AFFIRMATIVE ACTION, MISMATCH, AND ECONOMIC MOBILITY AFTER CALIFORNIA'S PROPOSITION 209*

Zachary Bleemer †

June 2021

Abstract

Proposition 209 banned race-based affirmative action at California public universities in 1998. Using a difference-in-difference research design and a newly-constructed longitudinal database linking all 1994-2002 University of California applicants to their educational experiences and wages, I show that ending affirmative action caused underrepresented minority (URM) freshman applicants to cascade into lower-quality colleges. The "Mismatch Hypothesis" implies that this cascade would provide net educational benefits to URM applicants, but their degree attainment declined overall and in STEM fields, especially among less academically qualified applicants. URM applicants' average wages in their 20s and 30s subsequently declined, driven by declines among Hispanic applicants. These declines are not explained by URM students' performance or persistence in STEM course sequences, which were unchanged after Prop 209. Ending affirmative action also deterred thousands of qualified URM students from applying to any UC campus. Complementary regression discontinuity and institutional value-added analyses suggest that affirmative action's net educational and wage benefits for URM applicants exceed its net costs for on-the-margin white and Asian applicants.
JEL Codes: I24, J24, J31, H75

*Thanks especially to David Card, Rucker Johnson, and Jesse Rothstein, and also to Peter Arcidiacono, Esteban Aucejo, Henry Brady, Christina Brown, Jonathan Holmes, V. Joseph Hotz, Enrico Moretti, Jack Mountjoy, Martha Olney, Marianne Page, Nina Roussille, Emmanuel Saez, Zoë Steier, and Christopher Walters, as well as conference participants at the NBER Economic Mobility Study Group and the 2019 WEAI Annual Conference for helpful comments. Frankie Lin, Sakthi Ponnuswamy, Sowgandhi Rayapudi, and Akcan Balkir provided excellent research assistance, and thanks to Tongshan Chang and Chris Furgiuele for help in obtaining and understanding the data. Thanks as well to John Douglass, Margaret Heisel, and especially Charles Masten for help in understanding the 1990s policy setting. The author was employed by the University of California in a research capacity throughout the period in which this study was conducted, and acknowledges financial support from the National Academy of Education/Spencer Dissertation Fellowship, the Center for Studies in Higher Education, and the Stone Center on Wealth and Income Inequality. The conclusions of this research do not necessarily reflect the opinion or official position of the University of California, the California Employment Development Department, or the State of California. All appendix material referred to in the text can be found in the Online Appendix. Any errors that remain are my own.

†759 Evans Hall – Department of Economics, UC Berkeley – Berkeley, CA 94720. E-mail: bleemer@berkeley.edu. Phone: (484) 678-6160. 14,600 words.

"Those who deny that preferences are not [sic] being given or that the granting of such preferences is without negative consequences do a great disservice to the need for finding reasonable solutions. Equally so, those who believe that social and economic equality of opportunity can be achieved merely by the passage of ballot initiatives, however justified the need might be, are misguided. The "heavy-lifting" to achieve a society of genuine inclusion and equality of opportunity merely begins with the removal of race-based decision-making."

∼UC Regent Ward Connerly, in introducing SP-1 and SP-2

1 Introduction

Educational attainment, income, wealth, and economic mobility exhibit racial disparities in the United States. Access to selective universities is a key determinant of economic success and intergenerational mobility (Chetty et al., 2020a). As a result, many selective universities provide admissions advantages to applicants from disadvantaged racial and ethnic groups. Proponents of affirmative action argue that it offsets applicant qualification gaps that result from systemically unequal educational opportunities (Johnson, 2019). Detractors argue that affirmative action limits opportunity for Asian and white applicants and may have unintended consequences for targeted students. This study examines three questions at the basis of this disagreement. First, which students are targeted by affirmative action, and to what degree does affirmative action impact where those students go to college? Second, what are the short- and long-run effects of enrolling at a more-selective university because of affirmative action? Finally, how are the net benefits and costs of affirmative action distributed across Asian, Black, Hispanic, and white university applicants?

Prior scholarship has arrived at conflicting conclusions about the value of enrolling at a more-selective university because of access-oriented admissions policies like affirmative action. On the one hand, several recent studies have shown that applicants with test scores and grades at selective universities' minimum admissions thresholds are benefited by admission (e.g. Hoekstra, 2009; Zimmerman, 2014; Anelli, 2019). Studies of affirmative action, however, have uncovered mixed evidence on student outcomes (Arcidiacono and Lovenheim, 2016), with some finding support for the so-called "Mismatch Hypothesis": that the lower-testing applicants targeted by affirmative action would benefit from enrolling at **less**-selective universities, where they better "match" their peers' academic qualifications (Sowell, 1972).

This study combines longitudinal administrative data with a difference-in-difference research design to estimate the impact of affirmative action on students' college quality, course performance, choice of major, degree attainment, and wages over the subsequent 15 years. I construct a novel database of all 1994-2002 freshman applicants to the University of California (UC) system, which comprises all public research universities in the state, and individually link each applicant to nationwide university records and annual California wages. I then compare the outcomes of Black and Hispanic UC applicants with those of academically-comparable white and Asian applicants before and after California's Proposition 209, which ended affirmative action at UC in 1998. I also link the applicant data to institutional value-added statistics to measure Prop 209's effect on applicants' university quality; to California high school records to examine Prop 209's effect on UC application-sending; and to five UC campuses' student transcripts to estimate Prop 209's impact on performance and persistence in demanding courses. Finally, I employ a regression discontinuity design to identify the value of being admitted to a selective public university for the on-the-margin white and Asian students likely to obtain greater university access after Prop 209.

I begin by documenting Prop 209's impact on admissions at UC's eight undergraduate campuses. Prop 209 curbed the large admissions advantages – some over 50 percentage points – provided by affirmative action to underrepresented minority (URM) UC applicants. As a result, UC's URM applicants cascaded into less-selective colleges and universities: those with a high "UC Academic Index" (AI, a weighted average of high school grades and test scores) tended to flow from more-selective UC campuses to less-selective campuses and private universities, while those with lower AIs mostly flowed to less-selective public colleges and universities. Overall, Prop 209 resulted in a net outflow of lower-income students from highly-selective public universities.

How did less-selective enrollment affect URM UC applicants? I estimate the average effect of Prop 209 using a difference-in-difference design estimated over the population of UC applicants. Each model estimates how URM applicant outcomes change after 1997 (the final year of affirmative action) relative to changes among non-URM applicants, with the second difference absorbing ethnicity-neutral enrollment trends in the 1990s.[1] High school fixed effects and AI covariates absorb spurious variation and observable selection bias into UC application. I also estimate effect heterogeneity by URM AI quartile and by URM ethnicity.

Implementing this model, I show that Prop 209 led URM UC applicants to enroll at relatively lower-quality colleges and universities on average, measured both by traditional metrics like graduation rate and by institutional value-added. In contrast with the predictions of the Mismatch Hypothesis, URM UC applicants' average educational outcomes deteriorated after Prop 209: Bachelor's degree attainment declined by 4.3 percentage points among URM applicants in the bottom AI quartile, and overall STEM and graduate degree attainment declined by 1.0 and 1.3 percentage points, respectively. Following these applicants into the labor market, I find that Prop 209 caused URM UC applicants to earn 5 percent lower average annual wages between ages 24 and 34, with larger proportional effects for lower-AI applicants. The observed wage effects are driven by Hispanic applicants; despite parallel enrollment and degree attainment outcomes, I find no evidence of average wage deterioration among Black UC applicants after Prop 209.

These estimated effects are averaged across every URM UC applicant, many of whose enrollments were likely unchanged by the affirmative action ban. This implies that treatment effects for directly-impacted applicants were likely much larger. Given the magnitude of UC's applicant pool, these estimates imply that Prop 209 caused an aggregate decline in the number of URM Californians in their early 30s with 2014 wages over $100,000 by at least 3 percent. American Community Survey data confirm a 2010s pattern of relative wage deterioration among high-earning early-career URM Californians.

The primary threat to this baseline research design is the possibility of sample selection bias arising from differential selection into UC application after Prop 209. Estimating a difference-in-difference model of the proportion of California public high school students who applied to UC by ethnicity and AI bin, I find that

[1] Non-URM applicants may not represent a traditional unimpacted comparison group, since some likely "crowded into" more-selective universities after Prop 209. I return to the question of non-URM applicant outcomes in Section 6, but the fact that non-URM applicants outnumber URM applicants by more than four-to-one in the applicant pool dilutes any "crowd-in" effects, implying that at least 80 percent of the observed differences are likely driven by changes in URM applicant outcomes.

UC annually received about 250 fewer Black and 900 fewer Hispanic applications after Prop 209, almost 80 percent of whom would likely have been admitted to at least one UC campus. While application deterrence could generate bias, I find that the baseline estimates are insensitive to a school-ethnicity-AI control function (following Card and Rothstein, 2007) and other highly-detailed socioeconomic and academic covariates.

The baseline research design does not separately identify the impact of Prop 209 on non-URM applicants' outcomes. Instead, I exploit a large discontinuity non-URM admissions at UC Berkeley before Prop 209 to study the return to selective university access for on-the-margin non-URM applicants, many of whom may have been admitted if not for affirmative action. Employing a regression discontinuity design, I find that students just below Berkeley's admissions threshold nevertheless ended up with similar educational and labor market outcomes after enrolling at other universities, though the confidence intervals cannot rule out positive treatment effects. This suggests that the value of selective public university access for on-the-margin non-URM students was small.

Next, I turn to mechanisms explaining URM UC applicants' deteriorated educational outcomes after Prop 209. Several prior studies have suggested that URM students' STEM course performance and persistence would improve absent affirmative action, which likely would have led to the opposite of Prop 209's effect on STEM degree completion (Loury and Garman, 1993; Holzer and Neumark, 2000; Arcidiacono et al., 2016). However, while URM UC students earned lower grades and were less likely to persist along introductory STEM course sequences than their non-URM peers before Prop 209, these gaps are largely explained by students' prior academic opportunities and preparation, not their enrollment institution.[2] Prop 209 has no observable effect on students' STEM course performance and persistence, which do not appear to contribute to the effects of Prop 209 on students' educational and wage outcomes.

I conclude with a discussion of the efficiency of affirmative action. Two sets of evidence favor its allocative efficiency, which in this case requires (to a first-order approximation) that the benefit of more-selective

[2]This study's examination of STEM course performance contributes to a literature interested in the production and composition of STEM graduates (e.g. Ehrenberg, 2010; Sjoquist and Winters, 2015; Denning and Turley, 2017). This study estimates how student outcomes in specific STEM courses change under different policy regimes.

university enrollment is greater for affirmative action's URM enrollees than for the non-URM students who would have enrolled in their place. First, the estimated return to UC Berkeley and UC Davis admission for on-the-margin non-URM students appears small, while URM applicants' estimated wage return to more-selective enrollment before Prop 209 is large.[3] Second, that latter return exceeds the average observed change in institutional value-added experienced by URM UC applicants, suggesting that the URM applicants impacted by Prop 209 had received above-average returns to more-selective university enrollment (as in Dale and Krueger, 2014; Bleemer, 2021). These evidence suggest that affirmative action both promotes socioeconomic mobility among URM youths and improves higher education's allocative efficiency.

This study makes three main contributions. First, while previous studies have analyzed the intermediate effects of universities' affirmative action policies – sometimes coming to conflicting conclusions – they share common limitations. Several studies have exploited cross-state policy variation to estimate the educational impact of banning affirmative action, but out-of-state enrollment confounds identification of the policies' effects on impacted students (Backes, 2012; Hinrichs, 2012). Others estimate models of applicant and university behavior to predict how affirmative action **could** impact student enrollment and outcomes, but do not validate these predictions using actual policy variation (Arcidiacono, 2005; Arcidiacono et al., 2016; Kapor, 2020). A third set of studies have analyzed administrative university data from before and after Prop 209, but limits on available covariates and outcomes have challenged attempts to separately identify the effect of affirmative action from compositional changes among UC's applicants and students (Arcidiacono et al., 2014).[4] This study augments previous research by implementing a quasi-experimental research design spanning all U.S. universities that identifies the individual-level effects of affirmative action, and by analyzing new intermediate outcomes like university "value-added," STEM performance and persistence, and graduate degree completion.

Second, this study causally links university quality to wage outcomes in the context of affirmative action,

[3]Black, Denning and Rothstein (2020) also provide evidence against large returns to more-selective university enrollment for the students who were "crowded out" of selective Texas universities by Texas Top Ten. However, Zimmerman (2019) shows that the largest returns to elite Chilean university enrollment accrue only to high-income students.

[4]Bagde, Epple and Taylor (2016) and Bertrand, Hanna and Mullainathan (2010) show that Indian universities' caste-based affirmative action improves targeted students' grades and wage outcomes, respectively.

bridging the affirmative action literature with a literature identifying heterogeneity in the return to higher education (Dale and Krueger, 2002; Arcidiacono, 2004). Much of the affirmative action literature has focused on measuring mismatch (Arcidiacono and Lovenheim, 2016), but my findings are inconsistent with the Mismatch Hypothesis at the mean.[5] On the other hand, while most studies of heterogeneous university returns focus on a relatively high-testing local margin (e.g. Hoekstra, 2009; Anelli, 2019), I estimate average returns to university quality across all URM UC applicants after an affirmative action ban. I also present regression discontinuity evidence highlighting the importance of applicants' counterfactual enrollments and heterogeneity in estimating the return to selective university enrollment.

Finally, I provide direct evidence that affirmative action has first-order implications for intergenerational mobility and socioeconomic gaps by ethnicity. A growing literature examines the mechanisms explaining opportunity gaps for lower-income and URM youths and the efficacy of available policies to narrow those gaps (e.g. Jackson, Johnson and Persico, 2016; Chetty, Hendren and Katz, 2016). I find little evidence that affirmative action narrows the Black-white mobility gap, which has received particular attention (Dobbie and Fryer Jr, 2011; Billings, Deming and Rockoff, 2014; Chetty, Hendren, Jones and Porter, 2020b; Derenoncourt and Montialoux, 2021), but find that it improved Black students' educational attainment and relatively increased (mostly lower-income) Hispanic youths' wages.

2 Background and Data

2.1 University of California Admissions in the 1990s

The University of California system is tasked by the 1960 Master Plan for Higher Education to educate roughly the top 12.5 percent of California public high school graduates. The system enrolled 137,000 undergraduates at eight campuses in 1999, with the campuses ranging in selectivity from the highly-selective

[5] Two recent studies of affirmative action mismatch also analyze the University of California in the 1990s (Arcidiacono et al., 2014, 2016). Bleemer (2020) discusses the limitations of that previous research and the arguments of Sander and Taylor (2012) in the specific context of Prop 209 and reconciles their analysis with my baseline findings. Dillon and Smith (2020) and Barrow et al. (2020) find evidence of test- and income-based 'mismatch' at US undergraduate institutions and elite high schools, respectively.

Berkeley and Los Angeles (UCLA) campuses (which admitted 35 percent of applicants with an average SAT score 1.5 sd above mean) to the less-selective Santa Cruz and Riverside campuses (with an 85 percent admission rate and SAT scores 0.5 sd above mean). Ranking campuses by their admissions rates in the period, I refer to the Berkeley, UCLA, and San Diego campuses as 'more selective', the Santa Barbara, Irvine, and Davis campuses as 'selective', and the Santa Cruz and Riverside campuses as 'less selective'. In 1999, California also had a 22-campus system of teaching-oriented universities – the California State University (CSU) system – and 114 two-year community colleges.

Affirmative action began at UC in 1964, the first year that the number of eligible applicants to UC Berkeley exceeded the number of available seats, and is now practiced by public universities in at least half of states (see Appendix A). The policy augmented UC's standard admissions protocol, which required that at least 50 percent of students be admitted solely based on their "Academic Index" (AI), a linear combination of high school GPA and SAT scores.[6] For example, archival documents from UC Berkeley (Figure A-3) show that it guaranteed admission to all applicants above an AI threshold (e.g. 7,150), but set a lower threshold (6,500) for African-American, American Indian, Chicano, and Latino "underrepresented minority" (URM) applicants. Applications with AIs below their respective threshold were "read" by admissions personnel, giving them a variable likelihood of admission, while those with AIs below a second threshold (7,000 for non-URM applicants, below 6,000 for URM applicants) were mostly mechanically rejected.

Figure I summarizes the relative admissions likelihood of normal URM and non-URM applicants to each campus by AI in two-year increments from 1994 to 2001.[7] At the most-selective Berkeley campus, for example, 1994-1995 URM applicants with AIs between 6,000 to 7,100 were 80 percentage points more likely to be admitted than same-AI non-URM applicants. The admissions advantage declines to zero above $AI =$ 7,400 because all such applicants were admitted. Seven of the eight UC campuses provided admissions

[6] In particular, $AI = min(HSGPA, 4) \times 1,000 + SATI + SATIIs$. The index included both SAT I components (math and verbal) and three SAT II scores: writing, math, and a third of the student's choosing. All SAT components were scored out of 800, so the maximum AI was 8,000. Some campuses employed variants of this formula.

[7] 'Normal' applicants exclude applicants without UC's minimum academic credentials and applicants to restricted programs like some engineering majors. Appendix B presents annual admissions likelihoods by AI at each campus for 'normal' applicants.

advantages to URM applicants under affirmative action, with the advantage shifting to higher-AI applicants over time as the campuses became more selective. UC Riverside admitted all ‘normal’ UC applicants. The figure’s superscripts show the empirical integrals under each curve by the contemporaneous AI distribution of each campus’s URM applicants, estimating the excess number of annual URM admissions relative to simulated URM admissions under the non-URM AI admissions rule. Many campuses admitted hundreds of URM applicants annually by affirmative action.

Increasing political controversy around affirmative action culminated in the mid-1990s, when the policy was prohibited first by the UC Regents in July 1995 and then by a voter referendum in November 1996. While the original Regents policy (SP-1) was rescinded in 2001, Prop 209 has prohibited UC and other public California institutions 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” since the Fall 1998 admission cohort.[8] Figure I shows that most campuses continued providing large admissions advantages to URM applicants in 1996 and 1997 (though some programs were curtailed), but those advantages shrank considerably in 1998.[9]

Starting in 1998, UC implemented outreach programs to increase enrollment from majority-URM high schools, but those programs wound down after 2001 with little evidence of success (Atkinson and Pelfrey, 2004; UCOP, 2003). Instead, UC’s primary policy response to the end of affirmative action was its Eligibility in the Local Context top percent policy, which did not begin until 2001 (Bleemer, 2021).

2.2 Data

This study analyzes the effects of Prop 209 using four primary data sources. The first, collected contemporaneously for administrative use by the UC Office of the President, covers all 1994-2002 California-resident

[8]Prop 209 also prohibited racial preferences in UC outreach and financial aid as well as affirmative action at the less-selective California State University system. Prop 209 banned racial preferences in state hiring (Marion, 2009) and graduate school admissions, though college-bound high school graduates shortly before and after 1998 all entered the labor market after 1998.

[9]Figures A-4 and A-5 show that some UC campuses saw relative declines in URM admissions and enrollment in 1996, particularly at UCLA and the less-selective UCs, but every UC campus saw sharp immediate declines in URM admission in 1998. The more selective UC campuses also saw sharp 1998 declines in URM enrollment.

freshman applicants to any University of California campus.[10] Each record contains an applicant's high school, gender, ethnicity, parental education, parental occupations, and family income.[11] Academic preparation measures include SAT and ACT standardized test scores by component, SAT II scores, high school grade point averages, and the number of 12th-grade honors courses.[12] Application, admission, and enrollment indicators are available for each UC campus, as are degree attainment and major choice for UC enrollees.

The second dataset, an extract from the National Student Clearinghouse's (NSC) StudentTracker database, contains enrollment and graduation records – covering nearly all U.S. two- and four-year colleges and universities – for all students in the UC application dataset, linked by full name and birth date. Science, Technology, Engineering, and Mathematics (STEM) majors are categorized by CIP code following the US Department of Homeland Security (2016).[13] I define Bachelor's (graduate) attainment as being within 6 (18) years of UC application. NSC data are available starting with the 1995 applicant cohort. The data appendix (D) provides additional details.

Third, I observe UC applicants' quarterly 2000-2017 wages from the California Employment Development Department, linked by SSN.[14] Wages are unavailable for workers not covered by California unemployment insurance, including out-of-state, federal, and self-employed workers. Annual wages are measured as the sum of quarterly wages, CPI-adjusted to 2018, and winsorized at the top and bottom one percent. About 69 percent of UC applicants have positive covered wages in each of 6-16 years after UC application.

[10] About one-third of UC students transfer from community colleges rather than enrolling as freshmen. Because affirmative action was likely less impactful for those applicants and because of limited data availability about those students' academic background (prohibiting selection correction on observables), transfer applicants are not directly analyzed in the present study, though freshman applicants may enroll at a community college and transfer to UC later.

[11] Parental education is observed as an index of maximum parental education for up to two parents, from 1 (no high school) to 7 (graduate degree). Parental occupations are observed as one of 17 occupation codes each for two parents (or 289 total codes), including codes like 'Clerical', 'Laborer', and 'Professional' as well as 'Homemaker', 'Retired', 'Other', or 'Deceased'. Family income is not reported by about 15 percent of applicants.

[12] Throughout the study period, each UC applicant was required to submit an SAT score and SAT II scores in writing, mathematics (1 or 2), and a third field of their choosing. Only 0.9 percent of applicants submitted ACT instead of SAT scores.

[13] See Tables A-1 and A-2 for the most common STEM and non-STEM majors in the data. This definition generally aligns with that used by Arcidiacono et al. (2016). Not all NSC majors have CIP codes; I assign each major to its modal CIP code (in the full observed NSC database) for categorization.

[14] Social security numbers on UC applications are not verified unless the student enrolls at a UC campus. Among enrollees, the verified social security number differs from that reported on their application in fewer than 0.25 percent of cases. All statistics estimated using EDD data were originally published as institutional research (Bleemer, 2019b).

The fourth dataset includes comprehensive student transcripts – including course enrollments and grades – for five UC campuses: Berkeley, Davis, Santa Barbara, Santa Cruz, and Riverside. The transcripts were obtained from campus Offices of the Registrar and are linked by name and birth date (Bleemer, 2018).

Additional educational administrative data come from several sources. Universities' admissions rate, average SAT scores, and six-year graduation rates from IPEDS are linked to NSC institutions.[15] Aggregated data from the California Department of Education provide the annual number of graduates from each public high school by gender and ethnicity. Finally, a comprehensive College Board SAT-taker database covering public California high school students is linked by name and birth date to the UC applicant pool.

2.3 University of California Descriptive Statistics

Table I provides descriptive statistics of UC applications, admissions, and enrollment for California-resident freshman applicants in three two-year cohorts: '94-95, who applied before Prop 209's passage; '96-97, who applied after the ban was approved but before its mandatory implementation; and '98-99, following the ban. The presented statistics indicate a university system steadily increasing in reputation and selectivity throughout the 1990s, with increases in non-URM applications of 25 percent overall and 42 percent at the more-selective campuses. Admissions rates consistently fell at all but the least-selective Riverside campus, but increasing yield rates – the percent of admitted students who enrolled – stemmed the decline in the proportion of applicants who enrolled at each campus. The average SAT scores of most campuses' applicants also rose steadily, as did the average scores of students admitted to each campus.

Almost 20 percent of UC applicants were URM in 1997, and URM applicants' average SAT scores rose through the period, potentially reflecting deterrence among lower-testing URM students. Table A-4 presents separate descriptive statistics by URM ethnicity, showing that about 20 percent of URM UC applicants were Black and nearly all of the rest Hispanic. Most campuses' URM admissions rates fell slightly in 1996 but then

[15] Average SAT scores are measured as the sum of the mean of universities' 25th and 75th Math and Verbal SAT percentiles. Admissions rates (and SAT scores) are fixed at 2006 (2000); graduation rates are contemporaneous. See https://nces.ed.gov/ipeds/.

sharply declined in 1998, matched by a sharp rise in URM admits' test scores. See Appendix C for additional details on URM UC admissions after Prop 209.

URM enrollment rates fell precipitously at UC's more-selective campuses, slightly declined at the selective campuses, and slightly increased at the less-selective campuses. The next section examines the URM 'cascade' from more- to less-selective universities after Prop 209 in greater detail.

2.4 UC Applicants' University Enrollment

Figure II shows how URM UC applicants' decreased likelihood of UC admission after Prop 209 affected their UC enrollment. Enrollment shares are shown for the full AI distribution of URM UC applicants for the two cohorts before and after Prop 209 and are smoothed across percentiles. Before Prop 209, about 30 percent of median-AI URM applicants enrolled at the three more-selective UC campuses, while only about 3 percent of similar-AI non-URM applicants did so. After Prop 209, this gap largely closed, and URM applicants across the entire AI distribution became less likely to enroll at more-selective UC campuses. Higher-AI URM applicants became more likely to enroll at the selective and less-selective campuses – likely as a result of their being rejected from the more-selective campuses – while lower-AI URM applicants' selective UC enrollment declined. Meanwhile, the increasing selectivity of UC campuses also led to decreased enrollment likelihoods of all but the highest-AI non-URM applicants.

Figure III broadly summarizes how Prop 209 reshaped UC applicants' enrollment across the public and private sectors of U.S. higher education. Each panel plots the percentage point difference in enrollment likelihood before and after Prop 209 for URM and non-URM UC applicants at each URM AI percentile. URM applicants' relative likelihood of enrollment at Berkeley and UCLA declined across the AI spectrum.[16] UC San Diego exhibits a pattern common to California's other public universities: URM enrollment increased relative to non-URM enrollment for higher-AI applicants (70-95th percentiles) and decreased for

[16] Figure A-6 shows that the URM students who exited Berkeley and UCLA following Prop 209 also came from much lower-income households than those who replaced them, generating a net enrollment shift at UC's more-selective campuses from students in the bottom three income quartiles (fixed in '96-97) to students in the top quartile.

those with somewhat-lower AIs (20-60th percentiles). The same pattern holds at lower AI bands for the selective and less-selective UC campuses: e.g. URM applicants at the 25th AI percentile became relatively less likely to enroll at the selective UC campuses but more likely to enroll at the less-selective campuses. The teaching-oriented CSU system and California community colleges also absorbed some low-AI URM applicants (relative to changes among non-URM applicants).[17] Some high-AI URM applicants were absorbed by the highly-selective Ivy+ universities, and middle-AI URM applicants became more likely to enroll at other private and out-of-state universities.

Overall, these patterns are consistent with a cascade of URM students from more- to less-selective institutions after Prop 209, with URM students from more-selective schools enrolling at less-selective universities where they replaced lower-AI URM students now rejected absent affirmative action.[18] This cascade explains why URM enrollment only declines at the more-selective UC campuses (see Table A-6).

Prop 209's broad impact on where URM UC applicants' go to college highlights the importance of analyzing California student outcomes across all U.S. institutions, since restricting to students at a smaller set of universities (like the UC system) will generate sample selection bias. The following section describes this study's baseline research design, which exploits longitudinal records for all California-resident UC applicants – following students wherever they enroll – to credibly estimate the effects of affirmative action on student outcomes.

3 Empirical Methodology

I estimate the impact of Prop 209 on URM UC applicants by comparing the change in URM applicant outcomes after Prop 209 to the change in outcomes of non-URM students with similar prior academic opportunity and preparation. Treating non-URM applicants as a comparison group differences out shifts in UC campuses'

[17]The increase in community college enrollment and decrease in the number of students with no observed enrollment in NSC likely reflects community colleges' entry into NSC reporting; see Appendix D.

[18]Figure A-7 shows that this cascade pattern is not reflected in applicants' UC application portfolios, implying that the observed patterns result from admissions rather than application decisions.

reputation and selectivity that shaped all UC applicant outcomes. However, non-URM UC applicants are not a traditional 'control' group; Prop 209 likely increased some non-URM students' admissions likelihoods at some UC campuses so that those campuses could preserve their net enrollment despite the absence of affirmative action.[19] As a result, the estimates presented below identify the impact of Prop 209 on URM outcomes relative to its impact on non-URM outcomes. There are about four times as many non-URM UC applicants as URM applicants, so if UC campuses' net enrollment did not respond to Prop 209, every 1 percentage point average decrease in URM applicants' enrollment likelihood corresponds to almost a 0.25 percentage point average **increase** in non-URM applicants' enrollment likelihood.[20] If universities' treatment effects for on-the-margin URM and non-URM students are similar, this implies that as much as 20 percent of the estimates described below could be explained by improved outcomes among non-URM students. I return to this argument in Section 6, presenting evidence that the benefits of Prop 209 to non-URM students likely explain a smaller share of the presented estimates.

To implement the proposed research design, I estimate difference-in-difference models of the form:

$$Y_{iy} = \alpha_{h_i} + \delta_y + \beta_0 URM_i + \sum_{t=1994}^{2002} \mathbb{1}_{\{t=y\}} \beta_y URM_i + \gamma X_{iy} + \epsilon_{iy} \tag{1}$$

where Y_{iy} is an outcome for California-resident freshman applicant i after they applied to UC in year y. I present results from two model specifications, both estimated by OLS. First, I restrict the sample to 1994-2002 applicants and set β_{1997} to 0, estimating the difference between URM and non-URM applicants' outcomes in the years before and after Prop 209. The β_{1996} coefficient can be interpreted as a placebo test that observed post-1998 effects are driven by Prop 209, while the β_{1994} and β_{1995} coefficients could possibly reflect changes in applicant outcomes as a result of SP-1 and Prop 209's passage (which led some UC campuses to begin

[19]Figure III shows that there is no 'control' group of URM UC applicants; Prop 209 shifted URM UC applicants' college enrollment at every AI, even among the highest-AI URM applicants. It also shows that the impacted non-URM students tend to have higher AI than the URM students exiting those universities, suggesting that if the baseline results below reflected non-URM outcomes they would be driven by high-AI applicants. In fact, most of the estimated effects are driven by low-AI applicants.

[20]Figure A-2 shows that annual growth in net California university enrollment appears unchanged by Prop 209, nor did Prop 209 observably impact the overall weighted-average institutional quality of that enrollment, with gains among non-URM students offsetting declines among URM students.

phasing out affirmative action in 1996). To estimate the effect of Prop 209 more concisely, I also estimate a specification further restricting the sample to 1996-1999 applicants and estimating a single $\beta_{'98-99}$ term, averaging outcomes two years after 1998 relative to the two years prior. No UC campus implemented any other known changes in their admissions processes in this period.

Each model includes high school fixed effects α_{h_i}, which absorb spurious cross-school application and outcome variation, and the components used to construct UC's Academic Index (X_{iy}), which absorb variation in applicants' observed academic preparation.[21] Standard errors are robust.

I also estimate three model variants to better understand Prop 209's effects on student outcomes. First, I separately estimate the model by '96-97 URM AI quartile to observe heterogeneous treatment effects for students with different prior academic opportunities and preparation. Second, because some UC campuses began phasing out affirmative action in 1996, I replace the model's 1996-1997 pre-period with 1994-1995 and re-estimate post-1998 outcomes relative to those earlier years. Finally, I interact β_0 and β_y with indicators for whether the student is Black or Hispanic (omitting Native American students because of sample size), identifying separate coefficients to estimate heterogeneity in Prop 209's impact by URM ethnicity.

It remains possible that the β_y estimates reflect sample selection bias resulting from the impact of Prop 209 on the composition of UC applicants, since a non-random selection of URM applicants may have been discouraged from UC application by their decreased likelihood of admission. I quantify the degree of Prop 209's URM application deterrence and test the model's sensitivity to alternative specifications in Section 5.

4 The Impact of Affirmative Action on Student Outcomes

Figure IV visualizes the impact of Prop 209 on URM UC applicants with estimates of β_y from Equation 1 for a sequence of enrollment, educational attainment, and labor market outcomes, all estimated relative to

[21] That is, X_{iy} includes Verbal and Math SAT scores, high school GPA, SAT II Writing score, SAT II Math score (and an indicator for submitting a Math 2 SAT II score), and a third SAT II score (along with indicators for which score was submitted). 15 percent of the sample is missing at least one test score (mostly the third SAT II); dummies are included for each missing value. I test models' sensitivity to covariate inclusion in Section 5.

1997. The subsections below discuss each of the measured outcomes in turn. Given that many URM applicants' undergraduate enrollment remained unchanged by Prop 209, the presented reduced-form coefficients likely underestimate impacted students' treatment effect of enrolling at less-selective universities after the affirmative action ban.

4.1 Institutional Quality

Prop 209 caused URM UC applicants to be 7.6 percentage points less likely to enroll at the more-selective UC campuses – particularly driven by the second and third URM AI quartiles – and led to small corresponding enrollment increases across the spectrum of other public and private higher education institutions.[22] Prop 209 led to larger relative enrollment declines at the more-selective UC campuses for Black applicants, with the top AI quartile of Black applicants facing a 15 percentage point enrollment decline (see Table A-8).

I summarize these changes in university enrollment quality by characterizing each institution in two ways: (1) using traditional measures of university quality like selectivity and graduation rate, and (2) using a set of novel "value-added" (VA) statistics, which estimate each institution's average treatment effects on their students' degree attainment and average wages between ages 30 and 34. I estimate the value-added statistics using fixed effect OLS regression over the 1995-1997 sample of UC applicants matched to their first enrollment institution, absorbing observable selection across institutions using either students' UC application and admission portfolios (following Mountjoy and Hickman (2020); "MH") or ethnicity indicators and fifth-order polynomials in SAT score and family income (following Chetty et al. (2020a); "CFSTY").[23] Appendix I provides methodological details and the estimated value-added statistics.

Table II presents difference-in-difference estimates of how Prop 209 impacted URM UC applicants' qual-

[22] See Table A-7. The empirical integral of URM students' changed enrollment at each UC campus by AI between '95 and '98-99 – over the '98-99 distribution of URM UC applicants – provides a lower-bar estimate for the number of URM students who enter and exit each campus as a result of Prop 209. Table A-9 shows that at least 1,200 URM applicants exited UC campuses – with more than 800 exiting Berkeley and UCLA – and 800 entered UC campuses after Prop 209.

[23] I do not shrink the value-added statistics, and both sets of covariates likely fail to fully absorb selection bias across universities. Given students' positive selection across institutional value-added and that most URM students enroll at lower-VA institutions following Prop 209, both of these factors likely lead toward over-estimation of the VA decline following Prop 209.

ity of enrollment institution. The first row shows that prior to Prop 209, URM students tended to enroll at higher-quality institutions – as measured by lower admissions rates, higher average SAT scores and graduation rates, and higher estimated "value-added" – than academically-comparable non-URM UC applicants. The second row shows that Prop 209 caused URM UC applicants to enroll at less-selective universities with lower average SAT scores and graduation rates after 1998, with larger observed institutional declines among lower-AI applicants. Those institutions are also estimated to have lower average "value-added": Prop 209 caused URM UC applicants to enroll at institutions that (on average) lead their students to lower likelihoods of Bachelor's degree attainment by 0.5-0.9 percentage points and whose graduates earn $400-$900 lower annual early-30s wages, with smaller value-added declines among high-AI URM applicants. The first panel of Figure IV shows that the institutions where URM UC applicants enrolled remained relatively steady in terms of their "CFSTY" early-30s annual wage value-added between 1995 and 1997, but sharply and persistently declined by almost $1,000 after 1998. In summary, Prop 209 caused URM UC applicants to enroll at lower-quality colleges and universities.

4.2 Degree Attainment

Next I turn to Prop 209's effects on URM UC applicants' educational outcomes: whether they earned a Bachelor's degree, an undergraduate STEM degree, and/or a graduate degree.[24] Given that Prop 209 caused the average URM UC applicant to enroll at a lower-quality university more similar to their academically-comparable non-URM peers' institutions, the Mismatch Hypothesis entails that URM applicants' outcomes will improve after Prop 209. Figure IV presents estimates from Equation 1 for six-year BA attainment among bottom-AI-quartile applicants, unconditional STEM degree attainment, and graduate degree attainment, instead showing that all three abruptly and persistently decline in 1998 following Prop 209.

Table III provides additional details on the impact of Prop 209 on URM UC applicants' degree attainment.

[24] I define undergraduate degree attainment using the union of UC and NSC data to augment imperfect NSC records from UC Santa Cruz; see Appendix D. This may upwardly bias the resulting estimates, since URM students are less likely to enroll at UC campuses following Prop 209. Estimates for each separate data source are presented in Table A-12; estimates are somewhat more-negative in NSC data and less-negative in UC data among UC enrollees.

The first two columns show that URM UC applicants were already less likely to earn Bachelor's degrees than academically-comparable non-URM applicants before Prop 209, and if anything became even less likely to earn degrees after affirmative action was eliminated, with a 95-percent confidence interval of -1.69 to 0.27 percentage point change in average six-year degree attainment.[25] This effect is wholly driven by the bottom AI quartile of URM applicants, whose enrollment was shown above to largely flow from the more-selective and selective UC campuses to less-selective public and private California universities.[26]

The third and fourth columns of Table III show that URM applicants may have become less likely to earn STEM degrees conditional on earning a college degree (95-percent c.i. -1.65 to 0.35 percentage points).[27] In combination with the decline in overall degree attainment, this provides strong evidence for Prop 209 causing a decline in **unconditional** STEM degree attainment by 1.0 percentage point (s.e. 0.4). Table A-13 presents major-specific estimates of changes in URM UC applicants' fields of study; the fields with largest increases after 1998 are biology (0.62 percentage points) and miscellaneous humanities fields (0.30), while those with the largest decreases are economics (-0.39), history (-0.32), and mathematics (-0.29), suggesting substantial heterogeneity between and within disciplines.

