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DIVERSITY IN UNIVERSITY ADMISSIONS: Affirmative Action, Percent Plans, and Holistic Review

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ABSTRACT

There is considerable interest in the impact of policy alternatives to race-based affirmative action (AA) on under-represented minority (URM) university enrollment. Widely-implemented alternatives include percent plans, which guarantee admission to top high school students, and holistic review, in which applications are evaluated on a comprehensive set of merits. This study estimates each policy's URM enrollment effect at the University of California (UC). Difference-in-difference estimates show that AA increased annual UC URM enrollment by more than 700 students (12%), and by more than 60% at the Berkeley and UCLA campuses. Three years after UC's AA program ended in 1998, UC guaranteed admission to the top 4 percent of students from each California high school under its Eligibility in the Local Context program. Extrapolation from a regression discontinuity design shows that ELC increased total URM enrollment among applicants annually by about 250, or 3.5%, primarily at three UC campuses. ELC largely ceased impacting UC enrollment after a 2012 reform, but triple-difference estimates show that several campuses' simultaneous switches to holistic review prevented URM enrollment decline. Six UC campuses have implemented holistic review, with an event study suggesting that each implementation increased URM enrollment *at that campus* by about 10%, though some enrollees were pulled from other UC campuses. While AA had a larger effect on URM enrollment than percent plans or holistic review, the latter policies have substantively mitigated URM enrollment declines at some UC campuses following AA's prohibition.

Keywords: Affirmative Action, University Admissions, University of California

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1 Introduction

Since at least the 1970s, many universities have implemented affirmative action (AA) admission policies designed to increase low-income and under-represented minority (URM) students' enrollment, in part intending to facilitate socioeconomic mobility by promoting disadvantaged students' human capital formation.[1] Since 1995, however, AA admissions policies have come under substantial popular, political, and judicial threat. Eight states have passed voter referendums prohibiting race-based AA at all public universities, and two others have banned the policy by executive order and legislation. Recent judicial threats to AA policies include ongoing lawsuits brought by Edward Blum's Students for Fair Admissions against Harvard University and the University of North Carolina alleging racial discrimination in the universities' admissions decisions. As a result, many universities are turning to alternative admissions programs in order to otherwise maintain their underrepresented minority (URM) enrollment.

This study estimates the number of URM students enrolled by a large public research university system by implementing affirmative action and AA's two most prominent replacements: "percent plans" and holistic review. Percent plans guarantee admission to high school graduates in the top x percent of their graduating class, and may increase URM university enrollment if top students from lower-preparation high schools are disproportionately URM.[2] Under holistic review, admissions officers consider a large set of criteria without fixed weights when selecting applicants for admission, allowing additional consideration for student hardships which may benefit URM applicants. Most selective private universities currently practice holistic review in admissions (Coleman and Keith, 2018), and percent plans are employed by three of the nation's largest public university systems.

The subject of this study is the University of California system (UC), which enrolls 225,000 undergraduate students on nine campuses. UC has not employed race-based affirmative action since the policy was prohibited by a 1996 voter proposition, but several admissions policies implemented over the intervening 20 years may have differentially benefited URM applicants. UC implemented its first percent plan in 2001, guaranteeing admission to students in the top 4 percent of their high school graduating class, and then expanded that program to the top nine percent of students from each high school in 2012.[3] Six UC campuses have begun conducting holistic review in their admissions process, starting with Berkeley in 2002; most recently, Davis and Santa Cruz commenced holistic review in 2012. While these policies were not explicitly implemented in order to increase or encourage URM enrollment, this study estimates that margin of their impact (see Yagan (2012)).

The data used in this study include comprehensive applications to all nine undergraduate UC campuses since 1995, including students' high schools, demographics, test scores, grades, and admission/enrollment outcomes at each campus. All analysis is restricted to California residents applying as freshmen, with out-of-state and transfer students likely being admitted under different admissions policies. I use a series of research designs–including difference-in-difference, event study, and regression discontinuity–to identify the enrollment impacts of the various key policy changes that have determined UC admissions since the late 1990s.[4] The primary objective of this study is to estimate (1) the increased number of annual URM enrollees who attend a given UC campus as a result of each studied policy, and (2) the percent increase in URM enrollees at a given campus as a result of each policy.

While considerable previous research has studied both AA and percent plans, the uniquely-detailed data available for this study enables both careful disentanglement of the wide variety of admissions policies implemented by universities and careful analysis of the actual policies enacted by UC. Cross-state estimation of the impact of affirmative action bans, for example, could confound changes in universities' AA policies with other simultaneous policies targeting URM enrollment, like the percent plan implemented by Texas the same year that it ended its affirmative action policy.[5] Long (2007) erroneously estimates the effects of UC's percent plan policy only at UC campuses that never implemented that policy, and subsequently notes that "universities were using other [admissions] strategies concurrently, which muddies the analysis".[6] Indeed, previous studies of UC's 2001-2011 Eligibility in the Local Context policy, a percent plan, assumed that it would merely guarantee admission to at least one UC campus (Rothstein, 2000; Long, 2004b, 2007), leading to substantial underestimates of that policy's impact.[7]

In the case of race-based affirmative action, I model admission and enrollment outcomes for URM applicants using a difference-in-difference model controlling for detailed measures of applicants' academic preparation. I find that URM applicants' likelihood of admission fell at all nine undergraduate UC campuses following AA's prohibition, but that the URM enrollment declines were concentrated at UC's two most-selective campuses, Berkeley and UCLA. Without accounting for changes in the composition of applicants, I estimate a decline in URM enrollment of 700 students, implying that AA increased UC's URM enrollment by 11.6 percent, driven by increases of 58 and 72 percent at the Berkeley and UCLA campuses. However, if URM applicants were discouraged from applying to UC prior to the 1998 prohibition (e.g. by the 1996 ballot proposition that prohibited AA), this might underestimate the decline. Employing the estimated no-AA enrollment model ton the 1995 applicant pool, I estimate a larger decline of 800 students, with declines seven of the nine campuses. This latter estimate suggests that AA likely increased URM enrollment by around 13 percent across the UC system. A future version of this study will employ machine learning models to more-accurately estimate counterfactual UC enrollment before and after the AA prohibition.

Turning to the 2001-2011 Eligiblity in the Local Context policy, I find ambiguous evidence around whether UC's 'percent plan' increased URM high school graduates' likelihood of applying to UC using an event study around high schools' initial ELC participation, though the estimates suggest little room for encouragement. However, seven UC campuses provided large admissions advantages to ELC-eligible applicants, with six near-guaranteeing admission to those students, leading to a substantial influx of new enrollees. Depending on model specification, I estimate that URM enrollment increased by around 250 students per year as a result of ELC (though some of those students may have crowded out other URM applicants), nearly all of whom attended the "Absorbing" San Diego, Davis, and Irvine campuses. This estimate implies that ELC increased the

Absorbing campuses' URM enrollment by 9 percent and system-wide URM enrollment by 3.5 percent. These estimates are confirmed by an event study around the end of the 2001-2011 ELC program.

The 2012 application year brought two simultaneous changes: the expansion of the ELC program from 4 to 9 percent, and all three Absorbing campuses' adoption (within a year) of holistic review. Regression discontinuity estimates at high schools' ninth percentile thresholds suggest that the new program is *de facto* defunct, with most campuses reneging on their eligibility guarantees; only Merced continues to admit nearly all ELC-eligible applicants, with only San Diego providing (relatively negligible) admissions advantages to eligible applicants. Despite ELC's cessation, however, URM enrollment at the Absorbing campuses did not decline, and if anything slightly increased, with holistic review more than offsetting ELC's end.

Event study estimates around UC campuses' initial implementation of holistic review, controlling for the end of the 2001-2011 ELC program, suggest that holistic review increased URM applicants' likelihood of admission relative to non-URM applicants by around 2 p.p., and increased their relative likelihood of enrollment by about 1 percentage point. Holistic review is estimated to have increased 2017 URM enrollment at UC by more than 800 students when summed across campuses, or an annual 10 percent increase in URM enrollment at participating campuses. However, because many of those students would have otherwise enrolled at other UC campuses, this estimate is an unachievable upper bound for the impact of holistic review on UC-wide URM enrollment.

In sum, while race-based affirmative action had a larger URM enrollment effect at UC than either its percent plan or holistic review, this study provides evidence that the latter programs have substantially mitigated the URM enrollment declines precipitated by affirmative action's prohibition.

Section 2 provides background information on the University of California system and its predominant admissions policies over the past 25 years. Section 3 discusses the data used in this study. Sections 4 to 6 each analyze the URM enrollment effects of one of the three mobility-targeted UC admissions policies discussed above–Affirmative Action, Percent Plan, and Holistic Review–implementing different empirical methodologies to answer a central question: how many URM students enrolled at each University of California campus as a result of this program, in total and as a proportion of the URM student body? Section 7 concludes.

2 Background

The University of California is the premier higher education system in the State of California. Founded in 1868, the University was tasked by the 1960 Master Plan for Higher Education to educate students from the top 12.5 percent of California public high school graduates. UC has nine undergraduate campuses–Berkeley, Davis, Los Angeles (UCLA), Riverside, San Diego, Santa Cruz, Santa Barbara, Irvine, and Merced, in order of their founding–and a tenth graduate-only campus in San Francisco. The system's California-resident undergraduate enrollment has grown with the state, from enrolling 30,600 new students from California high schools and community colleges in 1995 to enrolling 57,100 such students in 2018.[8] The system's Berkeley and UCLA flagship campuses have notably lower admissions rates and higher median postgraduate earnings than the other campuses, while undergraduate programs at Santa Cruz, Riverside, and Merced are relatively less selective.

Race-based affirmative action was practiced in University of California admissions since at least 1978, when Berkeley's course catalog advertised "Affirmative Action Counseling" that "helped [URM] students realize their potential and achieve academic success at Berkeley".[9] Increasing controversy around the policy came to a head in July 1995, when it was first prohibited by the UC Regents and then banned by a voter proposition to the same effect that passed in November 1996. While SP-1, the original Regents policy, was rescinded in 2001, Proposition 209 has prohibited UC from "discriminat[ing] against, or grant[ing] preferential treatment to, any individual or group on the basis of race, sex, color, ethnicity, or national origin in the operation" since the Fall 1998 admission cohort.

Provided funding by the state legislature, beginning in 1998 UC implemented a number of costly school-specific outreach programs to increase enrollment from majority-URM high schools and communities. However, those programs wound down after 2001 with little evidence of success in increasing URM enrollment (Atkinson and Pelfrey, 2004; UCOP, 2003), and are not analyzed in the present study. Two other programs constituted UC's primary mobility-motivated policy response to the end of affirmative action.[10]

First, UC introduced the Eligibility in the Local Context program in 2001. Students at participating California high schools—which by 2003 included 96 percent of public high schools and 80 percent of private high schools in the state—were guaranteed admission to at least one UC campus if their grades were in the top four percent of their class.[11] Class rank was determined directly by UC; high schools submitted the top 10 percent of their students' transcripts to UC Office of the President's Admissions Operations team, which calculated UC-specific semesterly 'ELC grade point averages (GPAs)' on a four-point scale using certain eligibility-relevant courses.[12] The 40th percentile ELC GPA at each high school was selected as the school's "ELC threshold" in that year, above which students were deemed ELC-eligible. Months prior to UC's application deadline, ELC-eligible students received a letter signed by the University of California's President informing them of their eligibility, along with the guarantee of admission to UC (but no information about which of UC's nine undergraduate campuses they would be able to attend). Administratively, each of the campuses was informed which students had been deemed ELC-eligible and permitted to make independent admissions decision for each student.[13]

Second, in 2002 all UC campuses switched their 30-year-old admissions process from a two-tiered system–in which at least half of students were enrolled on academic criteria, with only the remainder evaluated on other criteria like special skills or hardships–to "Comprehensive Review", in which campuses "evaluate students' academic achievements in light of the opportunities available to them". UC Berkeley went a step further, implementing "Holistic Review", in which "a trained evaluator or set of evaluators craft a single score for the applicant based upon a combination of the criteria" and "no single factor plays a deciding role in how an applicant is evaluated" (BOARS, 2012; UCOP, 2013). By de-emphasizing quantitative academic measures relative to applicants' special talents and disadvantages, Holistic Review could dramatically change the ethnic makeup of admitted students. UCLA implemented Holistic Review in 2007.

The early 2010s brought a new wave of UC admissions reforms. Following on the perceived popularity of the original ELC policy, in 2012 ELC eligibility was expanded to the top *nine* percent of students at each California high school. In order to decrease administrative costs, UC also ceased calculating its own ELC GPAs; instead, high schools sent UC top students' specifically-defined GPAs, using which UC calculated the school's (never-released) eligibility threshold and directly informed above-threshold students of their eligibility. Moreover, four additional campuses implemented Holistic Review: San Diego and Irvine in 2011, Davis and Santa Cruz in 2012.[14] There have been no additional major changes to UC's admissions policies since that time.

