) data to investigate the pathways that affect college completion in more detail than any other researcher to date, Adelman (1999, 2006) points us to important junctions in the pathway to a college degree that merit closer investigation. Not surprisingly, students with higher levels of measured academic skills are more likely to graduate from college than their less able peers. Our own analysis of the NELS data indicates that, among the highest achieving students in high school, college completion rates among students who begin at a four-year college are 77 percent. Among the lowest achieving students, 37 percent of those who enter a four-year college graduate by age 26.

Recent reports suggest that 28 percent of all first-time freshmen are enrolled in some remedial course (Parsad & Lewis, 2003). Although the large majority of these

students attend two-year institutions, approximately 26 percent of first-time freshmen attending four-year colleges are required to take remedial courses as well (Adelman et al., 2003). In fact, remedial course enrollment varies substantially across colleges and universities, with some institutions not offering remedial courses and others enrolling upwards of 50 percent of their incoming students in remedial classes. Current estimates of the cost to remediation suggest that public four-year colleges and universities spent in the range of \$435-543 million dollars in 2004-05 on remedial instruction, and that the total cost to students attending two-year or four-year institutions in the same year was about \$708-886 million in remedial education tuition and fees (Strong American Schools, 2008).²

In recent years, many states have been questioning the role of remedial courses in their postsecondary institutions (Venezia et al., 2005). Although some believe that these courses serve an important bridge between poor K-12 schooling opportunities and college readiness, others argue that remediation is the role of secondary schools or community colleges, not baccalaureate-granting colleges and universities. Several states have embraced this logic and stripped remedial programs from their colleges and universities (Gleason, 2000; Shaw, 1997). In some states, including California, community colleges have resisted increasing the number of remedial courses that they offer, arguing that providing remediation reduces their capacity to support students who intend to transfer to four-year colleges (Ignash, 1997). Moreover, to address the discrepancy between students' K-12 academic preparation and the demands of postsecondary schooling, many states have implemented or are considering K-16 or Pre-K-20 initiatives, albeit with a wide range of purposes, relationships, and end goals (United States General Accounting Office, 2003; Venezia et al., 2005). These efforts often involve aligning secondary and postsecondary curricula, as well as the curriculum within the elementary and secondary systems themselves (Martinez & Klopott, 2005). However, the success of these efforts (e.g., the California State University's Early Assessment Program) in improving college readiness has not been investigated.

Contrary to the certitude that characterizes much of the rhetoric around remediation, we know of little evidence on the effect of taking remedial courses on

² <http://www.strongamericanschools.org/diploma-nowhere>

college persistence and degree completion. In one study of students attending Ohio four-year colleges, Bettinger and Long (2004) find that students placed in remedial courses were more likely to drop out or transfer to a lower level college than observationally similar students who were not placed in such classes. However, among those students who do complete remedial coursework, the results are mixed, suggesting that these courses may help facilitate degree completion, albeit through a longer route of study. Two more recent studies find no effects, or even negative effects of remediation for students at the margin of passing a remediation exam attending public community colleges in Florida (Calcagno & Long, 2008) and attending all public two-year and four-year institutions in Texas (Martorell & McFarlin, 2008). Both studies evaluate the impact of remediation in academic subjects on student outcomes such as total credits, persistence, subsequent performance in academic subjects, and transfer to four-year institutions among community college entrants. In neither study did researchers find a benefit to remedial instruction for students at the margin of the remediation placement test on any of these outcomes. Of course, the studies are not able to evaluate the impact of remediation for lower ability students who may be far from the cutoff utilized in the regression discontinuity research design without imposing assumptions about the functional form of the relationship between the assignment criterion and student outcomes. Moreover, the impacts of specific remediation strategies on a variety of student outcomes have not been directly tested.

Why do so many college students appear to require remediation? Part of the explanation for the large share of remedial students in American colleges and universities may be a combination of limited information students possess regarding what they need to do to succeed in college and the (arguably) mistaken perception that everyone must at least attend if not complete college in order to succeed in the labor market. A majority of high school students, regardless of their academic performance, report that they will attend college. In fact, academic performance accounts for little of the variance in students' *expected* levels of educational attainment. Reynolds et al. (2006) find that between 1976 and 2000 the percentage of high school seniors indicating that they probably or definitely would complete *at least* a baccalaureate degree increased from 50 percent to 78 percent. At the same time, not surprisingly, the explanatory power of self-

reported grades and participation in a college preparatory program have declined appreciably (Reynolds, Stewart, MacDonald, & Sischo, 2006). These findings are consistent with those of Rosenbaum and his colleagues who report that high school seniors have little understanding of what it takes to succeed in higher education (Rosenbaum, 2001). Given changes in the marginal distribution of those expecting to attend college, it should come as no surprise that the level of secondary academic preparation among college entrants has declined over time (Bound, Lovenheim, & Turner, 2007).

3. THE EARLY ASSESSMENT PROGRAM

The Early Assessment Program (EAP) is an academic preparation program developed by the California Department of Education (CDE), the State Board of Education, and the California State University (CSU). The stated purpose of the program, now in its fifth year, is to bridge the gap between K-12 educational standards in English and mathematics and the requirements and expectations of postsecondary education at the California State University. The development of EAP was motivated by a desire to increase the English and math proficiency of entering freshmen at CSU campuses, thereby reducing high system-wide remedial course-taking rates. The information provided by EAP may reduce remedial course enrollments at CSU campuses by increasing the academic readiness of incoming students and/or reducing the likelihood that would-be remedial students choose to apply to and enroll in a CSU.

The three explicit goals of the Early Assessment program are as follows: (1) identify students *before* their senior year who need additional coursework or preparation in English and/or mathematics to succeed at a CSU; (2) provide students, parents, teachers, and administrators with information about their students' college readiness, and then partner with those parties to increase the quality of academic preparation; and (3) motivate students to take steps in their senior year to achieve readiness for college-level work.³ The program has three components: the 11th grade testing to identify academic preparation, a professional development component to aid high school teachers in facilitating improved college readiness among their students, and a supplemental

³ Information retrieved at: http://www.calstate.edu/eap/documents/presentation_cde.ppt#302

preparation for students in their senior year.⁴ All three components of the program are voluntary, a point to which we return below.

The first component of the program, and the one we investigate in this paper, is an early assessment of English and math skills among California 11th graders that began in the spring of 2004. The basic nature of the intervention is to add 15 optional multiple choice questions to each of the mandatory California Standards Tests (CST) in 11th grade English and mathematics.⁵ These additional test items were developed by CSU and K-12 faculty to reflect both California high school standards and CSU placement standards. Composite scores from the exam are computed based on a subset of CST questions augmented with the EAP items.

Based on these scores, students who elect to complete the additional test items receive a letter in the summer before their senior year in high school with one of three messages. If their score exceeds an upper threshold, they are exempted from remedial coursework and the CSU placement exam. Students whose score falls below a lower threshold are considered non-exempt from the remediation placement exams. They are advised about what courses to take in their senior year, and directed to additional resources to improve their readiness for CSU coursework following high school graduation.⁶ While there is only one threshold in English to distinguish the exempt and non-exempt outcomes, the mathematics EAP also includes a middle-range for scores that yields an outcome of exempt *conditional* on completing certain courses during their senior year in high school with a grade of “C” or higher. Appendix figures A1 and A2 illustrate the specific paths by which EAP operates to determine college readiness; note that EAP is not the only way to gain exemption from the CSU placement exam and/or

⁴ The teacher development component includes CSU teacher-education faculty sponsored reading institutes and materials through which high school teachers might improve their skills in helping students to read and write effectively. The supplemental student preparation component enables students to pinpoint their individual strengths and weaknesses by using the CSU Diagnostic Writing Service or the Mathematics Diagnostic Testing Project. Students who need better skills in expository reading and writing can take a specially designed 12th grade course, developed jointly by teachers from high schools and the CSU. Students who need to upgrade their mathematics skills have access to interactive online programs called *CSU Math Success* during their senior year.

⁵ The English EAP also requires that students complete an essay in a separate 45 minute session.

⁶ For additional information, see CSU-developed online resources to help students and their families make sense of their EAP results and what to do to prepare for CSU (<http://www.csusuccess.org>).

avoid remedial coursework. Exemption may alternatively be earned through sufficiently high SAT, ACT, or relevant AP test scores.

Given that EAP is voluntary (above and beyond the mandatory CST testing in 11th grade), how many students participate? There are several different ways of defining participation in EAP. Table 1 shows that 66.7 percent of all California juniors that took the mandatory California state standards test also sat for the English EAP exam in the first year of the program, but only 36.6 percent actually completed the exam (a little over half of those who signed up). For the math EAP, 74.6 percent of eligible juniors sat for the exam, and 72.7 percent actually completed the exam in the first year of the program. However, it is important to note that, unlike the English EAP, which is available to all high school juniors, the mathematics EAP is only available to those juniors who have completed at least Algebra II and are currently enrolled in a math class. Thus, this effectively reduces math EAP eligibility to those taking either the Algebra II or Summative Math CST exam. In this paper, we define participation in EAP as completion of the exam and receipt of the early information about college readiness.