The last three columns of Table III show the relative impact of Prop 209 on URM students' likelihood of earning a graduate degree. Graduate degrees tend to offer large labor market returns (Altonji, Arcidiacono and Maurel, 2016; Altonji and Zhong, 2021) and may represent an important benefit to more-selective university enrollment. URM applicants became 1.3 percentage points (s.e. 0.5) less likely to earn graduate degrees after Prop 209 relative to academically-comparable non-URM applicants, with particularly-large declines among lower-AI applicants. Almost half of this decline can be explained by a decline in STEM-oriented masters

[25]These estimates contrast with Arcidiacono et al. (2014), whose Table 3 suggests that Prop 209 increased URM UC graduation rates. Bleemer (2020) shows that those findings reflect selection bias on unobserved applicant characteristics: replacing the highly-censored SAT score and high school GPA covariates available in their data with continuous measures of the same metrics fully attenuates the observed effect.

[26]Applicants' changed degree attainment is less than half of the change in the six-year graduation rates of the institutions where they enroll, a lower ratio than those estimated by Cohodes and Goodman (2014) and Bleemer (2021) in other contexts. This suggests that the degree attainment of students targeted by affirmative action was relatively less sensitive to enrollment change. The bottom AI quartile had an estimated ratio closer to 1 (as in those other studies).

[27]This finding contrasts with a number of previous studies that show that increased university selectivity tends to decrease students' likelihood of earning STEM degrees along different margins (Arcidiacono et al., 2016; Mountjoy and Hickman, 2020; Bleemer, 2021). I further analyze Prop 209's effect on UC enrollees' performance and persistence in STEM courses in Section 7.

and doctoral degrees, for which attainment declines 0.58 percentage points (s.e. 0.21). There is only weak evidence of a decline in law degree attainment, and no such evidence for medical degrees.

4.3 Employment and Wages

Finally, I turn to the effect of Prop 209 on URM UC applicants' labor market outcomes. Figure V shows estimates of $\beta_{'98-99}$ annually estimated for each specified outcome six to sixteen years after UC application (when most applicants were age 34). The first panel shows that Prop 209 had no net effect on URM UC applicants' California labor market participation; 69 percent of applicants earned covered California wages annually before and after Prop 209.[28] Among wage-earning UC applicants, however, Prop 209 caused URM workers' wages to persistently decline by an average of \$1,800 (0.05 log points), or \$2,400 (0.04 log points) in their early 30s. As late as age 34, there is no evidence that the average wages of URM applicants impacted by Prop 209 recover to their earlier levels. Table A-14 shows that these wage declines are proportionally larger for lower-AI URM applicants, who also faced the greatest educational deterioration.

The last two panels of Figure IV present the dynamics of URM UC applicants' wages in the years before and after Prop 209. Panel (e) shows estimated β_y coefficients for the average of observed log wages 6-16 years after UC application. URM applicants' wages sharply decline between 1997 and 1998, reflecting the impact of Prop 209, but there is also evidence of a persistent relative trend of declining URM UC applicants' wages throughout the period. This trend is likely the result of ethnicity-specific wage dynamics in the California labor market, with URM workers' wage distribution potentially declining relative to the non-URM distribution as a result of rising inequality in the state (Juhn, Murphy and Pierce, 1991).

Following the insight of that study, I account for these wage dynamics by replacing applicants' wages with their percentile in the contemporaneous ACS wage distribution of same-ethnicity college-educated California workers born between 1974 and 1978, most of whom were already in college prior to Prop 209's 1998 imple-

[28] Figure A-9 shows that California labor market participation is unchanged after Prop 209 for all four AI quartiles of URM applicants. Prop 209 could have either increased or decreased URM applicants' likelihood of covered California employment: less-selective university enrollment likely decreases applicants' likelihood of seeking employment outside the state (since the credential is more geographically-specific), but increased out-of-state enrollment might have led to out-of-state employment.

mentation. Panel (f) shows that the resulting percentiles are unchanging in the periods either before or after Prop 209, successfully removing the time trend, with an approximately 1 percentage point decline observed between 1997 and 1998 caused by Prop 209. On average, a one percentile change in the 2001-2017 URM wage distributions corresponds to \$1,940, closely matching the estimated decline in URM UC applicants' wages after Prop 209 shown in Table IV and suggesting that the baseline wage estimates reliably capture the effect of Prop 209.

I examine the wage estimates' sensitivity to alternative parallel trends assumptions using the method of Rambachan and Roth (2020), who provide robust confidence intervals for difference-in-difference statistics in the presence of bounded group-specific trends. Figure A-10 shows that the wage estimates presented in Panel (e) of Figure IV are sensitive to alternative assumptions, but that the wage percentile estimates in Panel (f) are robust to the assumption of annual differential trends of up to almost 0.15 percentiles per year. I also find that the pre-trend persists if the ACS wage distribution is fixed in a given year, implying that ethnicity-specific wage dynamics, not the form of the percentile transformation, explain the resulting parallel trends (Figure A-11).

Table IV summarizes the changes in URM UC applicants' wages following Prop 209, showing that academically-comparable URM and non-URM workers earned similar wages before Prop 209 but diverged afterwards. The second panel shows striking evidence of heterogeneity across URM students: while the wages of Hispanic students sharply declined following Prop 209 relative to academically-comparable non-URM applicants, there is little such evidence for Black applicants (though their smaller sample size results in larger standard errors).[29] This widens a previously-existing gap between the two groups, with Black applicants already earning lower average wages than academically-comparable Hispanic students (who also earn somewhat higher wages than academically-comparable non-URM applicants). Figure VI contextualizes this finding: while Black UC applicants faced similar or larger declines in university quality and educational out-

[29]Estimating independent effects of Prop 209 on Black and Hispanic outcomes (e.g. dropping non-Black URM applicants to estimate the effect on Black applicants) does not change the presented results.

comes than Hispanic UC applicants after Prop 209, and Hispanic UC applicants' wage outcomes deteriorated after 1998, there was no observable parallel decline among Black UC applicants. This suggests that while UC's affirmative action provided long-run wage returns to Hispanic students, its average labor market benefits to Black Californians may have been small, though this finding is tempered by Black applicants' wider confidence intervals and the unavailability of a Black-specific ACS wage distribution (due to small sample size).

While Prop 209 caused a small number of mostly-Black URM UC applicants to enroll at out-of-state Ivy+ institutions, the impact of their exit from California on the presented wage statistics can be narrowly bounded. Consider, for example, the number of years in which URM applicants earn at least \$100,000 in the 6-16 years after UC application. Observationally, URM Ivy+ enrollees are about 15 percentage points less likely than other top-AI-quartile applicants to work in California annually, and almost one-third of URM Ivy+ enrollees who work in California earn over \$100,000 between 6 and 16 years after UC application. Given the 0.5 (1.0) percentage point increase in Ivy+ enrollment among URM (Black) UC applicants after Prop 209, this implies an expected decline in the number of years earning over \$100,000 of about 0.003 (0.005), small changes relative to the 0.08 fewer high-earning years among URM applicants and the 0.11 year gap between the estimated effects of Prop 209 on Black and Hispanic applicants reported in Table IV.

4.3.1 Contextualizing Prop 209's Labor Market Impact

While UC does not educate enough of the California workforce for its admissions policies to shift most moments of the state's aggregate wage distribution, the high wages earned by its graduates imply that its policies may meaningfully impact the composition of California's high-earning workers. About 56,000 URM students applied to UC between 1998 and 2002. Compared to a 1996-1997 baseline, the difference-in-difference estimates imply that Prop 209 caused each of those applicants to become about 1.3 percentage points less likely to earn at least \$100,000 per year in California in 2014, 12 to 16 years after college application, though some of that decline may reflect secular ethnicity-specific wage dynamics in California.[30] This implies a decline in the number of high-earning URM Californians by over 700. American Community Survey estimates show that there were 27,000 URM Californians earning over \$100,000 in 2014, implying that Prop 209 caused a decline in the number of such workers among UC applicants by about 3 percent.[31] Given that 30-to-34 URM workers made up 46 percent of the 2010 California workforce but only 14 percent of earners over \$100,000, this implies that affirmative action had been meaningfully mitigating inequality until Prop 209.

Figure A-13 shows that the fraction of early- and mid-30s URM Californians earning wages above \$100,000 indeed disproportionately declined in the years that those cohorts would have lost selective university access as a result of Prop 209.[32] For example, relative to a 2010 baseline, URM Californians between ages 33 and 37 became about 10 percent less likely to earn over \$100,000 between 2012 (when they all would have enrolled at university before Prop 209) and 2017 (when they all would have enrolled after Prop 209). Members of several comparison groups – including slightly older URM Californians, similar-aged URM non-Californians, and similar-aged non-URM Californians – all became slightly **more** likely to earn over \$100,000 over the period. This suggests that the baseline estimates' focus on UC applicants may yield an underestimate of the aggregate labor market effect of Prop 209 for high earners, with further declines likely coming from two groups: (1) URM non-UC applicants who could have become less likely to earn admission to the more-selective public CSU universities, which were also bound by Prop 209; and (2) URM high school graduates deterred from UC application by Prop 209. The next section quantifies the magnitude of this latter group.

[30] In 2014, \$100,000 was approximately the 90th (95th) percentile of wages among California (U.S.) workers aged 30 to 34, though it was earned by more than 20 percent of UC applicants 14 years after application. For annual estimated URM wage threshold declines relative to each baseline, see Figure A-12.

[31] The estimated \$130-\$150 million decline in 2014 wages earned by URM Californians between ages 30 and 34 represents a 0.4-0.5 percent aggregate decline for that group. All ACS statistics calculated using data from IPUMS (Ruggles et al., 2018).

[32] For this ACS analysis, I define Californians as those **born** in the state, to identify those likely impacted by Prop 209 and abstract away from post-education cross-state mobility.

5 Application Deterrence and Model Robustness

The primary potential threat to the difference-in-difference design is that Prop 209 may have deterred some URM students from sending an application to UC, which could have further contributed to income inequality but may also generate sample selection bias in the baseline estimates (Long, 2004; Dickson, 2006; Yagan, 2016).[33] I quantify the magnitude of this potential bias by first estimating the number and character of 'missing' URM UC applications. I match the applicant data to the annual number of 1994-2001 "UC-eligible" graduates from each public California high school by gender and ethnicity – with UC eligibility indicating that they had satisfactorily completed accredited college-level coursework – and estimate models of the form:

$$\frac{A_{syea}}{UC_{sye}} = \sum_{e' \in \{A,B,H\}} \sum_{y' \in \{96,98,00\}} \beta_{e'y'a} \mathbb{1}_{e=e', y \in \{y', y'+1\}} + \zeta_{sea} + \eta_{sya} + \epsilon_{syea} \tag{2}$$

where A_{syea} is the number of UC-eligible UC applicants from school s in years $\{y, y+1\}$ of ethnicity e in AI range a, and UC_{sye} is the number of UC-eligible high school graduates in those years. ζ_{sea} and η_{sya} are school-ethnicity and school-year fixed effects. Years are grouped into four pairs, from '94-95 to '00-01; ethnicities are grouped into Asian, Black, Hispanic, and white; and AI bins are defined as 200-point bins from 4,000 to 8,000. I estimate Equation 2 by weighted least squares (weighting to the student level using UC_{sye}) separately for each a, and interpret β_{e98a} as the average change in the proportion of UC-eligible e high school graduates who applied to UC following Prop 209, implicitly assuming that the true distribution of AI across school-year-ethnicity cohorts remains unchanged over time.[34]

Figure VII presents estimates of the Black and Hispanic $\beta_{e,'98-99,a}$ coefficients from Equation 2, scaled by the average total number of e UC-eligible California high school graduates in the '98-99 cohorts. The figure also shows the proportion of those applicants who would have likely been admitted to some UC campus had

[33] Card and Krueger (2005) use SAT 'sends' (measured by College Board) as a proxy for university applications and present evidence that the decline in UC applications after 1998 was wholly driven by low-testing students unlikely to be qualified for UC admission. Appendix F replicates their finding using College Board data and shows that replacing SAT 'sends' with actual applications (observed by linking College Board and UC applicant records) reverses that conclusion.

[34] Table A-15 presents estimated coefficients for a specification of Equation 2 across all AI. It shows that URM application rates following Prop 209 declined by between 4 and 6 percent of all UC-eligible URM public high school graduates.

they applied, where admission is predicted solely by e and AI.[35] The figure shows that while some deterred Black and Hispanic high school graduates were unlikely to be admitted to any UC campus, there were also a large number of applicants certain to be admitted to some campus – indeed, very likely to be admitted to UC's more-selective campuses – who were deterred from UC application after Prop 209.[36] The sum across the bars suggests that the number of Black and Hispanic UC applicants declined by 12-13 percent (about 1,200 per year), most of whom would have likely been admitted to some UC campus.[37]

Given this shift in the UC applicant pool, I test for the magnitude of sample selection bias in the baseline difference-in-difference estimates in the previous section by re-estimating the models with a series of additional covariates that could partially absorb remaining bias. First, I follow Card and Rothstein (2007) and construct a cross-school Heckit control function treating $p = \frac{A_{s_i yea}}{UC_{s_i ye}}$ as applicant i's likelihood of applying to UC (Heckman, 1979). This control function formally requires the exclusion restriction that the within-school-ethnicity-cohort choice to apply to any UC campus is (conditionally) uncorrelated with student outcomes, and it absorbs cross-group selection into UC application. I also construct an alternative Heckit function defining p by the leave-one-out percentage of UC-eligible high school graduates who applied to UC by an applicant's school, gender, and ethnicity. In addition to the inverse mills ratios of these p statistics, I also collect a detailed set of applicant covariates excluded from the main specifications: gender, parental education, log family income, parental occupations, UC eligibility, high school GPA rank, and the number of enrolled 12th-grade honors courses.[38]

[35] That is, the blue bar is the product of the black bar and the proportion of 1998-1999 URM UC applicants in bin a who were admitted to at least one campus. See Figure A-1 for evidence that e and AI were highly predictive of applicants' admission at most UC campuses, even after 1998. Admit estimates implicitly assume that each UC applicant's admission is small relative to the size and composition of the applicant pool.

[36] Table A-9 links these application declines to the AI- and campus-specific enrollment changes presented in Figure III to show that application deterrence caused a decline in URM UC enrollment by about 450 students, half from Berkeley and UCLA. Combined with the estimated enrollment decline among UC applicants, this implies that Prop 209 caused an annual decline in URM UC enrollment of about 800 students in '98-99, or 14 percent. This closely matches the differently-calculated estimates of Bleemer (2019a).

[37] Figure A-14 presents additional specifications of Equation 2. It shows that URM students were particularly discouraged from applying to the Berkeley and UCLA campuses, and that UC-ineligible applicants were only slightly deterred by Prop 209. As a placebo test, it also shows that application rates among Asian students increased by less than 2 percent relative to white applications.

[38] Rank is determined using UC GPA among UC applicants in that school-year. Parental education indicates the applicants' parents' highest education level (with seven codes); parental occupation indicates the parents' occupation set (with 17^2 codes). Covariates with missing values are included with missing value indicators.

I conduct a Monte Carlo exercise randomly selecting sets of these additional covariates for model inclusion (following Card, Fenizia and Silver, 2018) to test the presented estimates' sensitivity to alternative covariate specifications. In particular, I re-estimate Equation 1 specifying X_{iy} in the following ways: null (no covariates); including only the components of AI (as in the baseline specification); and then adding between 1 and 9 additional sets of covariates, selecting those that lead to the largest and smallest estimates of β_{98-99}. The resulting estimates are shown in Figure A-15 for six main outcomes.

While the AI components are important covariates for several outcome measures, likely absorbing substantive changes in the composition of UC applicants around 1998, there is no further combination of these highly-detailed control functions and covariates that meaningfully changes any of the β_{98-99} estimates, with the exception of six-year degree attainment growing slightly more negative.[39] These results show that the baseline estimates are highly insensitive to alternative model specifications conditioning on applicants' academic, demographic, and socioeconomic status and cross-school application behavior, though they may reflect sample selection bias on unobservables like orthogonal dimensions of their high school leadership activities.

6 Impact of Prop 209 on Non-URM UC Applicants

Prop 209 did not measurably impact the overall weighted-average institutional value-added of enrollment at public or all California universities (see Figure A-2) or among UC applicants; the decline in enrollment quality among URM students was offset by an improvement among non-URM students. As discussed in Section 3 above, I interpret the baseline difference-in-difference estimates as the impact of Prop 209 on URM UC applicants, despite the fact that – assuming constant treatment effects – as much as 20 percent of each estimate may reflect changes among non-URM applicants caused to enroll at more-selective universities.[40]

[39]For example, high school fixed effects explain 8.8 (3.0) percent of variation in six-year degree attainment (conditional log wages); the addition of the AI covariates brings the R^2 to 12.9 (5.8) percent; and adding the full suite of additional covariates raises the R^2 to 15.3 (6.9) percent. These increasing R^2 values suggest that the covariates could have been expected to shift the estimated effect of Prop 209 if the estimates exhibited sample selection bias.

[40]Appendix E shows that relative to academically-comparable white applicants, Asian applicants enrolled at similar universities and had indistinguishable wage outcomes after Prop 209, suggesting proportional effects of affirmative action for both groups.

Two sets of additional evidence suggest that the per-applicant impact of Prop 209 is smaller for non-URM than URM applicants (as in Dale and Krueger, 2014; Bleemer, 2021), implying that non-URM outcomes explain less than 20 percent of each baseline estimate. First, single-difference estimates show that non-URM outcomes are generally smooth in the years before and after Prop 209, while URM educational and wage outcomes sharply and persistently decline in 1998 (see Figure A-16). While this provides suggestive evidence of relatively small returns to more-selective UC enrollment for "crowding-in" non-URM students, the absence of an unimpacted comparison group prohibits separate identification of Prop 209's effect on non-URM students and secular trends.

Second, I employ an alternative research design to directly estimate the admissions return to one UC campus – UC Berkeley, the most selective campus and the campus where URM applicants' relative admissions advantages were largest until Prop 209 – for the non-URM applicants who were on the Berkeley admissions margin in the years before Prop 209. These non-URM students were likely among those who would have most benefited from Prop 209, since many of them could have been admitted in the absence of Berkeley's affirmative action policy.

In 1996 and 1997 Berkeley guaranteed admission to applicants above an annually-determined AI threshold.[41] Admissions officers then admitted some lower-AI applicants based on other application characteristics. Figure IX(a) shows the admissions likelihood of '96-97 non-URM Berkeley applicants at every AI, adding 70 points to 1996 AIs to align the two years' thresholds (7,360 and 7,430); admission was near-guaranteed above the threshold and provided to only half of slightly below-threshold applicants. Because applicants near Berkeley's admissions threshold are quasi-randomly distribution on one or the other side of the threshold, differentiated by small test score or grade differences, I interpret outcome differences on either side of the threshold as resulting from the above-threshold non-URM applicants' greater access to UC Berkeley.

I estimate the effects of UC Berkeley admission for on-the-margin non-URM '96-97 applicants using local

[41] See Figure A-3. Berkeley chose its annual threshold so that 50 percent of its admitted applicants had AI above the threshold. As a result, the threshold could not be chosen until after Berkeley observed all applicants' AIs, prohibiting applicants from manipulating their AI to exceed the threshold. Admissions around the threshold was noisier in '94-95; see Figure B-1.

linear regression discontinuity models following Calonico, Cattaneo and Titiunik (2014). Each plot visualizes the 6,086 '96-97 non-URM Berkeley applicants within 400 AI points of the threshold; regressions include a 1997 indicator covariate.[42] Figure IX(b) shows that the increased likelihood of Berkeley admission causes about one-third of newly-admitted on-the-margin non-URM students to enroll. However, those students would have otherwise enrolled at similar-quality institutions on average; Panel (c) shows that the "CFSTY" wage value-added of applicants' enrollment institutions is unimpacted at the threshold. Most of the students would likely have otherwise enrolled at UCLA or UCSD (6.1 percentage points, s.e. 3.5) or out-of-state universities (8.0 percentage points, s.e. 3.4).

Panels (d) to (f) of Figure IX show that graduate school enrollment, early-30s wages, and the number of years spent by each applicant in their early 30s earning over $150,000 per year are smooth across the Berkeley admissions threshold.[43] While the estimated standard errors cannot reject moderate returns to UC Berkeley admission, the observed effects suggest that on-the-margin non-URM students have access to alternative similar-value universities, and switching enrollment to UC Berkeley provides little measurable long-run economic return.

Appendix J presents comparable estimates for UC Davis, the only other UC campus to set a binding AI admissions threshold before Prop 209. It shows that on-the-margin non-URM applicants rejected from UC Davis enroll at lower-value-added universities but similarly face no observable change in their educational or wage outcomes, though there is some evidence of non-random selection into applying to Davis above its admissions threshold. Nevertheless, if these estimated returns to UC Berkeley and Davis are externally valid for the non-URM students who crowded into more-selective UC campuses following Prop 209, this suggests that Prop 209 provided minimal benefits to non-URM students.

[42] The distribution of applicants is smooth across the threshold, with the McCrary (2008) test yielding a p-value of 0.58. Sociodemographics are also smooth across the threshold: I predict annual log early-30s wages by gender-ethnicity indicators, log parental income, and parental education among '96-97 freshman UC-eligible UC applicants – omitting in-sample applicants within 400 AI of the threshold – and find that crossing the threshold yields lower 'predicted' income by 0.00027 log points, with standard error 0.018.

[43] There is no estimated change in likelihood of California employment across the Berkeley access threshold; despite their increased likelihood of out-of-state university enrollment, applicants' number of early-30s years employed in California increases by 0.14 years (s.e. 0.17). $150,000 is a better indicator of unusually high wages for this strongly positively-selected sample than $100,000; in their early 30s, they earned the former (latter) in 1.7 (0.6) out of five years.

7 STEM Course Performance and Persistence

Having documented Prop 209's high-level effects on impacted young URM Californians, I next turn to an investigation of educational mechanisms that could explain these effects. Several previous studies have hypothesized that students who attend more-selective universities as a result of affirmative action will earn lower grades and become less likely to persist in demanding courses, especially in STEM fields, than if they'd enrolled at a less-selective university with lower-testing peers Loury and Garman (1993); Arcidiacono et al. (2016). However, previous studies have focused on the impact of affirmative action on overall grade point averages and major choice instead of URM students' actual course performance and STEM course progression.[44] Complementing the finding that Prop 209 failed to increase URM UC applicants' likelihood of earning a STEM degree – indeed, it led to the opposite effect – I further test this "Science Mismatch Hypothesis" by estimating the impact of Prop 209 on URM UC enrollees' performance and persistence along introductory STEM course sequences. I test alternative formulations of this Hypothesis in Appendix G and arrive at similar conclusions.

Using five UC campuses' detailed course enrollment records, I match core introductory STEM course sequences across these campus (e.g., each campus's two-course introductory Physics sequence) and estimate models of students' performance and persistence along these sequences using an extension of the baseline difference-in-difference models estimated above:[45]

$$Y_{iysm} = \alpha_{h_i} + \delta_y + \beta_0 URM_i + \sum_{t=1994}^{2002} \mathbb{1}_{\{t=y\}} \beta_y URM_i + \gamma X_{iy} + \epsilon_{iysm} \tag{3}$$

for student i from high school h_i in cohort y who takes course s in term m. I define three outcomes of

[44] Differences in overall GPAs are at least as likely to reflect differing grading standards across departments and between lower- and upper-division courses as they are to reflect student course performance (Arcidiacono, Aucejo and Spenner, 2012; Bleemer and Mehta, 2020). Differences in major choice may reflect that students have different preferences across majors at more- or less-selective institutions in a manner unrelated to course performance.

[45] Introductory STEM courses include four courses in chemistry (two introductory, two organic), two in biology, two in physics, and three in computer science. Each of these courses generally requires the previous course as a prerequisite. When universities on the quarter system include three courses along a sequence, I include the first and third course. Course details are provided in Appendix H. Estimates are largely insensitive to omitting engineering students, who may face different STEM course incentives.

interest for each completed course: the student's SAT percentile relative to their peers; the student's grade (out of 4 grade points); and the student's persistence, defined as an indicator for whether they completed the subsequent course in the sequence (e.g. whether the student completed Chemistry 2 after completing Chemistry 1). Persistence is not defined for the final course in each sequence, and repeated course grades are omitted. The model is stacked over s and estimated across courses, weighted evenly across students. Covariates X_{iy} include the components of AI as above. Standard errors are two-way clustered by student and course.

This definition of persistence mirrors the concept employed in the STEM Mismatch Hypothesis. Because the regression is weighted evenly across individuals, persistence can be heuristically understood as ranging from 0 to 100 percent. A student whose only completed STEM course is Chemistry 1, without ever completing Chemistry 2, would have persistence of 0 percent. A student who takes Chemistry 1, 2, and 3 but not 4 would have persistence 66.6 percent, since they persisted after two courses but not the third. A student who takes only all 3 Computer Science courses would have persistence of 100 percent. The STEM Mismatch Hypothesis holds that URM students admitted by affirmative action have lower STEM persistence than they would have had at less-selective universities.

In the two years before Prop 209, URM UC enrollees earned lower average grades in introductory STEM courses by 0.42 GPA points and were less likely to persist along STEM course sequences by 11.2 percentage points (See Tables A-16 and A-17). These gaps are fully explained by URM enrollees' poorer prior academic opportunity and preparation; their performance and persistence was indistinguishable from those of academically-comparable non-URM students across the five UC campuses. Relative to academically-comparable non-URM UC students, however, '96-97 URM students were 7.3 percentiles lower in their classes' SAT distribution, largely reflecting their enrollment at relatively more-selective UC campuses. The first panel of Figure VIII shows that Prop 209 caused URM students to enroll in STEM courses in which their average SAT percentile was about 4 percentage points higher, closing the gap by more than half. However, this increase in class rank did not translate into any observable improvement in those students' likelihood of STEM persistence or course grades. URM enrollees STEM performance and persistence were unchanged when their class rank improved; the 95 percent confidence interval around the estimated change in STEM persistence narrowly bounds 0, from -2.3 to 3.5 percentage points, small effects relative to the raw STEM persistence ethnicity gap of 11.2 percentage points before Prop 209. Figure A-17 shows that Prop 209 similarly impacted Black and Hispanic UC enrollees' STEM persistence and performance outcomes.

I also estimate a difference-in-difference model of UC enrollees' likelihood of completing any STEM major (following Equation 1). URM UC enrollees' STEM major choice is precisely unchanged relative to academically-comparable non-URM enrollees after Prop 209, with a 95 percent confidence interval rejecting increases above 1.5 percentage points; the overall decline in STEM attainment thus appears driven by students who exit these UC campuses following Prop 209. These findings suggest that selectivity differences between public research universities are at best a second-order determinant of URM students' relative persistence and performance in STEM courses; instead, they appear largely explained by compositional differences in prior academic opportunity and preparation. In turn, the absence of changed STEM performance and persistence after Prop 209 suggests that course performance or persistence are not primary explanations for the effect of Prop 209 on students' educational and wage outcomes.

8 Discussion: Affirmative Action and Efficiency

The evidence presented above have implications for both the equity and efficiency of affirmative action. While affirmative action may have second-order effects on students whose admission was unrelated to the policy, such as through peer effects (Sacerdote, 2011) and the effect of campus diversity (Carrell, Rullerton and West, 2009), to a first approximation the (Kaldor-Hicks allocative) efficiency of affirmative action can be measured by the net impact of Prop 209 on two groups of students: the URM students targeted by affirmative action and the non-URM students who would have been admitted otherwise. Since net enrollment at more- and less-selective universities appears roughly unaffected by Prop 209 (see Figure A-2), this net effect can instead be summarized by the average relative returns to more-selective university enrollment for these two groups of students.

The single-difference and regression discontinuity estimates presented in Section 6 suggest that the non-URM students whose enrollment was impacted by Prop 209 received minimal returns from those changes, in line with the hypothesis that the return to more-selective university enrollment was relatively larger for the URM students targeted by affirmative action than it was for the non-URM students who replaced them after Prop 209. Unfortunately, Berkeley's URM admissions policies did not generate a sharp change in admissions likelihood at any AI, prohibiting parallel analysis for that group of students (See Figure B-1).

That hypothesis is further supported by a comparison between the change in URM students' early-30s wages and the change in the wage value-added of their enrollment institutions. While Prop 209 led URM students to enroll at universities with lower early-30s wage value-added by as much as $1,000, those students' actual early-30s annual wages fell by more than $2,000 (see Tables II and IV). Assuming that the presented value-added statistics either approximate or relatively overestimate the average difference in treatment effects of enrolling at those universities, this suggests that the wage effect of more-selective university enrollment for the students impacted by affirmative action is significantly larger than universities' average treatment effect. While the local average wage treatment effect for "crowding-in" non-URM students remains unobserved, that effect is very likely to be lower than the above-average effects for the URM students who benefited from affirmative action. These evidence suggest that affirmative action improved the allocative efficiency of California higher education.

9 Conclusion

Proposition 209 banned race-based affirmative action at public California universities starting in 1998. In the years immediately after the ban, URM UC applicants' university enrollment sharply shifted away from UC's most-selective Berkeley and UCLA campuses, causing a cascade of students to enroll at lower-quality public institutions and some private universities. Contrary to the Mismatch Hypothesis, less-selective university enrollment did not lead UC's remaining URM students to earn higher grades in challenging courses, but it did cause URM applicants to become less likely to earn STEM degrees and any graduate degrees, and undergraduate degree attainment declined among lower-testing URM applicants. These poorer educational outcomes in turn contributed to a 5 percent average annual decline in Hispanic – but not Black – applicants' early-career wages, exacerbating inequality by decreasing the number of early-career URM Californians earning over $100,000 by at least 3 percent. Prop 209 also discouraged thousands of additional academically-competitive URM students from sending applications to public research universities, likely leading to additional reductions in California's high-earning URM workforce.

Affirmative action decreases non-URM student enrollment for each net additional URM student that it causes to enroll. However, single-difference and regression discontinuity evidence suggest that those impacted non-URM students – whose more-selective university enrollment increased following Prop 209 – experienced relatively small long-run educational or wage effects after Prop 209. URM students, on the other hand, had received above-average wage returns to more-selective university enrollment under affirmative action, and thus faced disproportionate declines after Prop 209, suggesting that Prop 209 reduced both the equity and efficiency of California higher education. White and Asian students were proportionally impacted by Prop 209, with no evidence of disparate impacts for one or the other.

These findings differ from several existing analyses of the impacts of affirmative action, even those focusing on Prop 209, and highlight the importance of high-quality and detailed administrative data and a transparent research design to help to account for sample selection and omitted variable bias. They also contextualize the impact of university affirmative action policies relative to other policies aiming to close opportunity gaps for low-income and Black and Hispanic youths. Some limitations remain. The presented estimates are reduced-form, averaging over many URM students who were likely unimpacted by the Prop 209 policy change, which means that they likely underestimate the effect of Prop 209 on students whose enrollment was shifted by UC's policy change. They omit the impacts of Prop 209 on URM Californians dissuaded from UC application by Prop 209, who may have benefited from affirmative action at UC. The estimates also omit labor market outcomes for (endogenously-selected) non-Californian and self-employed workers. Nevertheless, this study documents the meaningful potential of affirmative action policies to promote economic mobility in the U.S. – though perhaps not to close white-Black mobility gaps – and the equity and efficiency consequences of affirmative action's prohibition.

UNIVERSITY OF CALIFORNIA, BERKELEY

References

Altonji, Joseph G. and Ling Zhong, "The Labor Market Return to Advanced Degrees," *Journal of Labor Economics*, 2021, *39* (2), 303–360.

Altonji, Joseph, Peter Arcidiacono, and Arnaud Maurel, "The Analysis of Field Choice in College and Graduate School: Determinants and Wage Effects," *Handbook of the Economics of Education*, 2016, *5*, 305–396.

Anelli, Massimo, "The Returns to Elite College Education: A Quasi-Experimental Analysis," *Journal of the European Economic Association*, 2019, *18* (6), 2824–2868.

Antman, Francisca and Brian Duncan, "Incentives to Identify: Racial Identity in the Age of Affirmative Action," *Review of Economics and Statistics*, 2015, *97* (3), 710–713.

Antonovics, Kate and Richard Sander, "Affirmative Action Bans and the "Chilling Effect"," *American Law and Economics Review*, 2013, *15* (1), 252—-299.

Arcidiacono, Peter, "Ability Sorting and the Returns to College Major," *Journal of Econometrics*, 2004, *121* (1-2), 343–375.

— , "Affirmative Action in Higher Education: How Do Admission and Financial Aid Rules Affect Future Earnings?," *Econometrica*, 2005, *73* (5), 1477–1524.

— **and Michael Lovenheim**, "Affirmative Action and the Quality-Fit Trade-off," *Journal of Economic Literature*, 2016, *54* (1), 3–51.

— **, Esteban Aucejo, and Ken Spenner**, "What happens after enrollment? An analysis of the time path of racial differences in GPA and major choice," *IZA Journal of Labor Economics*, 2012, *1* (5).

— **, — , and V. Joseph Hotz**, "University Differences in the Graduation of Minorities in STEM Fields: Evidence from California," *American Economic Review*, 2016, *106* (3), 525–562.

— **, — , Patrick Coate, and V Joseph Hotz**, "Affirmative action and university fit: Evidence from Proposition 209," *IZA Journal of Labor Economics*, 2014, *3* (7).

— **, Josh Kinsler, and Tyler Ransom**, "Asian American Discrimination in Harvard Admissions," *Institute of Labor Economics Discussion Paper*, 2020, *13172.*

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

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

Bagde, Surendrakumar, Dennis Epple, and Lowell Taylor, "Does Affirmative Action Work? Caste, Gender, College Quality, and Academic Success in India," *American Economic Review*, 2016, *106* (6), 1495–1521.

Barrow, Lisa, Lauren Sartain, and Marisa de la Torre, "Increasing Access to Selective High Schools through Place-Based Affirmative Action: Unintended Consequences," *AEJ: Applied Economics*, 2020, *12* (4), 135–163.

Bertrand, Marianne, Rema Hanna, and Sendhil Mullainathan, "Affirmative action in education: Evidence from engineering college admissions in India," *Journal of Public Economics*, 2010, *94* (1-2), 16–29.

Billings, Stephen B, David J Deming, and Jonah Rockoff, "School segregation, educational attainment, and crime: Evidence from the end of busing in Charlotte-Mecklenburg," *Quarterly Journal of Economics*, 2014, *129* (1), 435–476.

Black, Sandra, Jeffrey Denning, and Jesse Rothstein, "Winners and Losers? The Effect of Gaining and Losing Access to Selective Colleges on Education and Labor Market Outcomes," *Manuscript*, 2020.

Bleemer, Zachary, "The UC ClioMetric History Project and Formatted Optical Character Recognition," *CSHE Research Paper Series*, 2018, *18* (3).

— , "Diversity in University Admissions: Affirmative Action, Percent Plans, and Holistic Review," *CSHE Research Paper Series*, 2019, *19* (6).

— , *The impact of Proposition 209 on under-represented UC applicants, and the magnitude of subsequent UC admission policies on URG enrollment*, Oakland, CA: UCOP Institutional Research and Academic Planning, 2019.

— , "Mismatch at the University of California before Proposition 209," *UC-CHP Policy Brief*, 2020, *2020.5.*

— , "Top Percent Policies and the Return to Postsecondary Selectivity," *CSHE Research Paper Series*, 2021, *21* (1).

— **and Aashish Mehta**, "College Major Restrictions and Student Stratification," *UC-CHP Policy Brief*, 2020, *2020.3.*

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

Card, David, Alessandra Fenizia, and David Silver, "The Health Effects of Cesarean Delivery for Low-Risk First Births," *NBER Working Paper*, 2018, *24493.*

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

— **and Jesse Rothstein**, "Racial Segregation and the Black-White Test Score Gap," *Journal of Public Economics*, 2007, *91* (11-12), 2158–2184.

Carrell, Scott E., Richard L. Rullerton, and James E. West, "Does Your Cohort Matter? Measuring Peer Effects in College Achievement," *Journal of Labor Economics*, 2009, *27* (3), 439–464.

Chan, Jimmy and Erik Eyster, "Does Banning Affirmative Action Lower College Student Quality," *American Economic Review*, 2003, *93* (3), 858–872.

Chetty, Raj, John Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan, "Income Segregation and Intergenerational Mobility Across Colleges in the United States," *Quarterly Journal of Economics*, 2020a, *135* (3), 1567–1633.

— **, Nathaniel Hendren, and Lawrence F Katz**, "The effects of exposure to better neighborhoods on children: New evidence from the Moving to Opportunity experiment," *American Economic Review*, 2016, *106* (4), 855–902.

— **, — , Maggie R. Jones, and Sonya R. Porter**, "Race and Economic Opportunity in the United States: an Intergenerational Perspective," *Quarterly Journal of Economics*, 2020b, *135* (2), 711–783.

Cohodes, Sarah R. and Joshua S. Goodman, "Merit Aid, College Quality, and College Completion: Massachusetts'

Adams Scholarship as an In-Kind Subsidy," *American Economic Journal: Applied Economics*, 2014, *6* (4), 251–285.