3 Data

The primary data used in this study is an administrative University of California application database collected by the UC Office of the President. It includes one record for each application sent to each UC campus between 1995 and 2017, restricted to applications for freshman admission (omitting transfer applications) by California-resident applicants (defined as those previously enrolled at a California public or private high school). The applications contain a unique identifier for individual applicants, self-reported demographic characteristics (gender and 15-category ethnicity), and their most-recently-attended high school. Each applicant's SAT and ACT scores are converted using a standard concordance to a single 2400-scale score, which is included along with a weighted "A-G" high school GPA, SAT II scores, and the number of senior-year honors courses in which the applicant is enrolled. Finally, each record contains indicators for whether the student was admitted and whether they ultimately enrolled at that campus. Comprehensive summary statistics of these variables are well-known and available on the University of California Information Center.[15]

The data also include eligibility information for the ELC program. Between 2001 and 2011, the high school GPAs used to calculate schools' ELC thresholds and determine ELC eligibility were calculated by the UC Office of the President from high school records; eligibility is observable since 2001 and ELC GPAs are available starting in 2003. Since 2012, ELC eligibility has been determined using GPAs calculated by students' high schools; those GPAs are observed along with an eligibility indicator and the integer percentile of eligible students (between 1 and 9).

I do not directly observe the high-school-specific ELC thresholds used to determine students' ELC eligibility or the thresholds determining ELC-eligible students' percentile rank, instead only observing the ELC eligibility status (and ELC GPA) of those students who choose to apply to at least one University of California campus. Instead, for each threshold I estimate a support vector machine independently for each California high school and year and assign the threshold as the mean of all possible thresholds that minimize a linear penalty function across the school's UC applicants. More detail is provided in Bleemer (2019).

Finally, I collect a supplemental database of 12th grade California public high school enrollment by ethnicity from the California Department of Education.[16] Ethnicity is self-reported, with more than 94 percent of students recorded as having White, Black, Hispanic, or Asian ethnicity in every year between 2001 and 2011. The resulting database covers 61 percent of observed 2001-2011 UC applicants' high schools, which were attended by 70 percent of those applicants. As I discuss below, these enrollment figures will provide a baseline to measure the proportion of each high school's graduating class, overall and among URM students, who apply to the University of California.

4 Affirmative Action

In order to estimate the impact of the end of affirmative action (AA) on URM enrollment, I estimate a simple difference-in-difference model of application outcomes on applicants' URM status:

$$Y_{iyc} = \alpha_{h_i} + \beta_{1c} NoAA_y + \beta_{2c} URM_i + \beta_{3c} NoAA_y * URM_i + \gamma_c X_{iy} + \epsilon_{iyc} \quad (1)$$

where Y_{iyc} indicates whether individual i applied to UC campus c in year y, was admitted to that campus, or ultimately enrolled at that campus. The sample is restricted to 1995-2000, three years before and after the 1998 end of AA; no UC campus implemented any other large-scale change in their admissions processes in this period. The application model is estimated by OLS over the full population of UC freshman California-resident applicants, while the admission and enrollment models are estimated over the population of applicants to the particular campus.[17] Each campus

and outcome is estimated independently. The coefficients of interest are β_2, the degree to which URM students were more likely to have Y_{iyc} under the AA regime, and β_3, the change in that likelihood after AA ended (indicated by $NoAA_y$).

The key difference between this model and similar estimates elsewhere in the literature (Card and Krueger, 2005; Chang and Rose, 2010; Antonovics and Backes, 2014) is the inclusion of high school fixed effects α_{h_i}, which absorb considerable spurious cross-school application variation, and the highly detailed academic covariates in X_{iy}, including gender, SAT mathematics and reading comprehension scores, SAT II writing score, SAT II mathematics score (and an indicator for whether the Math 1 or Math 2 exam score was submitted), and the number of enrolled senior honors courses (winsorized at 95$). These controls can be generally summarized as students' observed academic preparation. Standard errors are robust.

Table 1 shows estimates of β_2 and β_3 for each model. Applicants' academic preparation and URM status explain 10-25 percent of variation in which UC campuses they apply to, 30-55 percent of variation in admission, and 4-11 percent of variation in enrollment. In the AA era, URM applicants to UC were 8-12 percentage points more likely to apply to the Berkeley and UCLA campuses and 2-10 percentage points less likely to apply to all remaining campuses than non-URM applicants, but this trend partially reversed when AA ended; while URM applicants remained more likely to apply to the most-selective campuses, the differential gaps shrunk. This was likely the result of sharp admissions differences at UC's flagship campuses: while URM applicants were 33.4 and 41.9 percentage points more likely than academically-comparable non-URM applicants to be admitted to UCLA and UC Berkeley, these advantages fell to 10.9 and 14.3 percentage points after AA's end.[18] Both of these effects are far larger than parallel changes at the other UC campuses, likely discouraging URM applicants to flagship UC campuses relative to the other UCs, though every campus had URM admissions advantages that substantially narrowed after 1998.

The third panel of Table 1 shows that URM applicants were also far more likely to enroll at UC's flagship campuses than similar non-URM applicants, likely primarily a reflection of their increased likelihood of admission. When AA ended, URM applicants' higher likelihood of enrollment declined by almost the same proportion as the decline in their likelihood of admission (about 70 percent). Interestingly, however, while URM applicants to all campuses became less likely to earn admission relative to similar non-URM applicants, they became *more* likely to enroll at some campuses (Santa Cruz, Santa Barbara, and Irvine). This is likely the result of a trickle-down effect, with URM applicants who would previously have attended the flagship campuses now more likely to attend other campuses as a result of the flagships' rejection.

The last column of each panel estimates Equation 1 across all eight campuses, defining admission and enrollment as whether the applicant was admitted to, or enrolled at, at least one campus. Across UC, URM applicants' admissions advantage over non-URM applicants conditional on academic preparation fell at the end of AA by 86.6 percent. URM applicants' unconditional relative likelihood of enrolling at a UC campus fell by 7.0 percentage points; without AA, URM applicants to UC were 2.3 percentage points *less* likely to ultimately enroll at a UC campus than non-URM applicants.

I use two methods to estimate the change in URM enrollment as a result of AA. First, I measure:

$$(\%URM_{c,1995-1997} - \%URM_{c,1998-2000}) * \frac{ENR_{c,1998-2000}}{3} \tag{2}$$

the difference in the percent of 1995-1997 enrolling students at campus c who were URM and that same percent in 1998-2000, scaled by the average number of enrolling students at that campus in 1998-2000 $ENR_{c,1998-2000}$. The 'Δ Enroll' row of Table 1 shows that UCLA and Berkeley's annual URM enrollments fell by 391 and 325 students, respectively, while the other campuses faced smaller enrollment changes (some positive); the UC system's URM enrollment fell by a summed total of 697. These represented large URM enrollment changes at the UC flagships–suggesting that re-instituting AA at UCLA and Berkeley would have increased their URM enrollments by 61 and 75 percent, respectively–but the smaller effects at the other campuses estimate that AA to only represented a 11.6 percentage point URM enrollment increase systemwide.

However, the statistic measured in Equation 2 would only reflect the true change URM enrollment 'caused' by AA if there were no other differences in the UC campuses' admissions procedures between the early and late years. In fact, two other things may have changed: steadily growing applicant pools may have led the campuses to become more selective, which in turn could heterogeneously impact URM applicants, and the composition of URM applicants may have changed in response to the end of AA, with less-academically-prepared URM students possibly discouraged from UC application even before 1998 (Long, 2004a; Card and Krueger, 2005; Antonovics and Backes, 2013). As an alternative estimate of AA's impact on UC student enrollment, I estimate:

$$\left(\frac{(URM_{c,1995} - \hat{E}[URM_{c,1995}|NoAA_{1995} = 0])}{URM_{c,1995}} - \frac{(RG_{c,1995} - \hat{E}[RG_{c,1995}|NoAA_{1995} = 0])}{RG_{c,1995}} \right) * \frac{ENR_{c,1998-2000}}{3 * ENR_{c,1995}} \tag{3}$$

where $URM_{c,1995}$ is the number of URM enrollees at c in 1995, $\hat{E}[URM_{c,1995}|NoAA_{1995} = 1]$ is the sum of 1995 URM applicants' predicted values from equation 1 with enrollment as the outcome, setting $NoAA_t$ to 1 (that is, as if affirmative action were not implemented in 1995), and

Represented Group RG is the complement of URM. This statistic estimates the greater degree to which the end of AA changes the expected enrollment of URM students relative to non-URM students, scaled by 1998-2000 enrollment. On the one hand, this method allows for differences in applicant pool by fixing applicants at the 1995 distribution, prior to the passage of SP-1 and Proposition 209, and allows for changes over time in campus selectivity by differencing out admissions differences for RG applicants. On the other hand, this method adds statistical noise from linear regressions with relatively-low R^2 values (bootstrapped standard errors are not yet reported) and may represent a lower bound on URM enrollment declines attributable to AA, because ending AA would also lead to a (relatively-small) increase in the second term of Equation 3 as RG students 'crowd in' to UC, such that the second term would be downwardly-biased as a measure of changing selectivity.

Estimates of Equation 3 are shown in the last row of Table 1, and suggest that URM enrollment may have declined less at the flagship campuses and more at the other campuses (especially Santa Cruz and Riverside) than estimated by Equation 2. These results suggest that URM applicants with strong observed academic preparation shifted their application preferences from the flagship campuses to less-selective UCs after 1998, exacerbating the URM enrollment decline at the flagships but artificially inflating the less-selective campuses' post-1998 gains. The net result is a slightly-larger UC-wide URM enrollment decline of 790 students, or about 13 percent.

5 Eligibility in the Local Context

Eligibility in the Local Context could increase UC URM enrollment along two margins. The first involves students who otherwise would not have applied to any UC campus, but choose to do so as a result of the ELC eligibility letter sent by UC, with some possibly choosing to enroll. UC also sent thousands of letters to almost-ELC-eligible students encouraging their applications, potentially yielding additional new enrollment. The second margin involves students who would already have applied to at least one UC campus, but could now be impacted by ELC eligibility in two ways: they could choose apply to more campuses, and their likelihood of admission could be higher at some of the campuses to which they apply.

I first consider the first margin, though evidence in either direction is relatively slim. One notable feature of the ELC program was that high schools' participation was optional, since participation required schools to send a large number of selected students' transcripts to a UC admissions team (which could pose logistical challenges). As a result, despite the substantial university admissions advantages available to eligible students, only 82 percent of public high schools and 61 percent of private high schools participated in the program's first year. Participation rose to 98 and 80 percent in the second year, respectively, and then continued to slowly rise thereafter.

A UC report to the Board of Regents in 2002 argued that the proportion of high schoolers who applied to UC at ELC-participating high schools in 2001 increased by 4.2 percentage points relative to the change at non-participating high schools (UCOP, 2002), but the unavailability of actual high school graduating class sizes likely upwardly biased those estimates.[19] I conduct similar analysis at the high school level by estimating the following event study model:

$$Y_{hy} = \alpha_h + \gamma_y + \sum_{i \in [-4,3]} \beta_i \mathbb{1}_{ELC_h = y+i} + \epsilon_{hy} \tag{4}$$

where Y_{hy} is the percent of 12th graders at high school h in year y who applied to at least one UC campus. High schools began participating in ELC in year ELC_h, and the estimates of interest β_i measure how participation i years earlier effects the outcome. Effects four and three years prior to participation are omitted. The sample includes all public high schools that match to the California Department of Education's student enrollment database and that enrolled students for at least four years on either side of initial ELC participation, omitting records more than four years away from initial participation. About 78 percent of observed high schools joined ELC in 2001, with another 16 percent joining in 2002 and the remaining schools joining through 2011. The later-joining schools tended to be new schools, including charters, that waited several years before joining ELC.

Panel (a) of Figure 1 shows that ELC did generally increase the proportion of students at participating ELC high schools that applied to UC, with the 2 percentage point change likely reflecting increased application rates among both ELC-eligible and ELC-ineligible students who received targeted UC communication. However, Panel (b) shows evidence that rejects substantial growth in the proportion of URM students who applied to UC; in the year that a high school begins ELC participation, URM application rates fall by about 0.5 percentage points, though the difference is statistically indistinguishable from 0. Moreover, both trends exhibit some evidence of a pre-trend in the two years prior to the schools commencing ELC, challenging their interpretation.

Why would ELC appear to fail to encourage URM applications to UC? Panels (c) and (d) of Figure 1 provide limited insight into that question. Panel (c) restricts the sample of high schools to those in the first SAT quartile of high schools.[20] Application rates increased by only 1.1 percentage points at those schools, half the state-wide average, despite ELC's larger impact at lower-performing schools where ELC-eligible students would have been otherwise less likely to be admitted to UC campuses. Panel (d) shows that the proportion of graduates who applied to only UCLA or Berkeley grew by about 0.4 percentage points at ELC-participating high schools, explaining as much as 20 percent of the total increase, despite UCLA and Berkeley's non-participation in the early ELC program (though this was not known by applicants at the time). Together, these results suggest that a large number of the new applications sent to UC after high schools began participating in ELC were unlikely to convert into UC enrollment, and are

better explained as speculative or "back-up" applications sent by otherwise-qualified students (largely from higher-tier high schools) who ultimately were unlikely to enroll at UC.

Estimates of the impact of ELC on high school students' application behavior are limited by the broad relatively-simultaneous initial participation in ELC by California high schools. Nevertheless, these estimates suggest that relatively few URM high school graduates would have otherwise not applied to any UC campus, but chose to do so *and ultimately enrolled at UC* as a result of the ELC program. The next section turns to the second enrollment margin–among students who already intended to apply to UC–where I find stronger evidence of measurable URM enrollment increases from the ELC program.