[Insert Table 1]

There are a number of reasons why students that sit for the exam do not actually complete it. Students may sign up at one point in time and then change their minds, or students may begin the exam and then decide they don't want to complete it. The English EAP test also requires the completion of an essay that is administered in a separate 45-minute session. According to those involved in administering the EAP, this additional requirement likely explains the large gap between the proportion of students who begin the English EAP and the proportion who finish it and why there is not a similar gap in math participation. Table 1 also shows that EAP participation has increased over time in English, but has remained fairly flat in math. Over three quarters (77 percent) of those who completed the English EAP were deemed not exempt from CSU remedial placement exams in English. Nearly half (44.5 percent) of those who completed the math EAP were deemed not exempt from CSU remedial placement exams in math. The seemingly higher level of math preparation among examinees stems from the fact that math EAP

participants have already achieved a greater level of academic preparation in math than the average high school junior. It is important to reiterate that students may gain exemption from taking the remediation placement exams and remedial courses at CSU by other means than EAP (see figures A1 and A2).

4. DATA AND METHODOLOGY

Does providing high school juniors with early information regarding their academic preparedness for college-level work reduce their probability of requiring remediation in college? Answering this question requires individual-level data on remediation need and its determinants, as well as information on EAP participation.

Data Description

Our study focuses on one CSU campus, Sacramento (CSUS). In 2003, over two-thirds of all CSU first-time freshmen were enrolled in a remedial math or English course, with the vast majority of campuses at over 50 percent, and the Sacramento campus at 66 percent (Figure 1). This is substantially higher than the national average of 28 percent, which includes selective four-year campuses (Parsad & Lewis, 2003). Whether the discrepancy from national statistics reflects higher standards in California (and thus lower thresholds for remediation) or lower levels of academic preparedness among California's college matriculants relative to the average college matriculants in the nation, the fact that eight of ten CSU freshmen require remediation speaks to the magnitude of the challenge educators in California face with respect to postsecondary preparation.

Despite our focus on one campus, this study is applicable to the entire 23-campus CSU system (serving over 350,000 undergraduates annually) for several reasons. First, the English and mathematics placement tests and standards are employed uniformly across all CSU campuses, so there is no loss of generality by focusing on one campus. Second, the Sacramento campus is representative of other campuses in the system in terms of its socioeconomic and racial/ethnic composition. It is among the largest of the 23 CSU campuses, enrolling approximately 24,000 undergraduate students or 7 percent

of all undergraduate CSU students.⁷ CSUS is surpassed in enrollment by only four other CSU campuses, all of which are located in southern California. Finally, EAP was implemented statewide in 2004, removing the possibility of learning effects that might have differentially influenced specific campuses, regions of the state, or high schools.

This study relies on longitudinal student-level data for California public high school students who were in the 11th grade between the 2001/2002 and 2004/2005 academic years, and who enter California State University Sacramento as first-time freshmen. The data come from two sources and span four academic years, including two years prior to and two years following the implementation of EAP.⁸ The California Department of Education (CDE) supplied information on all California 11th graders enrolled in public high schools in the state as well as attributes of those schools. Data from CDE include individual-level indicators for EAP participation in the first two years when EAP was offered (2003/04 and 2004/05), student demographic measures and high school codes. CDE merged these data with a file of all CSUS applicants provided to us by the California State University Sacramento Office of Institutional Research for four cohorts of first-time freshman applicants in the fall 2003, 2004, 2005 and 2006, which correspond to data on the four cohorts of high school juniors provided by CDE. The match was based on student name, date of birth, gender and high school attended.⁹ In the final dataset, we observe important student gender, race/ethnicity, academic preparation and ability measures like high school GPA and CST score in addition to their EAP participation. Table 2 includes the summary statistics for four cohorts of enrollees at CSUS. Our investigation of EAP effects focuses on enrollees at CSUS because these are the individuals for whom we have remedial placement information. Although we can predict this information for applicants and admitted students, the timing of the remediation tests and of notification of other exemption methods are such that we are

⁷ See http://www.calstate.edu/as/stat_reports/fall_summary.shtml for enrollment figures.

⁸ Appendix figure A3 depicts the EAP timeline to clarify which cohorts of students had access to EAP. In particular, note that the first EAP cohort can be thought of in terms of the high school junior class in 2003/04 or the first-time college freshmen class in 2005/06. To alleviate confusion, all date references are based on when members of a cohort were juniors in high school.

⁹ CDE's matching process was not perfect; they were only able to successfully match 85 percent of CSUS applicants in the original sample because they do not maintain a numeric identifier. Analysis of the matched sample indicates that it is more white and less Asian than the original pool of CSUS applicants, presumably because of complications involved in matching on student name.

only *certain* of final remediation need for enrollees. The pre-EAP years are the cohorts of juniors in 2001/02 and 2002/03 (entering CSUS in 2003 and 2004) and the post-EAP years are the cohorts of juniors in 2003/04 and 2004/05 (entering CSUS in 2005 and 2006). Comparing variable means pre- and post-EAP suggest that the CSUS enrollee samples have not changed in statistically significant ways over this time period. Table 2 reveals a roughly 4 percentage point drop in the proportion of students taking the CSU remediation placement exams in math (ELM) between 2002/03 and 2003/04, and a roughly 6 percentage point drop in the proportion of students taking the CSU remediation placement exams in, English (EPT), which could certainly be because of the availability of EAP as an additional means of exemption from these exams while other avenues for gaining exemption remained unchanged.

[Insert Table 2]

Given the voluntary nature of the EAP program, we seek to control for a range of covariates that influence both students' choices to sit for and complete the EAP portion of the California 11th grade standards test and their likelihood of requiring remediation should they choose to attend a CSU campus. To adjust for differences among high schools that could influence both need for remediation and EAP participation we control for high school size, demographic composition, and academic performance indicators based on data from the California Department of Education and the U.S. Department of Education's Common Core of Data. Table 3 provides summary statistics for the high school attributes that we utilize in the analysis. California high schools display considerable variability in size of student body, racial/ethnic composition, socioeconomic status (SES), and academic performance. We operationalize SES as the share of students eligible to participate in the federal free and reduced lunch program based on family income. We proxy school academic achievement based on the school's Academic Performance index (API) and the share of students eligible for admission to a UC or CSU campus, which is determined based solely on the courses they complete.¹⁰ The Academic

¹⁰ In order to be eligible to either the CSU or UC system, a high school student must complete a specific set of course requirements (called "a-g"). Each course represents a one-year college preparatory class. The

Performance Index (API) summarizes a school's academic performance and progress on California assessments, specifically the Standardized Testing and Reporting (STAR) Program and the California High School Exit Examination (CAHSEE).¹¹

[Insert Table 3]

School-Level EAP Participation Rates

Although EAP is available to all 11th grade students in the state, schools vary widely in the proportion of their juniors that participate in EAP (Table 3). Figures 2A and 2B provide information on the proportion of high schools that have EAP participation rates falling into various ranges (deciles) over the first three years of the program. Here we define EAP participation as simply sitting for and not necessarily completing the exam, in order to describe possible school differences in students' exposure to the EAP. In each of the first three years of EAP, approximately 10 percent of all high schools had no students participating in the English EAP (decile "0" in Figure 2A) and there is evidence of an increase over time in the proportion of high schools with greater than 80 percent English EAP participation rates. Less than 10 percent of all high schools have no students participating in the Math EAP (decile "0" in Figure 2B), and strong math EAP participation is clearly much more common relative to English. Math EAP participation rates in excess of 80 percent (deciles 9 and 10 in Figure 2B) are evident in over one quarter of all high schools in all three years of the program. Additionally, a non-trivial proportion of high schools have 100 percent EAP participation in math and/or English.

[Insert Figures 2A & 2B]

requirements include two history/social science (one on the U.S. and one on the world), four English language arts, three math, two laboratory science (one biological and one physical), two foreign language, once visual/performing arts, and one elective from the above subjects. Eligibility is additionally based on high school grades, performance on college admissions exams, advanced coursework, and (for some campuses) personal attributes. For more information, see http://www.calstate.edu/SAS/documents/CSU-UC_a-g_SubjectRequirements2008-09.pdf.

¹¹ State legislation, the Public Schools Accountability Act (PSAA) of 1999 (Chapter 3, Statutes of 1999), established the Academic Performance Index (API), which summarizes a school's or local educational agency's (LEA) academic performance and progress on a variety of statewide assessments. For more information, see <http://www.cde.ca.gov/ta/ac/ap/index.asp>.