Dale, Stacy and Alan Krueger, "Estimating The Payoff Of Attending A More Selective College: An Application Of Selection On Observables And Unobservables," *Quarterly Journal of Economics*, 2002, *107* (4), 1491–1527.

— **and** — , "Estimating the Effects of College Characteristics over the Career Using Administrative Earnings Data," *The Journal of Human Resources*, 2014, *49* (2), 323–358.

Denning, Jeffrey and Patrick Turley, "Was that SMART? Institutional Financial Incentives and Field of Study," *Journal of Human Resources*, 2017, *52* (1), 152–186.

Derenoncourt, Ellora and Claire Montialoux, "Minimum Wages and Racial Inequality," *Quarterly Journal of Economics*, 2021, *136* (1), 169–228.

Dickson, Lisa M., "Does ending affirmative action in college admissions lower the percent of minority students applying to college?," *Economics of Education Review*, 2006, *25* (1), 109–119.

Dillon, Eleanor Wiske and Jeffrey Andrew Smith, "The Consequences of Academic Match between Students and Colleges," *Journal of Human Resources*, 2020, *55* (3), 767–808.

Dobbie, Will and Roland G Fryer Jr, "Are high-quality schools enough to increase achievement among the poor? Evidence from the Harlem Children's Zone," *American Economic Journal: Applied Economics*, 2011, *3* (3), 158–87.

Dynarski, Susan, Steven W. Hemelt, and Joshua M. Hyman, "The Missing Manual: Using National Student Clearinghouse Data to Track Postsecondary Outcomes," *Educational Evaluation and Policy Analysis*, 2015, *37* (1S), 53S–79S.

Ehrenberg, Ronald G., "Analyzing the factors that influence persistence rates in STEM field, majors: Introduction to the symposium," *Economics of Education Review*, 2010, *29* (6), 888–891.

Fischer, Mary J and Douglas S Massey, "The effects of affirmative action in higher education," *Social Science Research*, 2007, *36* (2), 531–549.

Fryer, Roland G., Glenn C. Loury, and Tolga Yuret, "An Economic Analysis of Color-Blind Affirmative Action," *The Journal of Law, Economics, and Organization*, 2008, *24* (2), 319–355.

Griffith, Amanda, "Persistence of women and minorities in STEM field majors: Is it the school that matters?," *Economics of Education Review*, 2010, *29* (6), 911–922.

Heckman, James J., "Sample Selection Bias as a Specification Error," *Econometrica*, 1979, *47* (1), 153–161.

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

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

Holzer, Harry and David Neumark, "Assessing affirmative action," *Journal of Economic Literature*, 2000, *38* (3), 483–568.

Jackson, C Kirabo, Rucker C Johnson, and Claudia Persico, "The effects of school spending on educational and economic outcomes: Evidence from school finance reforms," *Quarterly Journal of Economics*, 2016, *131* (1), 157–218.

Johnson, Rucker, *Children of the Dream: Why School Integration Works*, New York: Basic Books and Russell Sage Foundation Press, 2019.

Juhn, Chinhui, Kevin M. Murphy, and Brooks Pierce, "Accounting for the Slowdown in Black-White Wage Convergence," in Marvin H. Koster, ed., *Workers and Their Wages*, Washington, DC: AEI Press, 1991, pp. 107–143.

Kapor, Adam, "Distributional Effects of Race-Blind Affirmative Action," *Manuscript*, 2020.

Long, Mark C., "College Applications and the Effect of Affirmative Action," *Journal of Econometrics*, 2004, *121* (1–2), 319–342.

Loury, Linda Datcher and David Garman, "Affirmative Action in Higher Education," *American Economic Review*, 1993, *83* (2), 99–103.

Marion, Justin, "How Costly Is Affirmative Action? Government Contracting and California's Proposition 209," *The Review of Economics and Statistics*, 2009, *91* (3), 503–522.

McCrary, Justin, "Manipulation of the running variable in the regression discontinuity design: A density test," *Journal of Econometrics*, 2008, *142*, 698–714.

Mountjoy, Jack and Brent R. Hickman, "The Returns to College(s): Estimating Value-Added and Match Effects in Higher Education," *Manuscript*, 2020.

National Student Clearinghouse Research Center, "Impact of Directory Information Blocks on StudentTracker Results," 2017.

Niu, Sunny and Marta Tienda, "Minority Student Academic Performance Under the Uniform Admission Law: Evidence From The University of Texas at Austin," *Educational Evaluation and Policy Analysis*, 2010, *32* (1), 44–69.

Rambachan, Ashesh and Jonathan Roth, "An Honest Approach to Parallel Trends," *Manuscript*, 2020.

Rose, Heather, "The Effects of Affirmative Action Programs: Evidence from the University of California at San Diego," *Educational Evaluation and Policy Analysis*, 2005, *27* (3), 263–289.

Ruggles, Steven, Sarah Flood, Ronald Goeken, Josiah Grover, Erin Meyer, Jose Pacas, and Matthew Sobek, *IPUMS USA: Version 8.0*, Minneapolis, MN: IPUMS, 2018.

Sacerdote, Bruce, "Peer Effects in Education: How Might They Work, How Big Are They and How Much Do We Know Thus Far?," *Handbook of the Economics of Education*, 2011, *3*, 249–277.

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

Sjoquist, David L. and John V. Winters, "State Merit Aid Programs and College Major: A Focus on STEM," *Journal of Labor Economics*, 2015, *33* (4), 973–1006.

Sowell, Thomas, *Black Education: Myths and Tragedies*, Philadelphia: David McKay, 1972.

UCOP, *Undergraduate Access to the University of California After the Elimination of Race-Conscious Policies*, Oakland, CA: University of California, 2003.

US Department of Homeland Security, "STEM Designated Degree Program List," 2016.

Vars, Frederick and William Bowen, "Scholastic Aptitude Test scores, race, and academic performance in selective colleges and universities," in C. Jencks and M. Phillips, eds., *The Black–White test score gap*, Washington, D.C.: Brookings Institution Press, 1998, pp. 457–479.

Yagan, Danny, "Supply vs. demand under an affirmative action ban: Estimates from UC law schools," *Journal of Public Economics*, 2016, *137*, 38–50.

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

— , "Elite Colleges and Upward Mobility to Top Jobs and Top Incomes," *American Economic Review*, 2019, *109* (1), 1–47.

Table I: Descriptive Statistics of 1990s UC Admissions by Ethnicity

	Application			Admission			Enrollment		
	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9
Panel A: Non-URM Applicants									
Average Number or Percent of Applicants									
More Selective UCs	15,659	18,941	22,262	48.2	43.2	37.7	15.2	13.4	13.2
Selective UCs	12,705	14,383	17,358	77.3	72.7	63.2	19.0	19.2	16.7
Less Selective UCs	7,251	7,827	10,098	83.7	85.5	84.5	15.7	18.4	17.5
All UCs	33,602	37,972	42,268	84.8	83.5	83.9	49.6	49.4	49.6
Average SAT Score									
More Selective UCs	1224	1227	1237	1320	1335	1339	1277	1294	1299
Selective UCs	1156	1160	1171	1193	1202	1222	1140	1156	1172
Less Selective UCs	1135	1134	1138	1157	1154	1158	1124	1121	1123
All UCs	1182	1187	1194	1207	1212	1216	1196	1208	1217
Panel B: URM Applicants									
Average Number or Percent of Applicants									
More Selective UCs	3,843	4,113	4,438	56.7	49.8	27.1	17.8	15.9	10.0
Selective UCs	2,889	2,970	3,356	78.2	74.5	57.2	18.0	16.5	15.6
Less Selective UCs	2,229	2,200	2,757	81.6	79.2	76.2	17.9	16.4	17.9
All UCs	9,478	9,498	9,922	81.3	79.4	73.4	47	44.3	39.6
Average SAT Score									
More Selective UCs	1054	1068	1083	1131	1158	1194	1102	1125	1149
Selective UCs	1017	1030	1045	1057	1074	1102	1018	1040	1068
Less Selective UCs	985	993	1006	1008	1019	1034	977	987	1004
All UCs	1025	1039	1048	1054	1071	1081	1052	1071	1077

Note: Count and mean average descriptive statistics of 1994-1999 California-resident freshman UC applicants who are or are not underrepresented minorities (URM). Statistics are averaged across campuses: Berkeley, UCLA, and San Diego are More Selective; Santa Barbara, Irvine, and Davis are Selective; and Santa Cruz and Riverside are Less Selective. URM includes Black, Hispanic, and Native American applicants. SAT score was on the 1600 scale. Percent admitted and percent enrolled are conditional on applying to that campus. Campus-specific statistics are presented in Table A-3. Descriptive statistics by ethnicity available in Tables A-4 (Black and Hispanic) and A-5 (white and Asian). Source: UC Corporate Student System.

Table II: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 University Quality

	First Four-Year Institution			First Institution Value-Added			
	Adm.	Avg.	6 Yr. BA	"MH" VA		"CFSTY" VA	
	Rate (%)	SAT	Rate (%)	BA (%)	Earn ($)	BA (%)	Earn ($)
Panel A: Difference-in-Difference Coefficients							
URM (β_0)	-7.3	37.1	3.5	2.0	1,896	2.8	2,862
	(0.2)	(1.0)	(0.1)	(0.1)	(75)	(0.1)	(84)
URM $\times$ Prop 209	3.6	-19.7	-1.7	-0.6	-384	-1.0	-922
($\beta_{\text{'}98-99}$)	(0.2)	(1.3)	(0.2)	(0.2)	(93)	(0.2)	(105)
$\bar{Y}$	51.1	1,187.6	68.2				
Obs.	173,958	171,565	169,945	177,365	173,878	176,092	173,591
Panel B: Estimates of URM $\times$ Prop 209 ($\beta_{\text{'}98-99}$) by AI Quartile							
Bottom	1.8	-25.5	-3.3	-1.6	-638	-1.9	-796
Quartile	(0.6)	(3.7)	(0.6)	(0.4)	(214)	(0.5)	(246)
Second	5.2	-28.7	-3.0	-0.5	-618	-1.3	-1,547
Quartile	(0.5)	(3.0)	(0.5)	(0.4)	(197)	(0.4)	(237)
Third	5.6	-21.1	-1.0	0.1	-374	-0.4	-1,273
Quartile	(0.5)	(2.7)	(0.4)	(0.3)	(182)	(0.3)	(218)
Top	2.0	-7.4	-0.7	-0.8	-157	-1.0	-480
Quartile	(0.4)	(2.4)	(0.3)	(0.3)	(224)	(0.3)	(233)

Note: Estimates of β_0 and $\beta_{\text{'}98-99}$ from Equation 1, a difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as characteristics of the first four-year university or the first two- or four-year institution at which the applicant enrolled within six years of high school graduation as measured in the NSC. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. IPEDS data (first three columns) are linked to NSC by OPE ID; admission rate and average SAT score (which is averaged across the available 25^{th} and 75^{th} math and verbal score percentiles) are fixed by institution in 2001, the earliest observed year, while six-year graduation rate is contemporaneous. Robust standard errors in parentheses. Value-added (VA) measures are estimated by regressing six-year BA attainment or average conditional wages 12 to 16 years after UC application, when most applicants are in their early 30s, on college indicators, year FEs, and either ("MH") indicators for each applicant's set of UC campus applications and admissions (following Mountjoy and Hickman, 2020) or ("CFSTY") ethnicity indicators and quintics in SAT score and family income (following Chetty et al., 2020a), estimated over the 1995-1997 UC applicant pool. Source: UC Corporate Student System, National Student Clearinghouse, the California Employment Development Department, and the Integrated Postsecondary Education Data System (IPEDS).

Table III: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Educational Outcomes

	Earn Bach. Deg. (%)		Earn STEM Deg. (%)		Earn Graduate Deg. (%)		
	4 Years	6 Years	Uncondit.	Condit.	All	STEM	JD
Panel A: Difference-in-Difference Coefficients							
URM	-1.90	-2.61	0.46	0.44	4.83	0.60	0.92
	(0.41)	(0.40)	(0.31)	(0.41)	(0.42)	(0.17)	(0.19)
URM $\times$ Prop 209	-0.85	-0.71	-0.98	-0.65	-1.31	-0.58	-0.21
	(0.51)	(0.50)	(0.38)	(0.51)	(0.53)	(0.21)	(0.22)
$\bar{Y}$	47.8	74.6	22.2	27.1	36.0	5.4	4.9
Obs.	199,321	199,321	199,321	148,771	199,321	199,321	199,321
Panel B: Estimates of URM $\times$ Prop 209 ($\beta_{'98-99}$) by AI Quartile							
Bottom Quartile	-2.09	-4.25	-1.23	-1.42	-2.77	-0.86	-0.08
	(1.21)	(1.44)	(0.65)	(1.08)	(1.25)	(0.33)	(0.32)
Second Quartile	0.55	-0.52	-1.05	-0.44	-1.11	0.34	-0.65
	(1.23)	(1.22)	(0.80)	(1.03)	(1.21)	(0.37)	(0.42)
Third Quartile	0.98	1.22	-0.76	-0.82	-1.26	-0.53	-0.68
	(1.19)	(1.05)	(0.89)	(1.07)	(1.16)	(0.42)	(0.48)
Top Quartile	-0.71	-0.03	0.81	0.14	-0.14	-0.32	-0.24
	(1.10)	(0.88)	(0.96)	(1.09)	(1.13)	(0.56)	(0.61)

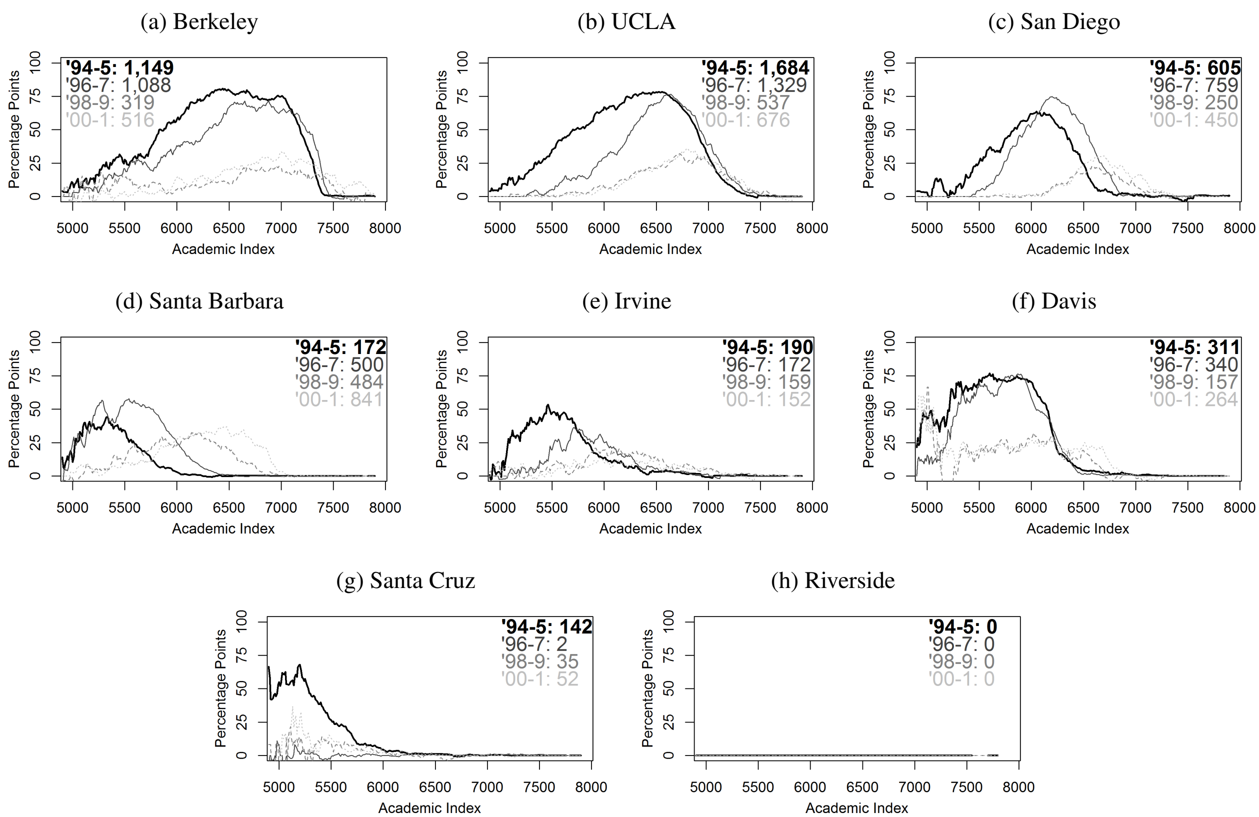
Note: Estimates of β_0 and $\beta_{'98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' educational outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as having earned a Bachelor's degree in five or six years, having earned a Bachelor's degree in a STEM field (unconditional or conditional on six-year degree attainment), or having ever earned a graduate degree (any, JD, or MD), all as measured in the union of UC administrative records and the NSC. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table IV: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 CA Wage Outcomes

	Average 6-16 Years after UC App.				Average 12-16 Years after UC App.			
	# Years Emp.	Total Wages ($)	Log Wages	# > $100K Wages	# Years Emp.	Total Wages	Log Wages ($)	# > $100 Wages
Panel A: Difference-in-Difference Coefficients								
URM	0.09	-159	0.01	-0.06	0.05	-807	-0.00	-0.03
	(0.04)	(359)	(0.01)	(0.02)	(0.02)	(531)	(0.01)	(0.01)
URM × Prop 209	-0.00	-1,822	-0.05	-0.08	0.00	-2,382	-0.04	-0.07
	(0.04)	(438)	(0.01)	(0.03)	(0.02)	(639)	(0.01)	(0.02)
$\bar{Y}$	7.55	60,888	10.69	1.48	3.30	79,064	10.89	1.01
Obs.	199,321	178,156	178,156	199,321	199,321	152,977	152,977	199,321
Panel B: Estimates with Separate Coefficients for Black and Hispanic Applicants								
Black	-0.60	-2,004	-0.08	-0.16	-0.27	-1,903	-0.09	-0.09
	(0.07)	(645)	(0.02)	(0.03)	(0.04)	(948)	(0.02)	(0.02)
Hispanic	0.38	596	0.05	-0.02	0.19	-300	0.03	-0.01
	(0.04)	(403)	(0.01)	(0.02)	(0.02)	(595)	(0.01)	(0.02)
Black × Prop 209	0.03	-479	-0.03	-0.01	0.02	-581	-0.03	-0.02
	(0.09)	(856)	(0.02)	(0.05)	(0.05)	(1,259)	(0.03)	(0.03)
Hispanic × Prop 209	-0.04	-2,300	-0.05	-0.12	-0.01	-3,000	-0.05	-0.09
	(0.05)	(482)	(0.01)	(0.03)	(0.03)	(699)	(0.02)	(0.02)
$\bar{Y}$	7.56	60,939	10.69	1.48	3.30	79,136	10.89	1.01
Obs.	197,804	176,825	176,825	197,804	197,804	151,854	151,854	197,804

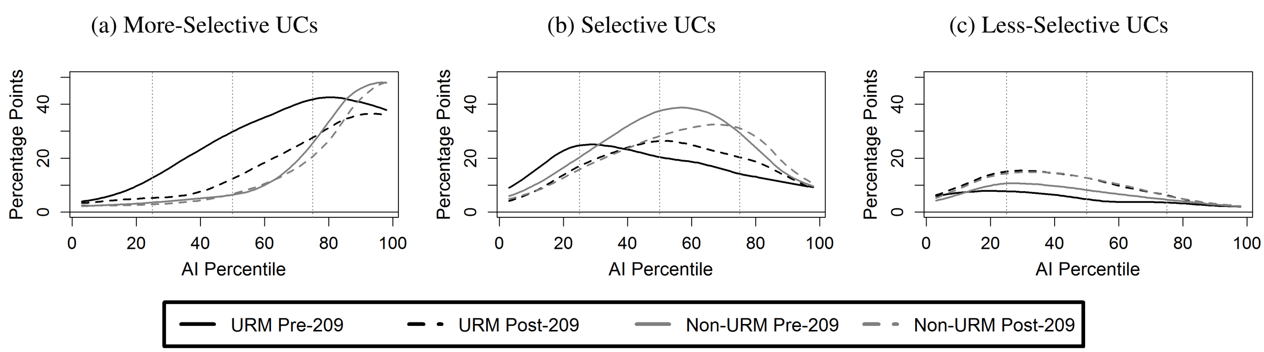
Note: Estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' wage outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Panel B interacts the coefficients with Black and Hispanic indicators to separately estimate outcomes for each group; Native American applicants are omitted. Outcomes are defined as number of years of non-zero California wages, average wages and log wages across years with non-zero wages, and number of years with wages above $100,000, among the years 6-16 or 12-16 years after initial UC application. Outcomes measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. The years 1996-1997 are omitted in Panel C because some universities preemptively curtailed their affirmative action programs in those years. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust standard errors in parentheses. Source: UC Corporate Student System and the California Employment Development Department.

Figure I: ‘Normal’ URM UC Applicants’ Greater Likelihood of Admission by Campus, Year, and AI



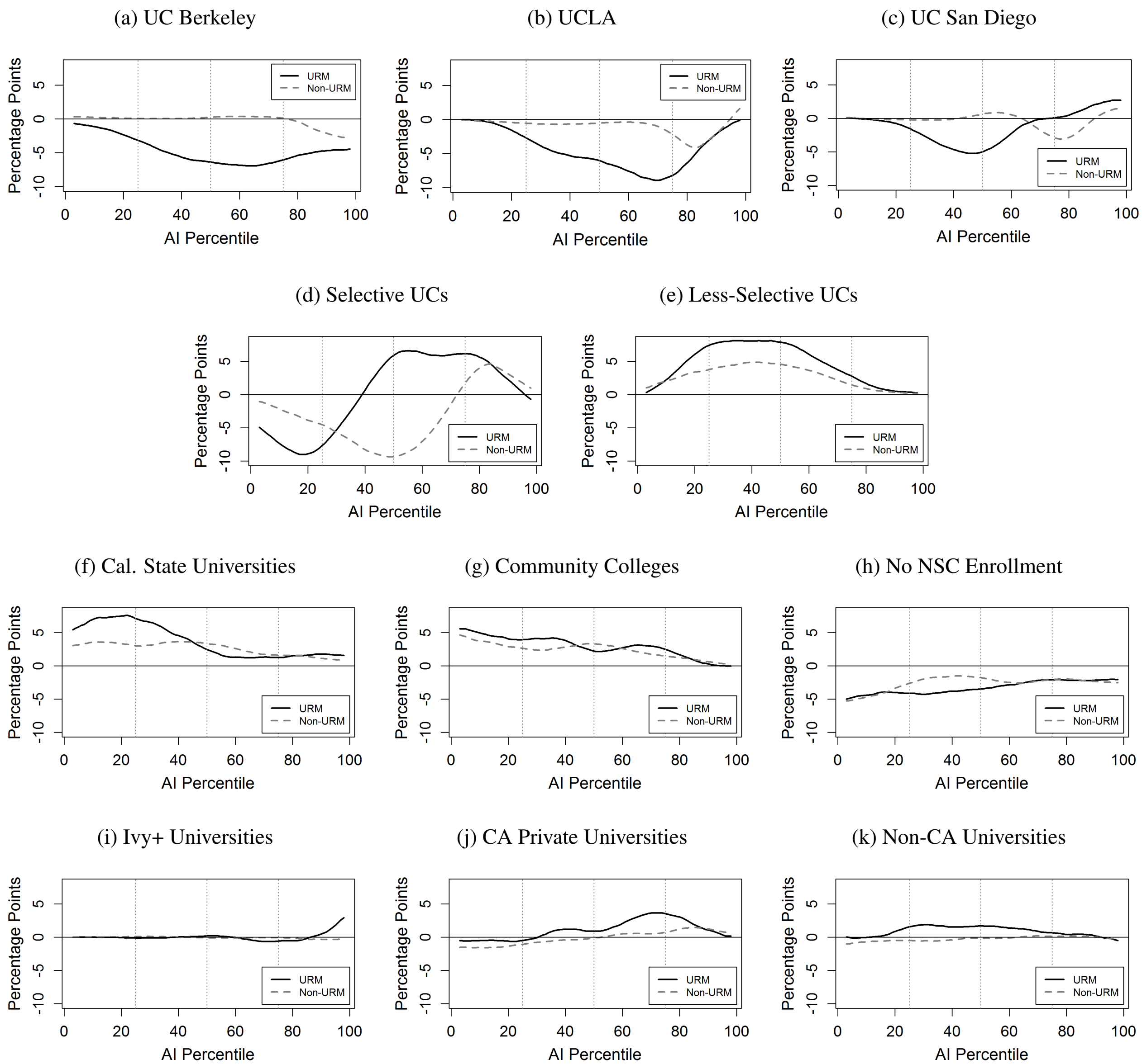
Note: The difference between the percent of URM applicants and the percent of non-URM applicants admitted to each campus by academic index (AI), in each of four two-year periods (1994-2001), with darker lines corresponding to earlier periods. The two later periods are after the implementation of Prop 209 ended UC’s affirmative action policies. The displayed statistics show the total annual number of additional URM students admitted to each campus in each period based on their higher likelihood of admission, calculated as the sum of the products between the increased admissions likelihood and the number of URM applicants by year and AI. The sample is restricted to freshman fall California-resident applicants who were “normal,” in that they (a) were UC-eligible, which means that they satisfactorily completing the required high school coursework, and (b) selected intended majors that did not have special admissions restrictions (e.g. engineering at some campuses). UC Riverside admitted all such applicants. “URM” includes Black, Chicano, Latino, and Native American applicants. Source: UC Corporate Student System.

Figure II: UC Enrollment before and after Prop 209 by Ethnicity and AI Percentile



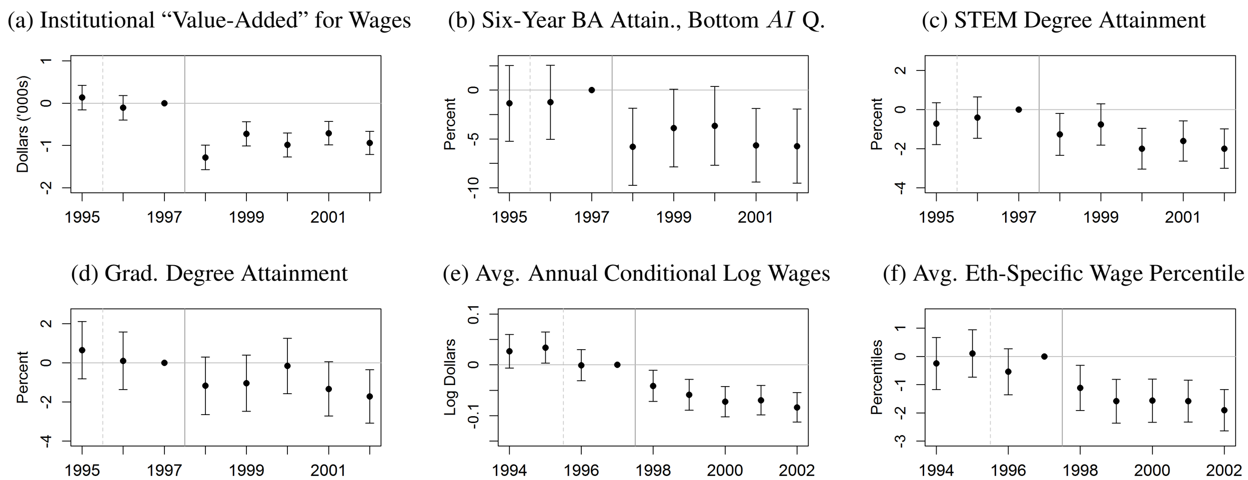
Note: The percent of all UC applicants who first enroll at each set of UC campuses before ('96-97 cohorts) and after ('98-99 cohorts) the end of affirmative action, by URM status and by percentile of academic index (AI) measured among 1996-1999 URM UC applicants. First enrollment measured in NSC up to six years after UC application. Statistics are smoothed with a triangular kernel with bandwidth 15. Source: UC Corporate Student System and National Student Clearinghouse.

Figure III: Changes in University Enrollment after Prop 209 by Ethnicity and AI Percentile



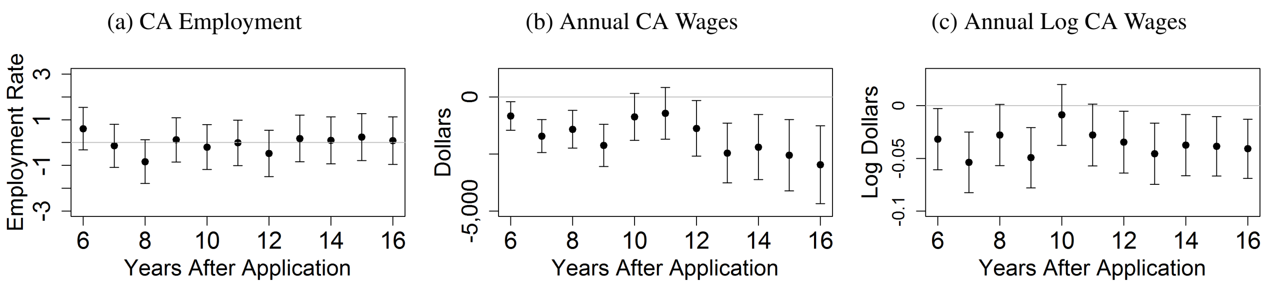
Note: Difference in percent of UC applicants who first enroll at each postsecondary institution(s) between 1998-1999 and 1996-1997, by URM status and by percentile of academic index (AI) measured among 1996-1999 URM UC applicants. First enrollment measured in NSC up to six years after UC application; university groups partition possible enrollments. Statistics are smoothed with a triangular kernel with bandwidth 15. "Ivy+" universities include the Ivy League, MIT, Stanford, and U. Chicago; private and non-CA universities exclude those institutions. Source: UC Corporate Student System and National Student Clearinghouse.

Figure IV: Annual Difference-in-Difference Estimates of URM UC Applicants' Outcomes after Prop 209



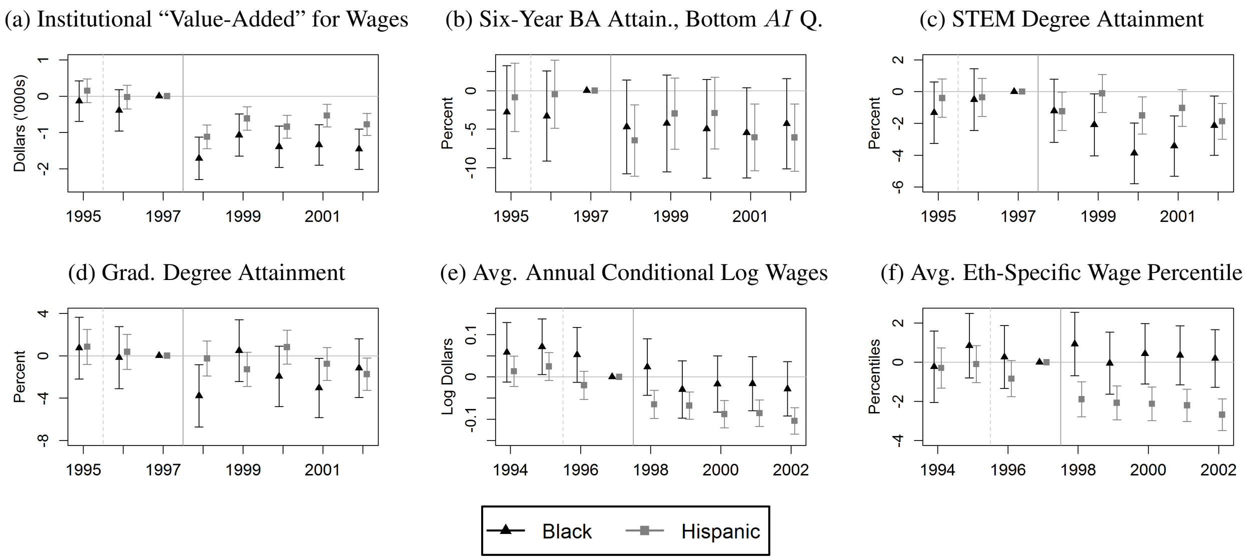
Note: OLS difference-in-difference coefficient estimates of Equation 1, the change in URM UC applicant outcomes relative to non-URM applicants, compared to the 1997 baseline. For details on outcomes (a) to (e), see notes to Tables II (with institutional value-added estimated following Chetty et al. (2020a)), III, and IV. Panel (f)'s outcome is defined as the average annual ethnicity-specific wage percentile between 6 and 16 years after UC application, omitting zero-wage years; percentiles are defined relative to the empirical distribution of wages earned in that year by same-ethnicity (URM, Asian, or White/Other) college-educated California ACS respondents born between 1974 and 1978, few of whom were directly impacted in university enrollment by Prop 209. Models include high school fixed effects, ethnicity indicators, and the components of UC's Academic Index (see footnote 21); 1994 NSC data are omitted. Panel (b) restricts the sample to the bottom AI quartile as measured among '96-97 URM UC applicants. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Bars show robust 95-percent confidence intervals. Source: UC Corporate Student System, National Student Clearinghouse, California Employment Development Department, and the American Community Survey (Ruggles et al., 2018).

Figure V: Annual Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Wage Outcomes



Note: Estimates of $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' employment outcomes compared to non-URM outcomes after Prop 209. Outcomes defined as non-zero California wages ("CA Employment") and California wages in dollars and log-dollars (omitting 0's) as measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. Coefficients in each year after UC application are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust 95-percent confidence intervals shown. Figure A-8 presents separate estimates for Black and Hispanic applicants. Source: UC Corporate Student System and the California Employment Development Department.

Figure VI: Annual Difference-in-Difference Estimates of URM UC Applicant Outcomes by Ethnicity

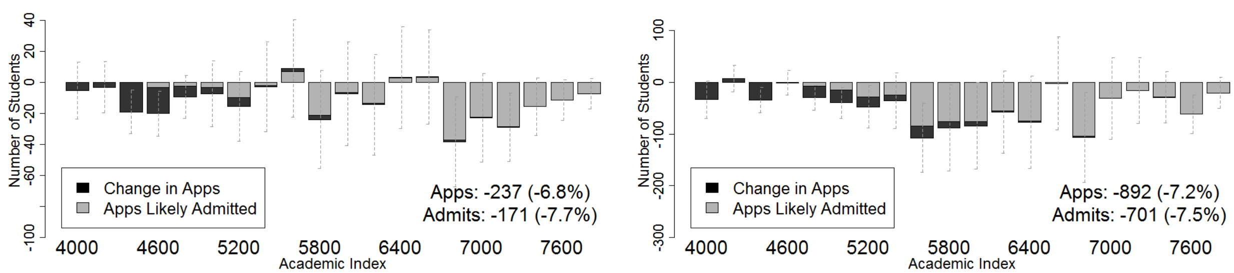


Note: OLS difference-in-difference coefficient estimates of an extension of Equation 1 interacting β_t with Black and Hispanic indicators, estimating the change in Black and Hispanic UC applicant outcomes relative to non-URM applicants compared to the 1997 baseline. For details on outcomes (a) to (e), see notes to Tables II, III, and IV; institutional value-added is estimated following Chetty et al. (2020a). Panel (f)'s outcome is defined as applicants' average annual ethnicity-specific wage percentile between 6 and 16 years after UC application, omitting zero-wage years; percentiles are defined relative to the empirical distribution of wages earned in that year by same-ethnicity (URM, Asian, or White/Other) college-educated California ACS respondents born between 1974 and 1978, few of whom were directly impacted in university enrollment by Prop 209. Models include high school fixed effects, ethnicity indicators, and the components of UC's Academic Index (see footnote 21); 1994 NSC data are omitted. Panel (b) restricts the sample to the bottom AI quartile as measured among '96-97 URM UC applicants. Native American applicants are omitted. Bars show robust 95-percent confidence intervals. Source: UC Corporate Student System, National Student Clearinghouse, California Employment Development Department, and the American Community Survey (Ruggles et al., 2018).