5.1 Four Percent Plan

Given ELC's negligible enrollment effect among high school graduates who would otherwise not have applied to any UC campus, consider instead ELC's enrollment effect among students who were already going to apply to UC, but whose application behavior may have been changed by ELC (and who were now guaranteed admission to at least six UC campuses, if they applied to them).

While students were deemed ELC-eligible at the UC-system level, each campus retained responsibility for whether to provide admission advantages to ELC-eligible students, with the system requiring at least one campus to admit each ELC-eligible student only if no campus otherwise admitted them. In fact, system coersion was hardly ever required in the original ELC program. Bleemer (2019) shows that six of the nine UC campuses near-guaranteed admission to all ELC-eligible students, and a seventh–San Diego–provided a substantial admission advantage to eligible students. Only UCLA and Berkeley provided no measurable admissions advantage to ELC-eligible applicants. On the margin, ELC-eligible URM applicants were diverted from the less-selective California State University system (5.2 percentage points) and less-selective UC campuses (3.0 p.p.), with smaller numbers coming from non-enrollment and non-public universities, into three Absorbing UC campuses (which saw an enrollment increase of 13.3 p.p.): San Diego, Irvine, and Davis.[21]

I estimate the number of URM students who enrolled at UC as a result of ELC eligibility by parameterizing a model of the likelihood with which ELC-ineligible URM students enrolled at UC and projecting that model to ELC-eligible URM students. In order to avoid bias from omitted variables and explicitly non-random selection into ELC eligibility, I focus on individuals near their high school's ELC GPA threshold in a regression discontinuity set-up. In particular, I estimate the following model using a local linear regression with a triangular kernel:

$$ENR_{it} = \alpha_{h_i} + \beta ELC_{it} + \gamma_1 \overrightarrow{GPA_{it}}(1 - ELC_{it}) + \gamma_2 \overrightarrow{GPA_{it}} ELC_{it} + \delta X_{it} + \epsilon_{it} \quad (5)$$

where ENR_{it} indicates whether UC applicant i who applied in year t from high school h_i ultimately enrolled at some UC campus, restricting the sample to URM applicants.[22] Permanent student characteristics X_{it} include application year indicators, gender-ethnicity interaction indicators, and a fifth-order polynomial in SAT score; results are highly insensitive to their inclusion or the inclusion of high school fixed effects α_{h_i}. Applicants' ELC eligibility is indicated by ELC_{it}, and the running variable GPA_{it} is the difference between applicants' ELC GPA and their high school's ELC GPA threshold. GPA_{it} is included as either a linear or quadratic term, depending on the specification.

The first panel of Figure 2 shows a binned scatterplot of true UC URM enrollment likelihood by GPA_{it}, along with the best fit lines defined by γ_1 and γ_2 in a linear specification. Marginally-ELC eligible students become much more likely to enroll at UC, by 8.6 percentage points (robust s.e. 1.7 (Calonico, Cattaneo, and Titiunik, 2014)).

The thick line then extrapolates the below-threshold best fit line defined by γ_1 for students above the threshold, linearly estimating the proportion of above-threshold URM applicants who would have enrolled at UC if not for ELC eligibility. Integrating the space between these two lines over the empirical density of students' GPA_{it} produces an estimate of the increased number of UC enrollees as a result of ELC eligibility of 231, with a block-bootstrapped (by high-school-year) 95% confidence interval of plus/minus 132.

However, comparing the linear fit to the binned scatterplot data suggests that the assumption of linearity may lead to an overestimate of the counterfactual likelihood of enrollment, with the enrollment likelihood decelerating in GPA near the threshold. Fitting a quadratic counterfactual instead of the linear counterfactual instead appears to over-fit the expected deceleration, leading (Panel (d)) to an estimated increase in enrollment of 432 URM students (with a wide 95 percent confidence interval of plus/minus 478 as a result of the additional degree of freedom). An estimate in between, around 250-300 students, appears most likely.

The remaining panels in Figure 2 provide cooroborating evidence for this estimate. Bleemer (2019) shows that ELC increased UC enrollment by increasing marginal applicants' likelihood of enrolling at three Absorbing UC campuses–Davis, Irvine, and San Diego–some of whom would have otherwise enrolled at three Dispersing UC campuses–Merced, Riverside, and Santa Cruz. Panels (b) and (e) show estimates for the enrollment increase at the Absorbing campuses, though neither the linear nor the quadratic fit seems to match the likely-declining likelihood of students' Absorbing UC campus enrollment at higher GPA levels; the quadratic fit suggests an enrollment increase of 263 URM students, but visual inspection suggests that an estimate just over 300 seems more likely. Meanwhile, the linear fit appears stronger (but nevertheless an underestimate) for the

Dispersing UC campuses, where enrollment appears to declined by around 50 URM students. The sum of these effects confirms ELC's net effect of increasing URM enrollment by around 250-300 students. Further evidence supporting this estimate from the end of the ELC program will be provided below, but first I turn to estimation of the effect of the post-2011 ELC program.

5.2 Nine Percent Plan

In 2011, the University of California expanded its Eligibility in the Local Context program to the top nine percent of students from each California high school. This expansion had ambiguous and difficult-to-measure effects on eligible students' likelihood of applying to UC–unlike in the earlier program, all California high schools commenced participation simultaneously in the 2012 application year–but here I focus on the increased likelihood of applicants to ultimately enroll at UC as a result of ELC eligibility.

In addition to extending ELC eligibility to more high school graduates, the new program made a number of administrative changes:

1. Rather than itself calculating ELC GPAs for top high school graduates, UC instead used a high-school-calculated GPA to determine ELC eligibility.
2. UC ceased determining annual percentile ELC thresholds, instead using the same threshold for multiple years before updating the threshold based on changes in high schools' grade distributions. The threshold remained unknown to high school administrators and students.
3. UC determined each applicants' ELC eligibility and also (conditional on eligibility) their centile rank from first through ninth, and shared that information with campus admissions offices.

While the first two changes were minor adjustments, primarily motivated to cut the program's cost, the last provided campuses with new information that could be used in admissions decisions. If a campus wanted to maintain the pre-2012 ELC policy, for example, then they could continue guaranteeing admission to fourth centile applicants while providing no admissions advantage to the remaining eligible students.

Using the same method described in the Data section above with regard to the ELC eligibility threshold, I estimate the GPA thresholds between each centile at each high school (from first through ninth) in each year.[23] For example, a student at the fourth centile margin is between the fourth and fifth centiles, and students below the ninth centile margin just miss ELC eligibility. I then estimate a generalized version of Equation 5:

$$Y_{citp} = \alpha_{ch_ip} + \beta_{cp}PERC_{itp} + \gamma_{1cp}\overrightarrow{GPA_{it}}(1 - PERC_{itp}) + \gamma_{2cp}\overrightarrow{GPA_{it}}PERC_{itp} + \delta_{cp}X_{it} + \epsilon_{citp} \quad (6)$$

where $PERC_{itp}$ indicates that applicant i to campus c is in centile p or better in their high school class. Among the population of applicants to campus c, Y_{citp} indicates either whether they were admitted or whether they enrolled at that campus. Equation 6 is estimated as a local linear regression (with a linear running variable $\overrightarrow{GPA_{it}}$ and triangular kernel) using optimal bandwidths and bias-corrected robust standard errors clustered by school-year (Calonico et al., 2019).[24]

Table 2 reports changes in marginally ELC-eligible (that is, ninth-centile) applicants' likelihood of admission and enrollment to UC campuses under the post-2011 ELC program between 2012 and 2017. It shows the baseline proportion of ineligible admits and enrollees ($\bar{\alpha}_{ch_ip}$) at each UC campus, along with the change in each across the eligibility threshold at each campus.[25] Estimates are shown for the full applicant pool and for URM applicants, who made up about half of compliers under the 2001-2011 program. The campuses are organized into three groups by their role in the 2001-2011 ELC program: the three "Absorbing" campuses gained students, while the "Dispersing" campuses net lost students and the "Unimpacted" campuses had no measurable enrollment effect.

Under the 2001-2011 ELC program, the Absorbing UC campuses provided admissions advantages to marginally-eligible students between 10 and 20 percentage points,leading to enrollment increases between 1 and 4 percentage points. The post-2011 program's effects are far smaller, and border on unmeasurably small despite strong statistical power. Among the Absorbing UC campuses, only San Diego experiences a measurable increase in admissions likelihood, by 3.6 percentage points, though the effect for URM applicants is a negligible 0.9 percentage points (and actually appears negative at Davis). The summed enrollment effect across the Absorbing UC campuses is a statistically significant 1 percentage point overall and 0.0 percentage points among URM applicants.

Similarly, ELC-eligible applicants earned no admissions advantage at the Riverside or Santa Cruz campuses (indeed, they appear less likely to be admitted to Riverside) despite their baseline admissions rate of around 78 percent, whereas those campuses near-guaranteed admission to ELC-eligible applicants under the pre-2012 ELC program. Only Merced persisted in that guarantee, likely as a result of centralized coercion: 93 percent of marginally-ineligible students were already admitted to the Merced campus, but ELC-eligible students became 5.9 percentage points more likely to earn admission. However, there is no evidence of take-up from Merced's admissions offer, with a precisely-estimated null effect on enrollment at the eligibility threshold. The same pattern holds for URM applicants, who became 10.0 percentage points more likely to be admitted to Merced but only a statistically-insignificant 0.6 percentage points more likely to enroll.

The Unimpacted UC campuses remained that way, with no evidence of their providing an admissions advantage to ELC-eligible students, let along experiencing a change in enrollment (where estimates were again precisely-measured 0's). In total, UC enrollment increased by 0.9 ± 2.9 percent overall and 1.4 ± 4.8 percent among URM applicants, wholly driven by the least-selective Dispersing Campuses, and in any case a small fraction of the 2001-2011 enrollment increases (under which URM applicants became 9.2 ± 4.0 percent more likely to enroll at a UC campus). Appendix Table A-1 shows regression discontinuity plots of each campus's ELC-eligibility admissions response, reiterating the absence of any response except at Merced.

Perhaps campuses chose to participate in a different way in the post-2011 ELC program, providing admissions advantages to students at GPA centile thresholds other than the 9th? Table 3 presents estimates of the change in URM admissions or enrollment likelihood for each campus at each of the nine ELC centile thresholds observable to the campuses. Some of the estimates are relatively large, the result of spurious noise that isn't well-captured by the local linear estimation framework, but no coherent patterns emerge in which campuses provide admissions advantages to URM applicants that covert into measurable enrollment increases. Indeed, there are as many negative estimates (suggesting decreased likelihood of admission for above-threshold applicants) as positive estimates, even among high-coefficient estimates that could reflect actual signals. Appendix Table A-1 shows a similar pattern for the full sample of applicants. These precise-zero estimates for the impact of the post-2012 ELC program on admissions at every UC campus and every ELC centile threshold, including the ninth centile (which determined ELC eligibility), highlighted in contrast with the 2001-2011 ELC program (which sharply changed applicants' admission likelihood and enrollment patterns), constitutes the UC campuses' near-complete *de facto* reneging from the ELC program.

How many URM students enrolled at UC each year as a result of its post-2011 ELC policy? While I am unable to estimate the program's impact on enrollment as a result of new UC applications, the evidence from the pre-2012 ELC program discussed above suggests that the number of such enrollees is likely small. The pre-2012 program increased the marginal likelihood of UC enrollment by about 5.7 percentage points (9.2 percentage points among URM applicants) and led to an enrollment increase around 200-250 students. The post-2011 ELC program, on the other hand, increased the marginal likelihood of UC enrollment by only 1 percentage point, with no magnified increase among URM applicants. These estimates justify a back-of-the-envelope estimate that the post-2011 ELC program increased UC's URM enrollment by fewer than 50 URM students per year.

5.3 Transition Between ELC Programs

Given that the post-2011 ELC program's estimated impact on URM enrollment was negligible, an alternative estimation strategy for measuring the enrollment effect of the pre-2012 ELC program arises: a comparison of enrollment at Absorbing UC campuses before and after 2012, relative to enrollment at the Unimpacted UC campuses. Because there might be other differences in the admission policies employed by Absorbing and Unimpacted campuses–indeed, another important change will be illuminated by below–I further difference across URM status, estimating outcomes for URM applicants relative to non-URM applicants.[26] Admission and enrollment outcomes are estimated overall and by ELC eligibility status across all UC applicants between 2008 and 2015 in the following OLS model:

$$Y_{iyc} = \alpha_{h_ic} + \beta_{1u_ie_iy}Abs_c + \beta_{2u_ie_iy}Disp_c + \gamma_c X_{iy} + \delta_{yce_i} + \zeta_{cu_ig_ie_i} + \eta_{yu_ig_ie_i} + \epsilon_{iyc} \quad (7)$$

where Y_{iyc} indicates admission to or enrollment at c by i in y, with u_i indicating i's URM status, g_i her gender, and e_i whether she is in the top four percent of her high school class (as relevant for ELC eligibility).[27] The coefficients of interest are $\beta_{1u_ie_iy}$, the triple-difference impact on URM outcomes at Absorbing UC campuses after the ELC reform; $\beta_{2u_ie_iy}$, which are not reported, capture similar differences at the Dispersing UC campuses. Controls include the standard triple-difference fixed effects interacted with whether the applicant's gender and whether she is in the top four percent of her class, along with high school fixed effects by campus α_{h_ic}. Estimates from 2008 and 2009, three and four years prior to the ELC transition, are omitted, allowing the two years prior to the transition to be estimated as placebos; non-zero estimates in those years would suggest additional changes in URM admissions policies at Absorbing UC campuses. Standard errors are clustered by student.