The observed variation in EAP participation rates across high schools depicted in Figures 2A and 2B has several important implications for our analysis. First, such variation at the school level highlights the utility of including school-level variables in our analysis of EAP's effect on students' remediation need. Figures 2A and 2B also make evident the importance of addressing the voluntary nature of the program at both the student and school levels. Thus, following the discussion of our results, section five explores the determinants of an individual's EAP participation decision as well as selection-corrected estimates of the effect of EAP on remediation need, accounting for both individual- and school-level selection into the intervention.

The Effect of EAP on Remediation Need

The quasi-experimental nature of the data enables us to employ a treatment-comparison research design to evaluate the effect of EAP on the probability of needing remediation in college. We estimate two types of treatment effects in this paper. First, by taking advantage of the temporal disjuncture in the availability of the EAP program along with measures of other covariates, we estimate the intent to treat effect (ITT) by comparing remediation rates for students eligible to participate in EAP by virtue of the year they entered eleventh grade (in 2003/04 or 2004/05) and those ineligible to participate because the program was not yet available (in 2001/02 or 2002/03). This amounts to comparing conditional rates of remediation before and after EAP became available. Second, we estimate the effect of the treatment on the treated (TT) by comparing remediation rates for those who do and do not complete the EAP among all those who were eligible for the assessment (e.g., those in the latter two high school cohorts in our data). Finally, we unpack the mechanisms by which the treatment leads to the observed outcome of lower remediation rates for the treated by exploring the potentially differential effect of the treatment conditions (exempt, non-exempt and, for math, conditionally exempt) on application to CSUS. The results suggest that the lower probabilities of remediation need among program participants are not due to diminished probabilities of applying to CSUS.

To estimate the effect of making the EAP available (ITT), we specify a model where an individual student's latent probability of requiring remediation in subject s , Y_{is}^* ,

is a function of individual characteristics, X_i , attributes of the individual's high school, Z_i , and a variable to indicate whether individual i had EAP available during their junior year, $PostEAP_i$. An identically distributed error term, ε_{is} , is permitted to be correlated within but not between schools.

$$Y_{is}^* = \beta X_i + \gamma Z_i + \alpha_1 PostEAP_i + \varepsilon_{is} \quad (1)$$

Although Y_{is}^* in equation (1) is unobserved, we do observe a binary indicator, Y_{is} , which is equal to 1 when $Y_{is}^* > 0$ and 0 otherwise. When combined with the assumption that ε_{is} is logistically distributed, we use logistic regression to examine the effect of EAP on the probability that student i requires remediation in subject s . The individual characteristics in the vector X_i include gender, race/ethnicity, several measures of academic ability, and parental educational attainment. The β parameters capture the effects of these student characteristics on the latent propensity of requiring remediation in subject s at CSUS. The high school attributes in the vector Z_i include API, the proportion of students who are CSU and UC eligible by virtue of the courses they complete, the proportion of students who are black and Hispanic, and the proportion eligible for the free and reduced-priced lunch program. The γ parameters capture the effect of these high school characteristics on remediation need. Holding all of these student and school factors constant, the parameter on $PostEAP_i$, α_1 , identifies the effect of making available the Early Assessment Program on the latent propensity that a student enters remediation at CSUS, the intent to treat effect (ITT).

To test the effect of actually participating in EAP (TT), we specify a model identical to (1) where an individual student's latent probability of requiring remediation in subject s , Y_{is}^* , is a function of individual characteristics, X_i , attributes of the individual's high school, Z_i , a variable to indicate whether individual i had EAP available during their junior year, $PostEAP_i$, and a separate variable to indicate whether individual i actually participated in the EAP in subject s , $EAPpartic_{is}$. Only those who complete the EAP are considered here as participants. Students who complete part but not all of the assessment (i.e., do not complete the essay for the English exam) are not considered as

EAP participants. An identically distributed error term, ε_{is} , is permitted to be correlated within but not between schools.

$$Y_{is}^* = \beta X_i + \gamma Z_i + \alpha_1 PostEAP_i + \alpha_2 (PostEAP_i * EAPpartic_{is}) + \varepsilon_{is} \quad (2)$$

Again, we use logistic regression to examine the effect of EAP on the probability that student i requires remediation in subject s . Of primary interest is the parameter on $(PostEAP_i * EAPpartic_{is})$, α_2 , which captures the effect of participating in EAP on remediation need relative to those students who chose not to participate despite having EAP available to them, or the effect of treatment on the treated (TT). All other parameters can be interpreted as discussed in equation (1), except here the parameter on $PostEAP_i$, α_1 , no longer identifies the intent to treat effect (ITT) directly, because upon inclusion of the interaction α_2 , represents the difference in our outcome between post-EAP non participants and pre-EAP students.

It is important to note that our empirical methodology is not a difference-in-differences strategy, but simply a treatment/control identification strategy. Given that EAP was implemented statewide, there are no EAP participants in the pre-EAP period that would enable a difference-in-differences estimation. We have perfect compliance among the control group for our ITT estimates since a) no high school junior could have participated in EAP prior to the 2003/04 school year and b) no student who had been a junior prior to the EAP program could have participated at a later date since the EAP is attached to the California Standards Test taken by high school juniors. Likewise, the treatment is in principle available to every high school junior in the state in the 2003/04 school year and beyond, giving us some justification for interpreting the effects of EAP participation as treatment effects on the treated. However, it may be the case that student access to EAP is differential *de facto* as a result of differences in the availability of information about EAP. We assess the robustness of our TT results by taking account of the propensity of students to participate in EAP based on observables using propensity matching and the propensity of schools to encourage participation among their students

by restricting our analyses to high schools with EAP participation rates in excess of 90 percent.¹²

5. RESULTS

Based on equation (1), we find no statistically significant effect of EAP availability on remediation need, controlling for a variety of individual- and school-level covariates. Thus, the idea that the mere presence of EAP, without participation in the program (ITT), contributed to a *reduction* in the need for remediation appears not to be supported. (Table A1 in the Appendix displays the full results from these models by subject.)

Turning to our primary focus of the treatment on treated estimates, based on equation (2), Table 4 shows the marginal effects of individual- and school-level covariates, EAP availability and EAP participation on the probability of remediation need for CSUS enrollees by subject. The marginal effects indicate the change in the probability of needing remediation associated with a change in each variable, holding all other variables constant at their sample means, where changes are from 0 to 1 for binary variables and 1 percentage point increases for continuous variables. As one would expect, higher high school GPAs are associated with lower probabilities of remediation, and this effect is bigger in math than in English. Higher CST scores and greater parental educational attainment are associated with lower probabilities of needing remediation.

Although not the primary focus of our research, we cannot help but be struck by the magnitude of the differences in the conditional probability of remediation need across important individual background characteristics. Even holding other measures constant at their sample means, we find pronounced racial/ethnic and gender differences in the probability of requiring remediation among Sacramento State enrollees. Across academic subjects, all non-white racial/ethnic groups are more likely to need remediation than whites. Differences in white/non-white conditional rates of remediation need are generally greater in English (at 14.8 percentage points to 23.3 percentage points) than in math (at 7.1 percentage points to 18.7 percentage points), consistent with potential racial/ethnic differences in first language. Among black students, however, the difference

¹² We also test the robustness of our findings employing school fixed effects models.

in the probability of requiring remediation in math (18.7 percentage points greater than whites at the sample mean) is even greater than the difference for English (14.8 percentage points greater than whites at the sample mean). Given the emergent literature on the female advantage in higher education (Buchmann & DiPrete, 2006), we find the gender difference in mathematics remediation especially surprising. Net of CST math scores and holding those scores and other covariates at the sample mean, we find that women attending Sacramento State are about 20 percentage points more likely to require math remediation than men.

We find statistically significant effects of EAP participation on remediation need (TT). Participation in EAP does appear to reduce the probability of remediation at CSU quite substantially, by 6.2 percentage points in English and by 4.3 percentage points in math. The EAP participation effect for math, however, only attains statistical significance at the .10 alpha level.

[Insert Table 4]

Examination of Selection Effects

As a result of the voluntary nature of the program, one might be concerned that the results discussed above suffer from selection bias. As a first step in addressing the selection problem we examine individual student participation decisions and then present selection-corrected estimates of the effect of EAP on remediation. These analyses (discussed below) reveal that the logistic regression results we present in Table 4 are robust to both individual and school self-selection.