Figure VII: Estimated Declines in Annual 1998-99 Applications and Admissions by Ethnicity

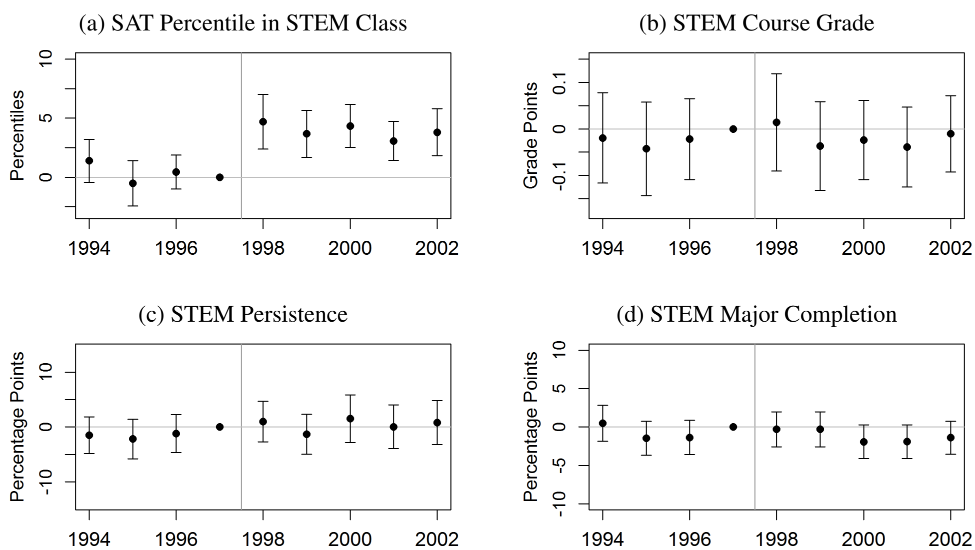
(a) Black

(b) Hispanic



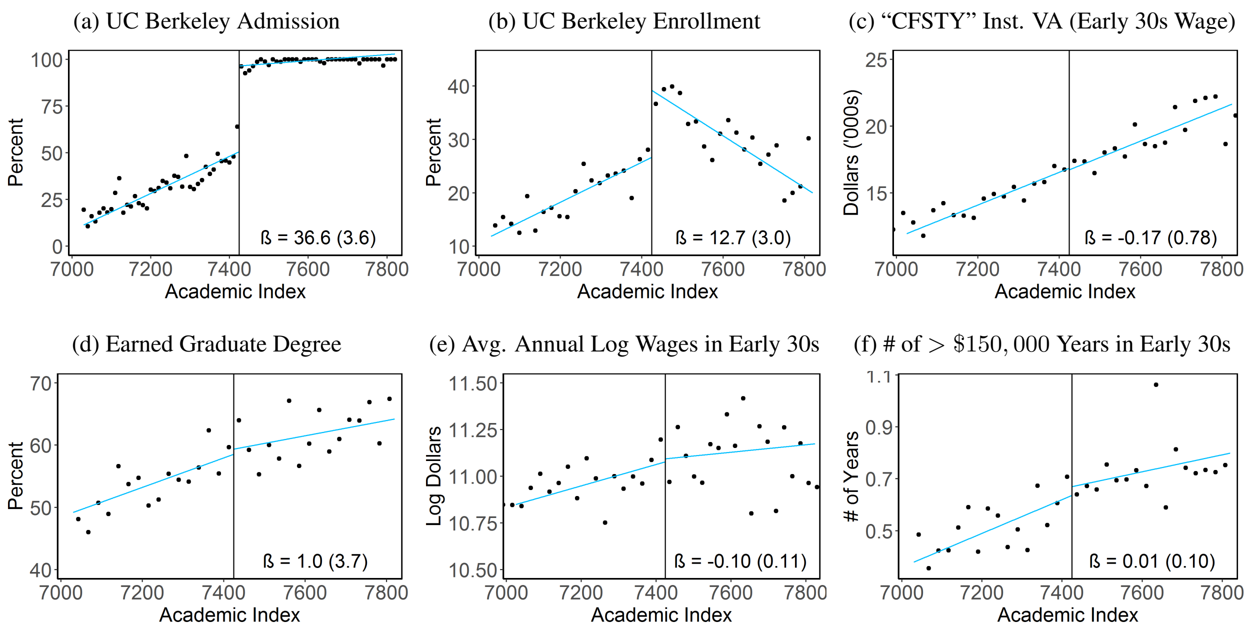
Note: Estimates of the change in the annual number of UC applicants (and admits) in 1998-1999 by ethnicity (e) and 200-point AI bin, relative to 1994-1995. The height of each black bar is the product of $\beta_{e,98-99,a}$ (estimated in Equation 2) and $\sum_s UC_{s,98-99,e}$, the average number of UC-eligible California public high school graduates of ethnicity e in 1998-1999. The height of each overlaying blue bar is the product of the black bar and the percent of 1998-1999 UC-eligible e UC applicants in that AI range admitted to at least one UC campus. The statistics in the bottom right sum the bars across all AI and report the sums as a share of all e UC applicants. 95-percent confidence intervals on the black bars from $\beta_{e,98-99,a}$ robust standard errors. Source: UC Corporate Student System and the California Department of Education.

Figure VIII: Difference-in-Difference Estimates of URM UC Enrollees' STEM Performance and Persistence



Note: Difference-in-difference WLS regression coefficient estimates of UCB, UCSB, UCD, UCSC, and UCR enrollees' introductory STEM course performance or persistence, differencing across URM status following Equation 3, relative to 1997. In Panels (a)-(c) each observation is a CA-resident freshman student-course pair in an introductory biology, chemistry, physics, or computer science course (see Appendix H) taken within 2.5 years of matriculation, stacking over courses and weighted evenly across observed students. SAT percentile is the fraction of other 1994-2002 freshman CA-resident peers who have lower SAT scores than the student; persistence indicates completing the subsequent course in the introductory STEM course sequence; and course grade is the grade points received in completed courses. In Panel (d) each observation is a student; the outcome indicates completing any UC STEM degree. Models include high school fixed effects, ethnicity indicators, and the components of UC's Academic Index (see footnote 21). UCSC is omitted from the GPA model because it did not mandate letter grades in the period. 95-percent confidence intervals are two-way clustered by student and course sequence level (e.g. second chemistry course). Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018).

Figure IX: Estimated Return to ‘96-97 UC Berkeley Enrollment for On-the-Margin Non-URM Applicants



Note: Regression discontinuity plots and estimates around the 1996-1997 UC Berkeley guaranteed admission AI threshold among non-URM applicants, estimated by local linear regression following Calonico et al. (2014). See the notes to Tables II, III, and IV for a description of the outcome variables; “CFSTY” institutional value-added measured relative to CSU Long Beach. Reduced form coefficients from local linear regressions (conditional on year), with bias-corrected robust standard errors in parentheses. Running variable defined as $AI + (70 \times \mathbb{1}_{1997})$ to align thresholds over years. Source: UC Corporate Student System, National Student Clearinghouse, and the CA Employment Development Department.

Online Appendix

Affirmative Action, Mismatch, and Economic Mobility after California's Proposition 209

Zachary Bleemer, University of California, Berkeley

June 2021

Table of Contents

Appendix A: Public Universities Practicing Affirmative Action in 2020

Many public and private universities are non-transparent about their undergraduate admissions policies. However, most universities publish annual "Common Data Set" reports that provide a response to the question: What is the "relative importance of each of the following academic and nonacademic factors in first-time, first-year, degree-seeking (freshman) admission decisions: ... Racial/ethnic status: Very Important, Important, Considered, and Not Considered".

The following is a list of states with public universities where race/ethnic status is at least considered in undergraduate admissions – according to their most recent common data set available in July 2020 – naming the university in parentheses if it differs from the state's flagship public university: CO, CT, DE, GA (Georgia Tech), IL, IN, LA (Grambling State), ME (University of Southern Maine), MD, MA, MI, NJ, NY, NC, OH, OR, PA, RI, SC, TN, TX, UT, VT, VI, and WI. The University of New Hampshire reports considering race in admissions, but is prohibited by law from providing preference to applicants based on their race. The University of New Mexico does not report whether or not it considers race in admissions.

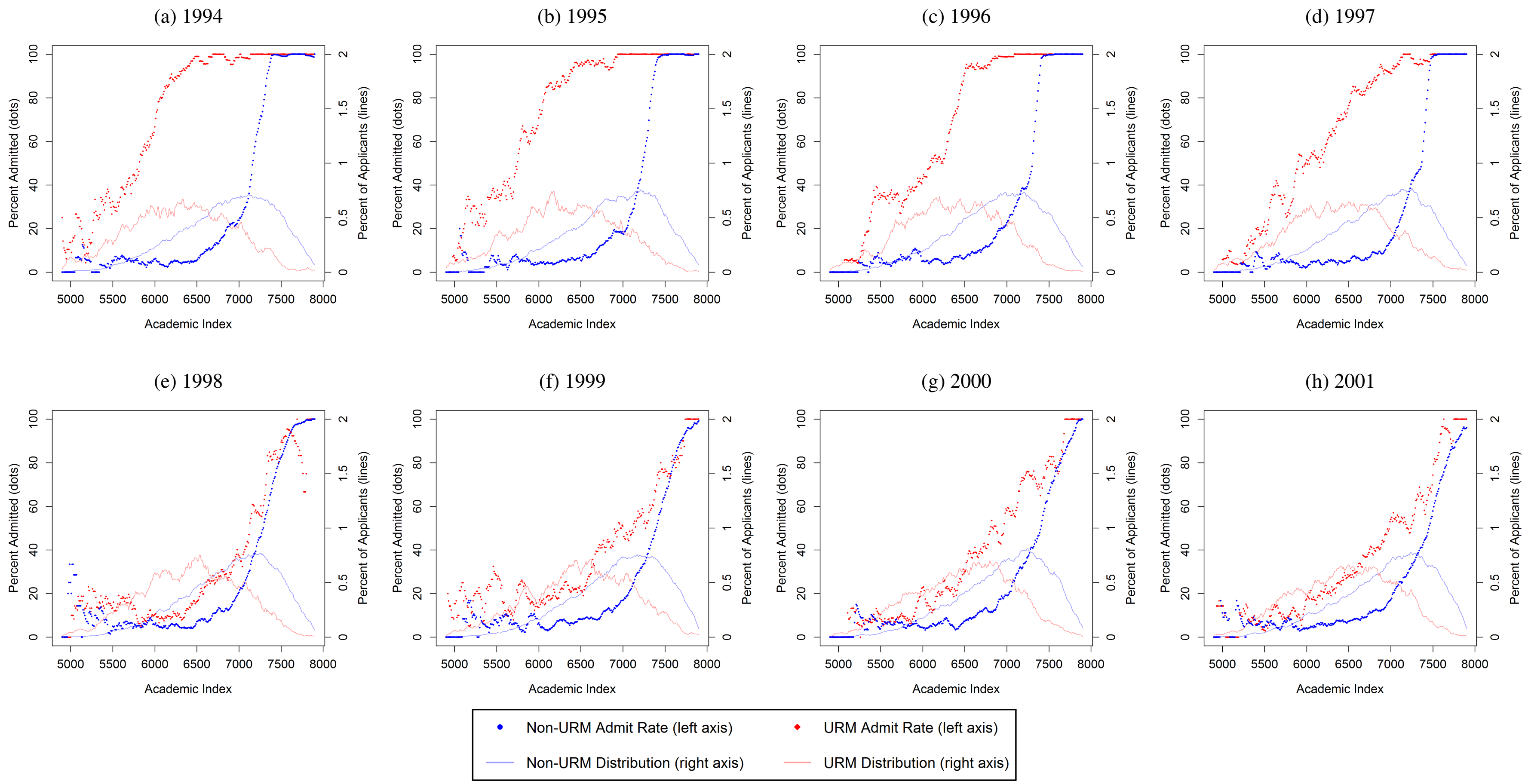
Appendix B: URM and Non-URM Admissions by UC Campus and AI, 1994-2001

The figures below show the raw admissions likelihood and application distribution of URM and non-URM applicants to each UC campus by Academic Index from 1994 to 2001. The figures clarify how affirmative action was practiced by different UC campuses before 1998, and how Prop 209 changed the admissions likelihood of URM applicants (and, to some degree, non-URM applicants).[46] For example, UC Davis and UC Santa Cruz guaranteed admission to nearly all UC-eligible URM applicants before 1996, while UC Berkeley extended their admissions guarantee to URM students with AI more than 1,000 points lower than the guarantee extended to non-URM students. The URM and non-URM admissions rates sharply converged after Prop 209, though at most campuses URM applicants at nearly every AI remained more likely to be admitted than non-URM applicants. The differences between the admissions likelihoods of URM and non-URM UC applicants in different years are summarized in Figure I.

The AI distribution of applicants was most-dissimilar by ethnicity at the Berkeley and UCLA campuses, which had far higher shares of low-AI URM applicants than low-AI non-URM applicants, reflecting the large admissions advantages provided by those campuses to even lower-AI URM applicants under affirmative action. The distribution of applicant AI rose over time at most campuses, likely driven both by grade inflation and growing cross-campus interest in UC enrollment among high-AI California high school graduates.

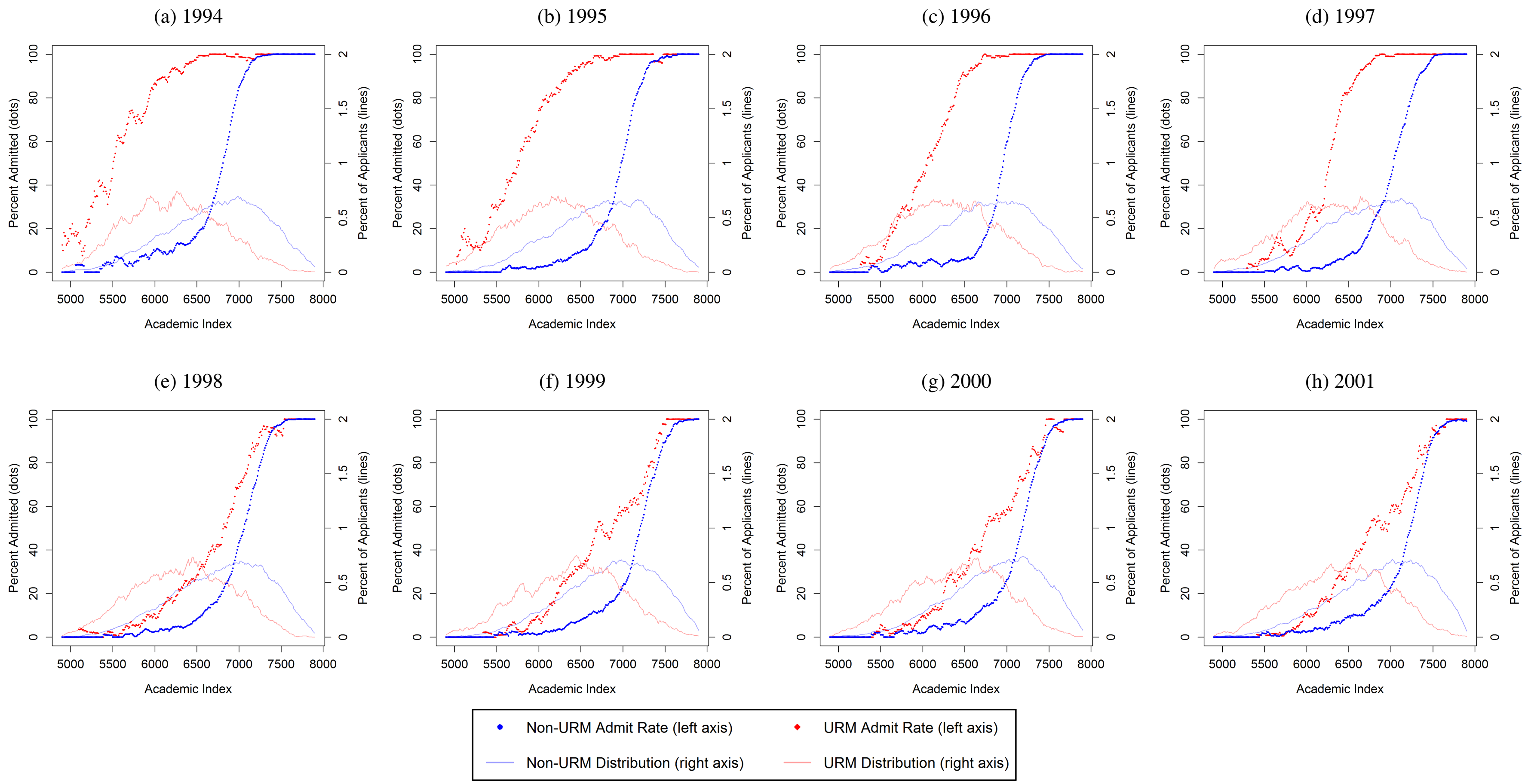
[46] Latino UC applicants – who made up about one in five URM UC applicants in the period – received somewhat smaller admissions advantages than American Indian, Black, and Chicano UC applicants in some years at some campuses (e.g. see Figure A-3). They are omitted from the figures in this Appendix.

Figure B-1: Annual "Normal" Admissions at UC Berkeley



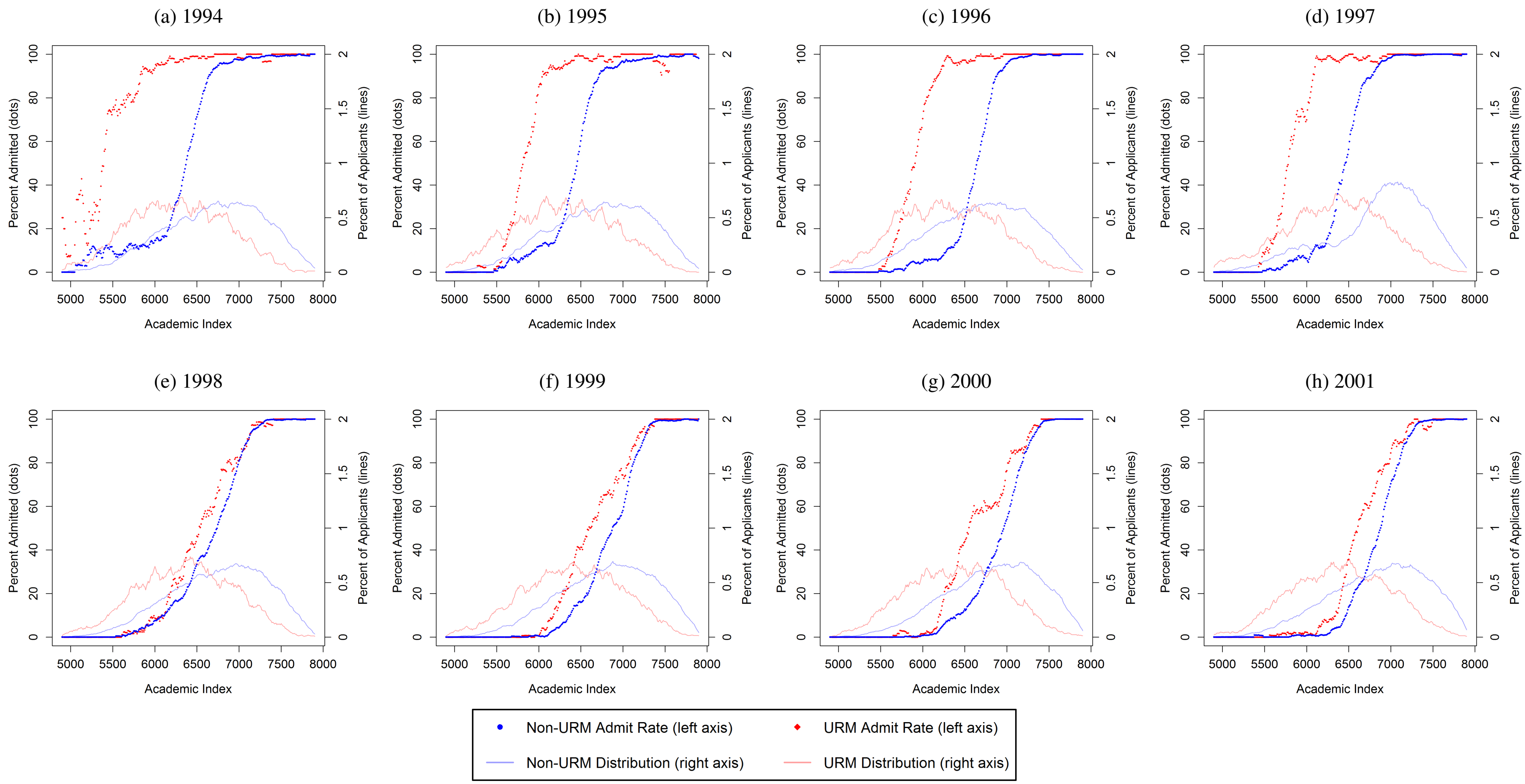
Note: This figure shows the 1994-2001 annual UC Berkeley admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Berkeley applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Berkeley by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC's minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-2: Annual “Normal” Admissions at UCLA



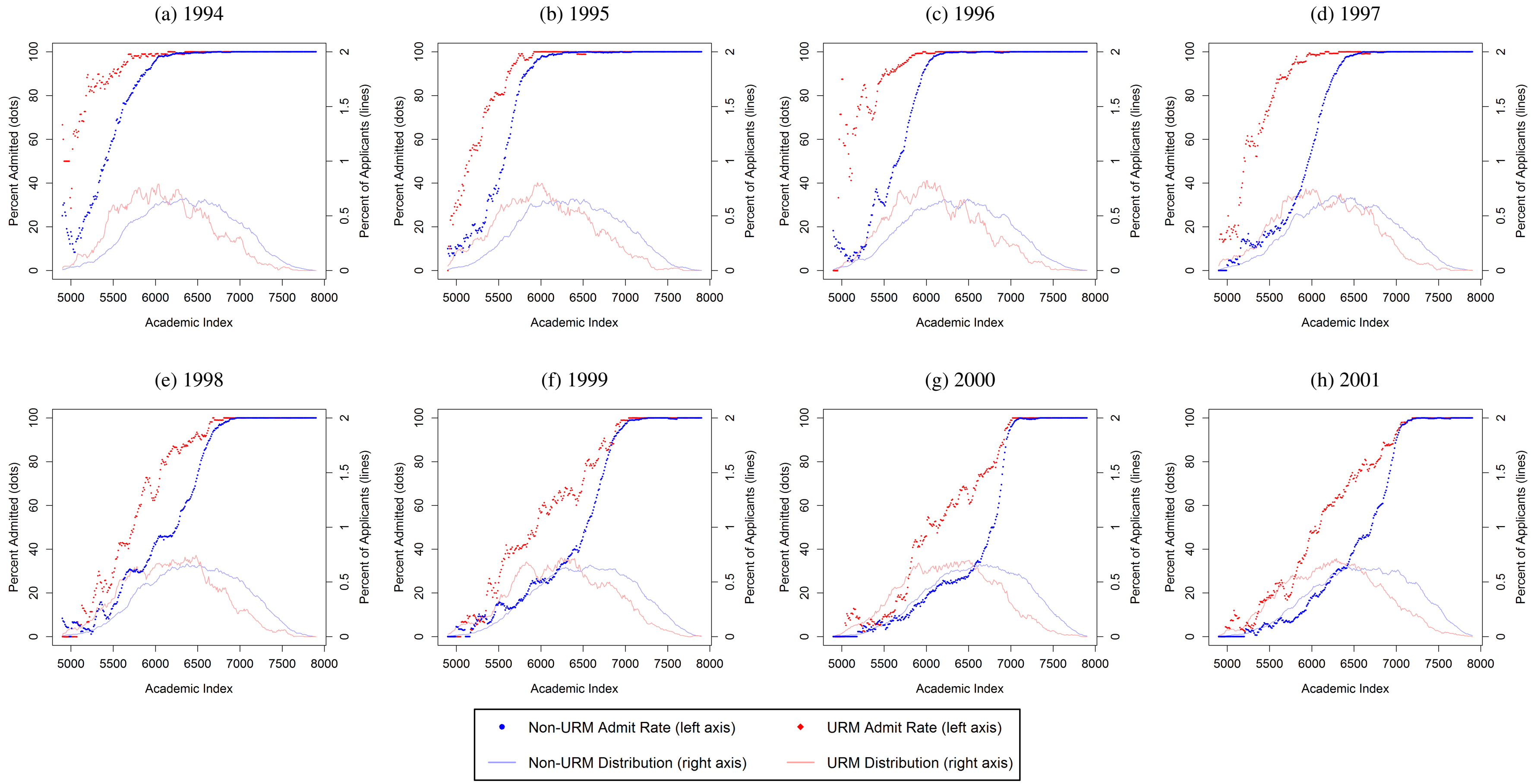
Note: This figure shows the 1994-2001 annual UCLA admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UCLA applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UCLA by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC’s minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-3: Annual “Normal” Admissions at UC San Diego



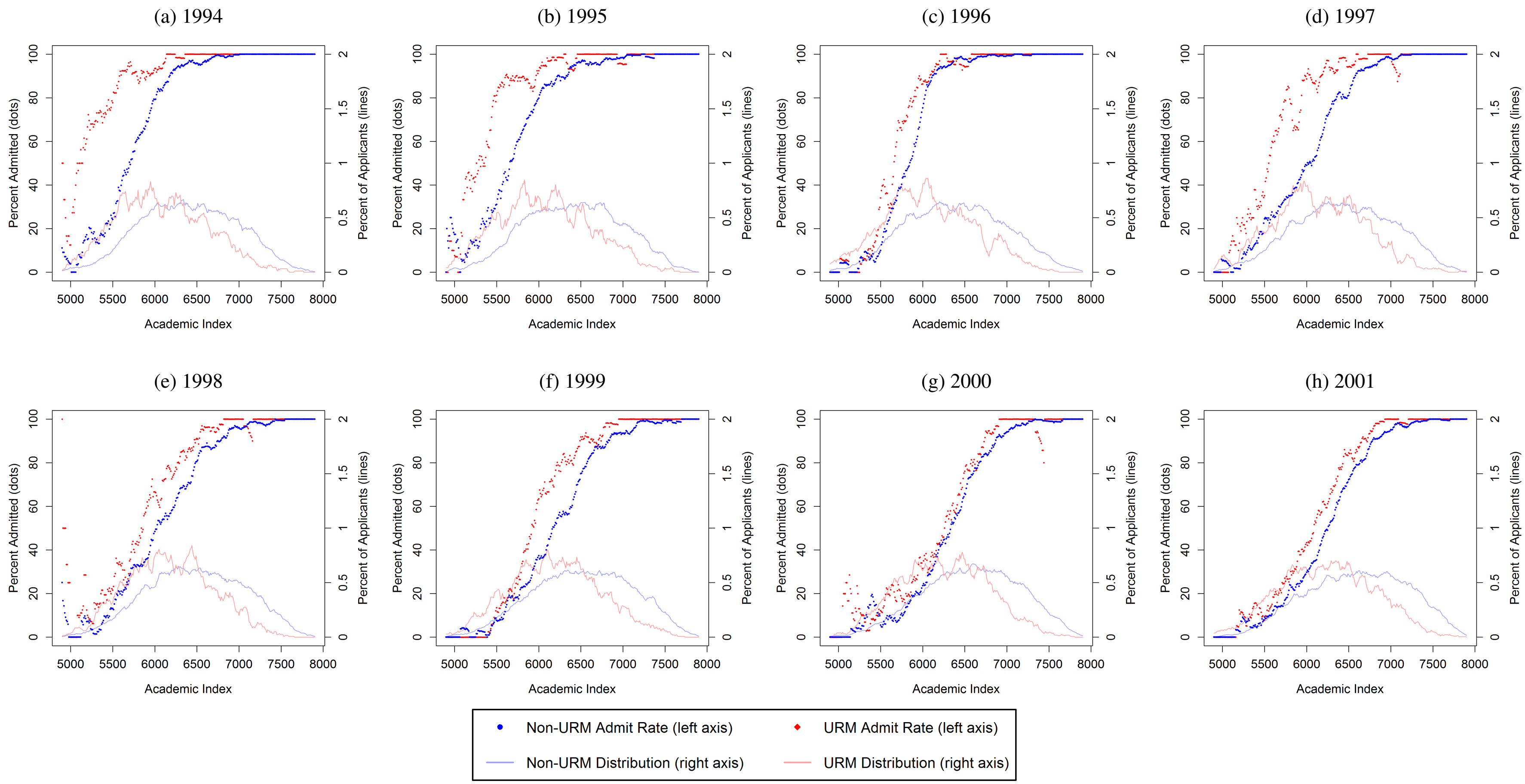
Note: This figure shows the 1994-2001 annual UC San Diego admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC San Diego applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC San Diego by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC’s minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-4: Annual “Normal” Admissions at UC Santa Barbara



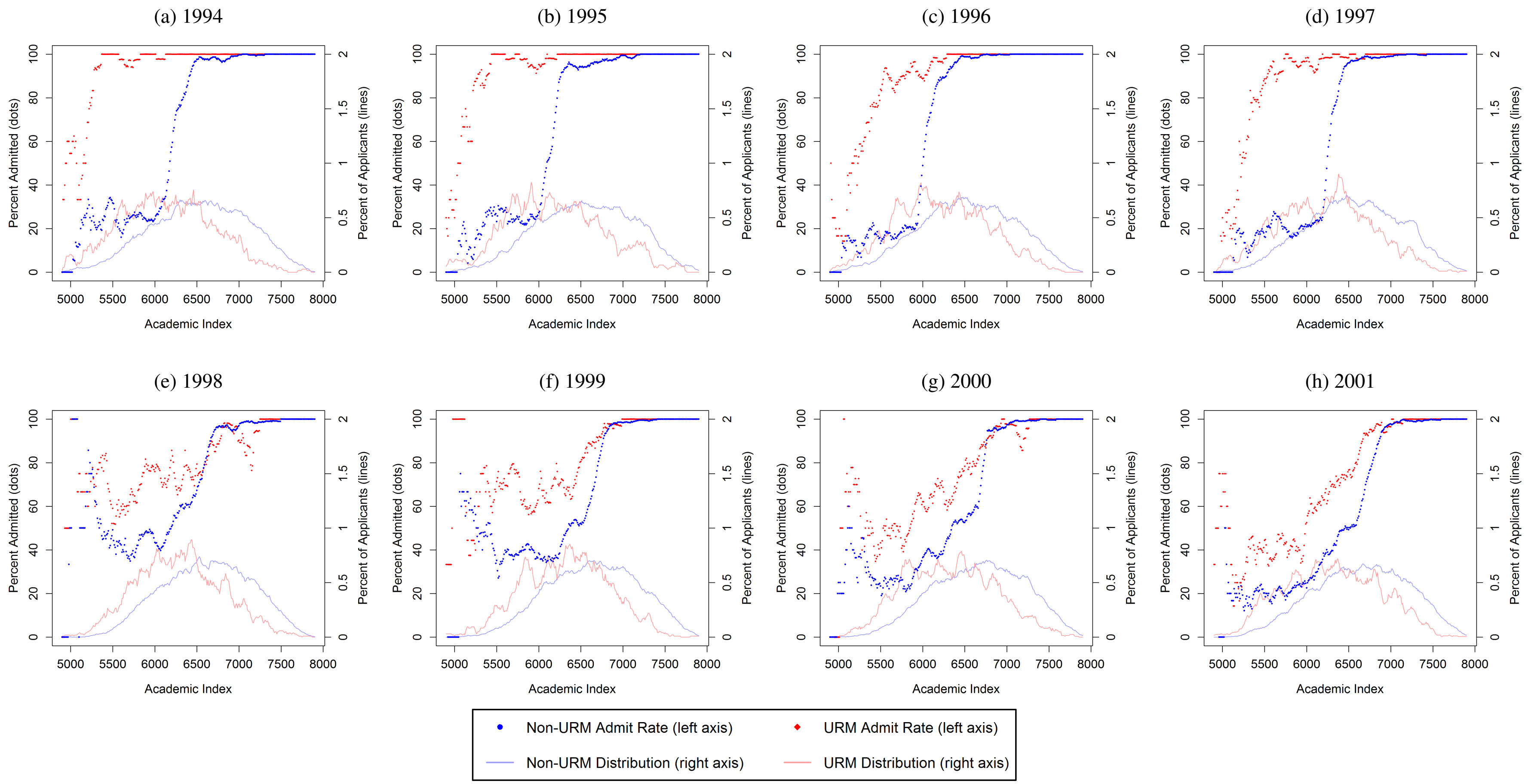
Note: This figure shows the 1994-2001 annual UC Santa Barbara admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Santa Barbara applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Santa Barbara by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC’s minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-5: Annual “Normal” Admissions at UC Irvine



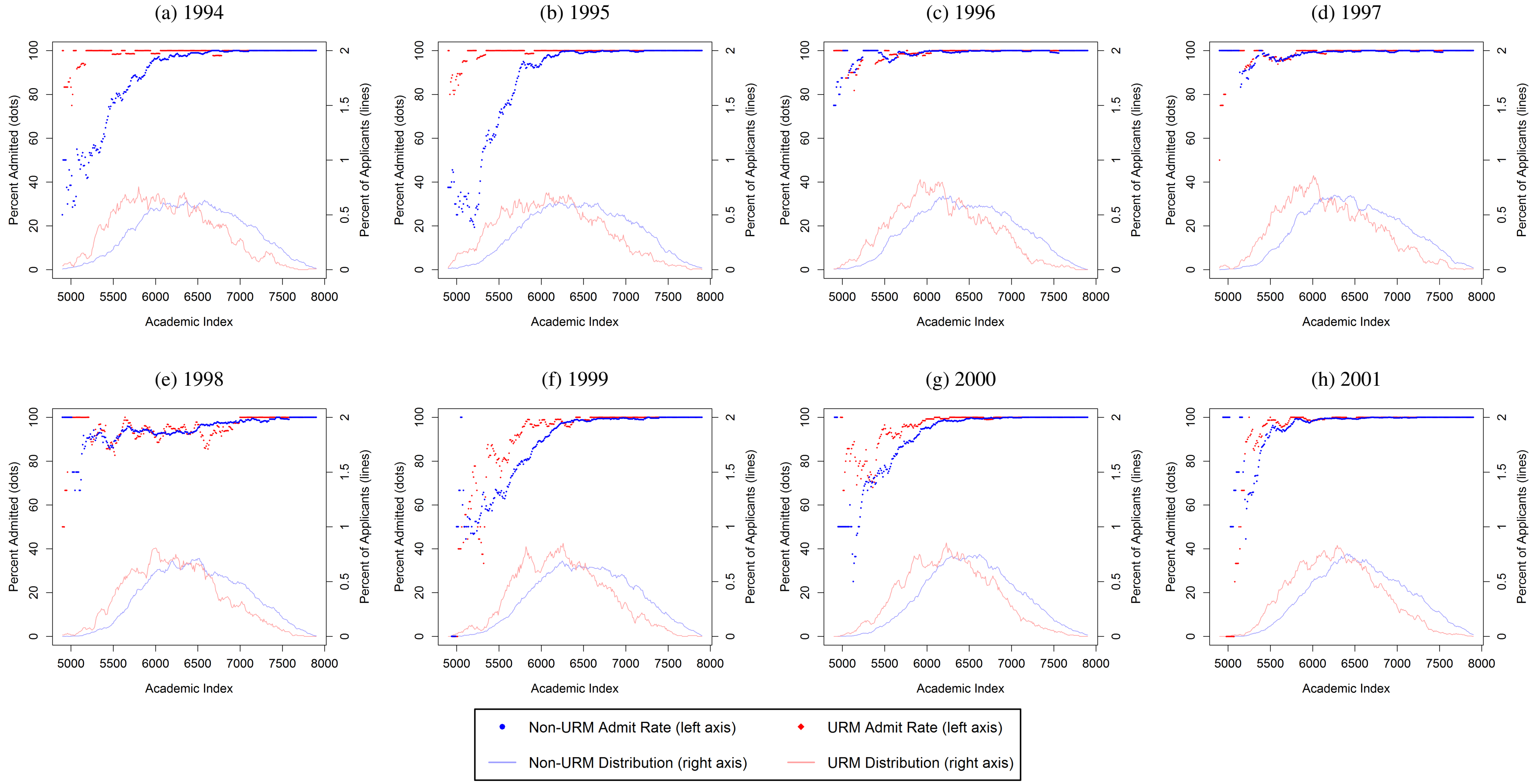
Note: This figure shows the 1994-2001 annual UC Irvine admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Irvine applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Irvine by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC's minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-6: Annual “Normal” Admissions at UC Davis



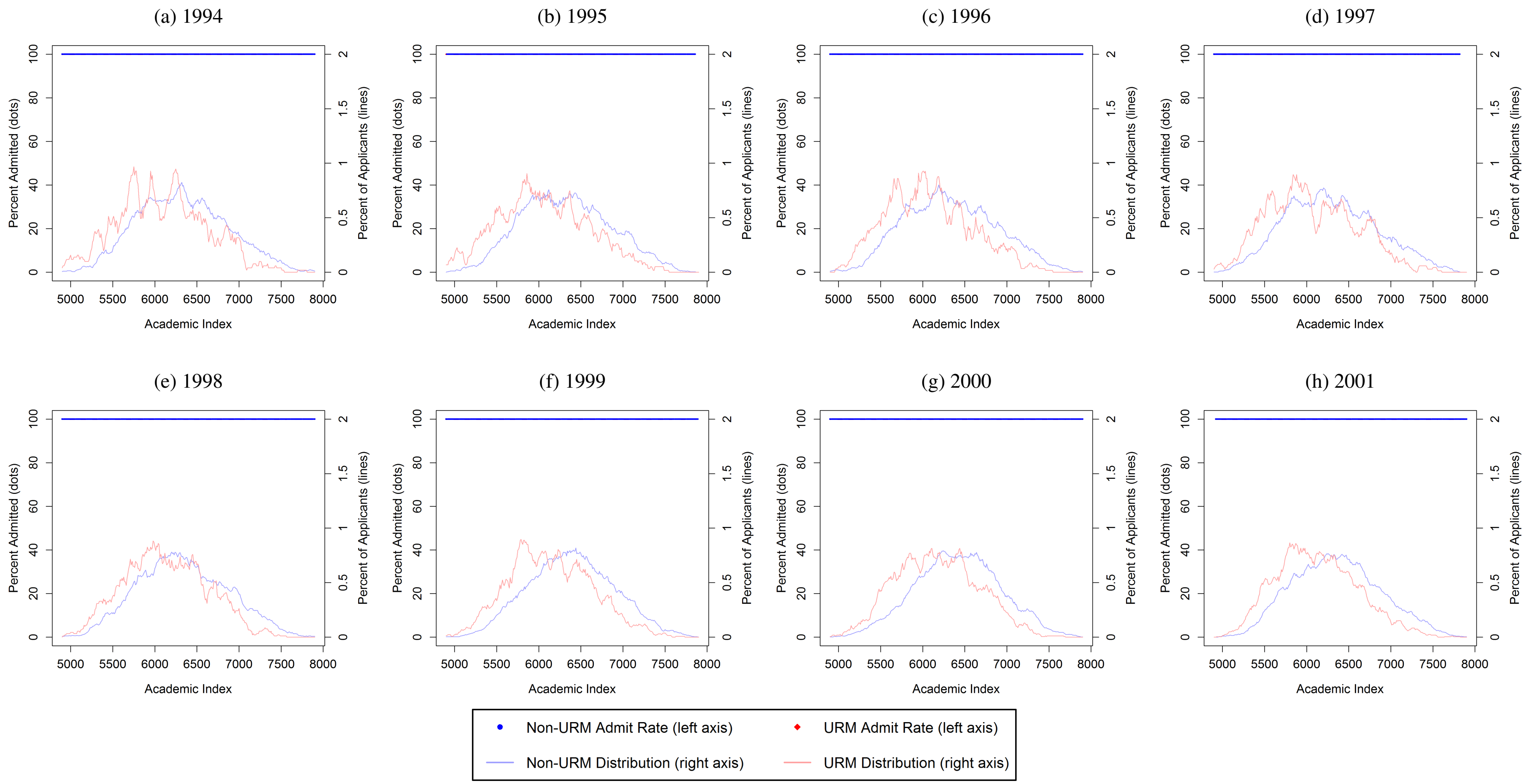
Note: This figure shows the 1994-2001 annual UC Davis admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Davis applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Davis by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC’s minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-7: Annual "Normal" Admissions at UC Santa Cruz



Note: This figure shows the 1994-2001 annual UC Santa Cruz admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Santa Cruz applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Santa Cruz by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC's minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure B-8: Annual "Normal" Admissions at UC Riverside



Note: This figure shows the 1994-2001 annual UC Riverside admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Riverside applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Riverside by Academic Index (AI) – the sum of (top-censored) high school GPA, SAT I score, and three SAT II scores – each year from 1994 to 2001 (left axis). The lines show the probability density function of URM and non-URM UC applicants by AI (right axis). Admission rates and distributions are smoothed with a uniform kernel of bandwidth 50; AI below 4900 and above 7900 are omitted. The sample is restricted to freshman fall California-resident applicants who (a) were UC-eligible, meaning that they satisfactorily completed UC's minimum high school coursework requirement, and (b) reported an intended major that did not have special admissions restrictions, like engineering at some campuses. Latino (but not Chicano) applicants received slightly smaller admissions advantages (see Figure A-3) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Appendix C: UC Admissions and Yield after Prop 209

Table C-1 presents estimates of Equation 1's β_0 and $\beta_{'98-99}$ for admission to each UC campus, estimated on the 1996-1999 sample of applicants to that campus. While URM applicants were 37 and 27 percentage points more likely than comparable non-URM applicants to be admitted to Berkeley and UCLA under affirmative action, these advantages fell to 13 and 11 percentage points after Prop 209.[47] URM applicants faced similar-magnitude declines in their admissions likelihood at San Diego and Davis, and their admissions advantage fell at every campus. Among all applicants to any UC campus, URM applicants' admissions advantage over non-URM applicants (to be admitted to at least one campus) fell from 9.3 to 1.4 percentage points. Prop 209 had generally-similar impacts on the admissions likelihood of Black and Hispanic UC applicants: though Black students received somewhat-larger admissions advantages under affirmative action relative to academically-comparable non-URM applicants, Prop 209 caused slightly larger admissions declines for Hispanic applicants to UC's more-selective campuses than for Black UC applicants.