The left column of Figure 3 shows that two years before the ELC reform, URM admissions at Absorbing campuses appeared statistically indistinguishable from admissions in the previous two years. One year before the reform, URM applicants' likelihood of admission spikes, increasing by 4.2 p.p., and but the difference between URM and non-URM admissions at Absorbing vs. Unimpacted campuses falls back to 1-2 percent increases in the years following the ELC reform. The same pattern follows in likelihood of enrollment: URM students become much more likely to enroll at Absorbing UC campuses (by 2.1 p.p.) the year prior to ELC reform, but the difference falls back to about 1 percentage point after the reform. These results surprisingly suggest that URM students actually became *more* likely to be admitted to, or enroll at, Absorbing UC campuses following the end of the pre-2012 ELC program, despite that program's estimated positive effect on URM enrollment at those schools (and the estimated negligible impact of the post-2011 ELC program).

Why didn't URM admission and outcomes fall? The central and right columns of Figure 3 provide important context, splitting the estimates by whether the applicant was in the top four percent of their graduating high school class (which guaranteed ELC eligibility both before and after the reform). Both groups become more likely to earn admission and choose enrollment prior to the ELC reform, though the increase is larger for "top-four" applicants. But following reform, top-four URM applicants became substantially *less* likely to be admitted or enroll at an Absorbing UC campus

(though the latter is statistically-insignificantly different from 0), while their non-top-four peers remained more likely to be admitted and enroll.[28]

These results are explained by the fact that while two of the three Unimpacted UC campuses already practiced holistic review prior to 2008, all three Absorbing UC campuses adopted holistic review between 2011 (San Diego and Irvine) and 2012 (Davis). The adoption of holistic review the year before ELC reform led to an increase in URM enrollment at the adopting campuses, but interestingly the programs seem to have relatively-neatly counteracted each other with regard to URM enrollment, with holistic review having a slightly-larger differential effect on URM enrollment than ELC. While the composition of URM students changed at the Absorbing campuses–from top high school student (in the top four percent of their classes) to lower-locally-ranked students–the URM enrollment effect of holistic review appears slightly larger than the URM enrollment effect of the pre-2012 ELC policy. The next section turns to direct estimation of the URM enrollment effect of holistic review, which serves as a sharp upper bound for the differential URM impact of ELC.

6 Holistic Review

Six UC campuses have implemented holistic review (HR): Berkeley in 2002, UCLA in 2007, San Diego and Irvine in 2011, and Davis and Santa Cruz in 2012. I begin by estimating the effect of HR implementation on the likelihood of URM applicants' admission and enrollment using a diff-in-diff event study design, comparing outcomes for URM applicants relative to non-URM applicants:

$$Y_{iyc} = \alpha_{h_ic} + \sum_{i\in[-5,4]} \beta_i \mathbb{1}_{HR_c=y+i} + \gamma_c X_{iy} + \delta_{yce_i} + \zeta_{cu_ig_ie_i} + \eta_{yu_ig_ie_i} + \theta_{Abs_cE_yu_ig_ie_i} + \epsilon_{iyc} \tag{8}$$

with coefficient of interest β_i measuring URM students' differential outcome $y+i$ years after c implemented HR in HR_c. The sample is restricted to 1997-2017 California-resident freshman Fall applicants. In addition to the same fixed effects present in Equation 7, I include fixed effects by gender, ethnicity, and whether the applicant is in the top four percent of her high school class for applicants to Absorbing UC campuses between 2001 and 2011 (indicated by E_y) in order to absorb the effect of the pre-reform ELC program.[29] Four and three years prior to HR implementation are omitted as the comparison period, and the β_{-5} and β_4 effects are defined to absorb all prior and subsequent years, respectively, and are not presented. Standard errors are clustered by applicant.[30]

Panel A of Figure 4 shows that HR substantially increases URM applicants' likelihood of admission and enrollment relative to non-URM applicants, with no evidence of a pre-trend in the years prior to HR's implementation. The effect is largest in the first year following implementation, when URM applicants are 3.0 p.p. more likely to be admitted and 1.18 p.p. more likely to enroll, but the effect appears to have stabilized by a few years after implementation with admissions and enrollment increases around 1.6 and 0.9 percentage points, respectively.

In order to aggregate these effects to estimate the total increased URM enrollment resulting from HR implementation, it is important to account for the direct crowd-out effect of HR on non-URM enrollment. I assume that HR did not correspond with an off-trend increase in campus enrollment. As a result, one p.p. increase in the likelihood of a URM applicant's enrollment (relative to a non-URM applicant's) as a result of HR implementation corresponds mechanically to a $nURM_{cy}$ percent increase in the non-relative likelihood of a URM applicant's enrollment as a result of HR implementation, where $nURM_{cy}$ is the percent of applicants to c in y who were not URM.[31] The percent of non-URM applicants to HR-implemented campuses in the sample period was 67.1. I also assume that the effect of HR had stabilized two years after implementation, and estimate the mean of β_2 and β_3, 0.92 p.p., as the annual relative URM enrollment advantage to HR implementation.[32]

An important limitation of this aggregation method is that Equation 8 estimates campus-specific changes in URM enrollment following HR implementation, but many of those students would have otherwise enrolled at other UC campuses. As a result, summing across campuses' enrollment increases leads to a substantial overestimate of the number of URM students brought into the UC system. The exercise is useful as an upper bound on the number of URM students pulled into the system, as well as estimating how a single campus's implementing HR (as conducted in the UC system) would be expected to change its URM enrollment, but these estimates should not be interpreted as direct parallels to the estimated changes in enrollment from affirmative action above.

Panel B of Figure 4 shows the estimated aggregate effect of HR implementation on URM enrollment at UC campuses. The total number of URM students who enrolled at UC as a result of HR was about 45 in 2002, when only Berkeley had implemented the policy, but grew to about 850 in 2017, with most of the growth occurring in 2011-2012 as four campuses implemented HR. HR implementation led to an increase in the URM population of implementing campuses of around 10 percent, varying by year depending on the number of URM applicants to the campuses; in 2017, HR increased URM enrollment at implementing campuses by about 10.9 percent, corresponding to a (maximum) UC system-wide URM enrollment increase of about 5.9 percent.

7 Conclusion

Many universities implement policies to increase underrepresented minority enrollment in order to maintain a diverse student community and promote socioeconomic mobility. This study examines the URM enrollment effect of three such policies–race-based affirmative action, a percent plan, and holistic review–as implemented at the University of California, a 225,000-undergraduate multi-campus public research university.

When UC eliminated its race-based affirmative action admission program in 1998, URM enrollment fell by at least 700, with a possible additional decline of around 100 students as a result of discouraged URM high school graduates choosing against applying to UC. This decline implies that AA increased UC's URM enrollment by about 13 percent. Most of that increase occurred at UC's most-selective campuses, where AA had increased URM enrollment by 60-70 percent (in part by encouraging URM applications).

When seven UC campuses guaranteed admission to the top four percent of graduates from each California high school, the most selective of them increased their URM enrollment by around 9 percent, or a total of just over 250 students per year. Some additional URM graduates may have been encouraged to apply to UC by the ELC program, though the additional enrollment growth resulting from those applications appears to have been negligible. However, when the system expanded the 'percent plan' guarantee to the top nine percent of high school graduates, most of the campuses reneged on their guarantees, *de facto* ending the program.

When the 2001-2011 ELC program ended, the campuses that were absorbing ELC-eligible students actually increased their URM enrollment by simultaneously adopting holistic review in their admissions procedure, suggesting that the latter policy sharply bounds (and has a slightly-larger URM enrollment effect than) the ELC program. Holistic review increased URM enrollment by about 11 percentage points at adopting campuses, and has led to the current annual enrollment of more than 800 URM students at UC. However, many of those students would have otherwise enrolled at other UC campuses, suggesting 11 percentage points as an unattainable upper bound on the URM enrollment effect of holistic review even if every campus were to adopt it .

This study is restricted to analyzing each of these admissions policies' impact on increased URM enrollment, which is only one of many possible reasons that a university might adopt each policy. Its companion paper (Bleemer, 2019) focuses instead on the educational and labor market outcomes faced by students whose university enrollment was made available by these policies.

Notes

[1]Rothstein (2019) argues that 1/9 of cross-CZ income transmission is attributable to human capital acquisition, most of which "seems to reflect access to higher education", and 1/3 of variation reflects "earnings differences not mediated by [aggregate] human capital", which include differences in university selectivity and field of study.

[2]The best-known percent plan is Texas Top Ten, which guarantees public university admission to the top ten percent of graduates from every Texas high school; see Long, Saenz, and Tienda (2010) and Niu and Tienda (2010).

[3]While students were guaranteed admission to at least one UC campus under each of these programs, each campus independently determined whether to guarantee admission to eligible students under both programs, with the system overriding a decision only if no campus admitted an eligible applicant.

[4]A large literature estimates the relative value of enrolling at a more-selective university for URM students as a result of affirmative action or other admissions policies, with various studies identifying important benefits (Hoekstra, 2009; Zimmerman, 2014; Cohodes and Goodman, 2014; Dale and Krueger, 2014; Andrews, Imberman, and Lovenheim, 2016; Bleemer, 2019) and costs (Sander and Taylor, 2012; Arcidiacono et al., 2014; Arcidiacono, Aucejo, and Hotz, 2016; Arcidiacono and Lovenheim, 2016). This paper does not estimate student outcomes from AA or its replacements, instead focusing on their effectiveness in increasing URM enrollment.

[5]See Howell (2010), Hinrichs (2012, 2014), Backes (2012), and Blume and Long (2014). Antonovics and Backes (2014) performs a similar analysis to the affirmative action estimation presented below, but focuses on compositional changes instead of changes in the magnitude of URM enrollment.

[6]Zwick (2017) similarly extrapolates ELC's effect from a campus (Santa Barbara) that was not impacted by ELC.

[7]Kidder and Gandara (2015) takes the absence of sharp year-over-year changes in the UC system-wide URM population in 2001 as evidence that ELC "did not increase diversity by any discernable amount", failing to allow for the program's phase-in and increasing impact as the Absorbing campuses became more-selective (reducing the likelihood of counterfactual admission for ELC-eligible applicants).

[8]See https://www.universityofcalifornia.edu/infocenter/admissions-residency-and-ethnicity.

[9]Available at http://digitalassets.lib.berkeley.edu/generalcatalog/text/1978_1979_intro.pdf

[10]In a report written by the President of the University of California throughout this period (1995-2004), Richard Atkinson (Atkinson and Pelfrey, 2004) points to these two programs as UC's most substantial response to Proposition 209, but also discusses a third major UC policy innovation: the Dual Admissions Program (DAP),

which strengthened the transfer pathway from community colleges into UC. However, DAP was never implemented, and a similar program, UC's 2004 Guaranteed Transfer Option (GTO), was aborted in its first year of implementation (Kurlaender and Grodsky, 2013).

[11]Cullen, Long, and Reback (2013) find that students switching high schools in order to 'game' this kind of high-school-percentile admissions policy was relatively uncommon in Texas, which has admitted the top ten percent of students from each Texas high school to all University of Texas campuses since 1998.

[12]The relevant courses were two years of English and Mathematics, one year of History, Lab Science, and Non-English Language, and four other UC-approved courses (Atkinson and Pelfrey, 2004). ELC GPAs were then weighted, with students receiving an additional GPA point for each honors-designated course in their junior year (such that many ELC GPAs were higher than the traditional 4.0 upper bound), and rounded to the nearest hundredth. Students or their parents could opt out of their high school's providing their transcript to UC at their discretion. This centralized ELC administration importantly differs from Texas's program, where high schools were directly responsible for identifying the top ten percent of students; some high schools purposefully extended "Top Ten" eligibility to a greater proportion of students in order to placate the students and their parents (Golden, 2000).

[13]Below-threshold students with satisfactory grades also received letters encouraging them to apply to UC, but their admission was not guaranteed.

[14]An additional 2012 systemwide admissions change designated a new "Entitled to Review" status for all applicants who met certain academic achievement thresholds, though ETR status did not guarantee any change in which applicants were admitted or rejected.

[15]E.g. https://www.universityofcalifornia.edu/infocenter/admissions-residency-and-ethnicity

[16]Available from https://www.cde.ca.gov/ds/sd/sd/filesenr.asp. These data were previously part of the California Basic Educational Data System (CBEDS). High schools are identified in the application records by College Entrance Examination Board (CEEB) codes, which are merged to State Department of Education (SDE) codes by a UCOP crosswalk and then by a CDE school crosswalk to the County-District-School (CDS) codes used in CDE records.

[17]All OLS estimation in this study is conducted using the *felm* function in the *lfe* R package, version 2.8-2.