In order to examine the individual EAP participation decision, we fit a logistic regression model to the probability that the i^{th} student participates in EAP in subject s as a function of student demographic characteristics in X_i , the attributes of their high school in Z_i and year fixed effects.

$$EAP\ Participation_{is} = \beta X_i + \gamma Z_i + \alpha_1 Yr_{2004/05} + \alpha_2 Yr_{2005/06} + \varepsilon_{is} \quad (3)$$

The variables included in X_i and Z_i are very similar to those included in equation (1 and 2). Because we estimate equation (3) with data on all California public high school juniors in the post-EAP years, we are constrained to the demographic information supplied by the California Department of Education on all California students.¹³ Table 5 contains the marginal effects for the individual student participation decisions modeled in equation (3). From these models we note that males, on average, are less likely to participate in math and English EAP than are females, controlling for a variety of demographic, academic, and school characteristics. Moreover, there are some important differences by race in EAP participation decisions, suggesting that Asians are more likely to participate in EAP than their white counterparts, and that Hispanics are also, on average, more likely to participate in the math EAP than observationally similar white students. We note that higher achieving students, as measured by the CST exam, are also more likely to participate in EAP, but the effect of measured achievement on EAP participation decisions is not linear. In addition, there are interesting school-level determinants of EAP participation; students from smaller, lower performing, and higher minority composition schools are, on average, more likely to participate in EAP. Finally, we note that, as expected, students enrolled in schools where there is greater EAP participation, are more likely to participate in EAP themselves.

[Insert Table 5]

Having noted systematic differences in the probability of EAP participation conditional on observable characteristics, we next pursue several different strategies to address selection in our substantive models of the treatment effect on the treated. To adjust for student self-selection, we pair EAP participants with non-participants in the post-EAP years as a function of observable characteristics using 1:1 propensity score matching and estimate the effect of EAP participation on differences in the probability of requiring remediation within pairs. In a second set of models we address selection into participation as a function of both individual and school characteristics, by restricting the

¹³ Summary statistics for the sample of EAP-eligible students statewide are provided in Appendix Table A2.

sample to schools with over a 90 percent rate of participation. This virtually eliminates school-level noncompliance from the model. We present the estimates of the effect of EAP participation on remediation need under these different specifications in Table 6.¹⁴

[Insert Table 6]

Table 6 allows us to compare our original results on remediation need (column 1 for English and column 4 for math) with two alternate strategies that attempt to correct for selection into the program. First, columns 2 and 5 present results from propensity score models, which correct for individual selection into EAP relying on observables. Results from these models reveal remarkably similar findings, a slightly larger effect of EAP participation in English (a 7.6 percentage point reduction in the probability of English remediation need versus 6.2 from the original model), and identical results in math (a 4.3 percentage point reduction in the probability of math remediation need). When comparing the results to models that correct for selection on individuals and schools (columns 3 and 6 of Table 6) where the sample is restricted to high EAP participation schools, we find slightly smaller effects for both English (5.2) and math (4.1). Overall, the estimated effect of EAP participation on remediation need across these different specifications is remarkably consistent.

6. EXAMINATION OF EAP MECHANISM

Now that we have plausibly established that participation in EAP reduces the probability of needing remediation in college, we look more closely at the mechanism behind this effect. Does the information gained from participation in EAP encourage students to become better prepared for college or discourage students from applying at all? We do not observe students' course-taking behavior or performance in their senior year of high school; thus, to better tease out the mechanism by which EAP works, we examine the decision to apply to CSUS. If EAP participation has a negative effect on the decision to even apply to CSUS, then there is some support for the notion that EAP

¹⁴ In addition, we also estimate a school fixed effects model to eliminate the contribution of both observed and unobserved school attributes to variation in EAP participation, which resulted in consistently similar findings; the full estimates from all of these models are available from the authors upon request.

works as a sorting mechanism by discouraging students from attending. Furthermore, the effect of the information gained by participating in EAP may depend on the actual signal EAP participants receive. If students learn that they are exempt from remedial coursework, for example, we hypothesize that they would be more likely to apply to CSUS but less likely to apply upon receiving a non-exempt signal.

We specify a model of the decision to apply to CSUS as a function of the four states into which post-EAP individuals might be categorized based on their observed choices and outcomes – exempt, conditionally exempt (in math only), not exempt, and non-participant – while also controlling for other student and school characteristics that influence college application decisions. Because all four of these categories only exist in the post-EAP period, the omitted category that serves as a reference group is pre-EAP individuals.

$$CSUS\ Applicant_{is} = \beta X_i + \gamma Z_i + \alpha_1 Exempt_{is} + \alpha_2 ConditionallyExempt_{imath} + \alpha_3 NotExempt_{is} + \alpha_4 Nonparticipant_{is} + \varepsilon_{is} \quad (4)$$

Estimating the parameters in equation (4) with logistic regression indicates how student and school characteristics as well as EAP participation and outcomes influence the probability that the i^{th} student applies to CSUS. These estimated parameters allow us to compare the marginal effect on application of non-participation or, for participants, receiving different outcomes on the EAP. Parameters α_1 , α_2 , and α_3 capture the application behavior of students that participate in EAP and receive an exempt, conditionally exempt, or not exempt signal, respectively, in subject s relative to pre-EAP individuals. Because nonparticipation in the post-EAP period is an option, parameter α_4 captures the application behavior of post-EAP individuals that chose not to participate in the subject s EAP exam relative to those pre-EAP individuals who did not have the program available. Following estimation, we examine the differences in how the exempt and not exempt signals compare in their effect on application probabilities.

Given differential feeder patterns and the selection issues discussed in section five, we estimate the logistic regression model in equation (4) using only Sacramento County high schools that directly feed CSUS and that have a 90 percent or greater EAP

participation rate. The marginal effects from the logistic regression are presented in Table 7. We find that English participants with exempt outcomes actually had slightly lower probabilities of applying than their observationally similar counterparts in pre-EAP years (only significant at the .10 alpha level), while participants with a non-exempt outcome in English have slightly higher probabilities of applying to CSUS relative to pre-EAP individuals. English non-participants in the post-EAP period were 4.5 percentage points less likely to apply than their pre-EAP counterparts. This result is not surprising given that participation in EAP is in itself some indication of college interest, and therefore non-participants (particularly in this sub-sample of schools with nearly universal EAP participation rates) may be quite different. Finally, we note that, relative to those who were exempt in English, individuals who received a non-exempt outcome on the English EAP were approximately 2 percentage points more likely to apply to CSUS and this difference is statistically significant. Thus, the mechanism by which the English EAP reduces remediation need does not appear to be through better sorting.

[Insert Table 7]

Turning to math, we find a somewhat different story. Students who receive an exempt or nonexempt outcome in math are not any more or less likely to apply to CSUS than are their counterparts for whom EAP was not available. Additionally, although the *signs* on the estimated parameters α_1 and α_3 are consistent with a sorting story, testing for a difference in these parameters reveals no statistically significant difference in the application behavior of exempt relative to non-exempt students in math. Thus, as in English, the mechanism by which the math EAP reduces remediation need does not appear to be through better sorting.

Table 7 indicates that, in math, all of the action appears to be among those individuals with a conditionally exempt outcome. Students with a conditional exemption on the math EAP are more likely to apply to CSUS than both their pre-EAP and exempt counterparts by a statistically significant difference of 5.1 and 5.4 percentage points, respectively. This finding, although tentative, has potentially important policy implications. The conditionally exempt category is distinct from exempt and non-exempt

in that it offers students a pathway to success rather than a summary judgment. Conditionally exempt students may be disproportionately on the margin of applying to Sacramento State relative to students who receive other signals (or no signal at all). They may respond to the partially positive signal they receive from EAP, recognizing that, with a little effort, they can become ‘college material.’

7. CONCLUSION

Most, if not all, public secondary and postsecondary systems of education are badly misaligned (Kirst & Venezia, 2004). Standards for academic success vary both within and across sectors. This variation poses a significant challenge to students and policy makers, the consequence of which is a great deal of confusion and even ignorance among students about the academic demands of college. It is no wonder they are confused; among Sacramento State’s students requiring remediation in either math or English in 2007, the average GPA they earned in high school in the subject for which they needed remediation was just above a 3.1.¹⁵ Their high schools told them that they were successful B students, but their colleges told them that they were not ready to do college-level work. This troubling state of affairs is exacerbated by an ethos of college for all, with little regard to academic preparation.

The EAP program is an intervention designed to improve the quality of information students have regarding the California State University’s standard for minimally acceptable levels of academic preparation in math and English. By providing this information to high school juniors, the architects of the EAP give students the opportunity to make more informed decisions about their secondary school curriculum and postsecondary pathways. The signaling value of ‘conditionally exempt’ may be especially powerful, as it provides a specific step forward, in addition to diagnostic information. Future research should explore whether student course taking in the senior year accounts for the relatively greater impact of the conditionally exempt signal on college application.