Table A-6 shows that admitted URM applicants became more likely to enroll at every UC campus after Prop 209, though URM applicants who were admitted to some UC campus became **less** likely to enroll at UC, a case of Simpson's Paradox reflecting the decline in the number of UC campuses to which URM applicants were admitted. Antonovics and Sander (2013) argue that this "warming effect" across UC campuses resulted from an increase in the signaling value of attending UC for URM applicants. As in that study, conditioning on the set of UC campuses to which applicants were admitted flips the sign of the UC-wide coefficient (to 2.8 percentage points); compared to academically-similar students admitted to the same UC campuses, post-1998 URM students are more likely to enroll at some UC campus. Admissions and enrollment statistics are slightly larger when estimated relative to the '94-95 baseline; see Table C-2.

Appendix D: Data Quality

D.1 Applicants Who Decline to Report Ethnicity

The percent of UC applicants who declined to report ethnicity on their application increased from 4.1 percent in '96-97 to 10.5 percent in '98-99, potentially challenging the identification of URM applicants.[48] To identify the ethnicity of missing-ethnicity applicants, I estimate a multinomial logistic regression of ethnicity (Asian, Black, Hispanic, and white) on the leave-one-out ethnicity shares of each known-ethnicity applicant for applicants' first name, middle name, last name, high school, zip code, and Census block, holding out a randomly-selected 10 percent of applicants. I then predict each missing-ethnicity applicant's likelihood of being each ethnicity, classifying them if their estimated likelihood of being that ethnicity exceeds 75 percent.[49]

[47] Note that these models do not control for family income or other measures of pre-college opportunity likely correlated with URM status. Since those factors remained part of UC admissions, it is unsurprising that the presented models still identify advantages for URM applicants despite Prop 209.

[48] Throughout this study, applicants are categorized as "Black" if they self-report their ethnicity as "Black/African American"; as "Hispanic" if they self-report as "Chicano/Mexican-American" or "Latino/Other Spanish-American"; and as "Asian" if they self-report their ethnicity as "Chinese/Chinese-American," "East Indian/Pakistani," "Japanese/Japanese-American," "Korean," "Pilipino/Filipino," "Thai/Other Asian," or "Vietnamese".

[49] Types 1 and 2 error by ethnicity, measured using the 10 percent of hold-outs, are: 13.2% and 15.2% (white), 3.9% and 12.4% (Asian), 0.3% and 55.5% (Black), and 1.2% and 27% (Hispanic). I replace non-reported ethnicity with predicted ethnicities in Figures IV(f) and VII to avoid dropping data.

Table C-1: Difference-in-Difference Estimates of Post-1998 URM Admissions by UC Campus

Campus:	UCB	UCLA	UCSD	UCSB	UCI	UCD	UCSC	UCR	Total
Overall admission conditional on application (%)									
URM	37.3	26.8	23.8	17.0	10.1	27.5	7.0	4.2	9.3
	(0.6)	(0.5)	(0.5)	(0.5)	(0.6)	(0.5)	(0.6)	(0.6)	(0.3)
URM × Prop 209	-24.5	-16.0	-18.7	-6.3	-3.1	-18.6	-5.8	-3.7	-7.9
	(0.7)	(0.6)	(0.6)	(0.6)	(0.7)	(0.7)	(0.8)	(0.7)	(0.4)
$\bar{Y}$	32.3	35.1	51.8	65.2	65.8	70.1	81.8	85.0	82.3
Obs.	88,905	108,327	93,238	82,061	70,343	73,834	45,053	45,396	199,321
Admission conditional on application (%), **Black**									
Black	49.8	44.4	28.8	22.8	23.7	40.1	14.9	18.3	15.9
	(1.0)	(0.8)	(1.1)	(1.1)	(1.2)	(1.1)	(1.3)	(1.3)	(0.6)
Black × Prop 209	-25.4	-25.5	-20.6	-8.7	-15.3	-27.2	-17.4	-20.9	-16.8
	(1.3)	(1.1)	(1.4)	(1.5)	(1.6)	(1.5)	(1.8)	(1.5)	(0.8)
$\bar{Y}$	33.8	38.2	53.6	68.3	68.7	69.0	82.4	84.7	83.5
Obs.	71,821	85,476	79,947	65,728	57,492	62,326	36,445	35,880	160,180
Admission conditional on application (%), **Hispanic**									
Hispanic	39.7	34.2	21.6	8.3	19.3	31.3	13.4	14.1	12.7
	(0.7)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.7)	(0.3)
Hispanic × Prop 209	-29.9	-26.2	-18.8	0.1	-13.6	-23.3	-12.1	-13.4	-11.1
	(0.9)	(0.7)	(0.8)	(0.7)	(0.8)	(0.9)	(0.8)	(0.8)	(0.4)
$\bar{Y}$	34.3	38.4	53.3	68.1	68.6	69.8	82.3	84.8	83.5
Obs.	77,988	95,495	87,802	74,487	64,688	67,352	42,051	41,654	180,540

Note: OLS coefficient estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, a difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' UC admission compared to non-URM applicants after Prop 209, overall or excluding non-Black or non-Hispanic URM applicants. Models are conditioned on applying to that UC campus. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21), and are estimated independently by campus or "Total" (all applicants to any UC campus). Robust standard errors in parentheses. Source: UC Corporate Student System.

In '96-97, I find that among the 88 percent of missing-ethnicity applicants whose ethnicity can be classified, 68 percent are white, 29 percent are Asian, 2.5 percent are Hispanic, and 0.6 percent are Black. The URM shares are hardly higher in '98-99; of the 87 percent classified, whites and Asians make up 65 and 29 percent, while Hispanics and Blacks make up 4.2 and 1.3 percent. Thus, while the decline in URM reporting incentives may have disproportionately increased non-reporting among URM university applicants (Antman and Duncan, 2015), the very large majority of non-reporters remains non-URM. These results justify the assumption in the baseline analysis that missing-ethnicity applicants are non-URM. No presented result changes statistically or qualitatively if predicted-URM applicants are re-assigned as URM.

D.2 National Student Clearinghouse Coverage

Dynarski, Hemelt and Hyman (2015) show that national NSC enrollment coverage at four-year institutions was below 50 percent in 1996, rising to over 80 percent by 2000.[50] Coverage at the somewhat-selective

[50]NSC reports that about 4 percent of records are censored due to student- or institution-requested blocks for privacy concerns, and that the only public university in California with censorship greater than 10 percent is UC Berkeley (National Student Clearinghouse Research Center, 2017).

Table C-2: Difference-in-Difference Estimates of Post-1998 URM Admissions by UC Campus, Compared to '94-5 Baseline

Campus:	UCB	UCLA	UCSD	UCSB	UCI	UCD	UCSC	UCR	Total
Application conditional on UC application (%)									
URM	11.8	9.9	-1.8	-8.6	-8.9	-4.8	-3.2	-8.2	
	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.3)	
URM × Prop 209	-2.9	-5.7	-1.3	3.1	-0.8	1.5	0.9	5.9	
	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	
$\bar{Y}$	43.9	53.5	48.1	40.8	35.7	37.8	23.1	23.8	
Obs.	190,540	190,540	190,540	190,540	190,540	190,540	190,540	190,540	
Admission conditional on application (%)									
URM	43.5	37.8	23.5	10.8	20.3	32.6	13.2	15.2	13.4
	(0.6)	(0.5)	(0.6)	(0.5)	(0.6)	(0.6)	(0.6)	(0.6)	(0.3)
URM × Prop 209	-29.6	-26.8	-19.7	-1.4	-14.0	-24.0	-12.9	-15.2	-12.4
	(0.7)	(0.6)	(0.7)	(0.7)	(0.7)	(0.8)	(0.8)	(0.7)	(0.4)
$\bar{Y}$	34.5	38.5	52.8	67.8	68.2	69.7	81.9	84.1	82.9
Obs.	82,637	100,991	91,227	77,640	67,320	70,424	43,987	44,165	190,540
Enrollment conditional on **application** (%)									
URM	14.6	12.9	0.3	-1.5	-1.6	4.4	-1.6	2.0	8.3
	(0.6)	(0.5)	(0.5)	(0.6)	(0.6)	(0.7)	(0.7)	(0.8)	(0.4)
URM × Prop 209	-10.6	-10.6	-2.2	2.8	-1.5	-4.4	-1.3	-4.5	-11.6
	(0.7)	(0.6)	(0.6)	(0.7)	(0.7)	(0.8)	(0.9)	(0.9)	(0.5)
$\bar{Y}$	16.4	14.8	13.0	16.4	18.0	18.7	17.1	17.2	49.6
Obs.	83,559	101,940	91,720	77,804	67,980	72,062	44,031	45,302	190,540
Enrollment conditional on **admission** (%)									
URM	-20.8	-17.9	-17.3	-7.8	-14.2	-12.0	-6.6	-3.5	1.6
	(1.1)	(0.9)	(0.8)	(0.7)	(0.8)	(0.8)	(0.8)	(0.9)	(0.5)
URM × Prop 209	10.9	9.2	10.7	5.2	5.1	6.2	3.2	0.8	-6.3
	(1.5)	(1.3)	(1.2)	(1.0)	(1.1)	(1.1)	(1.1)	(1.1)	(0.6)
$\bar{Y}$	42.7	38.5	24.7	24.1	26.6	27.3	20.8	21.0	59.7
Obs.	28,497	38,849	48,126	52,669	45,891	49,074	36,025	37,155	157,881

Note: This table shows that URM declines in UC admissions and enrollment were larger after Prop 209 when compared to '94-95 as a baseline. OLS coefficient estimates of β_0 and $\beta_{'98-99}$ from Equation 1, a difference-in-difference model of 1994-1995 and 1998-1999 URM UC freshman California-resident applicants' UC applications, admissions, and enrollment compared to non-URM applicants after the 1998 end of UC's affirmative action program. The years 1996-1997 are omitted because some universities preemptively curtailed their affirmative action programs in those years. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21), and are estimated independently by campus or "Total" (all applicants to any UC campus). Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

institutions at which UC applicants tended to enroll was much higher. Appendix A in Bleemer (2021) shows that while some California community colleges were not reporting enrollment statistics to NSC by the mid-1990s, only a small number of universities may not have been reporting graduation statistics by 1999 (the earliest year that 1996 applicants could plausibly earn a four-year degree), the largest of which was 2,100-student adult-education-oriented Brandman University. The same trend likely holds for other states; Table

Table E-1: Difference-in-Difference Estimates of **Asian** UC Applicants' Post-1998 Enrollment

	UC Campuses by Selectivity				Comm.		CA	Non-CA	Not in
	Most	Middle	Least	CSU	Coll.	Ivy+	Priv.	Univ.	NSC
Asian	6.5	-1.7	-1.3	-2.1	2.2	0.8	-1.6	-3.6	0.5
	(0.3)	(0.3)	(0.2)	(0.3)	(0.3)	(0.1)	(0.2)	(0.2)	(0.2)
Asian × Prop 209	-0.2	0.1	1.5	-0.1	-1.1	0.0	-0.6	0.8	-0.5
	(0.4)	(0.4)	(0.2)	(0.3)	(0.3)	(0.2)	(0.3)	(0.3)	(0.2)
$\bar{Y}$	22.6	20.6	6.4	12.7	11.7	2.8	8.8	9.1	5.8
Obs.	150,968	150,968	150,968	150,968	150,968	150,968	150,968	150,968	150,968

Note: Estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 Asian UC freshman California-resident applicants' enrollment outcomes compared to non-Asian outcomes after the 1998 end of UC's affirmative action program (restricting the sample to non-URM applicants). Outcomes defined as the first institution of enrollment by college or university type within six years of graduating high school, as measured in the NSC. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. "Ivy+" universities include the Ivy League, MIT, Stanford, and the University of Chicago; private and non-CA universities exclude those institutions. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

A-7 shows that only 6.2 percent of the baseline sample did not have observed enrollment in NSC, some of whom likely enrolled at community colleges before the colleges' NSC participation (and others who actually choose against postsecondary enrollment).

A comparison between UC and NSC graduation records suggests that only UC Santa Cruz failed to report a substantial number of earned degrees among the late 1990s graduation cohorts, while a comparison between NSC and UC major reporting (measured by which students earned STEM degrees) shows that NSC routinely captures more than 90 percent of STEM degree attainment at all campuses throughout the period (conditional on degree reporting in both data sets). The six-year graduation and STEM major choice estimates presented in Panel A of Table III are robust when restricted to NSC records only or to NSC records augmented by only UCSC degrees (see Table A-12). As a result, differential NSC non-reporting by URM applicants is unlikely to explain the observed degree attainment patterns. Moreover, this concern does not extend to the graduate degree estimates; most such degrees are not earned at the same institutions where applicants earned their undergraduate degrees, and NSC coverage was very wide by the time applicants in the sample were earning graduate degrees.

Appendix E: Differential Impact of Prop 209 on Asian UC Applicants

The baseline difference-in-difference analysis in the main text does not differentiate between groups of non-URM UC applicants, but there is some speculation that affirmative action policies differentially impact Asian applicants relative to white applicants (Arcidiacono, Kinsler and Ransom, 2020). I test for heterogeneity in Prop 209's effect on non-URM students by restricting the UC applicant sample to non-URM students and re-estimating versions of Equation 1 with Asian students as the treated group (replacing URM).[51] Table E-1 presents estimates of Prop 209's effect on Asian students' enrollment institutions. The coefficients on Asian

[51] Table A-5 presents descriptive statistics for white and Asian UC applicants before and after Prop 209, with both showing similar admissions trends after 1998.

students' enrollment at more-selective and selective UC campuses are precisely-estimated zeroes: ending UC's affirmative action program did not lead to a relative increase in Asian UC applicants' enrollment at those campuses. There is a small measurable enrollment shift from community and private California colleges into non-California universities and the less-selective UC campuses, though the effects' magnitudes are a small fraction of those observed for URM students. Figure E-1 shows that Prop 209 also caused no estimable change in Asian applicants' longer-run wage outcomes relative to other non-URM applicants. I conclude that there is little reason to treat white and Asian applicants as having been differently-treated by Prop 209, conditional on prior academic opportunities and preparation as measured by the components of AI.

Appendix F: Selection into Application: Reanalyzing Card and Krueger (2005)

Figure A-15 shows that the annual proportion of URM California high school graduates who applied to some UC campus declined (relative to non-URM applications) after 1998 among both low- and high-AI students. This contrasts with the evidence presented by Card and Krueger (2005) (hereafter CK), who use a difference-in-difference design to show that the annual proportion of URM California SAT-takers who send their scores to UC campuses – an oft-used proxy for university application, since score-sending is a mandatory component of many universities' applications – declined overall, but remained steady (or perhaps increased) among the high-SAT and/or high-GPA URM test-takers who were competitive candidates for selective university admission.

I reconcile these findings by matching the College Board SAT-takers database – only available for California public high school students, whereas CK includes private high schools – to the UC application database by name, birthdate, and high school.[52] While the College Board data show that more than 90 percent of UC Berkeley or UCLA applicants sent their SAT scores to those campuses, fewer than 60 percent of students who send their SAT scores to each of those campuses actually apply to them. This suggests that SAT-sending may be a poor proxy for university application in some contexts.

Table F-1 shows that among students at all California high schools (reported by CK) or at public California high schools, California URM SAT-takers who reported A and A+ average high school grades were no less likely to send their scores to any UC campus or to the more-selective Berkeley and UCLA campuses after 1998 relative to non-URM SAT-takers; indeed, URM send rates increased in 1995 and 1996 and only slightly declined in 1998. However, the pattern in actual university applications appears quite different: high-GPA URM students' relative likelihood of UC and Berkeley/UCLA application declined sharply in 1996 – when the application deadline was only a few months after the passage of Prop 209 – recovered in 1997, and then sharply (and somewhat-persistently) declined again in 1998 when the proposition went into effect. Models restricted to high-SAT test-takers reveal a similar pattern.[53]

In total, URM UC relative application rates declined by 1.9 percentage points between 1998 and 2000 (relative to 1994-1995), and relative application rates to the Berkeley and UCLA campuses declined by 1.8 percentage points. These patterns are consistent with Figure A-15, which shows a decline in high-AI URM

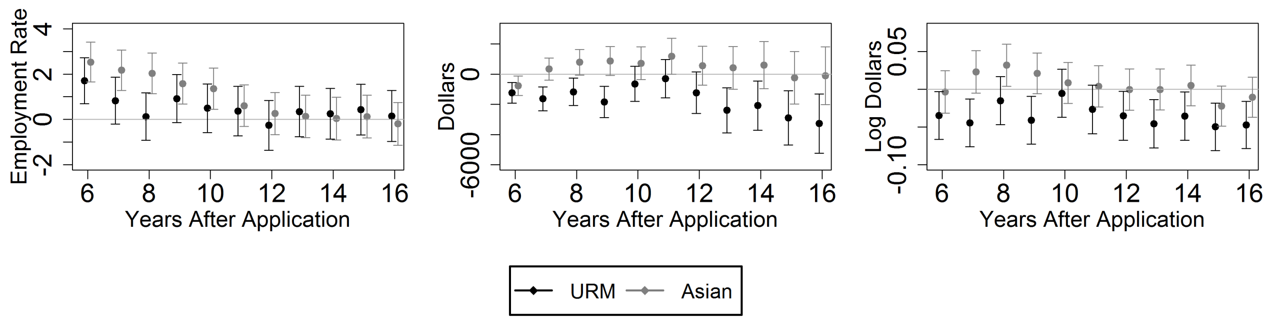
[52] The match rate of public-HS SAT-submitting freshman UC applicants to the College Board – matching any six of the seven pieces of available information (three names, three birthdate components, and high school) and dropping a small number of possible duplicate matches – is 93 percent among 1994-2001 applicants.

[53] See Tables F-2 and F-3. Table F-4 shows that score-sending to Berkeley and UCLA became a poor proxy for URM students' applications to those schools in 1996 (and worse still in 1999), when URM score-senders across the SAT distribution became less likely to apply to either, though after 1998 it became a particularly poor proxy for low-SAT students.

Figure E-1: Difference-in-Difference Estimates of Asian and URM UC Applicants' Post-1998 Wage Outcomes

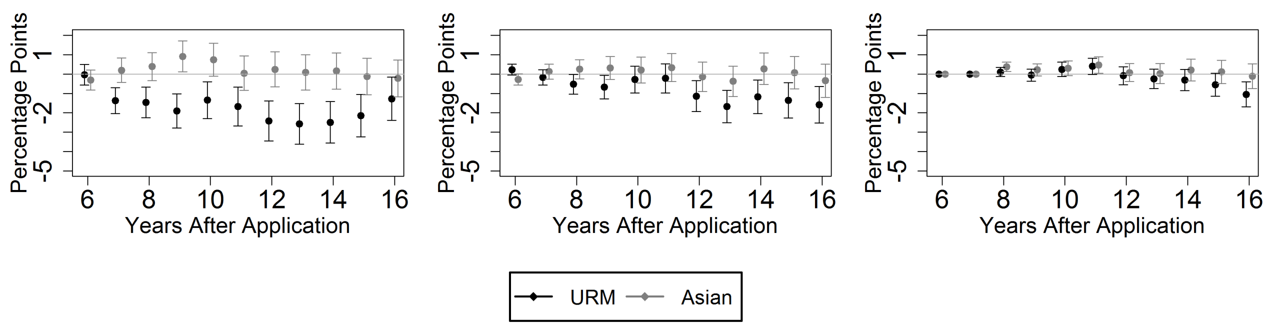
Panel A: Employment and Wages

(a) CA Employment (b) Annual CA Wages (c) Annual Log CA Wages



Panel B: Minimum Wage Thresholds

(d) Wages $> \$75,000$ (e) Wages $> \$100,000$ (f) Wages $> \$150,000$



Note: This figure shows simultaneous difference-in-difference estimates for URM and Asian labor market outcomes relative to white students, showing that Asian students' long-run labor market outcomes closely-tracked white students' outcomes while URM students' outcomes deteriorated. Estimates of $\beta_{\cdot 98-99}$ from an extension Equation 1 adding indicators for Asian students and Asian interacted with post-209 ($\beta'_{1998-1999}$), an OLS difference-in-difference model of 1996-1999 URM and Asian UC freshman California-resident applicants' educational outcomes compared to other non-URM students' outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as non-zero California wages ("CA Employment"), California wages in dollars and log-dollars (omitting 0's), and unconditional indicators for having wages above specified wage thresholds ($75,00, $100,000, and $150,000) as measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. Coefficients in each year after UC application are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust 95-percent confidence intervals shown. Source: UC Corporate Student System and the California Employment Development Department.

application rates, and suggests that academically-strong URM students were dissuaded from UC application by Prop 209 despite sending their SAT scores to UC campuses (which they may have done many months earlier, on the day they took the test).

Table F-1: Replication of Table 4 in Card and Krueger (2005) with New Specifications: *"Changes in the Relative Probability that Minority Students Send SAT Scores to Selective and Most Selective State Universities"*

	All UC Campuses			Berkeley and UCLA Only		
Dep. Var.:	Send	Send	Apply	Send	Send	Apply
URM × 1995	0.021	0.009	-0.002	0.023	0.011	-0.008
	(0.010)	(0.012)	(0.014)	(0.012)	(0.014)	(0.013)
URM × 1996	0.027	0.016	-0.029	0.030	0.015	-0.035
	(0.010)	(0.012)	(0.013)	(0.011)	(0.014)	(0.013)
URM × 1997	0.028	0.015	-0.006	0.037	0.029	-0.007
	(0.009)	(0.011)	(0.013)	(0.011)	(0.013)	(0.013)
URM × 1998	0.025	0.009	-0.028	0.029	0.011	-0.032
	(0.009)	(0.011)	(0.013)	(0.011)	(0.013)	(0.013)
URM × 1999	0.032	0.015	-0.019	0.026	0.013	-0.032
	(0.009)	(0.011)	(0.013)	(0.011)	(0.013)	(0.013)
URM × 2000	0.033	0.013	-0.038	0.039	0.017	-0.037
	(0.009)	(0.011)	(0.013)	(0.011)	(0.013)	(0.013)
URM × 2001	0.036	0.006	-0.002	0.045	0.025	-0.001
	(0.009)	(0.011)	(0.012)	(0.011)	(0.013)	(0.012)
CK Controls[1]	X	X	X	X	X	X
A/A+ GPA Only	X	X	X	X	X	X
Public HS Only		X	X		X	X
Source	CK	Replication		CK	Replication	
Average(1999-2001) - Average(1994-1995)[2]						
Estimate	0.018	0.006	-0.019	0.019	0.013	-0.018
(Std. Err.)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Obs.	-	179,682	179,682	-	179,682	179,682

Note: Difference-in-difference OLS regression coefficient estimates across all California 1994-2001 SAT-takers (or restricted to those from public high schools) of URM students' likelihood of either sending SAT scores or applying to any UC campus or the Berkeley and UCLA campuses, relative to 1994 and non-URM students. Models correspond to columns (3) and (6) in Card and Krueger (2005), with the sample restricted to SAT-takers who report A or A+ high school average grades. Test-taking and applicant records merged by name, birthdate, and high school. [1] "CK Controls" include indicators by year, ethnicity, SAT score category (< 1150, $1150 - 1300$, and > 1300), father's and mother's education, reported high school GPA (A or A+), and 8 class rank indicators (including missing). [2] Estimates from CK include 1994-1996 instead of 1994-1995, but the results suggest that URM application rates began falling in 1996 (following the passage of SP-1 and Prop 209). Standard errors (in parentheses) are robust. Source: College Board and UC Corporate Student System.

Appendix G: Course Performance and Persistence at Berkeley after Prop 209

Section 7 shows that the STEM performance and persistence of URM students across five UC campuses does not improve following Prop 209, despite those students' enrollment at less-selective campuses. This tests the "Science Mismatch Hypothesis" as implicitly stated by Griffith (2010) and Arcidiacono, Aucejo and Hotz (2016). However, other studies have tested narrower versions of the Hypothesis, claiming only that URM students admitted under affirmative action are lower-performing in STEM courses than their non-URM peers, unconditional (Loury and Garman, 1993; Holzer and Neumark, 2000; Fischer and Massey, 2007) or conditional on prior academic preparation (Rose, 2005).

Table F-2: Replication of Card/Krueger (2005), Table 4, for All UC Campuses

	Any UC Campus						
	Send	Apply	Send	Apply	Send	Apply	Apply
URM × 1995	0.005 (0.004)	-0.012 (0.004)	0.002 (0.013)	-0.007 (0.015)	0.009 (0.012)	-0.002 (0.014)	-0.004 (0.013)
URM × 1996	-0.002 (0.004)	-0.033 (0.004)	0.016 (0.013)	-0.012 (0.015)	0.016 (0.012)	-0.029 (0.013)	-0.032 (0.013)
URM × 1997	-0.010 (0.004)	-0.040 (0.004)	0.011 (0.013)	-0.026 (0.015)	0.015 (0.011)	-0.006 (0.013)	-0.008 (0.013)
URM × 1998	-0.019 (0.004)	-0.044 (0.004)	-0.010 (0.013)	-0.054 (0.015)	0.009 (0.011)	-0.028 (0.013)	-0.029 (0.013)
URM × 1999	-0.020 (0.004)	-0.049 (0.004)	0.001 (0.013)	-0.027 (0.015)	0.015 (0.011)	-0.019 (0.013)	-0.022 (0.013)
URM × 2000	-0.022 (0.004)	-0.047 (0.004)	0.012 (0.012)	-0.030 (0.015)	0.013 (0.011)	-0.038 (0.013)	-0.040 (0.013)
URM × 2001	-0.028 (0.004)	-0.038 (0.004)	0.004 (0.012)	-0.014 (0.014)	0.006 (0.011)	-0.002 (0.012)	-0.006 (0.012)
CK Controls[1]	X	X	X	X	X	X	X
Pred. Eth.							X
Sample	Full		High SAT		High GPA		
R^2	0.20	0.31	0.12	0.18	0.09	0.17	0.17
N	891,254	891,254	208,765	208,765	179,682	179,682	179,682

Note: This table shows that while the proportion of competitive URM applicants sending their SAT scores to UC only slightly declined after Prop 209, there is a larger decline in actual URM applications to those schools, suggesting that score-sending is a poor proxy in this context. Difference-in-difference OLS regression coefficient estimates across all California 1994-2001 public-HS SAT-takers of URM students' likelihood of either sending SAT scores or applying to any UC campus, relative to 1994 and non-URM students. Models are either unrestricted, restricted to SAT-takers with scores above 1150, or restricted to SAT-takers who report A or A+ GPAs, following the first three columns of Table 4 of Card and Krueger (2005). Test-taking and applicant records merged by name, birthdate, and high school. The final column augments reported ethnicity by predicting the ethnicities of non-reporters using name and high school; see Appendix D for details. Standard errors (in parentheses) are robust. [1] "CK Controls" include indicators by year, ethnicity, SAT score category (< 1150, $1150 - 1300$, and > 1300), father's and mother's education, reported high school GPA (A or A+), and 8 class rank indicators (including missing). Source: College Board and UC Corporate Student System.

Following this previous literature, I also test whether the persistence and performance of URM students at UC Berkeley – the campus where Prop 209 most impacted URM students' likelihood of admission – improved after 1998, when Prop 209 caused a decline in the URM share of the student body by more than half. I restrict the sample to 1996-1999 Berkeley students and estimate Equation 3 with and without academic covariates (α_{h_i} and X_{iy}). The last column of Table G-1 shows that before Prop 209, Berkeley's URM students earned lower average grades by 0.84 grade points and were 19 percentage points less likely to persist along STEM course sequences. These gaps are broadly present across most introductory STEM courses. If admissions mismatch is a primary cause of these large ethnicity gaps, then Prop 209 would be expected to sharply narrow them. In fact, Prop 209 does lead Berkeley's (higher-testing) URM students to earn slightly higher STEM grades (by 0.18 grade points), but if anything their STEM persistence slightly declined.

Panel B of Table G-1 adds academic covariates and shows that, as was the case across the five UC campuses, cross-high-school and AI differences wholly explain URM students' low persistence and performance before Prop 209; in the period when Berkeley was implementing affirmative action, URM students earned

Table F-3: Replication of Card/Krueger (2005), Table 4, for UC's Most-Selective Campuses

	Berkeley and UCLA								
	Send	Apply	Send	Apply	Send	Apply	Send	Apply	Apply
URM × 1995	0.002	-0.004	0.000	-0.013	0.011	-0.008	-0.006	-0.018	-0.019
	(0.004)	(0.003)	(0.016)	(0.015)	(0.014)	(0.013)	(0.011)	(0.012)	(0.012)
URM × 1996	-0.005	-0.026	0.024	-0.006	0.015	-0.035	0.002	-0.021	-0.022
	(0.004)	(0.003)	(0.015)	(0.015)	(0.014)	(0.013)	(0.011)	(0.012)	(0.011)
URM × 1997	-0.007	-0.030	0.012	-0.021	0.029	-0.007	-0.004	-0.035	-0.038
	(0.004)	(0.003)	(0.015)	(0.015)	(0.013)	(0.013)	(0.011)	(0.011)	(0.011)
URM × 1998	-0.016	-0.032	-0.007	-0.047	0.011	-0.032	-0.007	-0.035	-0.037
	(0.004)	(0.003)	(0.015)	(0.015)	(0.013)	(0.013)	(0.010)	(0.011)	(0.011)
URM × 1999	-0.018	-0.041	-0.005	-0.027	0.013	-0.032	-0.008	-0.075	-0.076
	(0.004)	(0.003)	(0.015)	(0.015)	(0.013)	(0.013)	(0.011)	(0.011)	(0.011)
URM × 2000	-0.020	-0.033	0.016	-0.011	0.017	-0.037	-0.006	-0.028	-0.031
	(0.004)	(0.003)	(0.015)	(0.015)	(0.013)	(0.013)	(0.010)	(0.011)	(0.011)
URM × 2001	-0.020	-0.027	0.021	-0.003	0.025	-0.001	0.014	-0.007	-0.007
	(0.004)	(0.003)	(0.015)	(0.015)	(0.013)	(0.012)	(0.010)	(0.011)	(0.011)
CK Controls[1]	X	X	X	X	X	X	X	X	X
Pred. Eth.									X
	Full		High SAT		High GPA		AI 5500-7000		
R^2	0.24	0.30	0.21	0.23	0.17	0.21	0.12	0.11	0.11
N	891,254	891,254	208,765	208,765	179,682	179,682	212,133	212,133	212,133

Note: This table shows that while the proportion of competitive URM applicants sending their SAT scores to Berkeley and UCLA only slightly declined after Prop 209, there is a larger decline in actual URM applications to those schools, suggesting that score-sending is a poor proxy in this context. Difference-in-difference OLS regression coefficient estimates across all California 1994-2001 public-HS SAT-takers of URM students' likelihood of either sending SAT scores or applying to either UC Berkeley or UCLA, relative to 1994 and non-URM students. Models are either unrestricted, restricted to SAT-takers with scores above 1150, restricted to SAT-takers who report A or A+ GPAs, restricted to SAT-takers with academic indices between 5500 and 7000 (who faced the most-dramatic decline in admissions likelihood at Berkeley and UCLA), following the last three columns of Table 4 of Card and Krueger (2005). Test-taking and applicant records merged by name, birthdate, and high school. The final column augments reported ethnicity by predicting the ethnicities of non-reporters using name and high school; see Appendix D for details. Standard errors (in parentheses) are robust. [1] "CK Controls" include indicators by year, ethnicity, SAT score category (< 1150, $1150 - 1300$, and > 1300), father's and mother's education, reported high school GPA (A or A+), and 8 class rank indicators (including missing). Source: College Board and UC Corporate Student System.

similar grades and were (if anything) **more** likely to persist in some of Berkeley's STEM fields than their academically-comparable non-URM peers. Unlike at those other campuses, however, ending affirmative action led to relative **declines** in URM students' persistence and (perhaps) performance across most STEM courses. Why would URM Berkeley students' relative STEM performance and persistence decline after Prop 209, instead of remaining steady as it did across the UC system? Table G-2 shows that the effects of Prop 209 on URM persistence were tightly-estimated 0's at the other four other observed UC campuses. One hypothesis is that Berkeley's post-209 'holistic review' admissions policy inefficiently targeted under-performing students as a result of its inability to provide direct race-based admissions advantages (Chan and Eyster, 2003; Fryer, Loury and Yuret, 2008). Under that hypothesis, the decline would likely be (partly) absorbed by family background covariates like parental income, education, and occupation; however, adding those covariates does not change the estimated coefficient. An alternative hypothesis is that SAT scores are relatively negatively-biased measures of low-testing URM students' academic preparation, such that Berkeley's selec-

Table F-4: The Relationship between SAT Send Rates and Most-Selective UC Application

		Coef.	St. Err.	p
Send		0.371	(0.003)	0.000
URM		0.020	(0.002)	0.000
Norm. SAT		-0.001	(0.001)	0.371
Send×URM		0.023	(0.006)	0.000
Indicator	1995	-0.001	(0.001)	0.479
	1996	0.002	(0.001)	0.155
	1997	0.003	(0.001)	0.015
	1998	0.002	(0.001)	0.027
	1999	0.008	(0.001)	0.000
	2000	0.007	(0.001)	0.000
	2001	-0.003	(0.001)	0.011
Send×	1995	0.032	(0.005)	0.000
	1996	0.042	(0.004)	0.000
	1997	0.026	(0.004)	0.000
	1998	0.030	(0.004)	0.000
	1999	0.042	(0.005)	0.000
	2000	0.046	(0.005)	0.000
	2001	0.080	(0.005)	0.000
URM×	1995	0.001	(0.003)	0.875
	1996	-0.004	(0.003)	0.253
	1997	-0.001	(0.003)	0.706
	1998	0.000	(0.003)	0.942
	1999	-0.007	(0.003)	0.026
	2000	-0.001	(0.003)	0.849
	2001	0.002	(0.003)	0.434
SAT×	1995	-0.001	(0.001)	0.337
	1996	0.002	(0.001)	0.139
	1997	0.003	(0.002)	0.053
	1998	0.007	(0.002)	0.000
	1999	0.012	(0.002)	0.000
	2000	0.009	(0.002)	0.000
	2001	-0.000	(0.001)	0.865
Send×SAT		0.189	(0.003)	0.000
URM×SAT		0.007	(0.002)	0.000
Send×URM×SAT		-0.035	(0.006)	0.000
Send×URM×	1995	-0.005	(0.009)	0.572
	1996	-0.032	(0.009)	0.000
	1997	-0.041	(0.009)	0.000
	1998	-0.042	(0.009)	0.000
	1999	-0.058	(0.009)	0.000
	2000	-0.052	(0.009)	0.000
	2001	-0.045	(0.009)	0.000
Send×SAT×	1995	0.001	(0.004)	0.886
	1996	0.009	(0.004)	0.021
	1997	0.016	(0.004)	0.000
	1998	0.012	(0.004)	0.001
	1999	-0.002	(0.004)	0.619
	2000	-0.001	(0.004)	0.773
	2001	0.003	(0.004)	0.482
URM×SAT×	1995	0.001	(0.003)	0.682
	1996	-0.001	(0.003)	0.615
	1997	0.001	(0.003)	0.775
	1998	-0.003	(0.003)	0.362
	1999	-0.006	(0.003)	0.032
	2000	-0.002	(0.003)	0.484
	2001	-0.000	(0.003)	0.965
Send×URM×SAT×	1995	0.008	(0.008)	0.320
	1996	0.015	(0.008)	0.061
	1997	0.004	(0.008)	0.572
	1998	0.000	(0.008)	0.959
	1999	0.021	(0.008)	0.007
	2000	0.021	(0.008)	0.007
	2001	0.029	(0.008)	0.000
CK Controls[1]	X			
R^2	0.51			
N	841,358			

Note: This regression shows that score-sending to Berkeley and UCLA became a poor proxy for URM students' applications to those schools in 1996, when URM score-senders across the SAT distribution became less likely to apply to either, though after 1998 it became a particularly poor proxy for low-SAT students. Quadruple-difference OLS regression of an indicator of applying to either UC Berkeley or UCLA on interactions between score-sending to one of those schools, URM status, normalized SAT score, and year (holding out 1994), restricting the sample to 1994-2001 SAT-takers from California public high schools. All coefficients are from the same regression. Standard errors are robust; p-values report statistical tests from the null hypothesis. [1] "CK Controls" include indicators by year, ethnicity, SAT score category (< 1150, $1150-1300$, and > 1300), father's and mother's education, reported high school GPA (A or A+), and 8 class rank indicators (including missing). Source: College Board and UC Corporate Student System.

tion away from those students causes a decline in URM enrollees' relative overperformance (Vars and Bowen, 1998; Niu and Tienda, 2010). This hypothesis is supported by the finding that the relative decline in URM performance is driven by URM students in the bottom two terciles of SAT scores, with no observed declines among high- or low-GPA high-SAT students (see Table G-2). However, the question remains open for future research.