[18]Note that these models do not control for economic hardship or other potential applicant disadvantages, some of which are likely correlated with URM status. Since hardship was partially considered in the admission of some students at each campus at the time, it is unsurprising that these models still find admissions advantages for URM applicants despite the end of explicit selection on URM status.

[19]The report estimated increases in African-American and Latino/Chicano applicant rates by 7.8 and 14.4 percentage points, respectively. However, the report does not directly observe the magnitude of high schools' graduating classes, instead 'projecting' using the mean class size from the previous three years, which likely substantially undercounted URM student growth at ELC-implementing high schools in Southern California.

[20]Schools are ranked by the average SAT scores of applicants near the school's ELC threshold in the year that the school began ELC participation. These schools produced more than 60 percent of ELC compliers among always-applicants to UC (Bleemer, 2019).

[21]A small number of URM students may also have been absorbed by UC's Santa Barbara campus, but because the enrollment differences were so small at that campus, I omit it from this study.

[22]All regression discontinuity estimation is conducted using the *rdrobust* package in R, Version 0.99.4 (Calonico, Cattaneo, and Titiunik, 2015).

[23]Although thresholds did not update annually under the post-2011 ELC policy, I do not observe the years in which they update (which vary by school). As a result, it is unhelpful to attempt to identify centile thresholds within high school across years.

[24]As above, X_{it} includes application year indicators, gender-ethnicity interaction indicators, and a fifth-order polynomial in SAT score.

[25]Table 2 mirrors Table 3 of Bleemer (2019), which shows parallel results for the pre-2012 ELC program.

[26]The end of the pre-2012 ELC program would also impact non-URM applicants, but given that half of ELC compliers were URM and URM students made up only 25 percent of Absorbing UC campuses' student bodies in 2011, the relative impact of changes to ELC would be around three times larger for URM applicants. As a result, these estimates might be somewhat biased towards 0. While the appeal of differencing across URM status–that it differences out non-race-specific within-campus admission policy changes, in particular campuses' increasing year-over-year general selectivity–outweighs its costs, the results are qualitatively similar when the diff-in-diff strategy is employed; see Appendix Figure A-2.

[27]Because the UC system ceased soliciting SAT II Mathematics and Writing exams in the 2000s, I replace X_{iy} with linear and interacted SAT and high school GPA measures.

[28]The enrollment pattern slowly reverses in the years following ELC reform. As discussed below, this likely arises from changes in Absorbing UC campuses' holistic review procedure, as the campuses gained experience in the admissions practice, that increasingly targeted top-four students who were likely to enroll at the campus.

[29]The UC campuses' all simultaneously switching to a "Comprehensive Review" policy from a more algorithmic admissions policy in 2002 is absorbed by the $\eta_{yu_ig_ie_i}$ fixed effect.

[30]Because I use these models to estimate the effect of HR on applicants' outcomes, treating HR as a uniform policy implemented at various UC campuses that learned how to implement the policy from each other, I do not cluster standard errors at the campus-year level. Since only six campuses have implemented HR, such standard errors are considerably larger than those reported, though HR's effect on URM enrollment remains statistically greater than 0 at the 10% level.

[31]Consider the two corner cases. When there are the same number of URM and non-URM applicants, a 1 percent increase in URM likelihood of enrollment relative to non-URM applicants corresponds to a 1*0.5=0.5 percent increase in URM likelihood of enrollment overall, which would in turn lead to a one-for-one 0.5 percent

decrease in non-URM likelihood of enrollment. When the number of URM applicants is marginal (and nearly 100 percent of applicants are non-URM), on the other hand, the 1 percent increase would lead to a 1*(1-ϵ)$\approx$1 percent overall increase, since the non-URM base would be unaffected. The relationship between the two is linear.

[32]An alternative strategy would be to estimate the annual relative URM enrollment advantage to HR implementation by β_4, but that coefficient could be biased by other admission policy changes implemented by HR-implementing campuses. There were no other large known admission policy changes following campuses' HR implementation 2-3 years afterwards.

References

Andrews, Rodney J., Scott A. Imberman, and Michael F. Lovenheim. 2016. "Recruiting and Supporting Low-Income, High-Achieving Students at Flagship Universities." National Bureau of Economic Research Working Paper 22260. URL Link.

Antonovics, Kate and Ben Backes. 2013. "Were Minority Students Discouraged from Applying to University of California Campuses after the Affirmative Action Ban?" Education Finance and Policy 8 (2):208–250. URL Link.

———. 2014. "The Effect of Banning Affirmative Action on College Admissions Policies and Student Quality." The Journal of Human Resources 49 (2):295–322. URL Link.

Arcidiacono, Peter, Esteban Aucejo, Patrick Coate, and V. Joseph Hotz. 2014. "Affirmative action and university fit: evidence from Proposition 209." IZA Journal of Labor Economics 3 (7). URL Link.

Arcidiacono, Peter, Esteban Aucejo, and V. Joseph Hotz. 2016. "University Differences in the Graduation of Minorities in STEM Fields: Evidence from California." American Economic Review 106 (3):525–562. URL Link.

Arcidiacono, Peter and Michael Lovenheim. 2016. "Affirmative Action and the Quality-Fit Trade-off." Journal of Economic Literature 54 (1):3–51. URL Link.

Atkinson, Richard C. and Patricia A. Pelfrey. 2004. "Rethinking Admissions: US Public Universities in the Post-Affirmative Action Age." CSHE Research Paper Series 11 (4). URL Link.

Backes, Ben. 2012. "Do affirmative action bans lower minority college enrollment and attainment? Evidence from statewide bans." Journal of Human Resources 47 (2):435–455. URL Link.

Bleemer, Zachary. 2019. "Affirmative Action, Percent Plans, and the Return to Postsecondary Selectivity." Manuscript URL Link.

Blume, Grant. A. and Mark C. Long. 2014. "Changes in Levels of Affirmative Action in College Admissions in Response to Statewide Bans and Judicial Rulings." Educational Evaluation and Policy Analysis 36 (2):228–252. URL Link.

BOARS. 2012. Comprehensive Review in Admissions at the University of California: an Update. Oakland, CA: University of California. URL Link.

Calonico, Sebastian, Matias Cattaneo, Max Farrell, and Rocio Titiunik. 2019. "Regression Discontinuity Designs Using Covariates." The Review of Economics and Statistics URL Link.

Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik. 2014. "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs." Econometrica 82 (6):2295–2326. URL Link.

———. 2015. "rdrobust: An R Package for Robust Nonparametric Inference in Regression-Discontinuity Designs." R Journal 7 (1):38–51. URL Link.

Card, David and Alan Krueger. 2005. "Would the elimination of affirmative action affect highly qualified minority applicants? Evidence from California and Texas." Industrial and Labor Relations Review 58:416—-434.

Chang, Tongshan and Heather Rose. 2010. "A Portrait of Underrepresented Minorities at the University of California, 1994-2008." In Equal opportunity in higher education: the past and future of California's Proposition 209. Cambridge, MA: Harvard Education Press, 83–102.

Cohodes, Sarah R. and Joshua S. Goodman. 2014. "Merit Aid, College Quality, and College Completion: Massachusetts' Adams Scholarship as an In-Kind Subsidy." American Economic Journal: Applied Economics 6 (4):251–285. URL Link.

Coleman, Arthur L. and Jamie Lewis Keith. 2018. Understanding Holistic Review in Higher Education Admissions. New York: College Board.

Cullen, Julie, Mark Long, and Randall Reback. 2013. "Jockeying for position: Strategic high school choice under Texas' top ten percent plan." Journal of Public Economics 97 (1):32–48. URL Link.

Dale, Stacy and Alan Krueger. 2014. "Estimating the Effects of College Characteristics over the Career Using Administrative Earnings Data." The Journal of Human Resources 49 (2):323–358. URL Link.

Golden, Daniel. 2000. "Fudge Factor." The Wall Street Journal May 15, 2000:A1,A8.

Hinrichs, Peter. 2012. "The Effects of Affirmative Action Bans on College Enrollment, Educational Attainment, and the Demographic Composition of Universities." The Review of Economics and Statistics 94 (3):712–722. URL Link.

———. 2014. "Affirmative action bans and college graduation rates." Economics of Education Review 42:43–52. URL Link.

Hoekstra, Mark. 2009. "The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Based Approach." The Review of Economics and Statistics 91 (4):717–724. URL Link.

Howell, Jessica S. 2010. "Assessing the Impact of Eliminating Affirmative Action in Higher Education." Journal of Labor Economics 28 (1):113–166. URL Link.

Kidder, William C. and Patricia Gandara. 2015. Two Decades After the Affirmative Action Ban: Evaluating the University of California's Race-Neutral Efforts. Princeton: The Educational Testing Services' Civil Rights Project. URL Link.

Kurlaender, Michal and Eric Grodsky. 2013. "Mismatch and the Paternalistic Justification for Selective College Admissions." Sociology of Education 86 (4):294–310. URL Link.

Long, Mark, Victor Saenz, and Marta Tienda. 2010. "Policy Transparency and College Enrollment: Did the Texas Top Ten Percent Law Broaden Access to the Public Flagships?" The Annals of the American Academy of Political and Social Science 627 (1):82–105. URL Link.

Long, Mark C. 2004a. "College applications and the effect of affirmative action." Journal of Econometrics 121 (1-2):319–342. URL Link.

———. 2004b. "Race and College Admissions: An Alternative to Affirmative Action?" The Review of Economics and Statistics 86 (4):1020–1033. URL Link.

———. 2007. "Affirmative Action and Its Alternatives in Public Universities: What Do We Know?" Public Administration Review 67 (2):315–330. URL Link.

Niu, Sunny and Marta Tienda. 2010. "The Impact of the Texas Top Ten Percent Law on College Enrollment: A Regression Discontinuity Approach." Journal of Policy Analysis and Management 29 (12):84–110. URL Link.

Rothstein, Jesse. 2000. "Race-Blind Diversity? Analyses of the Effect of "Percent Plans" in College Admissions." Unpublished Manuscript .

———. 2019. "Inequality of Educational Opportunity? Schools as Mediators of the Intergenerational Transmission of Income." Journal of Labor Economics 37 (S1):S85–S123. URL Link.

Sander, Richard and Stuart Taylor. 2012. Mismatch: How Affirmative Action Hurts Students It's Intended to Help, and Why Universities Won't Admit It. New York: Basic Books.

Tolbert, Caroline J and John A Grummel. 2003. "Revisiting the racial threat hypothesis: White voter support for California's Proposition 209." State Politics & Policy Quarterly 3 (2):183–202.

UCOP. 2002. Eligibility in the Local Context Program Evaluation Report. Oakland, CA: University of California. URL Link.

———. 2003. Undergraduate Access to the University of California After the Elimination of Race-Conscious Policies. Oakland, CA: University of California. URL Link.

———. 2013. Beyond the Numbers: Comprehensive Review. Oakland, CA: University of California. URL Link.

Yagan, Danny. 2012. "Law School Admissions under the UC Affirmative Action Ban." Manuscript URL Link.

Zimmerman, Seth. 2014. "The Returns to College Admission for Academically Marginal Students." Journal of Labor Economics 32 (4):711–754. URL Link.

Zwick, Rebecca. 2017. Who Gets In? Strategies for Fair and Effective College Admissions. Cambridge: Harvard University Press.

Table 1: The Impact of Proposition 209 on UC Campus Admissions

Campus:	UCLA	UCB	UCSD	UCSC	UCD	UCSB	UCI	UCR	Total
Application conditional on UC application (%)									
URM	8.21	11.61	-4.84	-2.47	-5.44	-7.24	-10.38	-7.23	
	(0.35)	(0.34)	(0.36)	(0.31)	(0.33)	(0.35)	(0.33)	(0.29)	
URM * Prop. 209	-4.31	-3.25	1.04	0.04	0.97	1.20	-0.54	4.56	
	(0.45)	(0.44)	(0.47)	(0.40)	(0.43)	(0.46)	(0.43)	(0.38)	
R^2	0.178	0.229	0.116	0.125	0.222	0.143	0.211	0.210	
Obs.	274,473	274,473	274,473	274,473	274,473	274,473	274,473	274,473	
Admission conditional on application (%)									
URM	33.38	41.90	25.05	8.46	28.10	15.02	13.05	6.07	8.71
	(0.38)	(0.46)	(0.42)	(0.47)	(0.49)	(0.44)	(0.48)	(0.48)	(0.23)
URM * Prop. 209	-22.44	-27.62	-18.65	-7.27	-18.25	-3.84	-7.36	-5.43	-7.54
	(0.48)	(0.59)	(0.53)	(0.59)	(0.64)	(0.55)	(0.60)	(0.56)	(0.30)
R^2	0.431	0.330	0.532	0.333	0.393	0.446	0.454	0.325	0.239
Obs.	155,593	129,069	143,068	66,941	108,313	118,653	101,456	66,238	274,473
Enrollment conditional on application (%)									
URM	11.00	15.04	0.75	-4.14	0.68	-0.13	-5.17	-3.44	4.70
	(0.36)	(0.43)	(0.39)	(0.60)	(0.53)	(0.46)	(0.52)	(0.62)	(0.37)
URM * Prop. 209	-8.61	-10.96	-1.99	1.86	0.56	2.07	1.82	1.93	-7.04
	(0.45)	(0.55)	(0.49)	(0.75)	(0.68)	(0.57)	(0.65)	(0.72)	(0.48)
R^2	0.080	0.083	0.063	0.063	0.059	0.036	0.061	0.107	0.073
Obs.	155,593	129,069	143,068	66,941	108,313	118,653	101,456	66,238	274,473
Δ Enroll.[a]	-368	-376	-50	-15	1	12	12	84	699
	[57.9%]	[71.8%]	[14.6%]	[4.0%]	[-0.2%]	[-1.9%]	[-2.7%]	[-12.6%]	[11.6%]
$\hat{\Delta}$ Enroll.[b]	-248	-92	75	-120	-80	24	-89	-259	790
	[39.0%]	[17.5%]	[-22.0%]	[32.1%]	[15.3%]	[-3.9%]	[19.2%]	[39.1%]	[13.1%]