Postponing secondary school preparation to the postsecondary level is both controversial and costly. While critics raise important questions about the appropriateness

¹⁵ http://www.asd.calstate.edu/remediation/07/Rem_Sys_fall2007.htm

of colleges taking on the task of remediation, there is a dearth of empirical evidence on interventions that effectively reduce remedial course-taking, particularly at the less-selective four-year institutions where remediation rates are quite substantial. This research indicates that participation in the Early Assessment Program is predicted to lower a student's probability of needing remediation by 6.2 percentage points in English and 4.3 percentage points in math when attending a typical campus in the CSU system. Moreover, our analysis of the mechanism by which EAP reduces remediation need rules out a simple sorting story. This suggests that the information about college readiness that EAP participants receive does not deter the students obtaining a "not college ready" signal from applying. Of course additional work on whether and how EAP is promoting students to take advantage of their 12th grade year to become college ready is needed to more fully evaluate the program's intention.

Recent reports by the Government Accounting Office and the Spellings Commission call for more systematic research on the determinants of college attrition and time to degree. This research responds directly to their calls. Our study provides an evaluation of an early intervention program that may also improve college persistence and completion rates by reducing the need for remediation in college. With the EAP, California State University has articulated more directly to high school students what it takes to be college ready. Soon, the California Community College system will be following suit as a result of Senate Bill 946, passed by the California legislature this past September, expanding the EAP to students entering the state's 110 community colleges.¹⁶

In 2007, nearly half of the 49,274 first-time freshmen entering the CSU system required remediation in English. Although not free to taxpayers, the EAP program is much less costly to the state or the student than remediation, particularly when weighed against the benefits of making more informed education decisions following high school. Decreases in remediation need of the magnitude we find in this study may yield a substantial reduction of remediation for the CSU system—the equivalent of about 3,000 students in English and 2,000 in math. Research on college persistence has consistently demonstrated that students with better academic preparation in high school are more

¹⁶ For additional information see the Legislative Analyst's Office Report, Back to Basics: Improving College Readiness of Community College Students, http://www.cos.edu/eli/files/ccr_readiness_0608.pdf

likely to complete college. In addition to improving the transition into college for large numbers of high school graduates, we believe this intervention has the capacity to ultimately increase students' probability of successfully completing a baccalaureate degree.

REFERENCES

- Adelman, C. (2006). The toolbox revisited: Paths to degree completion from high school through college. Washington, DC: U.S. Department of Education. Retrieved on June 30, 2006, from <http://www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html>
- Adelman, C. (1999). *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment*. Washington, DC: U.S. Department of Education.
- Adelman, C., Daniel, B., Berkovits, I., & Owings, J. (2003). Postsecondary attainment, attendance, curriculum, and performance: Selected results from the NELS:88/2000 postsecondary education transcript study (PETS), 2000 (NCES 2003-394). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences.
- Bettinger, E., & Long, B. T. (2004). Shape up or ship out: The effect of remediation on underprepared students at four-year colleges. Case Western Reserve University and Harvard University. National Bureau of Economic Research, Working Paper.
- Bound, J., Lovenheim, M. & Turner, S. (2007). "Understanding Changing College Completion Rates." University of Michigan Institute for Social Research, Ann Arbor.
- Buchman, C. & DiPrete, T.A. (2006). The Growing Demale Advantage in College Completion: The Role of Parental Resources and Academic Achievement. *American Sociological Review*, 71:515-541.
- Buchman, C. & DiPrete, T.A. (2006). Gender Specific Trends in the Value of Education and the Emerging Gender Gap in College Completion. *Demography*, 43:1-24.
- Calcagno, J.C. & Long, B. (2008). The Impact of Postsecondary Remediation Using a Regression Discontinuity Approach: Addressing Endogenous Sorting and Noncompliance. National Bureau of Economic Research, Working Paper.
- California Postsecondary Education Commission (2006). The Impact of the High School Academic Performance Index (API) on Student Eligibility. Report, March 2006, Available at: <http://www.cpec.ca.gov/completereports/2006reports/06-03.pdf>
- Gleason, B. (2000). Remediation phase-out at CUNY: The "equity versus excellence" controversy. *College Composition and Communication*, 51, 488-491.

- Horn, L., & Kojaku, L. K. (2001). High school academic curriculum and the persistence path through college: Persistence and transfer behavior of undergraduates 3 years after entering 4-year institutions (NCES-2001-163). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences.
- Ignash, J. M. (1997). Who should provide postsecondary remedial/developmental education? *New Directions for Community Colleges*, 100, 5-20.
- Kirst, M., & Venezia, A. (2004). From high school to college: Improving opportunities for success in postsecondary education. San Francisco: Jossey-Bass.
- Martinez, M. & Klopott, S. (2005). The Link between high school reform and college access and success for low-income and minority youth. Washington, DC: American Youth Policy Forum and Pathways to College Network.
- Martorell, P. & McFarlin, I. (2008). Help or Hindrance? The Effects of College Remediation on Academic and Labor Market Outcomes. Working Paper.
- Parsad, B., & Lewis, L. (2003). *Remedial education at degree-granting postsecondary institutions in fall 2000* (NCES 2004-010, Table 4). Data from U.S. Department of Education, NCES, Postsecondary Education Quick Information System (PEQIS), *Survey on remedial education in higher education institutions, fall 2000*.
- Person, A. E., Rosenbaum, J. E., & Deil-Amen, R. (2006). Student planning and information problems in different college structures. *Teachers College Record*, 108, 374-396.
- Reynolds, J., Stewart, M., MacDonald, R., & Sischo, L. 2006. Have adolescents become too ambitious? High school seniors' educational and occupational plans, 1976 to 2000. *Social Problems* , 53, 186-206.
- Rosenbaum, J. E. (2001). *Beyond college for all: Career paths for the forgotten half*. New York: Russell Sage Foundation.
- Shaw, K. M. (1997). Remedial education as ideological battleground: Emerging remedial education policies in the community college. *Educational Evaluation and Policy Analysis*, 19, :284-296.
- Turner, S. (2005). Going to College and Finishing College: Explaining Different Educational Outcomes, in Caroline Hoxby, ed. *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*. Chicago: University of Chicago Press.

U.S. Department of Education. 2006. "A Test of Leadership: Charting the Future of U.S. Higher Education." U.S. Department of Education, Washington, D.C.

United States General Accounting Office. (2003). *College completion: Additional efforts could help education with its completion goals*. Washington, DC: author.

Venezia, A., Callan, P. M., Finney, J. E., Kirst, M. W., & Usdan, M. D. (2005). *The governance divide: A report on a four-state study on improving college readiness and success*. San Jose, CA: The National Center for Public Policy and Higher Education.

Venezia, A., Kirst, M. W., & Antonio, A. (2003). *Betraying the college dream: How disconnected K-12 and postsecondary education systems undermine student aspirations*. Palo Alto, CA: Stanford University Bridge Project.

TABLES AND FIGURES

Table 1: Statewide Participation Rates in EAP among Eligible 11th Grade Students Since Program Inception, by Subject

| | English | | Math | |
|------------------|---------|-----------|---------|-----------|
| | Sat for | Completed | Sat for | Completed |
| Year 1 (2003/04) | 66.7% | 36.6% | 74.6% | 72.7% |
| Year 2 (2004/05) | 68.9% | 42.7% | 71.0% | 69.1% |
| Year 3 (2005/06) | 70.9% | 47.6% | 74.1% | 72.6% |

Source: Authors' calculations based on data from the California Department of Education.

Note: All 11th grade students taking the English CST are eligible to participate in the English EAP, but only those students taking either the Algebra 2 or Summative Math CST exams are eligible to participate in the mathematics EAP.

Table 2: Summary Statistics for CSUS Enrollees, by Year

| Variable | 2001/02 | 2002/03 | 2003/04 | 2004/05 |
|---------------------------|----------------|----------------|----------------|----------------|
| Male | 0.394 | 0.390 | 0.383 | 0.390 |
| <i>Race/Ethnicity</i> | | | | |
| White | 0.500 | 0.481 | 0.466 | 0.438 |
| Black | 0.084 | 0.093 | 0.098 | 0.113 |
| Hispanic | 0.166 | 0.167 | 0.174 | 0.163 |
| Asian | 0.155 | 0.158 | 0.170 | 0.186 |
| Other | 0.093 | 0.099 | 0.091 | 0.100 |
| <i>Parental Education</i> | | | | |
| Mom - HS Grad | 0.552 | 0.551 | 0.547 | 0.565 |
| Mom - College Grad | 0.268 | 0.255 | 0.242 | 0.248 |
| Dad - HS Grad | 0.515 | 0.483 | 0.528 | 0.523 |
| Dad - College Grad | 0.305 | 0.324 | 0.272 | 0.282 |
| Math Proficient | 0.523 | 0.550 | 0.574 | 0.527 |
| English Proficient | 0.417 | 0.413 | 0.435 | 0.438 |
| ELM Test (math) | 43.2 | 43.4 | 43.1 | 42.2 |
| Proportion non-zero | 0.699 | 0.696 | 0.652 | 0.682 |
| EPT Test (English) | 144.7 | 144.1 | 143.9 | 144.0 |
| Proportion non-zero | 0.792 | 0.790 | 0.730 | 0.737 |
| SAT | 966 | 961 | 969 | 955 |
| Proportion non-zero | 0.832 | 0.849 | 0.807 | 0.800 |
| ACT | 20 | 19 | 19 | 19 |
| Proportion non-zero | 0.220 | 0.219 | 0.218 | 0.181 |
| High School GPA | 3.2 | 3.2 | 3.2 | 3.2 |
| <i>N</i> | 1796 | 1726 | 1872 | 1917 |

Note: High school juniors in 2001/02 and 2002/03 were CSUS first-time freshmen in fall 2003 and fall 2004, respectively, and did not have access to EAP; those in 2003/04 and 2004/05 were CSUS first-time freshmen in fall 2005 and 2006, respectively, and did have access to EAP. See timeline in Appendix Figure A3 for clarification.