Table G-1: Difference-in-Difference Estimates of URM Berkeley Students' Post-1998 STEM Outcomes

	Chemistry				Biology		Physics		Comp. Science			
	1	2	3	4	1	2	1	2	1	2	3	Combined
Panel A: Unconditional Difference-in-Difference												
Grade in Course (if earned grade)												
URM	-0.75	-0.96	-0.98	-0.64	-0.93	-0.73	-0.86	-0.63	-0.64	-0.57	-0.00	-0.84
	(0.05)	(0.08)	(0.09)	(0.10)	(0.09)	(0.11)	(0.09)	(0.17)	(0.19)	(0.27)	(0.16)	(0.08)
URM × Prop 209	0.18	0.34	0.26	0.21	0.31	0.09	0.01	-0.02	-0.12	0.03	-0.76	0.18
	(0.08)	(0.14)	(0.15)	(0.17)	(0.14)	(0.21)	(0.15)	(0.27)	(0.31)	(0.41)	(0.45)	(0.08)
$\bar{Y}$	2.85	2.64	2.53	2.74	2.71	2.63	2.69	2.90	2.90	3.05	3.19	2.76
Obs.	4,837	3,339	3,270	2,348	2,392	2,263	2,504	1,307	1,757	1,238	1,139	26,394
Indicator for Persistence to Next Course (%)												
URM	-11.6	-11.4	-23.4		-30.4		-27.1		-25.9	-13.7		-18.6
	(2.6)	(2.6)	(3.3)		(3.9)		(3.8)		(7.4)	(9.2)		(2.8)
URM × Prop 209	-6.1	-5.0	0.1		-5.2		9.6		6.1	1.3		-3.1
	(4.2)	(4.8)	(5.8)		(6.5)		(6.4)		(12.2)	(15.9)		(2.6)
$\bar{Y}$	60.2	87.8	68.5		70.2		48.0		67.9	81.2		68.0
Obs.	4,949	3,393	3,321		2,418		2,542		1,777	1,256		19,656
Panel B: Conditional on Academic Preparation												
Grade in Course (if earned grade)												
URM	0.15	0.01	0.04	0.14	-0.00	0.23	0.04	-0.05	-0.12	-0.05	0.09	0.05
	(0.05)	(0.10)	(0.10)	(0.13)	(0.09)	(0.12)	(0.10)	(0.20)	(0.22)	(0.28)	(0.22)	(0.05)
URM × Prop 209	-0.13	-0.09	-0.06	-0.04	-0.02	-0.09	-0.14	-0.08	-0.14	-0.19	0.46	-0.04
	(0.07)	(0.15)	(0.16)	(0.21)	(0.13)	(0.21)	(0.15)	(0.35)	(0.32)	(0.61)	(0.52)	(0.04)
Acad. Prep.	X	X	X	X	X	X	X	X	X	X	X	X
$\bar{Y}$	2.85	2.64	2.53	2.74	2.71	2.63	2.69	2.90	2.90	3.05	3.19	2.76
Obs.	4,837	3,339	3,270	2,348	2,392	2,263	2,504	1,307	1,757	1,238	1,139	26,394
Indicator for Persistence to Next Course (%)												
URM	5.8	-4.4	0.1		-0.1		2.2		-8.0	0.4		3.1
	(3.2)	(2.9)	(4.4)		(5.0)		(5.3)		(10.3)	(12.0)		(2.2)
URM × Prop 209	-9.9	-9.4	-12.9		-16.5		1.7		-4.3	-15.3		-10.1
	(4.6)	(5.4)	(6.6)		(7.9)		(8.0)		(15.3)	(20.0)		(2.2)
Acad. Prep.	X	X	X		X		X		X	X		X
$\bar{Y}$	60.2	87.8	68.5		70.2		48.0		67.9	81.2		68.0
Obs.	4,949	3,393	3,321		2,418		2,542		1,777	1,256		19,656

Note: This table shows course-specific and stacked regression coefficients showing evidence of deteriorated unconditional URM course persistence in Chemistry and Biology courses at Berkeley after Prop 209, and widespread deterioration in performance and persistence relative to academically-similar non-URM students. Difference-in-difference OLS regression coefficient estimates across 1996-1999 UC Berkeley CA-resident freshman enrollees' introductory STEM courses, differencing across URM status and post-1998 using Equation 3. The final column stacks across courses, weights equally across students, and clusters standard errors by student and course; clustered standard errors may be downward-biased as a result of few clusters (15). Persistence indicates completing the subsequent course in the introductory STEM course sequence; course grade is the grade points received in completed courses. Academic covariates include high school fixed effects and the components of UC's Academic Index (see footnote 21). Standard errors (in parentheses) are robust. The specific courses comprising each sequence can be seen in Appendix H; courses taken after the first 2.5 years of matriculation are omitted. Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018).

Appendix H: Introductory STEM Courses at UC Campuses

Section 7 estimates changes in URM UC students' persistence and performance in introductory STEM courses after Prop 209. I identify those introductory courses – four courses in Chemistry (two introductory, two

Table G-2: Additional Specifications of Difference-in-Difference Models of Science Persistence

	Other Campuses					Restricted Samples, UC Berkeley			
	Santa Barbara	Davis	Santa Cruz	Riverside	Berkeley Add'l Cov.	High SAT Scores High GPA	High SAT Scores Low GPA	Low SAT Scores High GPA	Low SAT Scores Low GPA
URM	1.4 (4.4)	1.0 (2.7)	-3.6 (1.4)	0.6 (2.2)	6.1 (2.0)	-5.3 (4.2)	-4.9 (4.3)	7.3 (7.8)	12.4 (2.9)
URM × Prop 209	-0.3 (4.6)	-0.3 (1.8)	2.9 (2.0)	-1.0 (3.7)	-10.0 (2.7)	-5.4 (5.5)	12.6 (5.4)	-9.4 (10.1)	-9.0 (6.1)
Acad. Prep.	X	X	X	X	X	X	X	X	X
Parental Cov.					X				
$\bar{Y}$	50.1	56.8	60.5	55.7	68.0	76.0	65.0	62.2	49.7
# of Obs.	6,857	29,470	15,149	14,072	19,656	9,808	5,441	1,647	2,712

Note: This table helps to arbitrate between competing explanations for the relative decline in URM Berkeley students' STEM persistence after Prop 209. The table provides evidence against the hypothesis that holistic review negatively-selected URM students, and evidence favoring the hypothesis that the enrollment decline among lower-SAT URM students caused selection away from students whose academic capabilities are underestimated by standardized tests. Difference-in-difference OLS regression coefficient estimates across 1995-2000 UC Berkeley or other UC campus enrollees' introductory STEM courses (excluding out-of-state, transfer, and engineering students), differencing across URM status and post-1998 using Equation 3. The outcomes indicates whether the student completes the following course in the specified course sequence; see Appendix H. Academic covariates include high school fixed effects and the components of UC's Academic Index (see footnote 21). Parental covariates include parental income (with an indicator for missing income), (289) parental occupation fixed effects, and (7) max parental education fixed effects. The last four columns partition students by whether their high school GPAs and SAT scores are in the top tercile of 1996-1999 URM Berkeley students' grades and scores. Standard errors (in parentheses) are robust. Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018)

organic), two in Biology, two in Physics, and three in Computer Science – using contemporaneous course catalogs and the student transcript data.[54] I chose these fields because they are uniformly available across campuses, offer similarly-structured introductory course sequences, and are not generally required for non-STEM majors (like Mathematics and Statistics, in which many non-STEM fields often require partial course sequence completion). Some schools had multiple versions of a given introductory course, all of which are included in the analysis. Where schools on quarter systems required three courses in a sequence instead of two, I define the sequence by its first and third courses. Here is the full list:

- Intro. Chem.: UCB CHEM 1A/B, UCD CHEM 2A/C, UCR CHEM 1A/B, UCSC CHEM 1B/C, UCSB CHEM 1A/B
- Organic Chem.: UCB CHEM 3A/B or 112A/B, UCD CHEM 8A/B or 118A/B, UCR CHEM 112A/B, UCSC CHEM 108A/B or 112A/B, UCSB CHEM 6A/B or 107A/B
- Biology: UCB BIO 1B/A, UCD BIO 1A/C, UCR BIO 5A/C, UCSC BIOL 10-12 or 20A/C, UCSB MCDB/EECB/BIOL 1A/4A/5A and 1C/4C/5C/2
- Physics: UCB PHYSICS 8A/B, UCD PHYSICS 1A/B or 5A/C or 7A/C or 9A/C, PHYSICS PHYS 2A/C, UCSC PHYS 5A/C or 6A/C or 7A/B, UCSB PHYS 6A/C
- Computer Science: UCB COMPSCI 61A/B/C, UCD ECOMPSCI 20-or-30/40/50, UCR EEC 10/12/14, UCSC CMPS 12A/B/C-or-101, UCSB CMPSC 10/20/30

Berkeley allowed students to take BIO 1A before BIO 1B, but only 25% of students did so. Berkeley also allowed many students to skip CHEM 1B; persistence to CHEM 1B is defined to include students who complete CHEM 3A or 12A.

[54]Catalogs for UC Berkeley available from the Berkeley Library, and for other campuses from CollegeSource Online.

Appendix I: Value-Added Statistics

In order to characterize the change in institutional quality faced by URM UC applicants after Prop 209, I estimate university and college value-added statistics for two student outcomes – six-year degree attainment (as measured in the union of NSC and UC records) and average wages 12-16 years after UC application, when most applicants are in their early 30s – using the 1995-1997 sample of UC California-resident freshman fall applicants who enroll at a postsecondary institution. Applicants' early-30s wages are averaged over years in which they have observed EDD-covered wages, and the wages are CPI-adjusted to 2018 and winsorized at the top and bottom one percent. The value-added statistics are estimated using a fixed effect specification:

$$Y_{iy} = \zeta_y + \alpha_{U_i} + X_i + \epsilon_{iy} \tag{I-1}$$

where U_i is the first institution where applicant i enrolled (in NSC) after applying to enroll in y, within six years of y. Value-added coefficients α_U are estimated using year fixed effects ζ_y and three sets of X_i covariates, which are intended to absorb the sample selection bias that arises from applicants' non-random enrollment across postsecondary institutions. First, following Mountjoy and Hickman (2020) ("MH"), I define X_i to include indicators for every combination of UC campuses to which the applicant applied and UC campuses to which they were admitted.[55] Second, I augment this approach by estimating a much higher-dimension version of this model including indicators for every combination of postsecondary institutions to which the applicant applies, proxying application by SAT sends (as in Card and Krueger (2005)) by matching the applicant pool to College Board's SAT database by name and birthdate ("MH+"). This approach limits the sample size to public high school graduates matched in the available College Board data and as a result of the high-dimensionality of applicants' score-send set, with unique sets dropped from the sample. Third, following Chetty et al. (2020a) ("CFSTY"), I define X_i to include (15) ethnicity indicators and quintics in both SAT score and family income.[56] I also estimate a version of "CFSTY" value-added statistics for the interaction between institution indicators α_{U_i} and applicant ethnicity: white, Asian, Black, or Hispanic. For interpretative simplicity (and because they already prove too conservative), I do not shrink the value-added coefficients or otherwise account for noise in their estimation.

Value-added coefficients are not calculated for institutions with fewer than 50 in-sample enrollees. Effective sample sizes differ across specification – for example, students who apply and are admitted to a unique set of UC campuses are omitted from "MH" value-added estimation – and wage VA measures omit the 26 percent of applicants with no observable wages 12-16 years after UC application. The total samples for the "CFSTY" value-added measures after omissions are 112,707 for six-year graduation and 82,807 for early-30s wages. More than half of in-sample applicants (66,400) enroll at a UC campus, with the remainder enrolling at CSU campuses (14,800), California community colleges (10,800), and private and out-of-state universities (20,700, with 3,900 at USC and 1,500 at Stanford). The sample size statistics in the tables below show the number of students who enroll at each school and have observable early-30s wages.

In order to evaluate the quality of these estimated value-added statistics, I also estimate a version of

[55] This strategy was first proposed by Dale and Krueger (2002), and is implemented by Mountjoy and Hickman (2020) using applications and admissions to schools in the University of Texas system.

[56] Chetty et al. (2020a) measure incomes in age-specific rank instead of dollars. I include a dummy for applicants without observed family income – winsorizing family income at the top and bottom 1 percent – but omit the few applicants without observed SAT scores.

Table I-1: 1995-1997 Value-Added Estimates for Public California Universities

	6-Yr. Grad.			Wages in Early 30s					High School GPA			
Inst.	Raw All	MH All	CFSTY All	Raw All	MH All	CFSTY All	CFSTY Black	CFSTY Hisp.	Raw All	MH All	CFSTY All	Sample Size
Panel A: University of California System												
Berkeley	34.5	19.8	24.0	30,100	12,900	16,800	3,900	4,400	0.66	0.04	0.37	9,078
Davis	31.7	18.7	22.2	20,800	10,100	12,400	18,100	9,500	0.45	0.02	0.28	5,927
Irvine	29.1	18.0	20.6	14,900	7,200	7,000	16,400	1,300	0.37	0.01	0.21	5,730
UCLA	35.7	20.1	25.8	24,900	8,900	15,000	5,200	4,200	0.61	0.01	0.39	8,271
Riverside	33.2	25.1	28.1	9,000	6,400	4,700	11,700	1,000	0.21	0.01	0.12	1,204
San Diego	36.3	20.4	25.4	21,800	8,400	11,100	15,200	4,800	0.62	0.03	0.38	5,648
Santa Barbara	29.1	19.2	19.6	12,800	7,600	6,900	1,300	-1,400	0.24	-0.00	0.11	8,104
Santa Cruz	21.7	14.6	12.9	-2,600	-1,900	-9,000	-1,100	-10,500	0.19	-0.02	0.04	3,976
Panel B: California State University System												
Cal Poly.	21.8	12.8	12.3	25,600	19,100	19,500	21,800	10,600	0.34	0.06	0.20	2,626
Cal Poly. Pom.	0.5	0.3	-2.8	7,100	6,500	3,800		-1,200	0.02	0.00	-0.03	1,031
Chico	21.3	17.8	12.9	7,800	7,200	2,900		200	0.01	0.03	-0.04	372
Dom. Hills	-8.1	-8.6	0.2	-5,400	-6,400	3,800	-1,400	-1,300	-0.10	-0.15	0.03	137
East Bay	5.6	2.9	4.8	5,700	1,100	5,200	-7,600		0.07	-0.06	0.07	216
Fresno	9.5	4.8	9.3	6,700	2,600	5,000		2,500	0.19	0.03	0.22	311
Fullerton	4.2	5.2	3.7	1,400	1,800	900	2,800	-1,100	-0.05	-0.02	-0.06	835
Long Beach	0.0	0.0	0.0	0	0	0	0	0	0.00	0.00	0.00	1,286
Monteray Bay	10.1	10.8	8.6	-6,700	-2,800	-6,100			-0.10	-0.04	-0.09	60
Northridge	-3.8	-4.1	-2.3	-900	-700	-700	-5,600	-3,400	-0.09	-0.05	-0.05	995
Sacramento	5.3	2.1	2.4	13,000	8,800	10,200		9,100	0.11	-0.00	0.06	453
San Bern.	-0.8	-1.0	1.8	100	1,900	3,900		0	-0.01	0.00	0.03	270
San Marcos	2.4	0.4	-0.3	-3,800	-4,100	-6,400		-3,800	0.08	0.00	0.07	112
Stanislaus	8.1	2.9	2.9	7,800	3,500	5,900			0.20	0.01	0.13	69
Humboldt St.	2.3	-1.2	-5.0	-11,300	-10,900	-15,300			0.10	0.02	-0.02	204
San Diego St.	3.4	2.2	1.4	400	-300	500	1,000	-3,800	-0.02	-0.01	-0.04	1,677
San Fran. St.	-0.1	-0.3	-3.9	3,000	1,300	300	-4,100	-2,200	-0.03	-0.05	-0.07	918
San Jose St.	-0.5	-1.0	-3.1	16,800	14,700	13,800	-6,300	14,700	-0.03	-0.04	-0.05	728
Sonoma St.	11.4	7.8	0.4	-5,100	-7,400	-8,600			0.06	-0.01	-0.03	88

Note: This table shows value-added estimates for the University of California and California State University public university systems. Value-added estimates from Equation I-1 using 1995-1997 UC CA-resident freshman fall applications. See text for outcome definitions and covariate definitions "MH" (following Mountjoy and Hickman, 2020) and "CFSTY" (following Chetty et al., 2020a). "Raw" coefficients estimated with null X_i. Ethnicity-specific coefficients estimated by interacting U_i with five ethnicity buckets: white, Black, Hispanic, Asian, and other. Sample size for "CFSTY" wage value-added coefficients. Estimates are not shrunk or otherwise adjusted for noise. Source: UC Corporate Student System, National Student Clearinghouse, and the CA Employment Development Department.

Equation I-1 replacing the outcome with applicants' high school GPAs (on a weighted 5 point scale). GPAs are not included as a covariate in any value-added specification, and thus provide a useful placebo to test whether the covariate sets are fully absorbing the sample selection bias that arises from both universities' admissions decisions and applicants' subsequent enrollment choice. Effective value-added statistics should likely largely absorb cross-institution differences in applicants' high school GPAs.

Tables I-1, I-2, and I-3 present "MH" and "CFSTY" value-added coefficients for the full set of available institutions, omitting coefficients with insufficient sample sizes. "CFSTY" coefficients are presented overall and for Hispanic applicants (as well as Black applicants at UC and CSU campuses, where their sample size is sufficiently high). For UC and CSU campuses, I also present an additional series of statistics: "Raw" estimates of α_{U_i} from a version of Equation I-1 with null X_i and estimates of high school GPA "value-added". All value-added coefficients are estimated relative to CSU Long Beach (LB), a high-enrollment teaching-oriented California public university.

Panel A of Table I-1 shows that the students who enroll at UC campuses are 20-40 percentage points

Table I-2: 1995-1997 Value-Added Estimates for California Community Colleges

	6-Yr. Grad.		Wages in Early 30s			
Inst.	MH All	CFSTY All	MH All	CFSTY All	CFSTY Hisp.	Samp. Size
Allan H.	-17.6	-13.5	-6,100	-3,300		61
Am. River	-17.1	-16.9	-7,300	-5,000		85
Cabrillo	-25.6	-29.0	7,700	9,200		63
Canada	5.9	0.0				
Cerritos	-21.1	-15.6	-4,200	-2,300	-10,100	185
Chabot	-1.8	-1.1	7,900	8,800	2,600	174
Chaffey	-20.3	-17.3	-12,100	-9,000	-4,800	81
SF	2.8	-0.5	6,900	4,300	-9,200	405
San Mateo	1.7	-2.6	17,300	15,200		259
C. of Des.	-18.5	-9.4	-1,100	6,400	6,400	67
Cuesta	-14.4	-18.2	400	-1,400		129
Cypress	-14.5	-14.5	-2,700	-7,200		112
De Anza	-0.6	-2.4	15,000	12,600	13,700	651
Diab. Vall.	0.5	-3.3	9,300	8,700	1,400	478
East LA	-32.5	-23.3	-9,700	-6,300	-12,500	50
El Camino	-18.1	-16.4	-6,000	-5,400	-7,700	308
Foothill	-3.6	-5.1	10,000	9,500		258
Fresno	-23.4	-23.3	-13,500	-14,800		87
Fullerson	-12.0	-11.7	-5,800	-7,800	-11,200	154
Hartnell	-14.4	-7.5	4,400	5,700	6,600	56
Irv. Vall.	-11.6	-17.3	1,200	-1,900		213
Laney	-4.2	-3.8	4,500	4,100		86
Las Positas	-10.8	-14.3	6,600	7,800		55
L. Beach	-20.4	-18.9	-2,900	-1,900	-7,600	184
LA Pierce	-15.2	-17.1	-4,600	-8,400		75

	6-Yr. Grad.		Wages in Early 30s			
Inst.	MH All	CFSTY All	MH All	CFSTY All	CFSTY Hisp.	Samp. Size
LA Valley	-20.0	-17.0	-300	-1,400		51
MiraCosta	-2.7	-1.8	5,100	500		86
Moorpark	-5.7	-8.3	6,300	4,800		168
Mt. SA	-14.5	-13.9	-2,000	-3,900	-7,500	451
Mt. SJ	-15.6	-13.4	1,600	2,600		69
Ohlone	-9.0	-12.3	16,600	13,400		94
Or. Coast	-31.2	-34.1	-12,200	-16,900		65
Palomar	-11.1	-13.9	-4,100	-7,700		105
Pasadena	-14.6	-15.0	-3,100	-6,100	-13,200	369
Riverside	-11.6	-5.1	1,500	3,100	-800	583
Sac.	-15.4	-10.0	-200	2,800		174
Saddleback	-7.0	-11.6	5,500	2,600		213
SB Valley	-2.8	6.7	2,300	6,000	700	77
SD	-26.0	-26.3	-18,400	-17,100		56
SD Mesa	-13.0	-12.4	-1,100	-2,400	-8,000	295
SD Mir.	-11.2	-10.8	3,000	1,700		75
SJ Delta	-20.3	-22.0	-3,500			
Santa Ana	-18.8	-17.9	-5,200	-3,100	-7,700	156
S. Barb.	-28.9	-33.9	-8,100	-10,700		72
S. Monica	-12.7	-12.9	-1,000	600	-9,200	671
S. Rosa	-6.5	-8.9	-5,000	-4,200		91
Sierra	-14.8	-15.7	-2,900	-2,600		108
Skyline	4.0	2.0	17,900	18,000		141
Solano	-4.4	0.2	28,100	31,400		52
Ventura	-15.0	-9.6	-3,500	-2,500	-2,100	101

Note: This table shows value-added estimates for estimable California Community Colleges. Value-added estimates from Equation I-1 using 1995-1997 UC CA-resident freshman fall applications, excluding colleges with fewer than 50 in-sample enrollees (or 30 enrollees for ethnicity-specific estimates). See text for outcome definitions and covariate definitions "MH" (following Mountjoy and Hickman, 2020) and "CFSTY" (following Chetty et al., 2020a). Ethnicity-specific coefficients estimated by interacting U_i with five ethnicity buckets: white, Black, Hispanic, Asian, and other. Sample size for "CFSTY" wage value-added coefficients. Estimates are not shrunk or otherwise adjusted for noise. Source: UC Corporate Student System, National Student Clearinghouse, and the CA Employment Development Department.

more likely to earn a college degree within 6 years than those who enroll at LB. Some of this gap – around 10-15 percentage points in most cases – is absorbed by both sets of covariates, with the "MH" covariates tending to absorb more of the gap. Similarly, the students who enroll at the most-selective UC campuses have higher average early-30s wages than LB enrollees by 25 to 30 thousand dollars, though about half of the gap is absorbed by covariates. UC campuses' wage VA statistics are uniformly lower for Hispanic students, especially at the more-selective campuses, but highly varying for Black students, whose wage VA is above-average at half of UC campuses.

The final columns of Table I-1 show that there is substantial high school GPA variation across UC campuses, with UC Berkeley enrollees having higher average GPAs than UC Santa Cruz enrollees by almost a half of a letter grade. The "MH covariates" fully absorb this variation, while the "CFSTY" covariates absorb only absorb about half of the variation on average, with poorer performance at the more-selective UC campuses. This suggests that "CFSTY" value-added statistics likely still incorporate a degree of sample selection bias, with the coefficients strongly suggesting that the bias is positively correlated with university selectivity. As discussed in the text, this likely implies that the baseline difference-in-difference in URM UC applicants' "CFSTY" institutional value-added measures are somewhat upwardly-biased relative to the actual average difference in average treatment effects across those institutions.

The highest wage VA coefficients among public universities were estimated for the California Polytechnic

Table I-3: 1995-1997 Value-Added Estimates for Private and Out-of-State Universities

	6-Yr. Grad.		Wages in Early 30s					6-Yr. Grad.		Wages in Early 30s			
	MH	CFSTY	MH	CFSTY		Samp.		MH	CFSTY	MH	CFSTY		Samp.
Inst.	All	All	All	All	Hisp.	Size	Inst.	All	All	All	All	Hisp.	Size
American	32.4	27.5	27,500	22,500		52	Pitzer	30.6	31.3	-800	-2,100	-3,400	113
Arizona	6.7	-0.2	7,900	3,600		101	P. L. Naz.	20.9	16.7	-6,900	-9,300		87
AZ State	22.3	21.0					Pomona	28.9	32.9	13,400	14,200	6,200	299
Asuza Pac.	25.6	25.8	-2,300	-600		84	Port. State	1.2	-0.6				
Biola	24.2	23.3	-14,500	-15,300		101	Princeton	32.3	35.9	36,700	35,800		166
Boston C.	-20.8	-20.0	12,500	13,100		127	Rice	10.3	12.6				
Boston U.	23.2	20.9	3,200	300		245	St. Mary's	26.4	25.3	11,700	12,700	4,300	333
Brandeis	26.8	28.3	8,500	7,800		59	Santa Clara	32.2	31.7	31,000	31,400	27,700	545
BYU	-10.3	-11.2	400	2,200		159	Scripps	28.4	28.3	3,700	-2,300		92
Bryn Mawr	27.8	30.4					S. Meth.	26.3	23.3				
CA Luth.	24.3	23.0	12,400	7,400		87	Spelman	34.2	46.0			-7,300†	32
Carleton	28.4	29.1					Stanford	28.2	32.0	37,100	36,800	23,300	1,116
CMU	19.7	18.8					Swarthmore	33.1	35.7				
Clar. Mc.	28.3	30.4	27,700	25,900	11,800	239	Syracuse	30.5	30.0	19,300	20,600		113
CO State	24.8	21.3	6,700	4,400		50	Tufts	28.9	29.8	4,900	500		80
Columbia	23.9	27.6	12,000	12,700		189	Tulane	28.9	27.6	20,000	17,500		80
Cornell	26.3	28.8	18,300	19,200		320	Colorado	24.9	20.2	17,700	14,900		472
Creighton	26.7	24.0	26,800	22,400		59	Michigan	30.2	30.9	29,500	31,800		99
Dartmouth	-57.8	-55.5	26,500	24,600		119	Nevada	10.8	8.5				
Duke	-21.2	-18.7	40,300	42,900		167	Oregon	26.2	18.6	2,100	-6,400		253
Georgetown	29.3	33.3	37,400	40,300	18,100	169	U. Penn.	28.0	30.7	38,200	39,700		271
Gonzaga	26.5	25.7					Puget Sound	24.6	21.9	700	-5,600		90
Harvard	-37.2	-32.9	20,100	19,000		89	Redlands	28.6	29.2	-700	-2,700	1,900	157
H. Mudd	24.5	26.7	27,500	27,200		109	USF	27.2	24.3	12,100	12,600	9,500	460
J. Hopkins	22.1	25.3	25,500	26,100		121	USC	20.8	21.7	17,400	18,100	5,900	3,192
La Sierra	4.9	8.0	-100	-4,600		75	U. Pacific	24.2	25.5	26,100	26,300	7,000	421
Lew. & Clk.	30.7	25.6	-2,400	-12,100		62	Virginia	32.6	33.2				
Loyola M.	22.0	21.6	11,700	12,700	9,800	853	Washington	24.9	25.7				
Mills	29.3	27.6	-9,200	-10,400		72	Wisconsin	24.0	23.3	5,800	3,500		106
Mt. Holyoke	-48.8	-48.8					Vanderbilt	28.4	29.7	16,800	19,200		101
Mt. St. M.	23.8	28.2	4,300	6,800	1,900	129	Wash. In SL	21.8	24.8				
NYU	23.2	21.8	-7,700	-10,500		242	Wellesley	30.0	33.9	9,100	12,000		88
N. Arizona	24.7	17.0	4,500				Wesleyan	34.7	34.2				
Northwest.	24.4	27.5	20,100	20,900		210	Westmont	-42.6	-44.4	-8,300	-12,000		123
Oberlin	0.9	-0.1					Whitman	32.7	33.1				
Occidental	33.6	34.5	1,800	3,900	-4,100	194	Whittier	26.2	29.3	6,900	9,600	5,600	147
Penn. State	21.8	17.5					Williams	33.0	35.1				
Pepperdine	29.3	27.3	4,700	6,000	3,200	316	Yale	29.0	33.8	39,100	39,300	13,400	260

Note: This table shows value-added estimates for all estimable private and non-California colleges and universities. Value-added estimates from Equation I-1 using 1995-1997 UC CA-resident freshman fall applications, excluding colleges with fewer than 50 in-sample enrollees (or 30 enrollees for ethnicity-specific estimates). See text for outcome definitions and covariate definitions "MH" (following Mountjoy and Hickman, 2020) and "CFSTY" (following Chetty et al., 2020a). Ethnicity-specific coefficients estimated by interacting U_i with five ethnicity buckets: white, Black, Hispanic, Asian, and other. Sample size for "CFSTY" wage value-added coefficients. Estimates are not shrunk or otherwise adjusted for noise. † Spelman is a historically Black college; this estimate is for Black students. Source: UC Corporate Student System, National Student Clearinghouse, and the CA Employment Development Department.

Table I-4: Comparison Between Various Value-Added Estimates and Student Outcomes for Matched Samples

	"MH" VA[1]				"MH+" VA[1]				"CFSTY" VA[1]				Eth.-Specific "CFSTY" VA[1]			
	Six-Year Deg.		Early-30s Wage		Six-Year Deg.		Early-30s Wage		Six-Year Deg.		Early-30s Wage		Six-Year Deg.		Early-30s Wage	
	VA	Obs.	VA	Obs.	VA	Obs.	VA	Obs.	VA	Obs.	VA	Obs.	VA	Obs.	VA	Obs.
Panel A: Difference-in-Difference Coefficients																
URM	2.0	-2.8	1,860	-786	3.0	-3.2	2,378	-1,010	2.8	-2.9	2,818	-805	1.7	-2.2	1,359	-808
	(0.1)	(0.4)	(83)	(573)	(0.1)	(0.5)	(84)	(633)	(0.1)	(0.4)	(94)	(574)	(0.1)	(0.4)	(91)	(601)
URM × Prop 209	-0.6	-0.5	-447	-2,239	-1.2	0.0	-1,032	-2,039	-1.0	-0.5	-952	-2,243	0.1	-0.1	57	-2,115
	(0.2)	(0.5)	(102)	(691)	(0.2)	(0.6)	(104)	(765)	(0.2)	(0.5)	(115)	(692)	(0.2)	(0.5)	(110)	(723)
Obs.	177,365	177,365	136,237	136,237	145,690	145,690	112,205	112,205	176,092	176,092	136,032	136,032	169,534	169,534	129,477	129,477
Panel B: Estimates of URM × Prop 209 ($\beta_{\cdot 98-99}$) by AI Quartile																
Bottom Quartile	-1.6	-3.6	-591	-2,152	-2.3	-3.7	-883	-1,169	-1.9	-3.6	-734	-2,152	-1.1	-3.1	97	-1,485
	(0.4)	(1.6)	(235)	(1,579)	(0.5)	(1.8)	(262)	(1,797)	(0.5)	(1.6)	(270)	(1,582)	(0.5)	(1.7)	(288)	(1,685)
Second Quartile	-0.5	-0.7	-448	-1,384	-1.4	-0.1	-1,493	-316	-1.3	-0.6	-1,269	-1,382	0.2	0.0	454	-1,512
	(0.4)	(1.3)	(219)	(1,450)	(0.4)	(1.4)	(232)	(1,585)	(0.4)	(1.3)	(264)	(1,451)	(0.4)	(1.3)	(253)	(1,500)
Third Quartile	0.1	1.8	-468	-2,160	-0.7	2.1	-1,291	-2,648	-0.4	1.9	-1,372	-2,117	0.9	1.9	85	-1,899
	(0.3)	(1.1)	(202)	(1,451)	(0.3)	(1.2)	(206)	(1,598)	(0.3)	(1.1)	(242)	(1,452)	(0.3)	(1.1)	(219)	(1,515)
Top Quartile	-0.8	-0.1	-387	-2,637	-0.5	0.4	-726	-2,624	-1.0	-0.3	-708	-2,641	0.1	-0.3	284	-2,517
	(0.3)	(0.9)	(248)	(1,648)	(0.2)	(1.0)	(231)	(1,788)	(0.3)	(0.9)	(257)	(1,648)	(0.3)	(0.9)	(223)	(1,707)

Note: This figure tests the performance of several institution and institution-gender-ethnicity value-added estimates against actual changes in student outcomes after Prop 209, with some measures performing relatively-well in measuring degree attainment but all measures generally underestimating (and poorly explaining the patterns in) declines in early-30s wages. Estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, a difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as estimated value-added of the first two- or four-year institution at which the applicant enrolled within six years of UC application as measured in the NSC, or actual student outcomes matching the value-added measures: six-year Bachelor's degree attainment or average conditional California wages between 12 and 16 years after UC application. Outcome samples are restricted to observations with observed VA (implying that the student first enrolled at an institution with sufficient sample size to estimate VA), and wage VA samples restricted to observations with observed early-30s wages (omitting observations with no California employment in that period, 12-16 years after UC application). Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Robust standard errors in parentheses. [1]Value-added measures are estimated by regressing six-year BA attainment (in NSC) or 15-year conditional wages (in EDD) on college indicators, year FEs, and either indicators for each applicant's set of UC campus applications and admissions (following Mountjoy and Hickman (2020), "MH"), indicators for each applicant's complete set of institutions to which they sent their SAT scores (using matched College Board testing data; an extension of Mountjoy and Hickman (2020), "MH+") or ethnicity indicators and quintics in SAT score and family income (following Chetty et al. (2020a), "CFSTY") using the 1995-1997 UC applicant pool. Ethnicity-specific coefficients estimated by interacting U_i with five ethnicity buckets: white, Black, Hispanic, Asian, and other. Source: UC Corporate Student System, National Student Clearinghouse, and the California Employment Development Department.