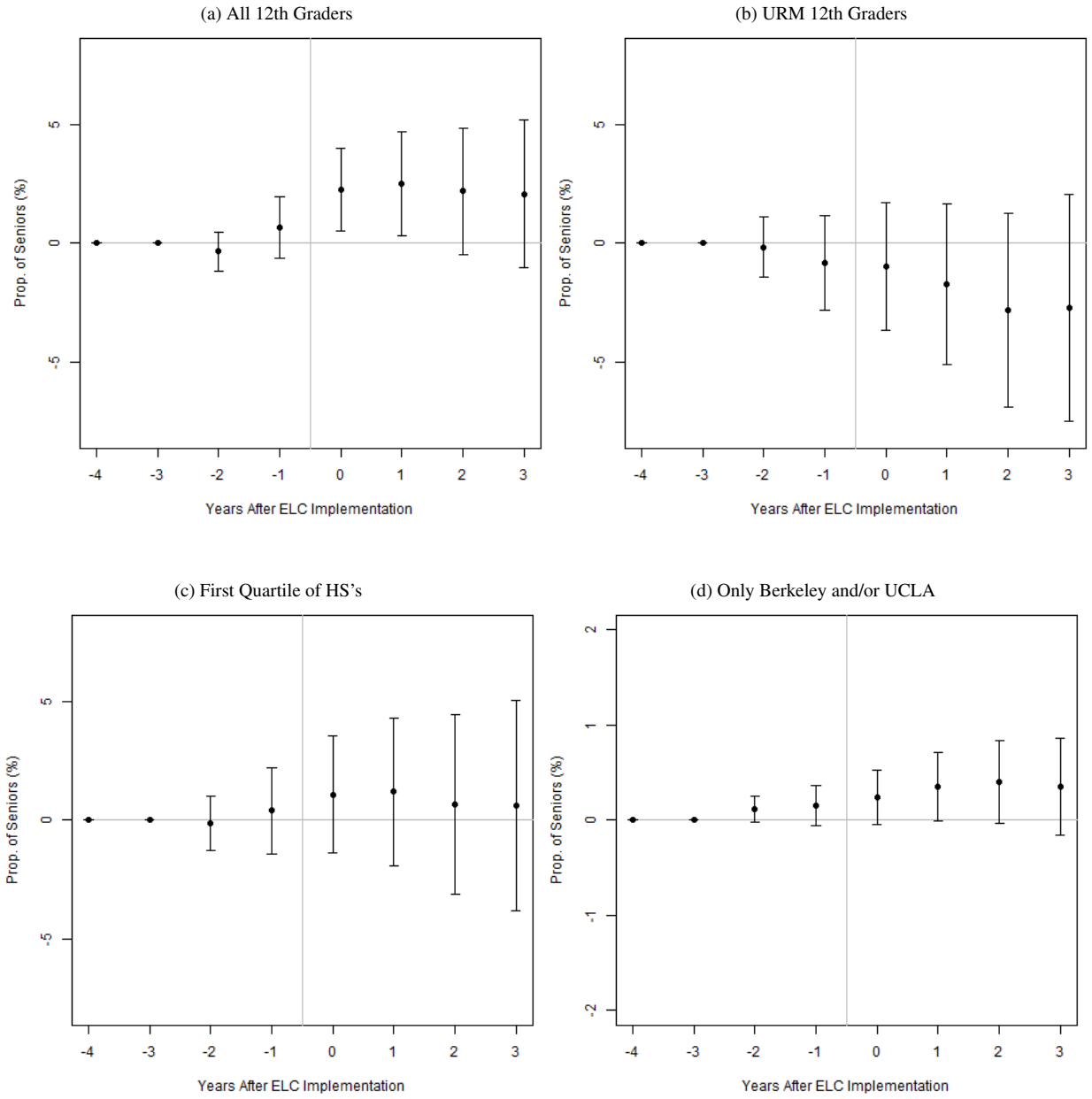
Note: OLS coefficient estimates from 1995-2000 UC campus-specific difference-in-difference regressions of likelihood of application, admission, or enrollment on URM status interacted with an indicator for 1998-2000 years (after Prop. 209 was implemented), controlling for high school fixed effects and SAT I and II scores, high school GPA, gender, and number of senior-year honors courses. "Application" is conditional on application to at least one UC campus; "Admission" and "Enrollment" are conditional on application to that campus. Robust standard errors in parentheses. Total column is conditional on application to at least one campus, and measure admission or enrollment to at least one campus.

[a] The difference between the average proportion of URM students at each campus in 1998-2000 and in 1995-1997, multiplied by the school's average incoming class size in 1998-2000 (Equation 2).

[b] The difference between estimated 1995 URM enrollment under Prop 209 admissions (given the 1995 applicant pool) and actual 1995 URM enrollment, scaled by changes in non-URM enrollment (to account for differential selectivity) and overall campus growth from 1995 to 1998-2000 (Equation 3).

Source: UC Corporate Student System

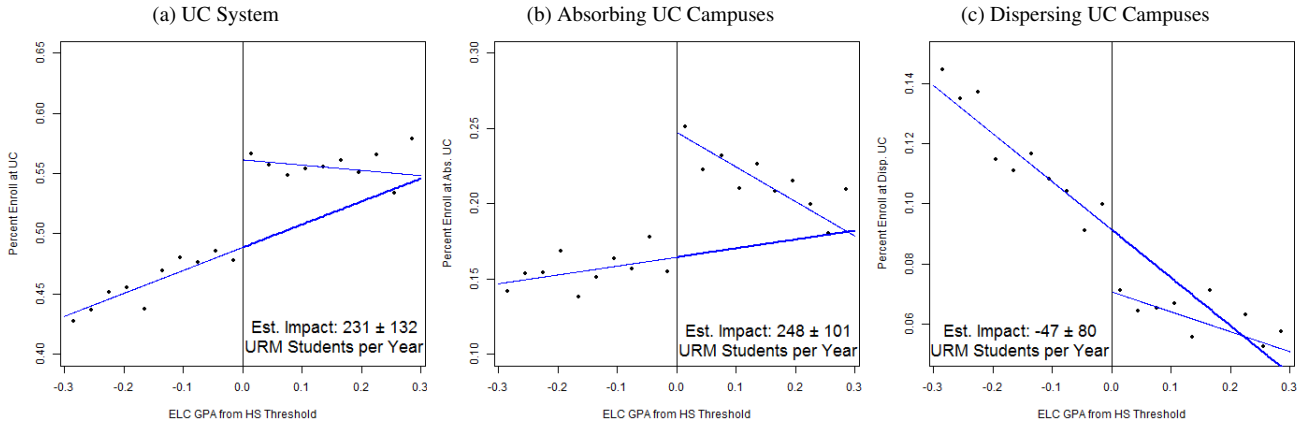
Figure 1: Event Study Impact of ELC High School Implementation on Senior Class UC Application



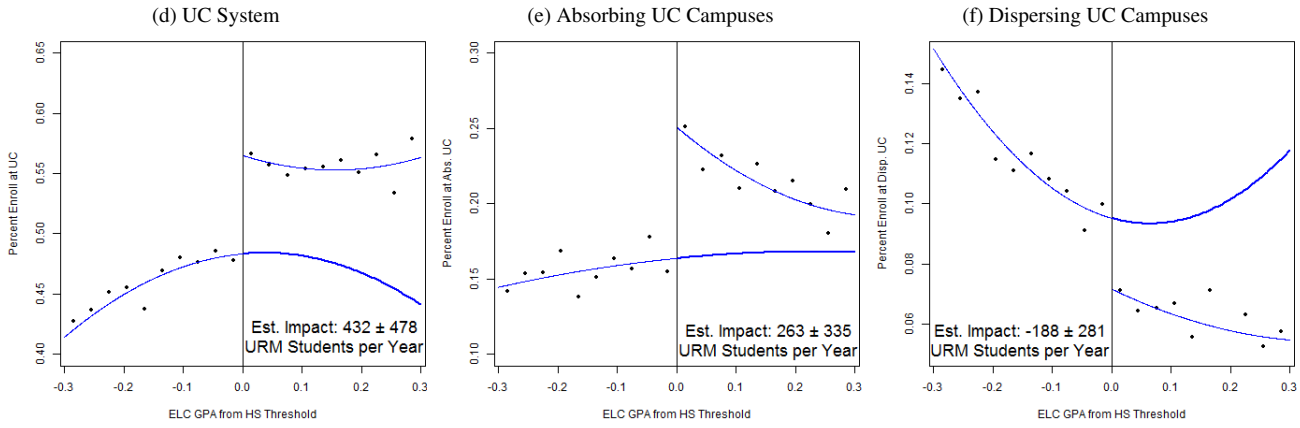
Note: Event study estimates and 95-percent confidence intervals of the impact of ELC implementation on high schools' UC applicants, admissions, and enrollments in the three years following ELC implementation, compared to three and four years before implementation. The full sample includes all public high schools (HS) in California in the 2001-2011 UC application database that could be matched to annual 12th grade enrollment statistics available from the California Department of Education (representing 61% of all high schools, public and private, and 70% of applicants). URM includes Black, Hispanic, Native American, and Pacific Islander students. High school quartiles by SAT score of students within 0.3 GPA points of the ELC threshold, weighted by number of applicants; school quartiles are fixed at their quartile in the closest available year to their initial ELC implementation. Source: UC Corporate Student System and California Department of Education

Figure 2: Estimated Impact of ELC on URM Enrollment on the Admission Margin

Panel A: Linear Extrapolations



Panel B: Quadratic Extrapolation



Note: Extrapolated local linear and local quadratic best fit lines for the proportion of 2003-2011 URM UC applicants who enroll at any UC campus, an Absorbing UC campus (Davis, Irvine, or San Diego), or a Dispersing UC campus (Merced, Riverside, or Santa Cruz) by the distance between students' ELC GPA and their high school's ELC threshold, with best fit lines estimated separately on each side of the threshold. The below-threshold line is extrapolated 0.3 GPA points above the threshold, and the gap between the lines is integrated across the true distribution of applicants to estimate the change in the number of enrolled UC students as a result of the ELC program, conditional on application. Ninety-five percent confidence intervals estimated from block-bootstraps by high-school-year. URM is defined to include Black, Hispanic, Native American, and Pacific Islander applicants. A triangular kernel in distance from 0 is used to fit local best fits. Linear fits may tend to underestimate impacts, while quadratic fits likely overestimate impacts. Average total 2003-2011 URM enrollment at the Absorbing UC campuses was 3,351. Source: UC Corporate Student System

Table 2: Impact of 2012-2017 ELC on Admissions and Enrollment for 9th Percentile Students by UC Campus

	Admission (%)				Enrollment (%)			
	All		Bottom Quart.[a]		All		Bottom Quart.	
	Baseline	β	Baseline	β	Baseline	β	Baseline	β
Unimpacted Campuses								
Berkeley	17.0	-0.0	9.2	-1.4	5.9	-0.5	2.2	-0.2
		(1.0)		(1.8)		(0.6)		(0.7)
UCLA	12.3	-0.3	9.3	0.4	4.1	0.6	3.4	0.7
		(0.8)		(1.4)		(0.6)		(0.8)
Santa Barbara	55.8	-0.6	37.2	-2.8	6.1	-0.1	5.6	-0.6
		(1.5)		(2.3)		(0.6)		(1.2)
Absorbing Campuses								
Davis	59.9	-1.1	35.9	-5.9	7.7	0.3	5.0	0.6
		(1.8)		(2.6)		(0.5)		(1.3)
San Diego	40.0	3.6	19.8	0.9	6.2	0.4	2.5	-0.2
		(1.1)		(1.8)		(0.6)		(0.7)
Irvine	55.4	0.5	36.5	-1.9	7.1	0.5	5.8	-0.4
		(1.7)		(2.9)		(0.6)		(1.2)
Dispersing Campuses								
Riverside	77.7	-5.2	66.7	-3.9	3.3	-0.0	6.2	0.2
		(1.9)		(2.6)		(0.6)		(1.2)
Santa Cruz	79.2	-0.0	65.3	3.1	3.7	0.2	4.9	0.6
		(1.6)		(3.6)		(0.4)		(0.9)
Merced	92.6	5.9	89.1	10.0	1.5	0.0	2.9	0.6
		(1.9)		(2.7)		(0.3)		(0.8)

Note: The estimated baseline (ELC-ineligible) proportion of marginal students at their high school's ninth percentile ELC threshold admitted or enrolled at each UC campus 2003-2011 ($\bar{\alpha}$), and the estimated change in admission or enrollment for marginally ELC-eligible applicants (β), overall and for students from the bottom SAT quartile of high schools. Values in percentages. Enrollment is not conditional on admission to that campus. Estimates from local linear regression discontinuity models controlling for year, gender-ethnicity, and high school fixed effects (for high schools with more than 50 students in the sample) and a fifth-order polynomial in SAT score; bias-corrected cluster-robust (by school-year) standard errors in parentheses (Calonico, Cattaneo, and Titiunik, 2014). Applicants from high schools with approximated ELC thresholds between 3.96 and 4.00 are omitted. [a]Bottom quartile of high schools by SAT scores of students within 0.3 GPA points of the ELC threshold.