Table 3: Means Across California High Schools Since Early Assessment Program Inception (Standard Deviation in Parentheses)

| Variable | 2003/04 | 2004/05 | 2005/06 |
|----------------------------------|-------------------|-------------------|-------------------|
| Academic Performance Index | 669.86 (93.34) | 685.02 (96.56) | 694.07 (93.69) |
| Enrollment (in 00s) | 16.72 (10.77) | 16.34 (11.07) | 15.95 (11.13) |
| <i>School junior proportion:</i> | | | |
| Participating in English EAP | 0.267 (0.299) | 0.299 (0.314) | 0.332 (0.331) |
| Participating in math EAP | 0.647 (0.308) | 0.587 (0.317) | 0.623 (0.320) |
| Parent is high school graduate | 0.353 (0.174) | 0.367 (0.162) | 0.373 (0.172) |
| Parent is college graduate | 0.214 (0.178) | 0.219 (0.179) | 0.218 (0.180) |
| UC and CSU eligible | 0.064 (0.047) | 0.065 (0.048) | 0.065 (0.048) |
| Black or Hispanic | 0.433 (0.284) | 0.448 (0.286) | 0.462 (0.288) |
| Free/reduced lunch eligible | 0.337 (0.253) | 0.354 (0.251) | 0.350 (0.273) |
| <i>N</i> | 1,042 | 1,097 | 1,149 |

Source: Authors' calculations based on data from the California Department of Education and the Common Core of Data.

Table 4: Marginal Effects from Model Predicting Remediation Need, by EAP Subject

| Variable | English | z | Math | z |
|-------------------------------------|----------------|----------|-------------|----------|
| <i>Individual Characteristics</i> | | | | |
| Male | -0.0167 | -1.09 | -0.2033 | -12.74 |
| Black | 0.1480 | 6.58 | 0.1872 | 5.26 |
| Hispanic | 0.1891 | 11.07 | 0.0812 | 3.13 |
| Asian | 0.2335 | 13.61 | 0.0725 | 2.82 |
| Other race | 0.1759 | 9.09 | 0.0709 | 2.37 |
| High school GPA | -0.1104 | -5.56 | -0.2019 | -9.19 |
| CST Score | -0.0076 | -15.94 | -0.0062 | -19.75 |
| Dad college grad | -0.0384 | -2.12 | -0.0022 | -0.11 |
| Mom college grad | -0.0549 | -2.86 | -0.0708 | -3.64 |
| <i>High School Characteristics</i> | | | | |
| Academic Perform. Index | -0.0003 | -1.39 | -0.0001 | -0.22 |
| % UC and CSU eligible | -0.4834 | -1.86 | -0.1281 | -0.46 |
| % black or Hispanic | 0.1293 | 2.04 | -0.1776 | 2.49 |
| % free/reduced lunch eligible | 0.1008 | 1.73 | 0.1768 | 2.84 |
| <i>EAP and Time Characteristics</i> | | | | |
| Post-EAP | 0.0444 | 2.02 | 0.0029 | 0.11 |
| EAP participation | -0.0616 | -2.87 | -0.0431 | -1.71 |
| Pseudo R-squared | 0.3107 | | 0.2800 | |
| Predicted probability | 0.6259 | | 0.3311 | |
| N | 6,210 | | 4,796 | |

Note: Math analysis restricted to sample of students who took the Algebra 2 or Summative Math CST exams, which would have made them eligible to participate in EAP.

Table 5: Marginal Effects from Model Predicting Individual EAP Participation Decisions by EAP Subject

| Variable | English | z | Math | z |
|---|----------------|----------|-------------|----------|
| <i>Individual Characteristics</i> | | | | |
| Male | -0.0505 | -41.32 | -0.0367 | -27.36 |
| Black | -0.0022 | -0.85 | -0.0048 | -1.57 |
| Hispanic | -0.0022 | -1.27 | 0.0244 | 12.71 |
| Asian | 0.0828 | 37.58 | 0.0335 | 17.78 |
| Other race | 0.0400 | 14.19 | 0.0307 | 11.45 |
| CST score (same subject) | 0.0106 | 122.64 | 0.0023 | 32.31 |
| CST score squared | -1.14e-04 | -89.15 | -2.34e-06 | -21.90 |
| Parent is high school grad | 0.0188 | 12.83 | 0.0014 | 0.83 |
| Parent is college grad | 0.0464 | 27.20 | 0.0049 | 2.76 |
| <i>High School Characteristics</i> | | | | |
| Enrollment (in 00s) | -0.0002 | -3.44 | -0.0006 | -7.97 |
| Academic Performance Index | -0.0008 | -47.00 | -0.0002 | -10.76 |
| % UC and CSU eligible | -0.1108 | -5.54 | 0.0971 | 4.75 |
| % black and Hispanic | 0.0416 | 8.87 | 0.0155 | 2.83 |
| % free/reduced lunch eligible | -0.0017 | -0.39 | -0.0046 | -0.92 |
| Peer EAP participation rate | 1.42 | 475.28 | 0.9804 | 262.03 |
| Year _{2004/05} dummy (EAP yr. 2) | 0.0183 | 11.83 | -0.0016 | -0.96 |
| Year _{2005/06} dummy (EAP yr. 3) | 0.0295 | 18.58 | 0.0017 | 0.96 |
| Pseudo R-squared | 0.2956 | | 0.1784 | |
| Predicted probability | 0.4720 | | 0.7569 | |
| N | 1,054,397 | | 494,521 | |

Note: Model is estimated on the post-EAP sample only (11th grade students in 2003/04, 2004/05, and 2005/06). Summary statistics for these variables provided in Appendix Table A1.

Table 6: Marginal Effects from Models Predicting Remediation Need under Different Specifications, by EAP Subject (standard errors in parentheses)

| Variable | English | | | Math | | |
|-------------|--------------------------|---|--|--------------------------|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| | Original model (Table 4) | Average Treatment Effect using Propensity Score | Subsample of schools w/ >90% EAP Participation | Original model (Table 4) | Average Treatment Effect using Propensity Score | Subsample of schools w/ >90% EAP Participation |
| EAP Partic. | -0.062 (0.021) | -0.076 (0.023) | -0.052 (0.029) | -0.043 (0.025) | -0.043 (0.025) | -0.041 (0.032) |
| <i>N</i> | 6,210 | 3,251 | 4,330 | 4,796 | 2,592 | 3,418 |

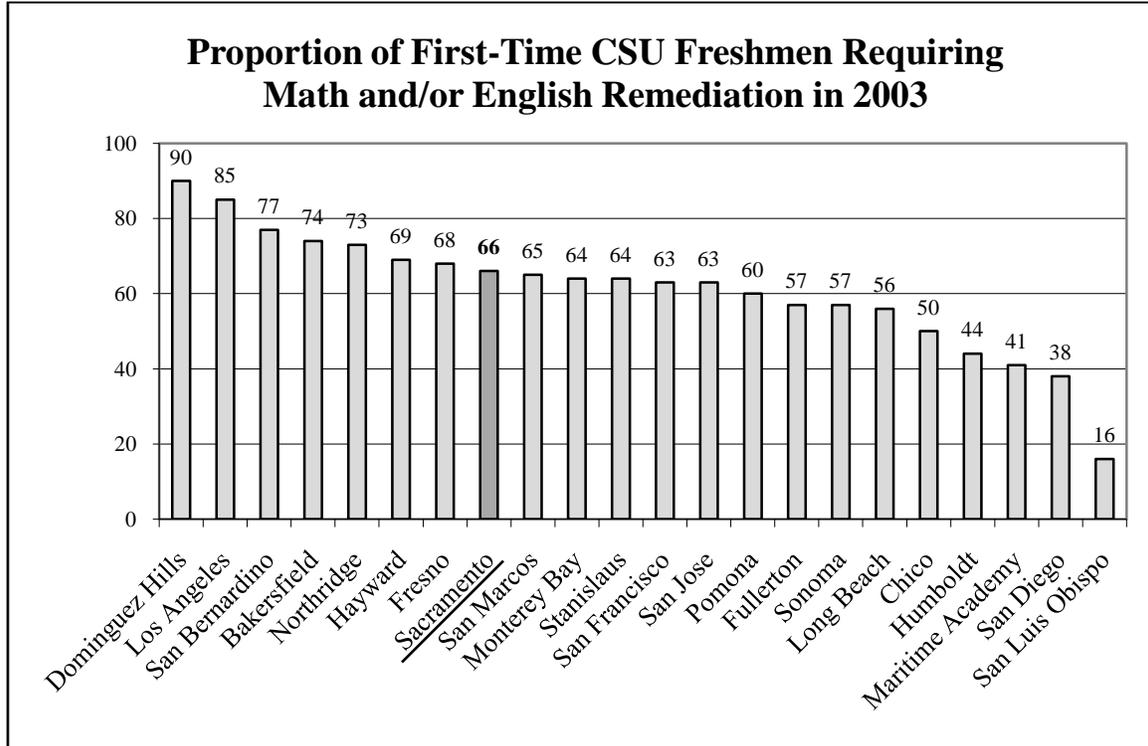
Note: Propensity score estimation is based on the covariates predicting individual EAP participation decisions presented in Table 5, and relies only on matched sample; additional information on propensity score estimation can be obtained from the authors.