Institute (Cal Poly), a teaching-oriented university in the CSU system. Panel B of Table I-1 shows that most CSU campuses had degree and wage VA estimates similar to CSU Long Beach, lower than most UC campuses, but that three CSU campuses – Cal Poly, CSU Sacramento, and San José State – appear comparable to UC. Those three also have notably-high ethnicity-specific VA coefficients for Hispanic students. Sample sizes are generally too small to estimate ethnicity-specific VA coefficients for Black students outside of the UC system. Even though the "MH" application and admission partition does not include outcomes at the CSU campuses, the "MH" procedure nevertheless largely eliminates cross-campus average differences in enrollees' high school GPAs, while the "CFSTY" estimates continue to identify some cross-campus GPA variation.

Table I-2 shows that California's community colleges have estimated degree VA below most of the institutions in the UC or CSU systems, but there is substantial variation in community colleges' wage VA estimates, with many colleges having wage VA estimates comparable to CSU or UC campuses. The high-wage-VA community colleges are clustered in the high-wage and high-cost-of-living "South Bay" of northern California, like Ohlone College in Fremont, Skyline College in San Bruno, De Anza in Cupertino, and Foothill College in Los Altos. Though the table does not show it, the estimates show that there is relatively little variation across community colleges in their UC-applicant enrollees' average high school GPAs: the standard deviation of raw average high school GPA coefficients is 0.09 across community colleges, whereas the standard deviation across "MH" estimates of high school GPA is 0.04 (and 0.09 for "CFSTY").

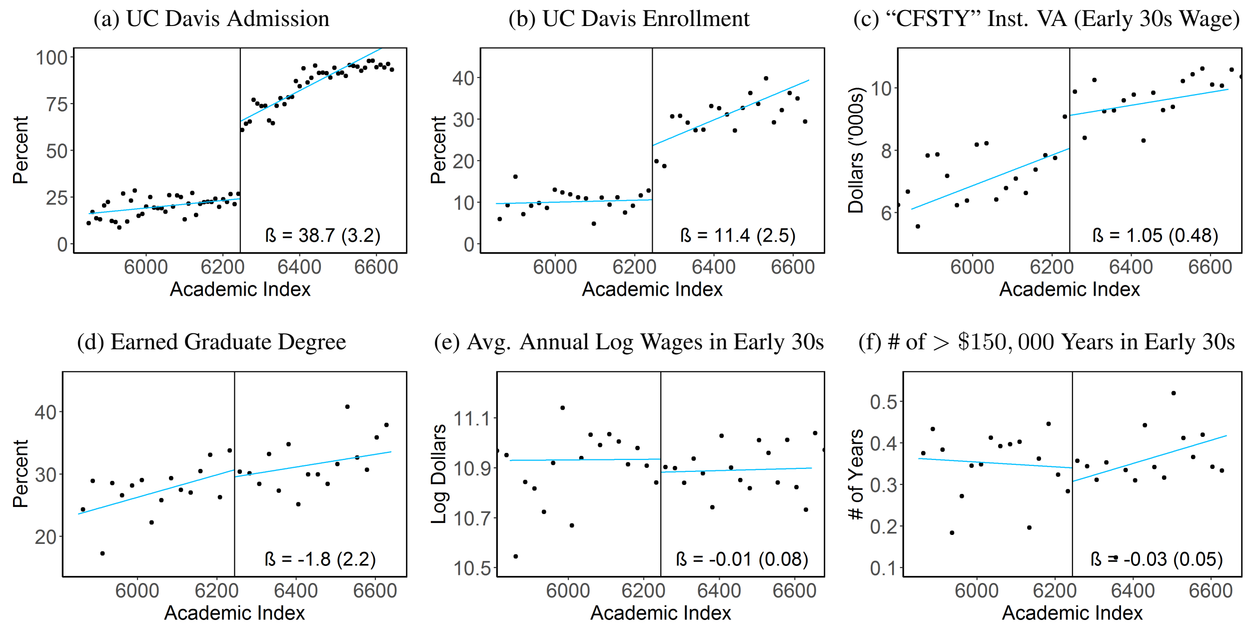
Table I-3 shows that the private and out-of-state universities where UC applicants tend to enroll have degree VA estimates as larger or larger than the UC system, and many have wage VA estimates higher than UC, though there is a great deal of variation.[57] With many of these institutions among the nation's more-selective, Wage VA estimates are highest at many of the nation's more-selective universities, including Ivy League institutions like Princeton, the University of Pennsylvania, and Yale as well as Duke and Stanford. Out-of-state flagship public universities tend to have similar VA estimates to the UC system, while California's less-selective private institutions vary widely, from the high-VA Santa Clara University to lower-VA Mills College (though even the lower-VA California institutions have high degree VA estimates relative to less-selective public institutions). As in the case of the UC campuses, there is substantial variation in average high school GPAs across these institutions (s.d. 0.25), but most is absorbed by "MH" value-added estimates (s.d. 0.08; 0.15 using "CFSTY").

Figure III shows that Prop 209 tended to shift URM UC students' enrollment from the more-selective UC campuses into the less-selective campuses, CSU campuses, and some private and out-of-state institutions. Students also cascaded out of the moderately and less-selective UC campuses into other institutions, yielding unchanged URM enrollment at all but the more-selective UCs. The estimates presented in these tables specify the way in which these switches led students to enroll at institutions with lower estimated value-added in terms of degree attainment and early-career wages, as summarized in Table II.

There has been minimal quasi-experimental validation of university value-added statistics. I conclude by testing the degree to which value-added measures explain the observed changes in URM applicant outcomes after Prop 209. Table I-4 presents VA and observed degree attainment and early-30s wages for several VA specifications, aligning samples for missing data. It shows that changes in URM applicants' university enroll-

[57]A small number of institutions, like Duke University and Dartmouth College, may have low degree VA estimates as a result of incomplete NSC degree reporting in the sample period.

Figure J-1: Estimated Return to '96-97 UC Davis Enrollment for On-the-Margin Non-URM Applicants



Note: This figure shows that on-the-margin 1996-1997 non-URM applicants to UC Davis would have otherwise enrolled at lower-value-added institutions but experienced similar educational and wage outcomes, though interpretation is challenged by the increase in above-threshold students likelihood of applying to Davis. Regression discontinuity plots and estimates around the 1996-1997 UC Davis guaranteed admission AI threshold among non-URM applicants, estimated by local linear regression following Calonico et al. (2014). See the notes to Tables II, III, and IV for a description of the outcome variables; "CFSTY" institutional value-added measured relative to CSU Long Beach. Reduced form coefficients from local linear regressions (conditional on year), with bias-corrected robust standard errors in parentheses. Running variable defined as $AI + (250 \times \mathbb{1}_{1997})$ to align thresholds over years. Source: UC Corporate Student System, National Student Clearinghouse, and the CA Employment Development Department.

ment's estimated value-added statistics yield relatively-accurate predictions of the decline in degree attainment by AI quartile, but underestimates of the actual changes in observed early-30s wages. The "MH" value-added statistics yield the most compressed distribution of value-added statistics across universities, as would be expected given their near-complete absorption of cross-school variation in high school GPAs, but this yields poorer performance in explaining outcome variation after Prop 209. Allowing gender- and ethnicity-specific VA coefficients (using the "CFSTY" approach) yields precise 0's for the wage VA estimates across all AI quartiles, implying particularly poor performance.

Figure A-18 visualizes these discrepancies, plotting smoothed (but not covariate-adjusted) difference-in-difference averages for both VA and actual degree attainment and early-30s wages. The two lines poorly mirror each other, suggesting both that VA poorly-explains and substantially underestimates the observed labor market effects of Prop 209.

Appendix J: Return to UC Davis Enrollment for On-the-Margin Non-URM Applicants

Figures B-1 to B-8 show that only two UC campuses exhibited discontinuities in their applicants' likelihood of admission before Prop 209 when ordered by AI: the campuses at Berkeley and Davis. As a result, UC

Davis's admissions policies admit a regression discontinuity design that could provide additional evidence, along with Section 6, on the return to UC admission for the on-the-margin non-URM students who may gain access to the campus following Prop 209.

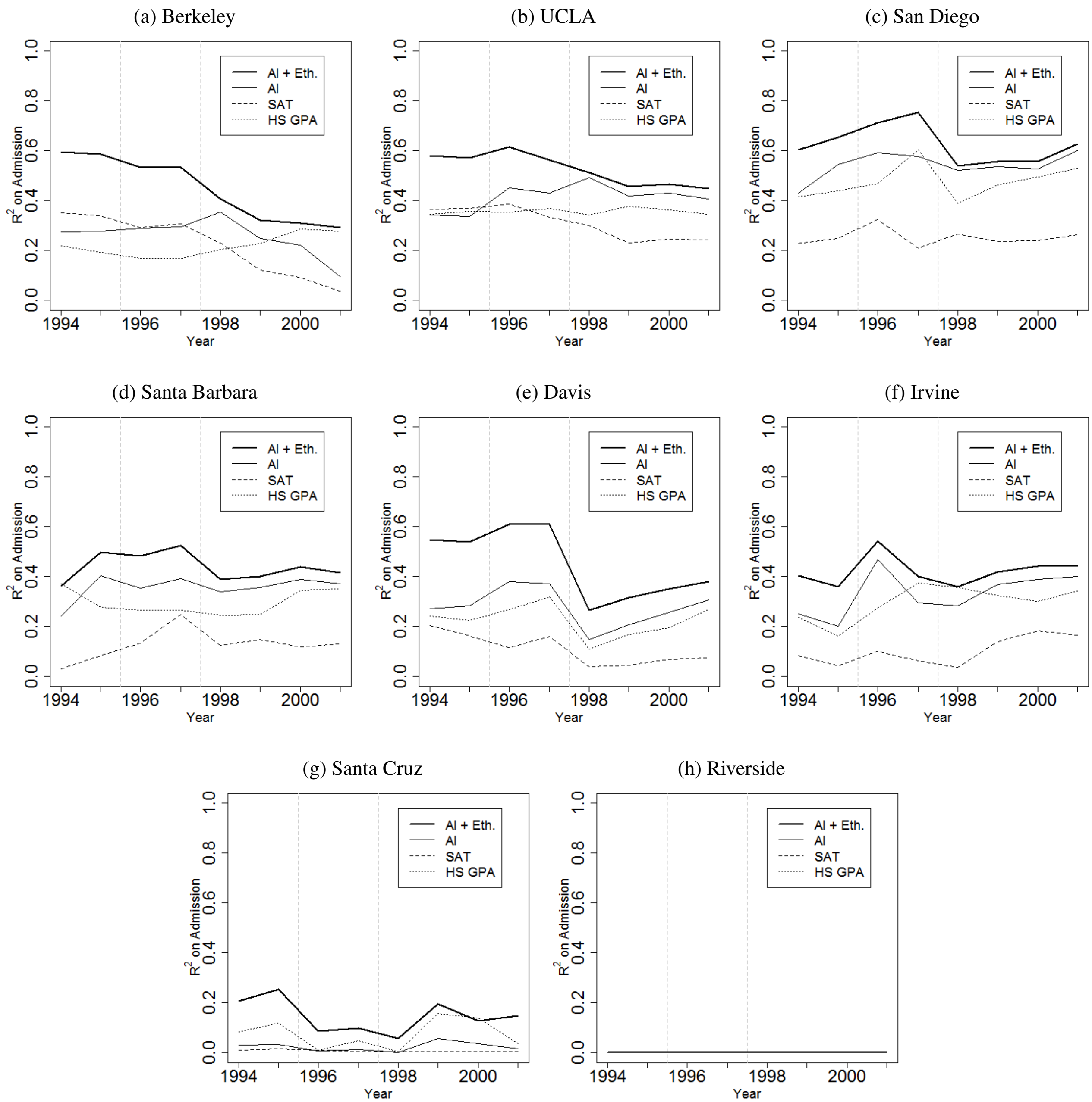
The challenge in interpreting the return to enrollment at UC Davis for on-the-margin non-URM 1996-1997 applicants is that the discontinuities themselves – at exactly 6,000 in 1996 and 6,250 in 1997 – appear to have been known by some applicants. McCrary (2008) tests fail at both thresholds (p=0.016 and p=0.025) as a result of a 13 percent increase in students' likelihood of applying to UC Davis at the campus's AI admissions threshold. As in Section 6, I test for selection on observables at the UC Davis AI admissions threshold by characterizing each applicant by their expected log wages on the basis of demographic and socioeconomic features and find weak evidence of negative selection above the threshold, with lower predicted wages by 0.025 log points (s.e. 0.020 log points) immediately above the threshold.

Despite these limitations to the research design, Figure J-1 shows how UC Davis's applicants above and below that school's AI admissions threshold differ in terms of educational and employment outcomes. Above-threshold students are 40 percentage points more likely to attend Davis, and excluding a small group of applicants immediately above the threshold, take-up appears to be close to half, with enrollment increases around 20 percentage points. Unlike in the Berkeley context, UC Davis is a higher-value-added institution than on-the-margin applicants' counterfactual enrollments, leading to an estimated $1,000 increase in wage value-added at the threshold, about four times the average increase in value-added for non-URM enrollees at California public universities after Prop 209 (see Figure A-2). But as in the case of UC Berkeley, enrolling at UC Davis does not generate returns for on-the-margin non-URM students, who are no more likely to earn a graduate degree or earn higher wages if they have access to UC Davis; indeed, all three point estimates are negative (and statistically indistinguishable from 0).

The smoothness of the resulting wage trends suggests that these findings are not just limited to the differentially-selected students close to the eligibility threshold, but also reflect broader negligible treatment effects of access to UC Davis on non-URM student outcomes prior to Prop 209. This evidence further supports the main text's claim that non-URM students on the margin of admission to UC campuses prior to Prop 209 appear to derive small benefits from enrolling at those campuses, particularly in comparison with the estimated costs faced by URM students who lost access to selective universities following Prop 209.

Other Appendix Figures and Tables

Figure A-1: Annual Explanatory Power of Academic Index and Ethnicity for UC Admission

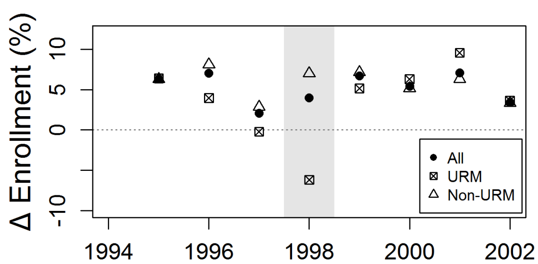


Note: This figure shows that a large share of UC campuses' admissions, especially before 1998 but also after, can be explained strictly by students' Academic Index, with a large additional share explained by ethnicity before 1998. The R^2 coefficients of annual OLS regressions of admission on the leave-one-out likelihood of admission for students with the same Academic Index (AI), SAT score, high school GPA (rounded to the nearest hundredth), or AI and ethnicity, among 'normal' UC freshman fall applicants to each campus. 'Normal' applicants are freshman fall California-resident applicants who (a) were UC-eligible, which means that they satisfactorily completing the required high school coursework, and (b) who selected intended majors that did not have special admissions restrictions (e.g. engineering at some campuses). Figure A-5 shows the differences between the first and second line for each campus. Source: UC Corporate Student System.

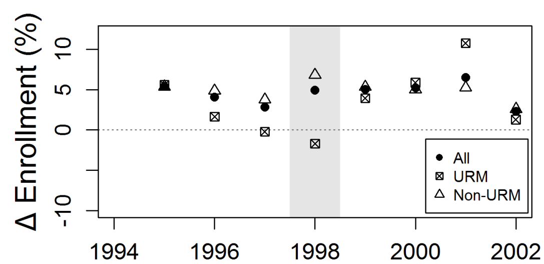
Figure A-2: Annual Changes in Undergraduate Enrollment at California Institutions

Panel A: Annual Change in Freshman Fall Undergraduate Enrollment

(a) Public California Universities

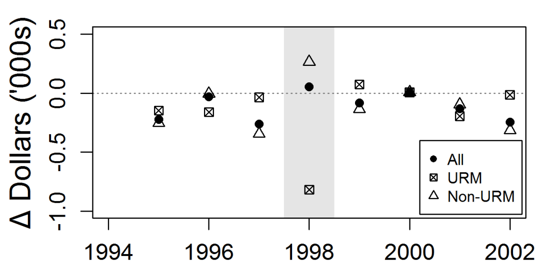


(b) California Universities

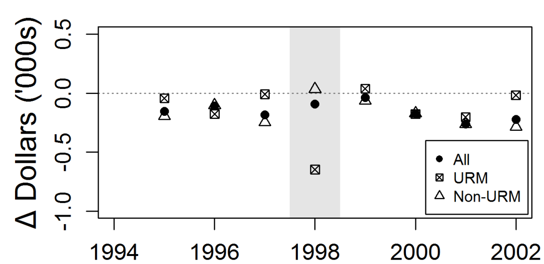


Panel B: Annual Change in Undergraduate Enrollment “CFSTY” Value-Added

(c) Public California Universities

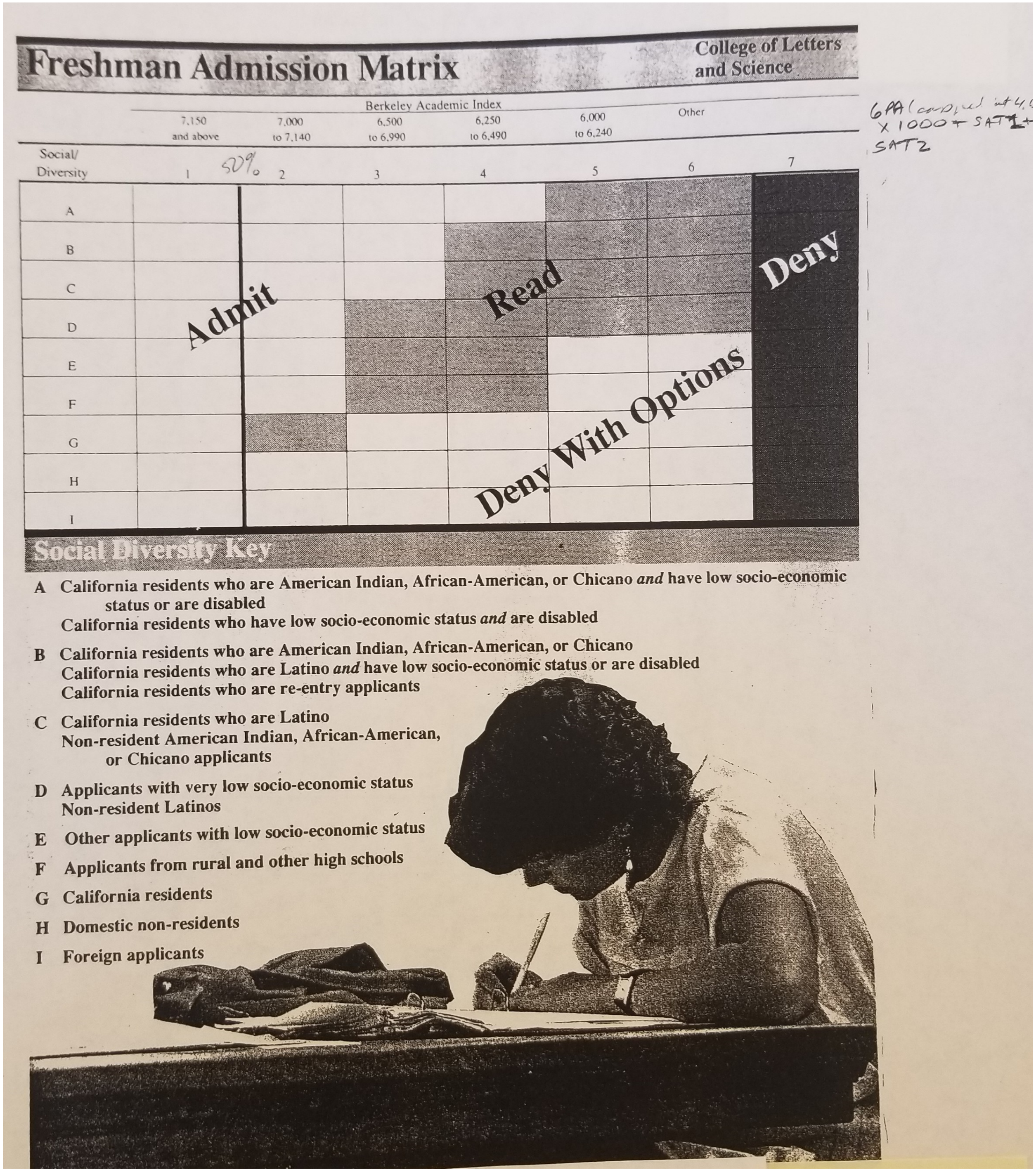


(d) California Universities



Note: This figure shows that while Prop 209 may have slightly depressed the growth of California public universities in 1997 and 1998, it had no measurable net effect on either the growth of all California institutions or the relative number of students enrolled at higher- or lower-value-added California institutions, with sharp declines in the value-added of URM students' enrollment institutions compensated for by increases among non-URM students in 1998. Year-over-year changes in freshman fall undergraduate enrollment and the enrollment-weighted average value-added of public and all California universities, overall and for URM and non-URM freshman students. Universities include all four-year institutions in California. See Appendix I for methodological details and the estimated “CFSTY” value-added statistics; value-added measured relative to CSU Long Beach. Source: The Integrated Postsecondary Education Data System, UC Corporate Student System, and the CA Employment Development Department.

Figure A-3: Archival Example of UC Berkeley Pre-1998 Admissions Policy



Freshman Admission Matrix

College of Letters and Science

Social/ Diversity	1 (7,150 and above)	2 (7,000 to 7,140)	3 (6,500 to 6,990)	4 (6,250 to 6,490)	5 (6,000 to 6,240)	6 (Other)	7
A							
B							
C							
D							
E							
F							
G							
H							
I							

Berkeley Academic Index

Admit

Read

Deny

Deny With Options

50%

GPA (capped at 4.0) x 1000 + SAT1 + SAT2

Social Diversity Key

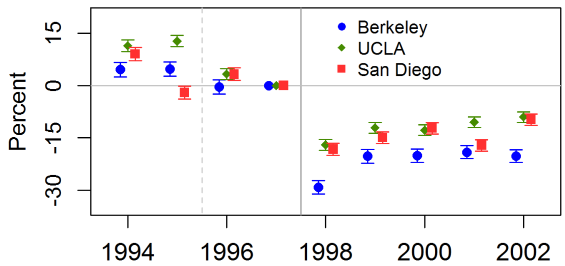
- **A** California residents who are American Indian, African-American, or Chicano *and* have low socio-economic status or are disabled
  California residents who have low socio-economic status *and* are disabled
- **B** California residents who are American Indian, African-American, or Chicano
  California residents who are Latino *and* have low socio-economic status or are disabled
  California residents who are re-entry applicants
- **C** California residents who are Latino
  Non-resident American Indian, African-American, or Chicano applicants
- **D** Applicants with very low socio-economic status
  Non-resident Latinos
- **E** Other applicants with low socio-economic status
- **F** Applicants from rural and other high schools
- **G** California residents
- **H** Domestic non-residents
- **I** Foreign applicants

Note: This figure presents an example of UC Berkeley's pre-1998 admissions policy. The table shows that the university guaranteed admission to all applicants above a designated Academic Index threshold, where that threshold was set every year to admit 50 percent of all Berkeley admits. The university then set lower AI guarantee thresholds for other groups of students, including disadvantaged ethnic groups, disabled students, and students with "low socio-economic status", though it is unclear how the latter were defined. The specific numbers presented at the top of the page do not match the admissions data in any specific year, suggesting that this document (found with minimal context in UC Berkeley's Bancroft Library) was presented as an example rather than a specific year's policy. Further archival documentation suggests that most other campuses used highly-comparable admissions rules. Source: UC Berkeley Bancroft Library: CU-558, Box 2, Page 8-942.

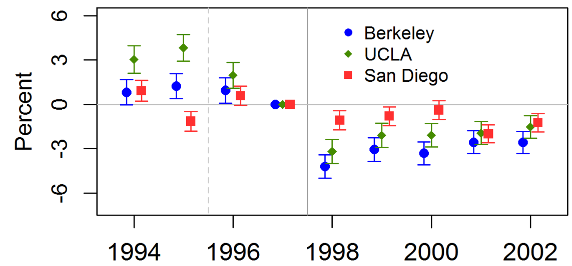
Figure A-4: Annual Difference-in-Difference Estimates of Post-1998 URM Admissions by UC Campus

Panel A: More-Selective UC Campuses

(a) Admission

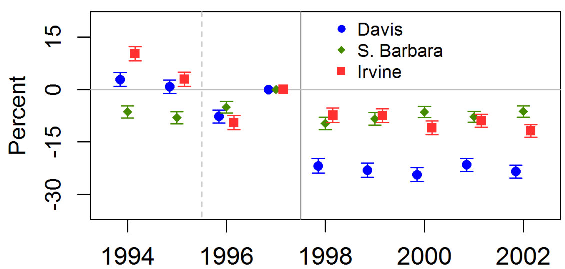


(b) Enrollment

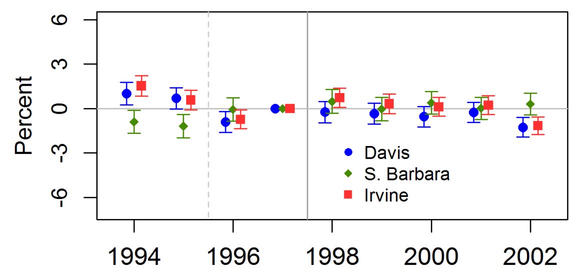


Panel B: Selectivity UC Campuses

(c) Admission

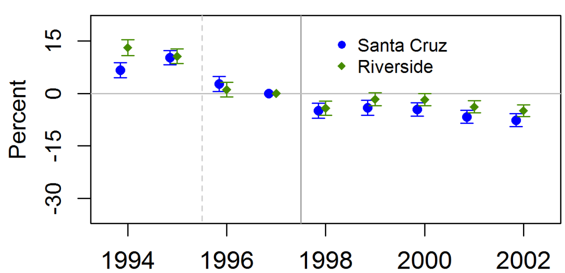


(d) Enrollment

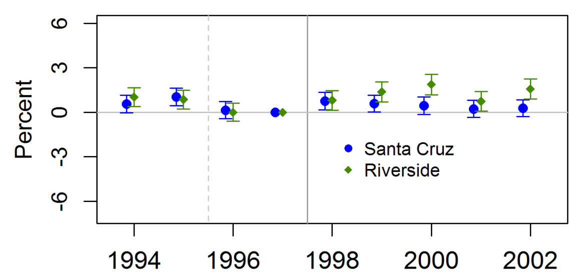


Panel C: Less-Selective UC Campuses

(e) Admission

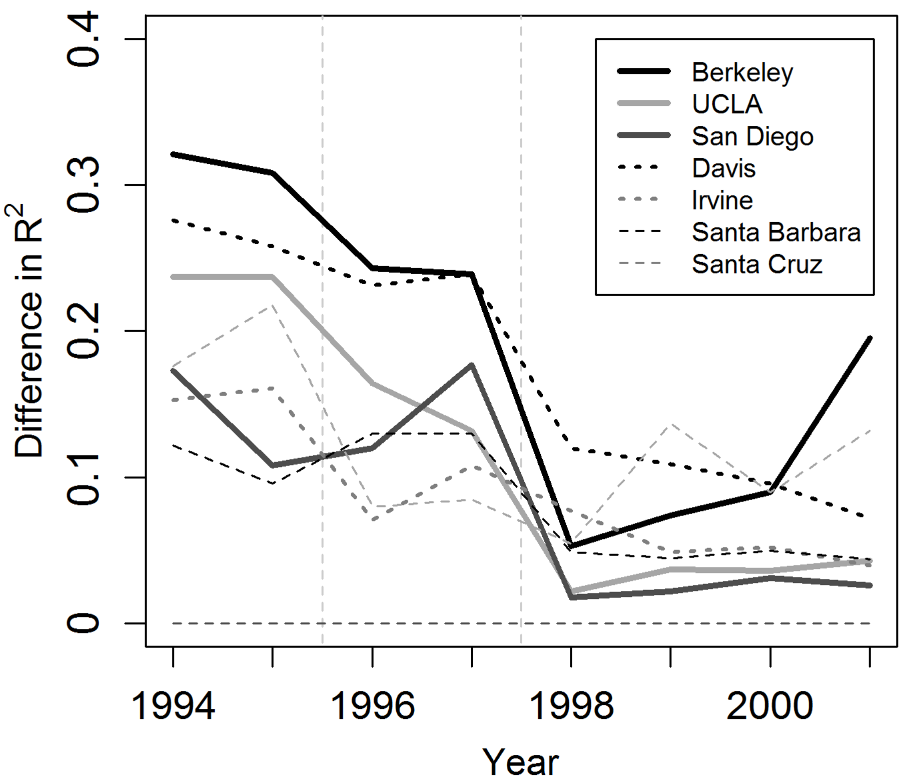


(f) Enrollment



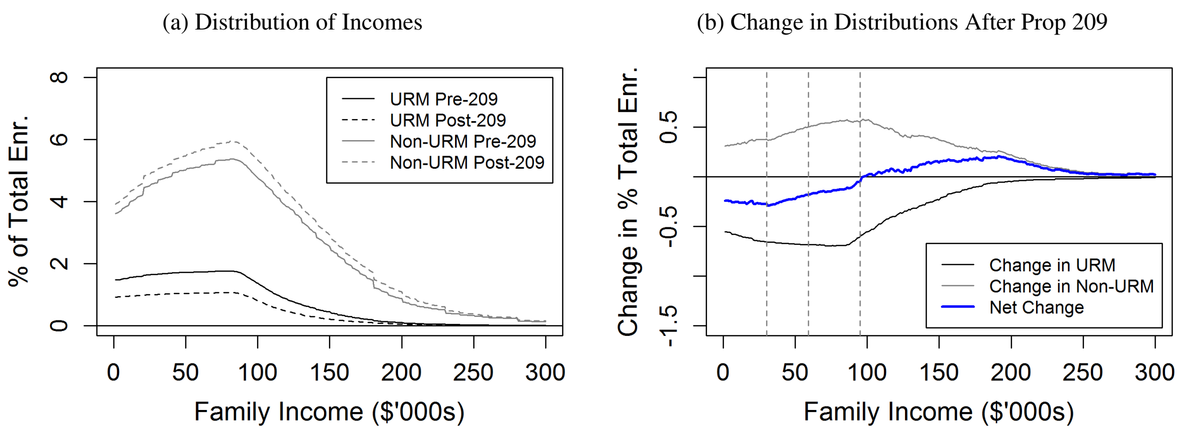
Note: This figure shows that URM UC applicants' admissions likelihood sharply and persistently declined at every UC campus in exactly 1998, but that some campuses also exhibited declines in 1996. OLS difference-in-difference coefficient estimates of the change in URM applicants' likelihood of admission or enrollment at each UC campus relative to non-URM applicants' respective likelihood, compared to the 1997 baseline. Campuses are ordered by their mid-1990s admissions rate. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Bars show 95-percent confidence intervals from robust standard errors. Admission is conditional on applying to that campus; enrollment is conditional on applying to any UC campus. Source: UC Corporate Student System.

Figure A-5: Estimated Annual First-Order Contribution of Ethnicity to UC Campuses' Admissions Decisions



Note: This figure shows that the share of variation in admissions at each UC campus that could be explained by ethnicity (above that explained by AI) fell across all campuses in 1998, though it had begun to fall at some campuses by 1996. Each point measures the difference in R^2 coefficients between two linear models of admission to each respective UC campus among 'normal' UC applicants. The first model predicts admission based on the leave-one-out likelihood of admission for students with the same academic index and ethnicity, which explains 40-70 percent of variation in most campuses' admissions decisions before 1996. The second model predicts admission based on the leave-one-out likelihood of admission for all students with the same academic index. The models are visualized separately in Figure A-1. The difference can be understood as a proxy for the annual magnitude of the first-order contribution of ethnicity to UC admission by campus. 'Normal' applicants are freshman fall California-resident applicants who (a) were UC-eligible, which means that they satisfactorily completing the required high school coursework, and (b) who selected intended majors that did not have special admissions restrictions (e.g. engineering at some campuses). UC Riverside admitted all such applicants. Source: UC Corporate Student System.

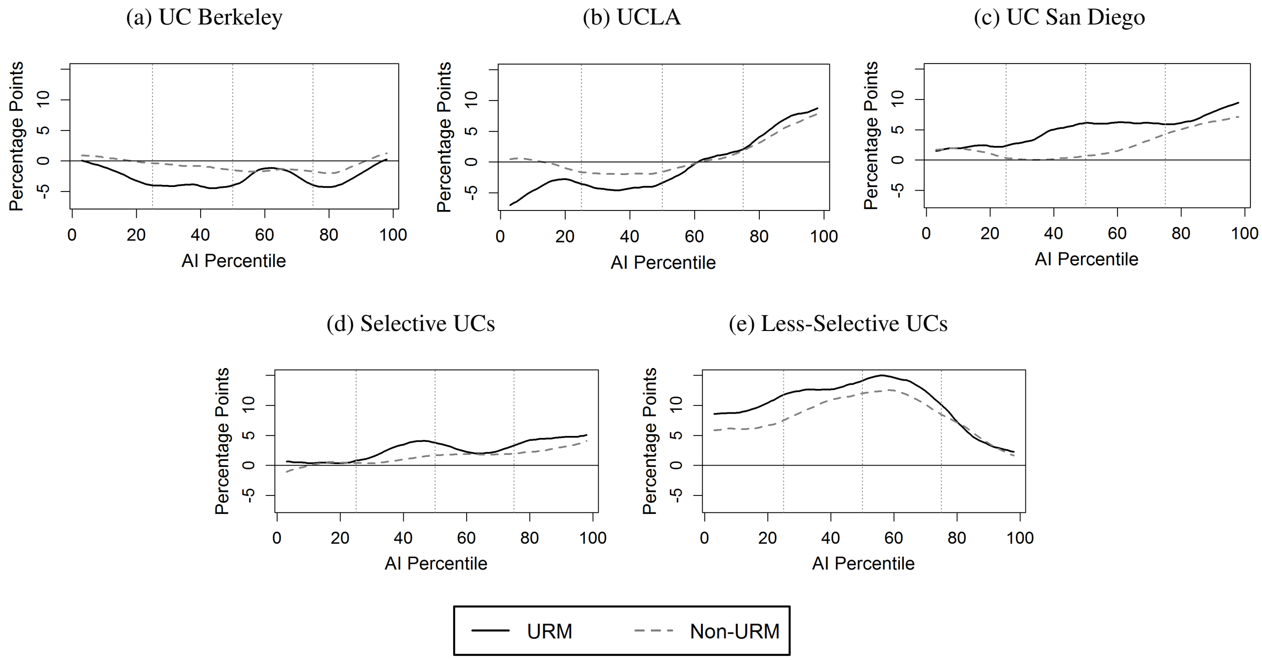
Figure A-6: Average Family Income of Berkeley and UCLA Students by Ethnicity Before and After Prop 209



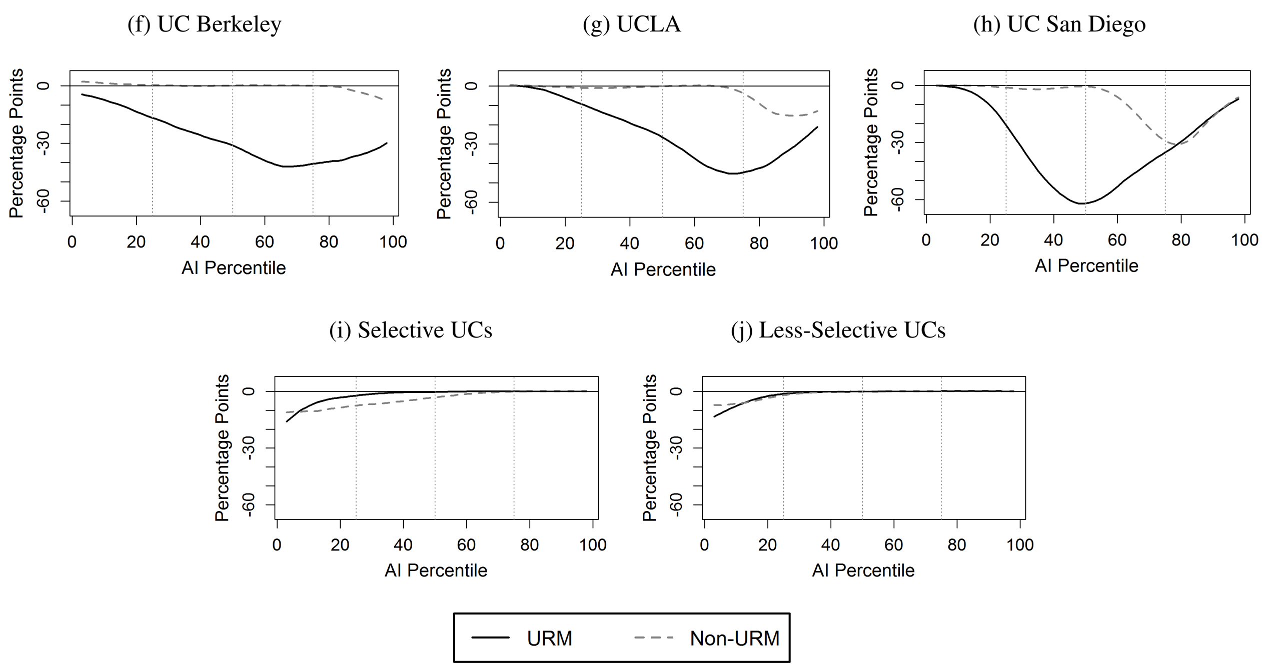
Note: This figure shows that the URM students who enrolled at UC Berkeley and UCLA under affirmative action had lower average incomes than the non-URM students who crowded into those campuses following Prop 209, leading to a net shift of students from the bottom three income quartiles (fixed in '96-97) to the top quartile after 1998. Shares of 1996-1999 UC Berkeley and UCLA students by income and ethnicity before and after Prop 209, differences of those shares by income and ethnicity, and the summed net enrollment change by income. The y-axis is scaled per $10,000 for readability; e.g. there was a net decline in UC Berkeley and UCLA students with family incomes of ∼$30,000 by about 0.5 percent of total enrollment after Prop 209. Dashed lines in Panel (b) show the 25th, 50th, and 75 percentiles of in-sample '96-97 family incomes. Figures are smoothed by a uniform kernel with bandwidth $20,000. Family incomes are not reported by 15 percent of the sample, increasing from 11 percent in '96-97 to 18 percent in '98-99; I impute incomes for these students by OLS regression of log family income on high school indicators, Zip code indicators, parental occupation indicators, max parental education indicators, standardized test scores, and gender in the full '96-97 CA-resident freshman UC applicant pool with observed family incomes. Imputed incomes are available for 95 percent of students with missing income; the regression's adjusted R^2 is 0.48, and the predicted values have a correlation with observed in-sample family income of 0.59. The distribution of predicted incomes among non-reporters is highly similar to the reported income distribution, with true (predicted) moments first quartile $29,500 ($41,100), median $60,000 ($60,200), mean $74,200 ($68,000), and third quartile $100,000 ($90,000). Source: UC Corporate Student System.