Source: UC Corporate Student System and National Student Clearinghouse

Table 3: The Impact of ELC Percentile on URM Admissions and Enrollment to UC Campuses

Panel A: Impact on Admission, Conditional on Application (%)

	UCB	UCLA	UCSB	UCD	UCSD	UCI	UCR	UCSC	UCM
First Centile	-2.95	3.58	-3.26	-2.36	4.47	0.79	-3.76 *	4.61	-1.60
Second Centile	-4.68	-1.84	-3.79	-3.27	1.77	0.34	-3.75	3.55	-3.41
Third Centile	5.57	3.41	0.84	-5.59 *	1.84	-1.79	-0.60	4.28	0.17
Fourth Centile	-3.46	-0.76	-3.50	7.36 *	-4.91	0.17	-0.43	2.23	-2.42
Fifth Centile	-1.22	0.39	0.55	-5.12	-1.39	-0.87	-0.84	-0.52	1.12
Sixth Centile	-1.26	-2.49	-4.70	-1.58	4.62	-3.08	1.32	-0.87	-2.26
Seventh Centile	1.46	0.63	-2.09	-1.00	1.37	0.33	0.89	-0.83	4.10
Eighth Centile	0.67	0.03	-0.40	1.83	0.99	-0.83	-3.33	2.05	3.05
Ninth Centile	-1.43	0.45	-2.75	-5.87 *	0.88	-1.86	-3.90	3.11	9.99 **

Panel B: Impact on Enrollment, Conditional on Application (%)

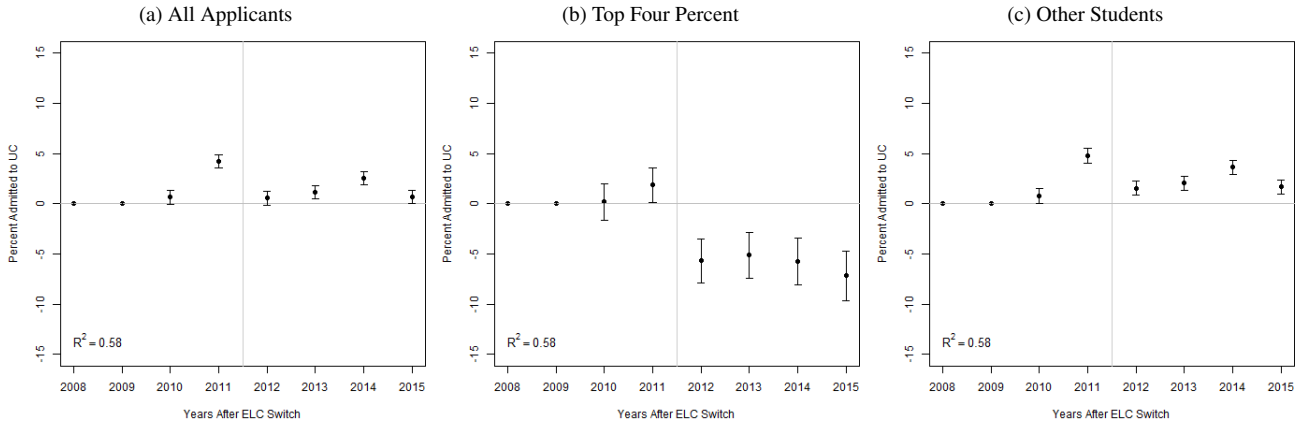
	UCB	UCLA	UCSB	UCD	UCSD	UCI	UCR	UCSC	UCM
First Centile	2.22	-5.25	1.80	-0.15	4.30 *	-0.40	0.95	-0.20	-0.41
Second Centile	-2.05	-0.17	1.27	-4.23 *	1.06	0.88	0.51	0.81	-0.81
Third Centile	-1.70	3.08	1.64	-3.57 *	0.62	-1.01	-0.82	-1.32	0.27
Fourth Centile	-2.55	-0.26	2.72	1.90	-1.33	4.55 *	0.11	0.36	0.60
Fifth Centile	-0.28	-0.63	1.56	0.15	0.87	-0.16	0.90	0.20	0.89
Sixth Centile	0.19	0.15	1.25	-1.43	1.27	-1.11	0.45	-0.97	0.06
Seventh Centile	0.95	0.48	1.26	-1.62 †	-0.28	0.03	1.04	0.24	0.37
Eighth Centile	0.69	-0.06	0.82	0.09	1.42 †	-0.42	-0.60	-0.67	-0.90
Ninth Centile	-0.24	0.70	-0.57	0.63	-0.18	-0.42	0.25	0.56	0.63

Note: Beta (treatment) coefficients on URM applicants' likelihood of admission and enrollment at each UC campus and at each 2012-2017 ELC GPA centile threshold from local linear regression discontinuity estimation, with indicated statistical significance (from 0) estimated by bias-corrected cluster-robust (by school-year) standard errors (Calonico, Cattaneo, and Titiunik, 2014). Estimates control for year, gender-ethnicity, and high school fixed effects (for high schools with more than 50 students in the sample) and a fifth-order polynomial in SAT score. Applicants from high schools with approximated ELC thresholds between 3.96 and 4.00 are omitted. Statistical significance: † 10 percent, * 5 percent, ** 1 percent.

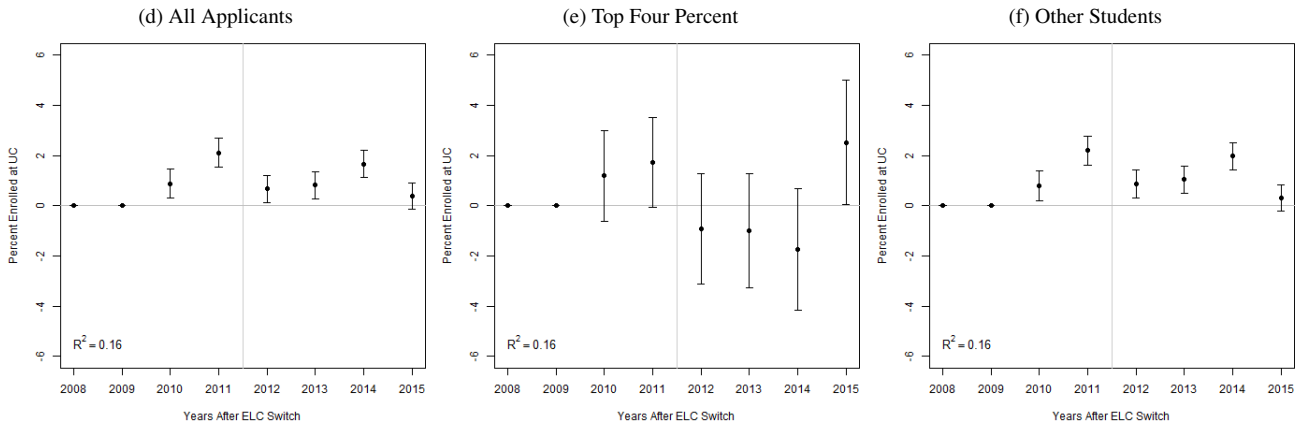
Source: UC Corporate Student System

Figure 3: Estimated Triple-Differenced Impact of 2011-2012 ELC Transition on URM Admissions and Enrollment, Relative to non-URM Applicants

Panel A: URM Admission to Absorbing UC Campus



Panel B: URM Enrollment at Absorbing UC Campus

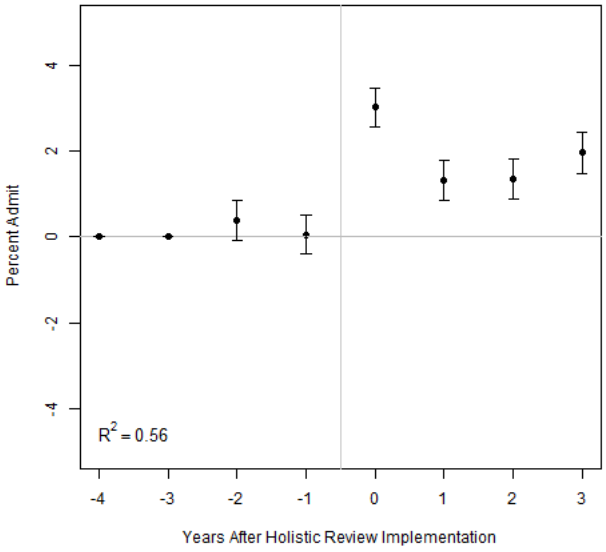


Note: Triple- and quadruple-difference beta estimates of the impact of the 2011-2012 transition to the post-2011 ELC policy on URM applicants at Absorbing UC campuses, differenced across time, campus (compared to the Unimpacted UC campuses), and URM status. Sample restricted to freshman California residents and, in the center and right columns, further differenced by whether the students were in the top four percent of their high school class by ELC GPA. OLS regressions control for campus-by-high-school fixed effects and campus-by-SAT-score-by-GPA; standard errors are clustered by applicant. 2008 and 2009 indicators are omitted. Two of the three Absorbing UC campuses implemented holistic review in 2011, and the other implemented in 2012; there were no changes in holistic review policies at the Unimpacted campuses in this period (though two had previously implemented the policy). Full model R^2 in the bottom-left corner of each chart. Source: UC Corporate Student System

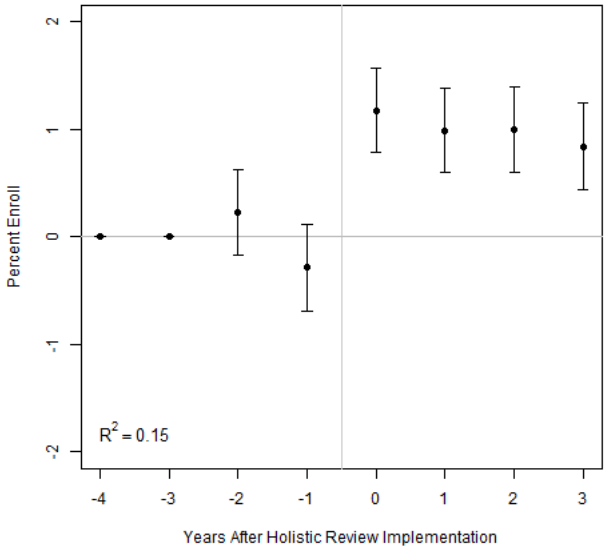
Figure 4: Estimated Diff-in-Diff Impact of Holistic Review on URM Admissions and Enrollment