Table 7: Marginal Effects from Model Predicting CSUS Application for Subsample of Schools with >90% EAP Participation Rates in Sacramento County

| Variable | English | z | Math | z |
|------------------------------------|----------------|----------|-------------|----------|
| <i>Individual Characteristics</i> | | | | |
| Male | -0.0291 | -8.74 | -0.0598 | -8.63 |
| Black | 0.0002 | 0.03 | 0.0168 | 1.21 |
| Hispanic | -0.0010 | -0.19 | 0.0283 | 2.11 |
| Asian | 0.0740 | 11.81 | 0.0568 | 5.63 |
| Other race | 0.0376 | 5.36 | 0.0518 | 3.62 |
| Parent is high school grad | 0.0037 | 0.92 | -0.0004 | -0.04 |
| Parent is college grad | 0.0159 | 3.67 | 0.0036 | 0.39 |
| CST score | 0.0015 | 2.88 | 0.0054 | 5.94 |
| CST score squared | -7.97e-07 | -1.03 | -7.99e-06 | -5.91 |
| <i>High School Characteristics</i> | | | | |
| Enrollment (in 00s) | 0.0015 | 5.90 | 0.0039 | 6.16 |
| Academic Performance Index | 0.0004 | 10.88 | 0.0003 | 3.34 |
| % UC and CSU eligible | 0.3020 | 5.55 | 0.1474 | 1.15 |
| % black and Hispanic | -0.0217 | -1.06 | -0.0138 | -0.29 |
| % free/reduced lunch eligible | 0.2131 | 12.78 | 0.1605 | 4.18 |
| <i>EAP Outcomes</i> | | | | |
| Exempt | -0.0103 | -1.79 | 0.0083 | 0.39 |
| Conditionally Exempt (Math) | | | 0.0510 | 4.65 |
| Not Exempt | 0.0095 | 2.25 | -0.0034 | -0.30 |
| Non-Participant | -0.0454 | -10.96 | -0.0382 | -3.64 |
| Pseudo-R-squared | 0.1020 | | 0.0270 | |
| Predicted Probability | 0.1120 | | 0.2679 | |
| <i>N</i> | 37,125 | | 16,521 | |

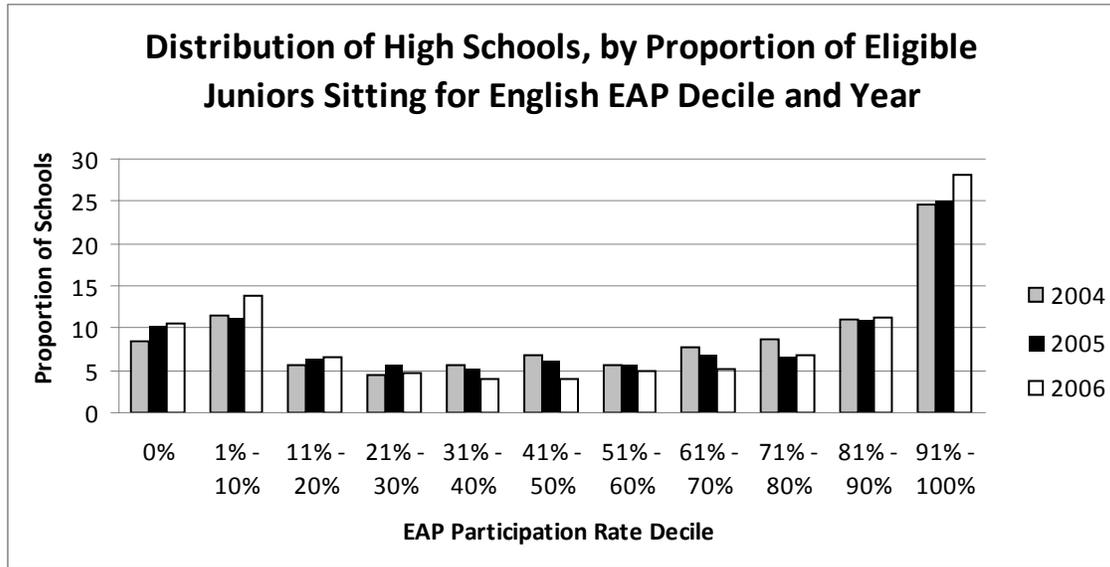
Note: Model is estimated on subsample of California high school juniors who attended one of 38 Sacramento County high schools with 90 percent or higher EAP participation rates.

Figure 1:



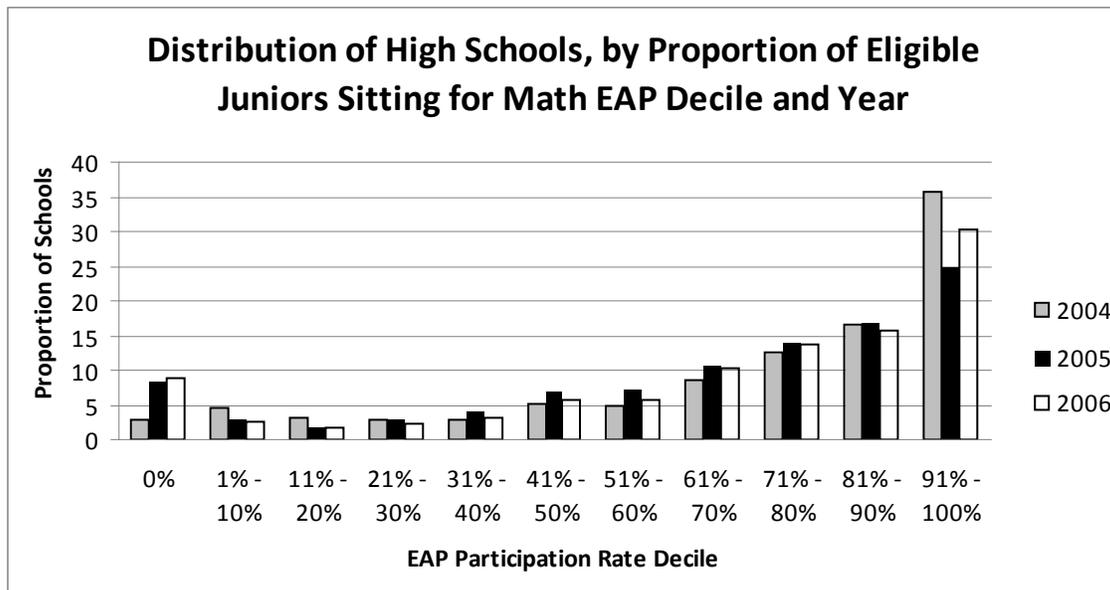
Source: Authors' calculations based on data from the California State University Chancellor's Office, Division of Analytic Studies.

Figure 2A:



Note: Decile 1 is the proportion of high schools with 1-10 percent of eligible juniors participating in the English EAP. Decile 10 is the proportion of high schools with 91-100 percent of eligible juniors participating in the English EAP. 6.63 percent of schools in 2003/04, 6.68 percent of schools in 2004/05, and 7.15 percent of schools in 2005/06 have math EAP participation of 100 percent.

Figure 2B:



Note: Decile 1 is the proportion of high schools with 1-10 percent of eligible juniors participating in the math EAP. Decile 10 is the proportion of high schools with 91-100 percent of eligible juniors participating in the math EAP. 11.19 percent of schools in 2003/04, 8.14 percent of schools in 2004/05, and 9.22 percent of schools in 2005/06 have math EAP participation of 100 percent.

Appendix: Tables and Figures

Table A1: Marginal Effects from Model Predicting Remediation Need as a function of EAP Availability, by EAP Subject

| Variable | English | z | Math | z |
|-------------------------------------|---------|--------|---------|--------|
| <i>Individual Characteristics</i> | | | | |
| Male | -0.0162 | -1.05 | -0.2030 | -12.73 |
| Black | 0.1477 | 6.58 | 0.1882 | 5.30 |
| Hispanic | 0.1895 | 11.12 | 0.0823 | 3.17 |
| Asian | 0.2337 | 13.63 | 0.0731 | 2.84 |
| Other race | 0.1754 | 9.05 | 0.0708 | 2.37 |
| High school GPA | -0.1111 | -5.59 | -0.2021 | -9.20 |
| CST Score | -0.0076 | -16.01 | -0.0062 | -19.80 |
| Dad college grad | -0.0389 | -2.13 | -0.0023 | -0.11 |
| Mom college grad | -0.0541 | -2.82 | -0.0701 | -3.62 |
| <i>High School Characteristics</i> | | | | |
| Academic Perform. Index | -0.0003 | -1.61 | -0.0001 | -0.29 |
| % UC and CSU eligible | -0.4560 | -1.76 | -0.1207 | -0.43 |
| % black or Hispanic | 0.1174 | 1.85 | -0.1726 | 2.42 |
| % free/reduced lunch eligible | 0.0944 | 1.63 | 0.1731 | 2.78 |
| <i>EAP and Time Characteristics</i> | | | | |
| Post-EAP | 0.0055 | 0.33 | -0.0295 | -1.58 |
| Pseudo R-squared | 0.3098 | | 0.2796 | |
| Predicted probability | 0.6257 | | 0.3313 | |
| N | 6,210 | | 4,796 | |

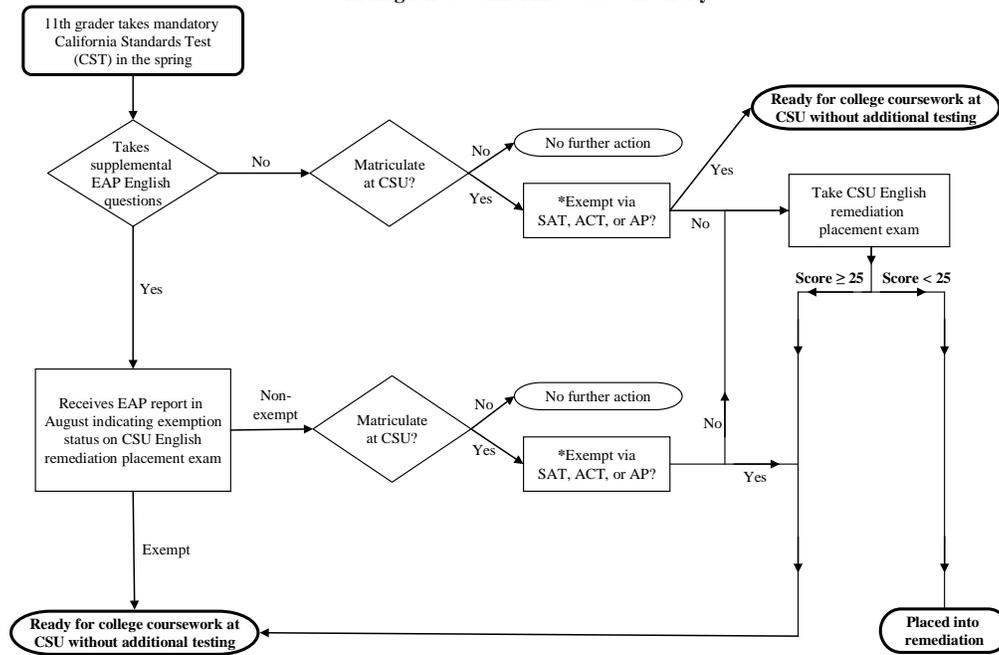
Note: Math analysis restricted to sample of students who took the Algebra 2 or Summative Math CST exams, which would have made them eligible to participate in EAP.

Table A2: Summary Statistics for EAP Eligible 11th Grade Students Statewide Since Early Assessment Program Inception, by Subject

| Variable | English | Math |
|-------------------------------------|----------------|-------------|
| <i>Individual Characteristics</i> | | |
| Male | 0.497 | 0.467 |
| Black | 0.074 | 0.057 |
| Hispanic | 0.388 | 0.280 |
| Asian | 0.107 | 0.171 |
| Other race | 0.055 | 0.063 |
| CST score (same subject) | 326.742 | 311.424 |
| Parent is high school grad | 0.355 | 0.313 |
| Parent is college grad | 0.288 | 0.397 |
| <i>High School Characteristics</i> | | |
| Enrollment (in 00s) | 23.772 | 23.587 |
| Academic Performance Index | 694.542 | 713.471 |
| % UC and CSU eligible | 0.071 | 0.081 |
| % black and Hispanic | 0.476 | 0.434 |
| % free/reduced lunch eligible | 0.346 | 0.313 |
| Peer EAP participation rate | 0.496 | 0.514 |
| <i>EAP and Time Characteristics</i> | | |
| EAP Participation | 0.496 | 0.721 |
| 2003/04 Cohort (EAP yr. 1) | 0.317 | 0.307 |
| 2004/05 Cohort (EAP yr. 2) | 0.339 | 0.336 |
| 2005/06 Cohort (EAP yr. 3) | 0.344 | 0.357 |
| <i>N</i> | 1,054,397 | 494,521 |

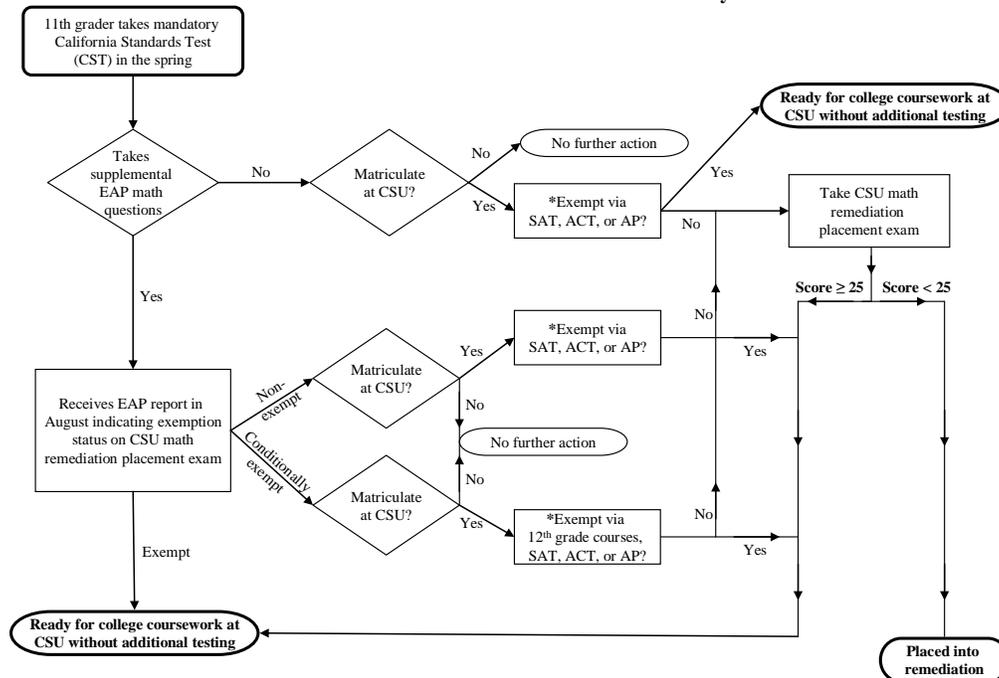
Note: Summary statistics are for the post-EAP sample only (11th grade students in 2003/04, 2004/05, and 2005/06).

Figure A1: Paths to College Readiness or Remediation in English at California State University



* Exemption requires a score of 550 or above on SAT I verbal or a score of 680 on the SAT II writing test, a score of 24 or above on ACT English, or a score of 3, 4, or 5 on either the AP Language and Composition exam or the AP Literature and Composition exam.

Figure A2: Paths to College Readiness or Remediation in Mathematics at California State University



* Exemption requires a score of 550 or above on SAT I math or on Level IC or IIC of SAT II math, a score of 23 or above on ACT math, a score of 3, 4, or 5 on the AP Calculus AB, AP Calculus BC, or AP Statistics exam. In 'Conditionally Exempt' cases, the completion Algebra II for a second time with a grade of 'C' or better or the completion of a math or stats course that requires Algebra II with a grade of 'C' or better also yields exemption.

Figure A3: Timeline for EAP Participation and College Entrance