Panel A: Event Study Estimates

(a) Likelihood of URM Admission

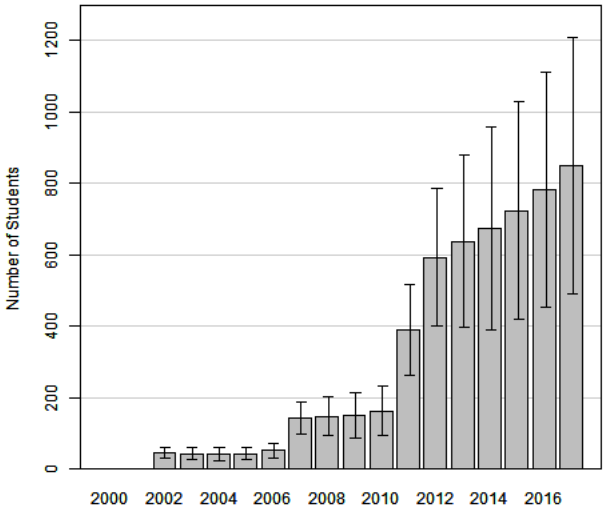


(b) Likelihood of URM Enrollment

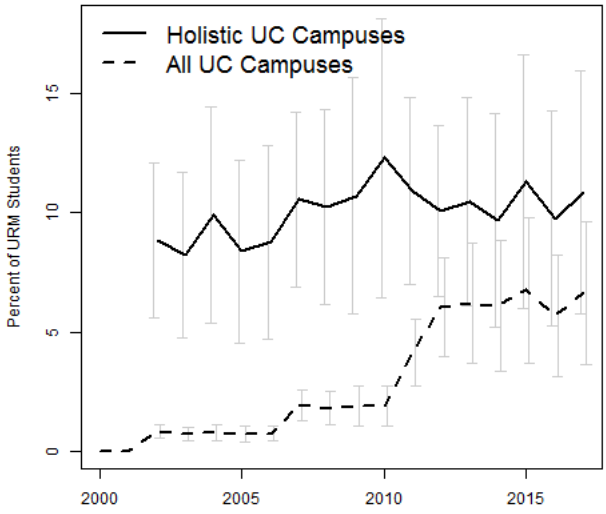


Panel B: Aggregate Annual Impact on URM Enrollment

(c) Number of URM Students

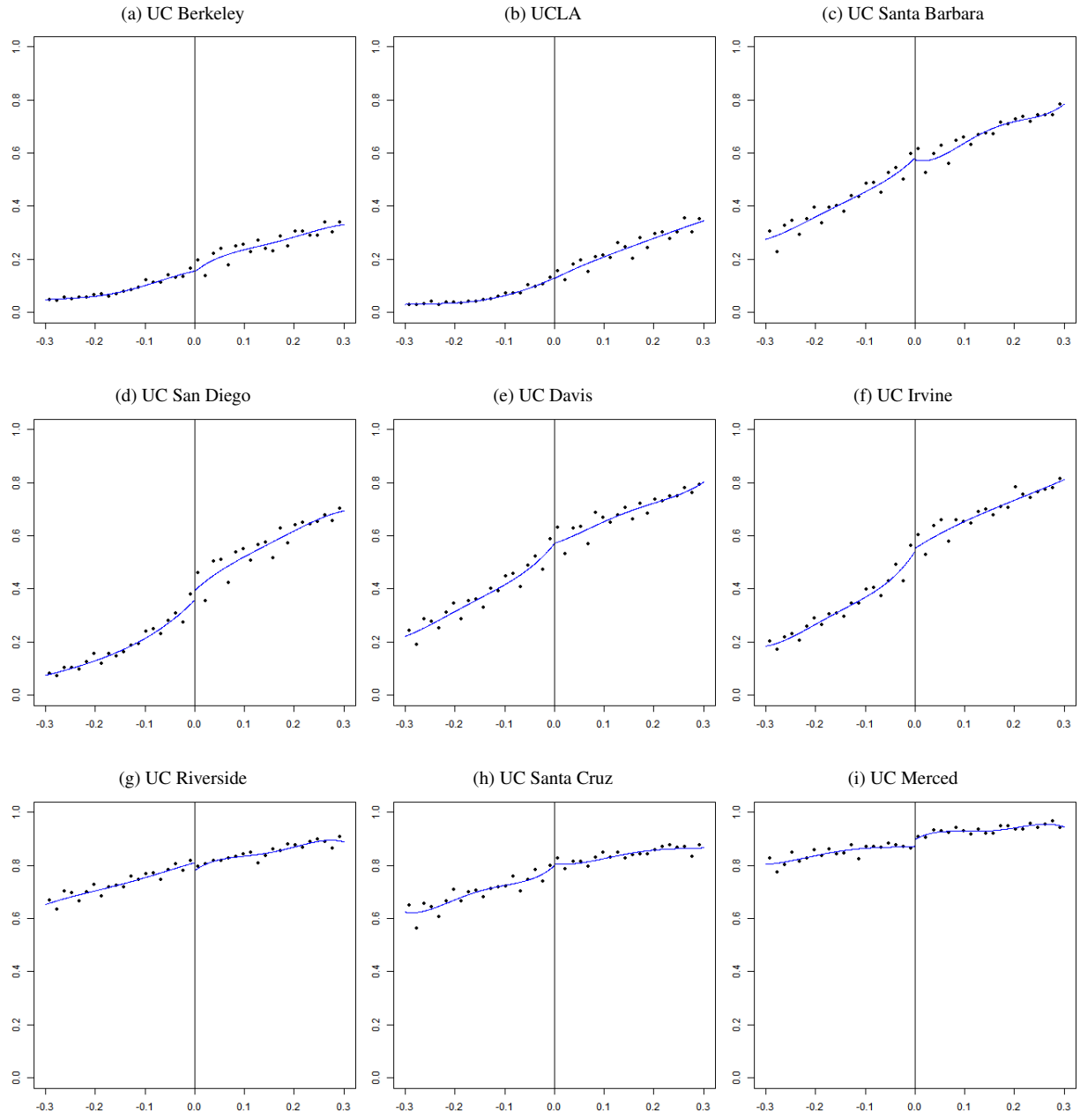


(d) Proportion of URM Students



Note: Difference-in-difference event study beta estimates of the impact of holistic comprehensive review in undergraduate admissions on URM applicants at implementing UC campuses, differenced across time, campus, and URM status. Sample restricted to freshman California residents. OLS regressions control for campus-by-high-school fixed effects as well as campus-identity, year-identity, and campus-year fixed effects (defining identity by race-gender pairs) all interacted with whether the student is in the top four percent of their class (post-2000, to difference out effects of ELC), as well as campus-by-SAT-score-by-GPA. Standard errors are clustered by applicant, with standard errors in Panel B cluster-bootstrapped. Indicators for three and four years prior to holistic review implementation are omitted. The campuses that implemented holistic review are Berkeley (starting 2002), UCLA (2007), San Diego (2011), Irvine (2011), Davis (2012), and Santa Cruz (2012); other campuses are included and combined with indicator for more than four years prior to implementation. Full model R^2 in the bottom-left corner of each chart. Source: UC Corporate Student System

Figure A-1: 2012-2017 Change in Likelihood of Admissions at the Ninth Percentile High School ELC Cutoff, by Campus



Note: Binned averages of 2012-2017 applicants' likelihood of admission to each undergraduate UC campus by ELC GPA distance to their high school's ELC eligibility threshold. Thresholds are at the ninth percentile of ELC GPAs by high school and are approximated by a support vector machine algorithm described in the text. Each chart includes 20 evenly-spaced bins on either side of the ELC threshold; the fit lines are fifth-order polynomials. Source: UC Corporate Student System.

Table A-1: The Impact of ELC Percentile on URM Admissions and Enrollment to UC Campuses

Panel A: Impact on Admission, Conditional on Application (%)

	UCB	UCLA	UCSB	UCD	UCSD	UCI	UCR	UCSC	UCM
First Centile	-1.42	1.38	-1.77	-0.43	1.23 †	0.04	-0.56	-1.43	
Second Centile	-0.53	3.02	-0.13	0.73	3.53 **	1.06	-0.65	1.13	-0.22
Third Centile	4.00 *	0.47	0.78	-1.42	1.51	-0.24	-0.72	1.71 †	0.88
Fourth Centile	1.82	1.08	-0.11	1.51	0.47	2.42 *	1.04	-0.45	0.32
Fifth Centile	-0.83	0.00	0.83	0.67	-1.03	0.36	-0.62	1.06	1.13
Sixth Centile	1.41	-0.11	-0.13	-0.69	1.96	-0.61	-1.79	1.39	-0.36
Seventh Centile	1.00	1.21	-0.55	-0.25	0.68	0.07	0.42	0.23	0.91
Eighth Centile	-0.76	1.18	-0.69	-1.17	2.67 *	-0.22	-0.61	-0.28	0.46
Ninth Centile	-0.04	-0.27	-0.62	-1.11	3.61 **	0.50	-5.21 **	-0.05	5.94 **

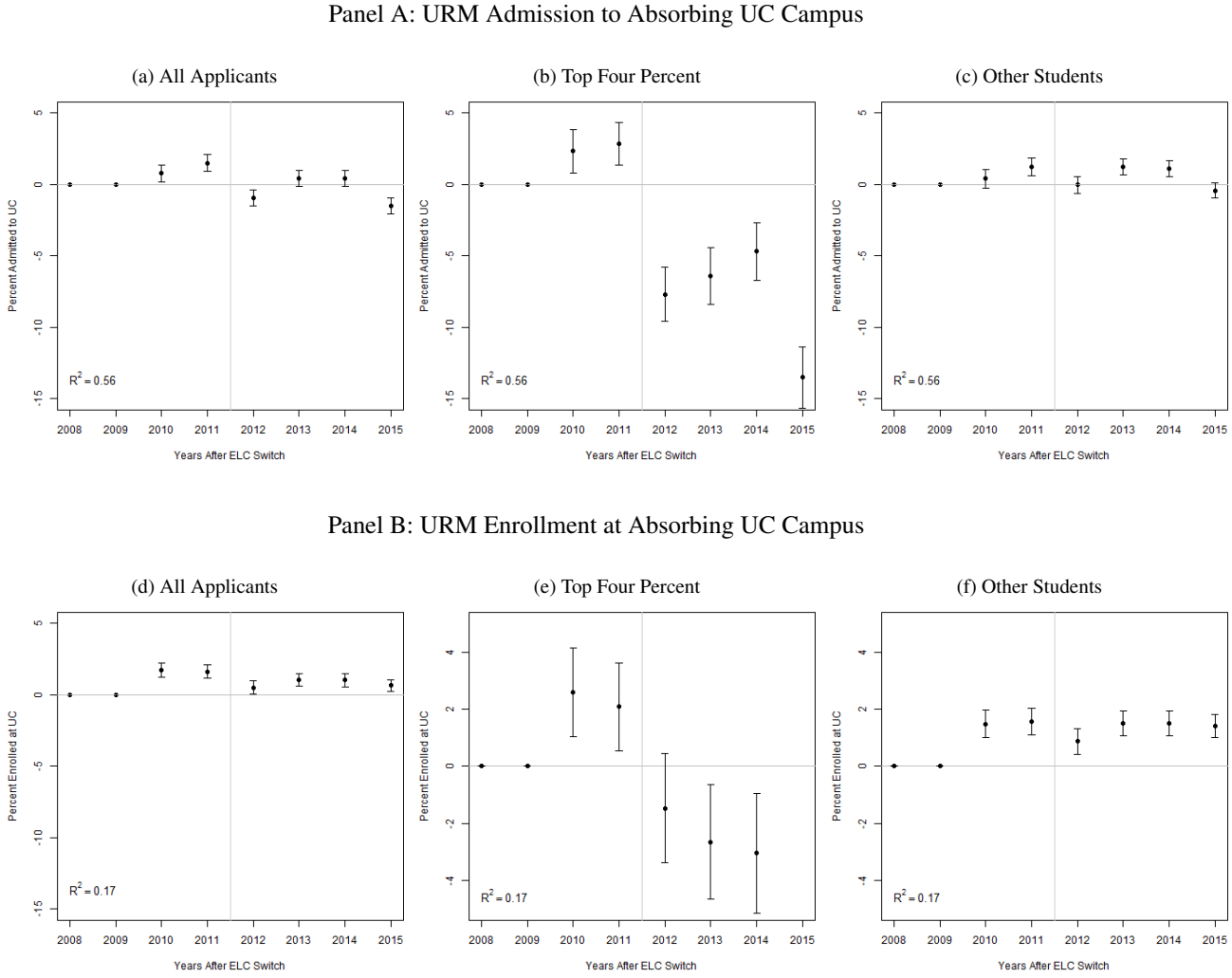
Panel B: Impact on Enrollment, Conditional on Application (%)

	UCB	UCLA	UCSB	UCD	UCSD	UCI	UCR	UCSC	UCM
First Centile	-0.26	-0.14	0.90 †	0.21	1.46 †	-1.27 †	0.51 †	-0.10	-0.09
Second Centile	-0.78	-0.10	0.57	-1.29	-0.49	0.24	0.25	0.16	-0.18
Third Centile	0.12	-1.12	0.64	-2.18 **	0.44	0.52	-0.45	-0.08	0.11
Fourth Centile	0.46	0.63	-0.07	-0.17	-0.94	0.54	0.27	0.61 †	0.08
Fifth Centile	-0.10	-0.05	1.25 †	0.54	-0.62	0.91	0.22	0.05	0.06
Sixth Centile	0.68	0.58	0.32	-1.07	0.20	0.32	-0.24	0.42	0.29
Seventh Centile	0.38	0.31	0.67	-0.59	0.23	-0.62	0.21	-0.09	0.13
Eighth Centile	-0.29	0.78	0.22	-0.39	0.85	0.04	-0.11	0.12	-0.33
Ninth Centile	-0.49	0.64	-0.07	0.28	0.45	0.49	-0.05	0.23	0.02

Note: Beta (treatment) coefficients on URM applicants' likelihood of admission and enrollment at each UC campus and at each 2012-2017 ELC GPA centile threshold from local linear regression discontinuity estimation, with indicated statistical significance (from 0) estimated by bias-corrected cluster-robust (by school-year) standard errors (Calonico, Cattaneo, and Titiunik, 2014). Estimates control for year, gender-ethnicity, and high school fixed effects (for high schools with more than 50 students in the sample) and a fifth-order polynomial in SAT score. Applicants from high schools with approximated ELC thresholds between 3.96 and 4.00 are omitted. Statistical significance: † 10 percent, * 5 percent, ** 1 percent.

Source: UC Corporate Student System

Figure A-2: Estimated Difference-in-Difference Impact of 2011-2012 ELC Transition on URM Admissions and Enrollment



Note: Difference-in-Difference beta estimates of the impact of the 2011-2012 transition to the post-2012 ELC policy on URM applicants at Absorbing UC campuses, differenced across time and campus (compared to the Unimpacted UC campuses). Sample restricted to *URM* freshman California residents, and in the center and right panels are additionally differenced over whether they were in the top four percent of their high school class by ELC GPA. OLS regressions control for campus-by-high-school fixed effects and campus-by-SAT-score-by-GPA; standard errors are clustered by applicant. 2008 and 2009 indicators are omitted. Two of the three Absorbing UC campuses implemented holistic review in 2011, and the other implemented in 2012; there were no changes in holistic review policies at the Unimpacted campuses in this period (though two had previously implemented the policy). Full model R^2 in the bottom-left corner of each chart. Source: UC Corporate Student System