Figure A-7: Changes in UC Application and Admission after Prop 209 by Ethnicity and AI Percentile

Panel A: Changes in UC Campus Application Likelihood by AI and Ethnicity, Among UC Applicants

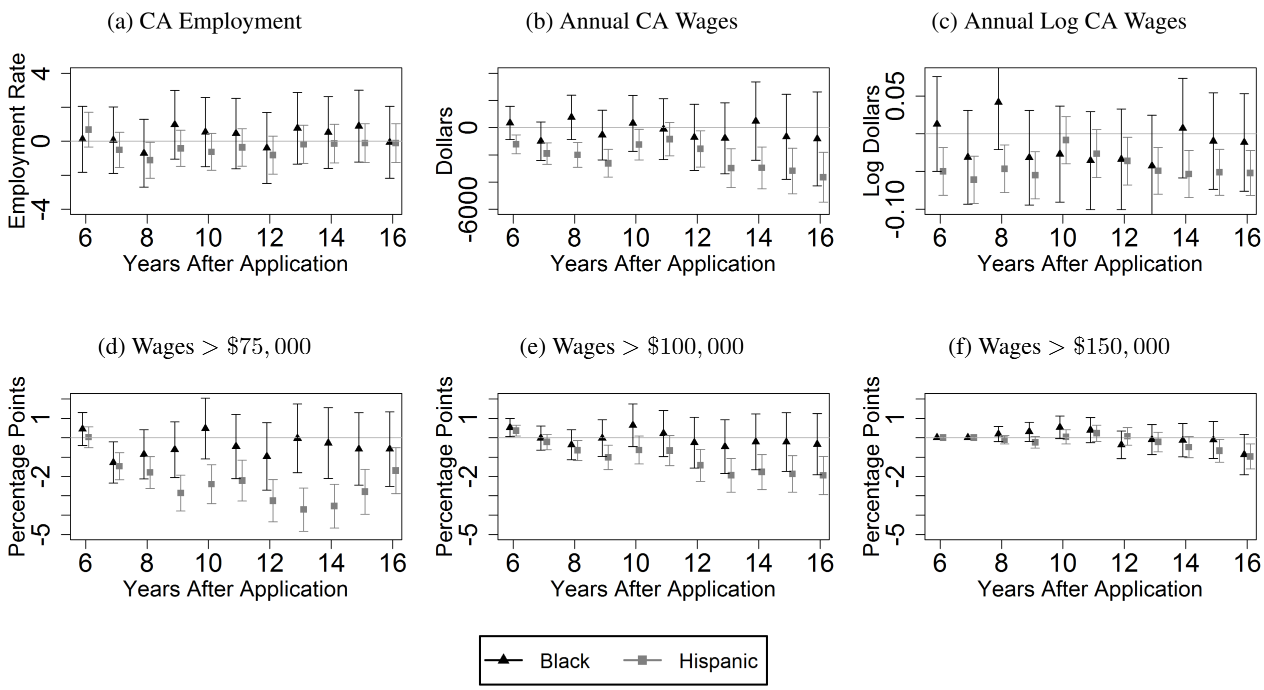


Panel B: Changes in UC Campus Admission Likelihood by AI and Ethnicity, Among Applicants



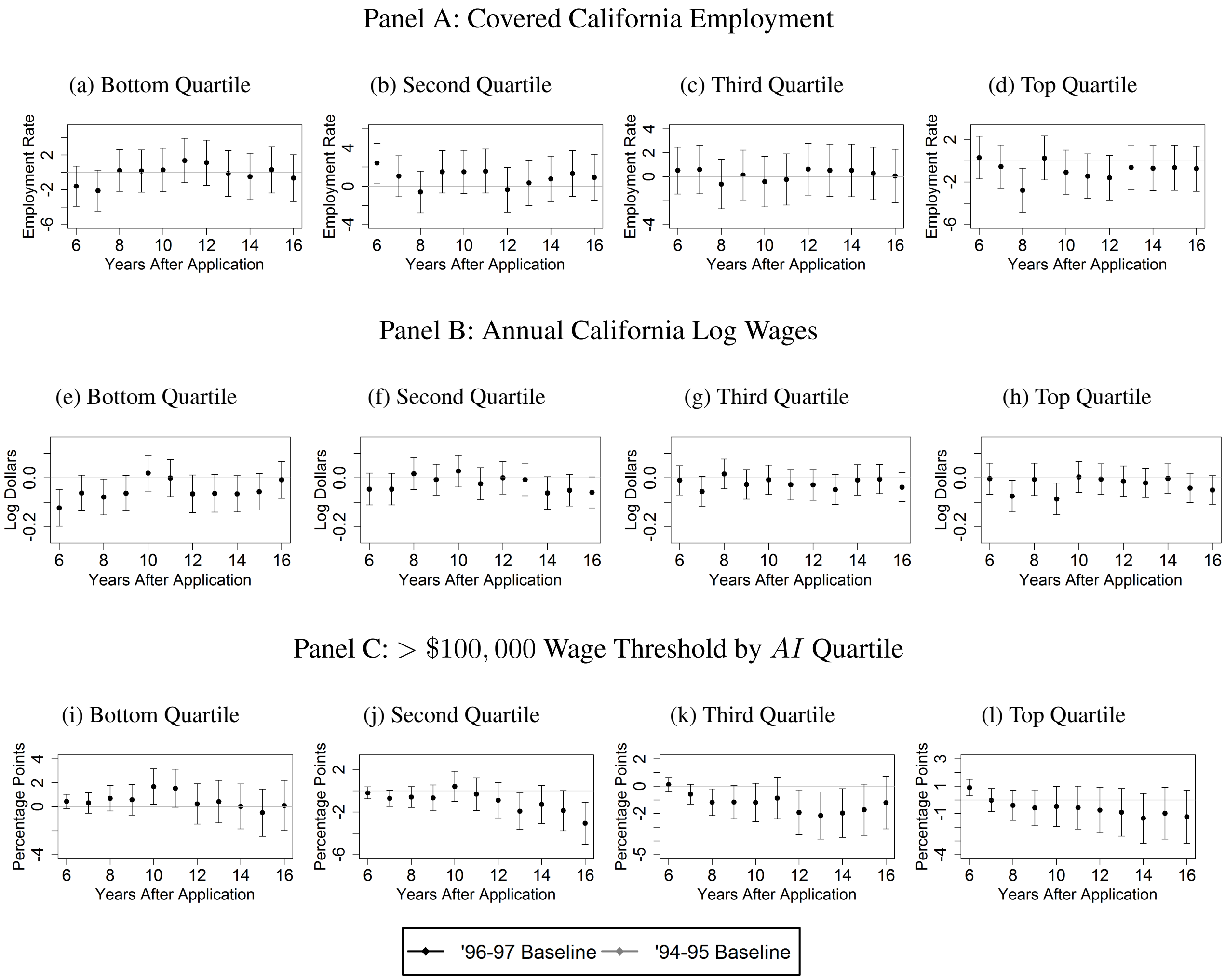
Note: This figure shows that changes in application patterns among URM UC applicants did not closely mirror changes in those applicants' UC admissions likelihood following Prop 209; for example, high-AI URM applicants were (relatively) no less likely to apply to UCLA after Prop 209 despite sharp declines in admissions likelihood at that campus. Difference in the percent of UC applicants who apply to or are admitted to each UC campus(es) between 1998-1999 and 1996-1997, by URM status and by percentile of academic index (AI) measured among all 1996-1999 URM UC applicants. Admit statistics are conditional on application to that campus. Statistics are smoothed with a triangular kernel with bandwidth 15. Source: UC Corporate Student System.

Figure A-8: Difference-in-Difference Estimates of Black and Hispanic UC Applicants' Post-1998 Wage Outcomes



Note: This figure shows that Hispanic UC applicants faced persistent labor market deterioration following Prop 209, while estimates for Black UC applicants' wage deterioration are noisy but generally appear smaller. Estimates of β_0 and $\beta_{\cdot 98-99}$ from an extension Equation 1 splitting the URM indicator into separate Black and Hispanic indicators interacted with post-209. The model is an OLS difference-in-difference model of 1996-1999 URM and Asian UC freshman California-resident applicants' educational outcomes compared to other non-URM students' outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as non-zero California wages ("CA Employment"), California wages in dollars and log-dollars (omitting 0's), and unconditional indicators for having wages above specified wage thresholds ($75,00, $100,000, and $150,000) as measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. Coefficients in each year after UC application are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust 95-percent confidence intervals shown. Source: UC Corporate Student System and the California Employment Development Department.

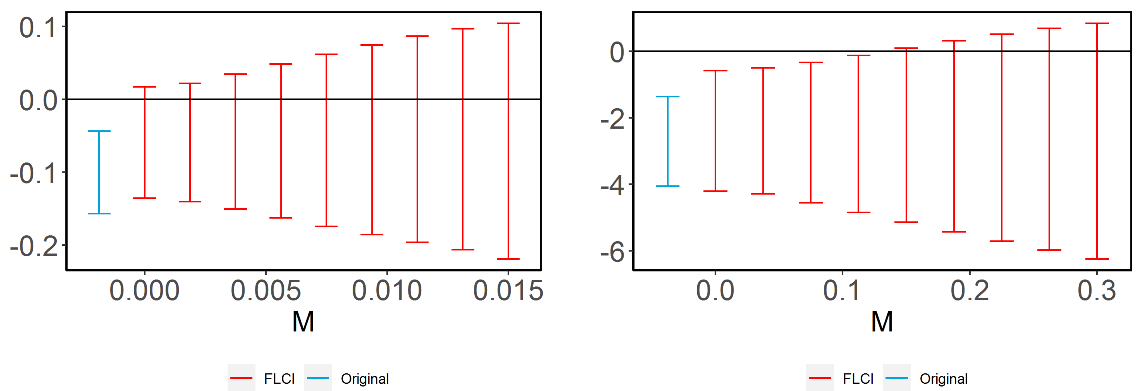
Figure A-9: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Labor Market Outcomes



Note: This figure shows that URM applicants' California employment was largely unchanged among all four AI quartiles, but that all experienced log wage declines and all but the bottom quartile became less likely to earn at least \$100,000 annual California wages, with larger estimated declines relative to the '94-95 baseline. Estimates of $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' wage outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as non-zero California wages ("CA Employment"), average log wages (excluding zeroes), and unconditional indicators for having wages above specified wage thresholds (\$75,00, \$100,000, and \$150,000) as measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. Coefficients in each year after UC application are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. Panel C replaces the 1996-97 pre-209 UC applicants with 1994-95 UC applicants, showing coefficients from both sets of models. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust 95-percent confidence intervals shown. Source: UC Corporate Student System and the California Employment Development Department.

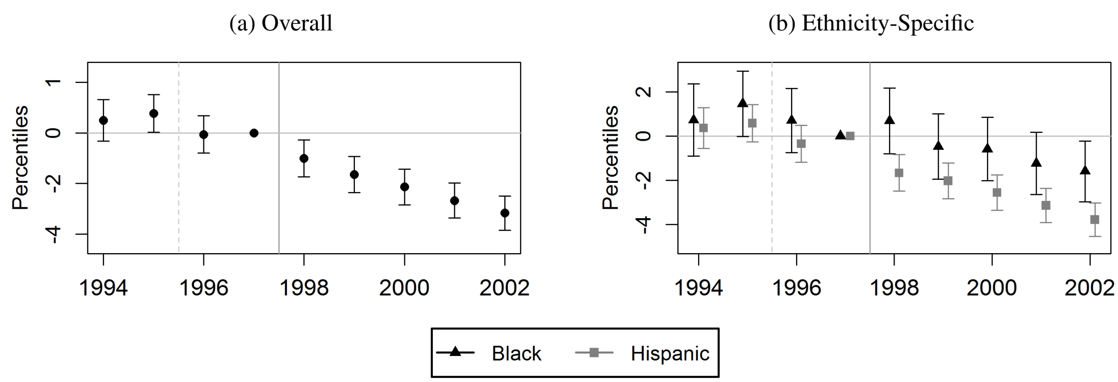
Figure A-10: Difference-in-Difference Robustness to Non-Parallel Trends

(a) Avg. Annual Conditional Log Wages (b) Avg. Eth-Specific Wage Percentile



Note: This figure shows that while the difference-in-difference log wage estimates are sensitive to loosening the parallel trends assumption, replacing wages with ethnicity-specific wage percentiles generates estimates relatively insensitive to assumptions allowing bounded pre-trends of up to almost 0.15 percentiles per year. Estimates of $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' wage outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program, by varying assumptions over the maximal annual degree to which the parallel trends assumption may be violated (following Rambachan and Roth, 2020). The blue bars show the baseline estimates; the black bars present fixed length confidence intervals permitting $\Delta^{SD}(M)$ (the x-axis) deviations from the parallel trends assumption. Source: UC Corporate Student System and the California Employment Development Department.

Figure A-11: Difference-in-Difference Percentile Estimates with Fixed 2017 Wage Distributions

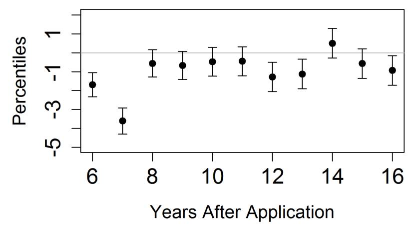


Note: This figure shows that downward-slowing pre-trends in URM students' relative conditional average wages persist when their wages are transformed into ethnicity-specific wage percentiles using a fixed year's wage distribution, implying that the parallel trends assumption for Figure IV(f) (with time-varying wage percentiles) is satisfied as a result of its accounting for ethnicity-specific wage dynamics in California (as suggested by Juhn et al., 1991), not the percentile transformation per se. OLS difference-in-difference coefficient estimates of Equation 1, the change in URM UC applicant outcomes relative to non-URM applicants, compared to the 1997 baseline. The outcome is defined as the average ethnicity-specific wage percentile between 6 and 16 years after UC application, omitting zero-wage years; percentiles are defined relative to the 2017 empirical distribution of wages earned by same-ethnicity (URM, Asian, or White/Other) college-educated California ACS respondents born between 1974 and 1978, few of whom were directly impacted in university enrollment by Prop 209. Models include high school fixed effects, ethnicity indicators, and the components of UC's Academic Index (see footnote 21). Annual wages are CPI-adjusted to 2018. Bars show robust 95-percent confidence intervals. Source: UC Corporate Student System, California Employment Development Department, and the American Community Survey (Ruggles et al., 2018).

Figure A-12: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Labor Outcomes

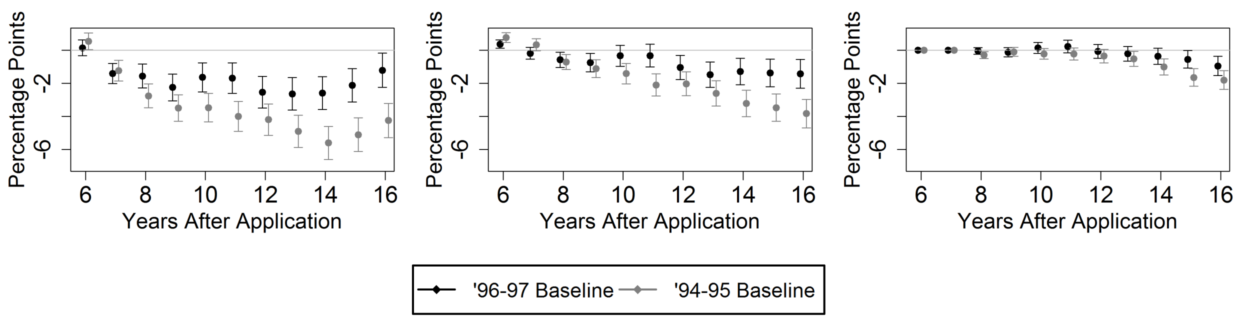
Panel A: Annual Differences in Eth-Specific Wage Percentile

(a) Wage Percentile



Panel B: Wage Threshold Estimates Using '96-97 and '94-95 Baselines

(b) Wages $> \$75,000$ (c) Wages $> \$100,000$ (d) Wages $> \$150,000$

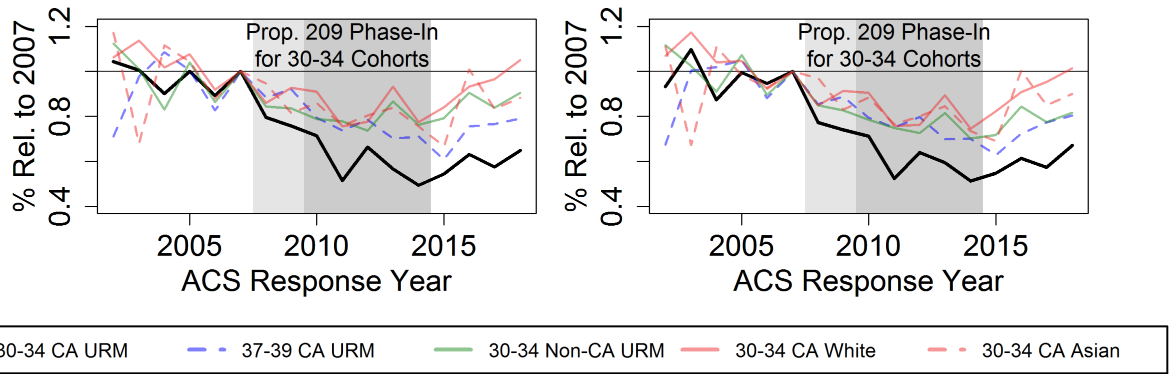


Note: This figure shows that URM UC applicants faced a long-run decline in their average wage percentile relative to same-ethnicity college-educated workers not impacted by Prop 209, and that URM UC applicants' likelihood of attaining various high-earning thresholds declined after Prop 209, and moreso relative to a '94-95 baseline. Estimates of $\beta_{'98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' wage outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. The outcome in Panel A is defined as the average annual ethnicity-specific wage percentile between 6 and 16 years after UC application, omitting zero-wage years; percentiles are defined relative to the empirical distribution of wages earned in that year by same-ethnicity (URM, Asian, or White/Other) college-educated California ACS respondents born between 1974 and 1978, few of whom were directly impacted in university enrollment by Prop 209. Outcomes in Panel B defined as annual unconditional indicators for having wages above specified wage thresholds ($75,00, $100,000, and $150,000) as measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. Coefficients in each model and year after UC application are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6. The gray estimates replace the 1996-97 baseline with with 1994-95 UC applicants. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust 95-percent confidence intervals shown. Source: UC Corporate Student System, the California Employment Development Department, and the American Community Survey (Ruggles et al., 2018).

Figure A-13: Share of $> \$100,000$ Workers among Rolling Cohorts Before and After Prop 209's Impact

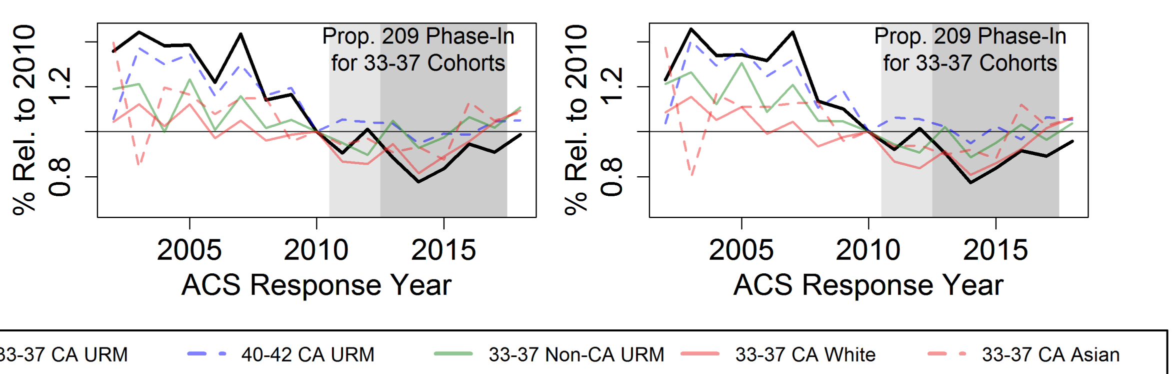
Panel A: Rolling Cohorts Age 30-34

(a) All Workers (b) College Enrollees



Panel B: Rolling Cohorts Age 33-37

(d) All Workers (e) College Enrollees

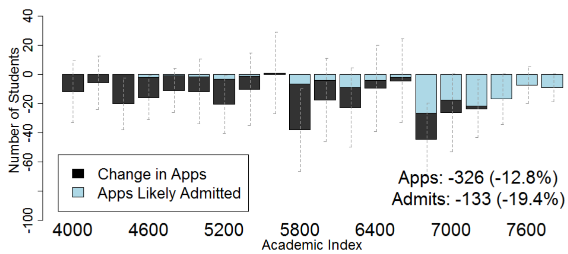


Note: This figure shows that early-career URM Californians ten to twenty years after Prop 209 were less likely to achieve high wages than a variety of reasonable comparison groups (like non-URM Californians and URM non-Californians), and that the gaps (across rolling cohorts) seem to originate and widen in the years when URM workers of that age would have been first impacted by Prop 209 (hitting age 18 around 1998). The fraction of ACS respondents earning at least \$100,000 per year in wages by ethnicity, contemporaneous age range, and either California birth or contemporaneous California residency status, normalized to 1 in 2007 or 2010 for each group. Grey lines denote the years 2010-2014 (2013-2017) in which the age 30-34 (33-37) URM cohort would have largely switched from people who graduated high school before the 1998 implementation of Prop 209 to those who graduated after implementation, assuming graduation at age 18. Some public universities began phasing out affirmative action two years earlier (in 1996), justifying the 2007 baseline. Wages are in 2018 CPI-adjusted dollars. All statistics are two-year moving averages. Source: 2001-2017 American Community Survey (Ruggles et al., 2018)

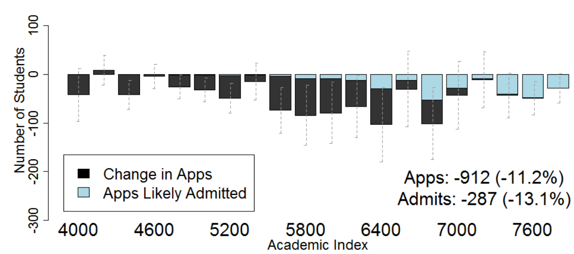
Figure A-14: Further Estimated Declines in 1998-99 Application and Admission by Ethnicity

Panel A: Changes in UC-Eligible Application Likelihood to Most-Selective UC Campuses

(a) Black

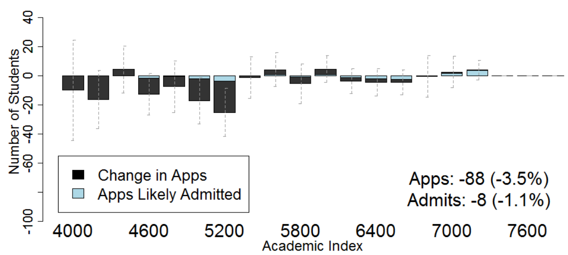


(b) Hispanic

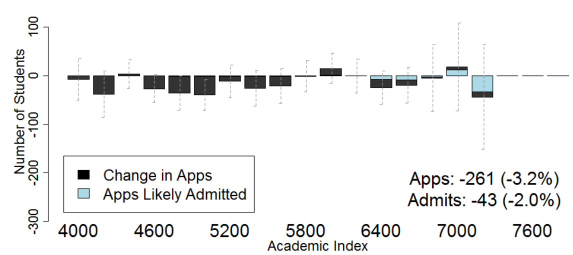


Panel B: Changes in UC-**In**eligible Application Likelihood to UC

(c) Black

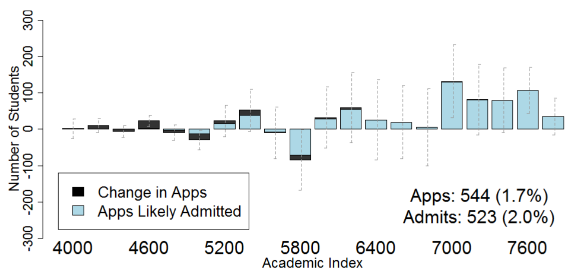


(d) Hispanic

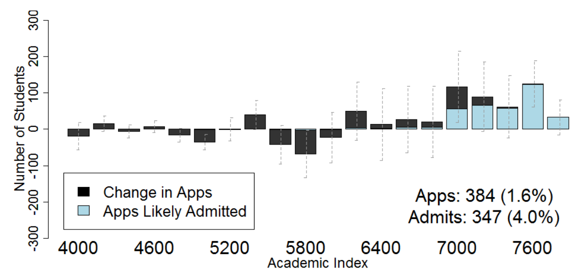


Panel C: Asian

(e) Any UC Campus

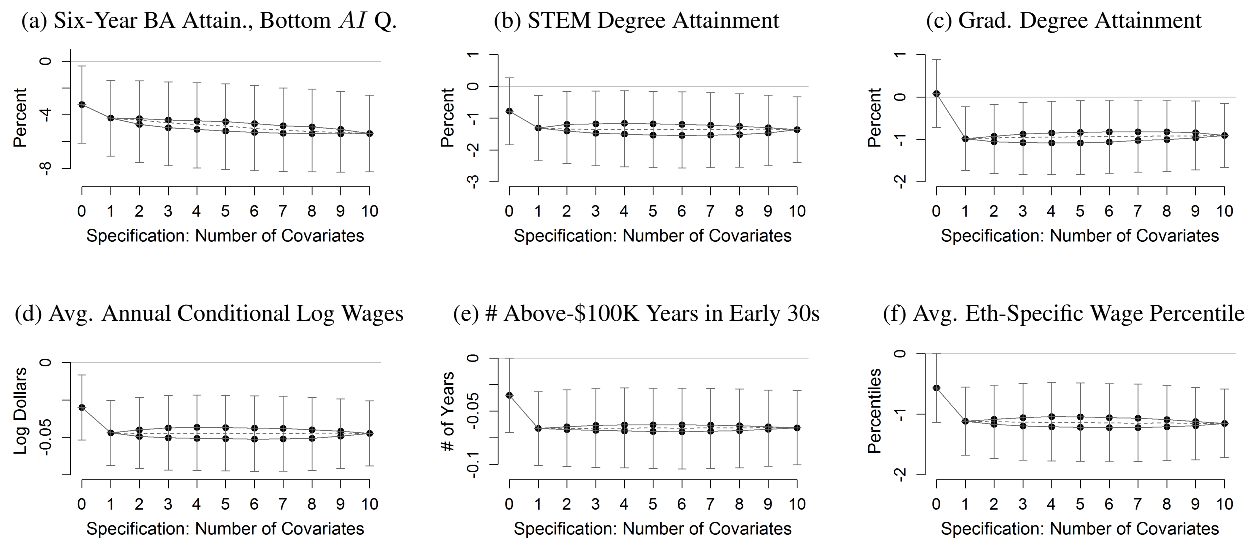


(f) Most-Selective Campuses



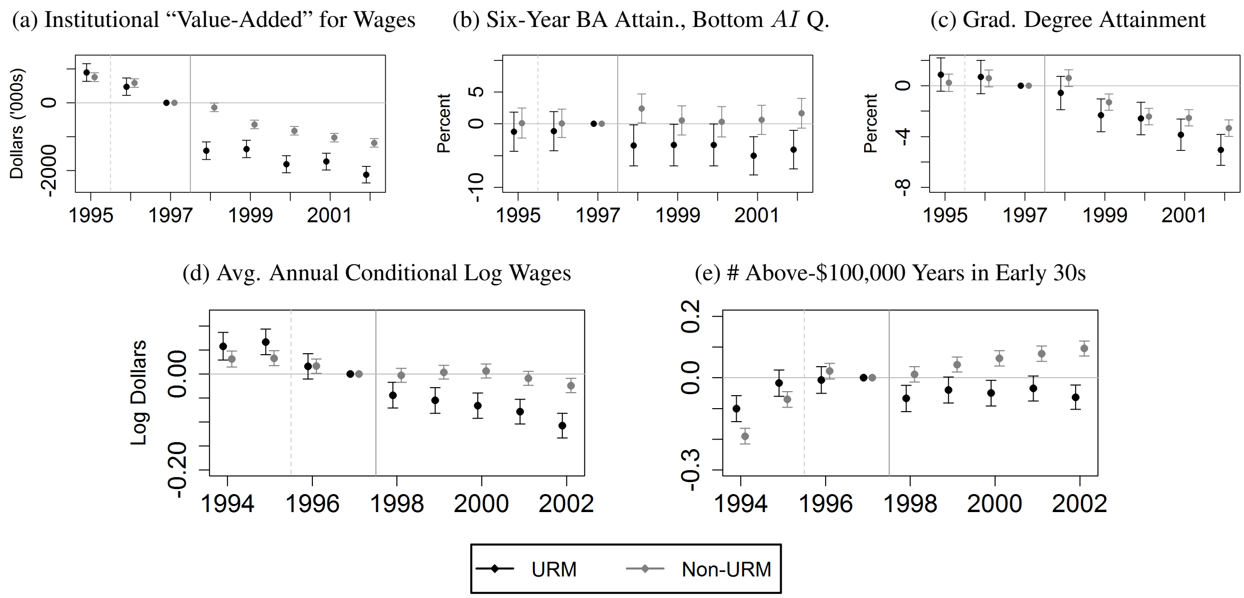
Note: This figure shows that URM application declines to the Berkeley and UCLA campuses can explain up to 20 percentage points of the decline in URM enrollment at those campuses, while application rates only slightly declined among UC-ineligible students and only slightly increased among Asian students relative to applications among white students (a sort of placebo test). Estimates of the change in the number of UC applicants (and admits) in 1998-1999 by ethnicity (e) and 200-point AI bin, relative to 1994-1995. The height of each black bar is the product of $\beta_{e,98-99,a}$ (estimated in Equation 2) and $\sum_s UC_{s,98-99,e}$, the average number of UC-eligible California public high school graduates of ethnicity e in 1998-1999. The height of each overlaying blue bar is the product of the black bar and the percent of 1998-1999 UC-eligible e UC applicants in that AI range admitted to at least one UC campus. The statistics in the bottom right sum the bars across all AI and report the sums as a share of all e UC applicants. Panel A and half of Panel C re-estimate Equation 2 restricting to applicants to UC Berkeley or UCLA. Panels A and C are restricted to UC-eligible high school graduates and UC applicants; Panel B re-estimates Equation 2 for UC-ineligible graduates and applicants. 95-percent confidence intervals on the black bars from $\beta_{e,98-99,a}$ robust standard errors. Source: UC Corporate Student System and the California Department of Education.

Figure A-15: Alternative Covariate Specifications of URM UC Applicants' Post-1998 Estimated Outcomes



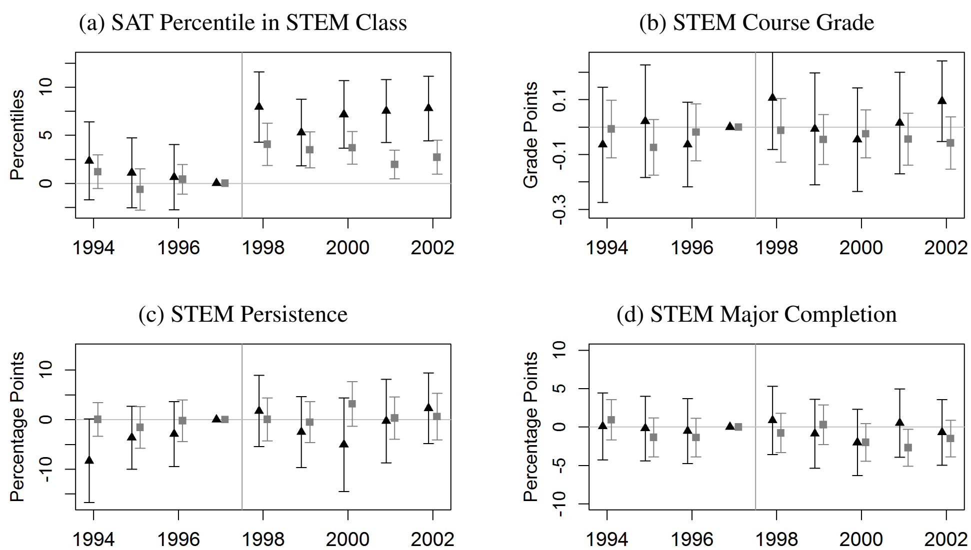
Note: This figure shows the results of a Monte Carlo exercise evincing the stability of the baseline estimates in the presence of detailed additional covariates. Estimates of $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of the change in six '96-99 CA-resident freshman URM UC applicant outcomes after Prop 209 relative to non-URM applicants, with different specifications of the covariate matrix X_{iy}. Specification 0 sets X_{iy} to be null, while Specification 1 includes the components of UC's Academic Index (see footnote 21). Specifications 2-10 add additional sets of covariates progressively, presenting the highest and lowest $\beta_{\cdot 98-99}$ estimates from models including 1-9 additional sets of covariates, respectively: gender indicator, log family income, (7) highest parental education indicators, (289) parents' occupation indicators, high school GPA rank, number of 12th-grade honors courses, UC eligibility indicator, and Heckit control functions constructed using two estimates of p: $\frac{A_{s_i yea}}{UC_{s_i ye}}$ (see Equation 2) and the leave-one-out percent of UC-eligible graduates who applied to UC that year in i's school, gender, and ethnicity. For details on outcomes, see notes to Table III and IV. Panel (a) restricts the sample to the bottom AI quartile as measured among '96-97 URM UC applicants. Bars show the union of the robust 95 percent confidence intervals of the two presented estimates. Source: UC Corporate Student System, National Student Clearinghouse, and California Employment Development Department.

Figure A-16: Annual Single-Difference Estimates of URM UC Applicants' Post-1998 Outcomes



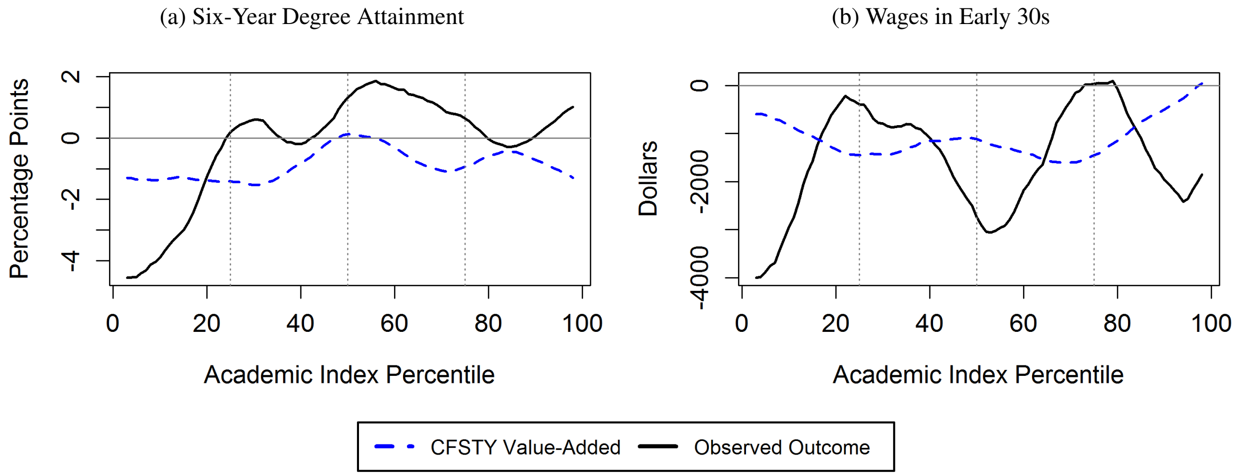
Note: This figure shows single-difference analogues to the baseline estimates, showing that the estimated effects appear largely driven by immediate 1998 declines in enrollment value-added and outcomes among URM students, not 1998 increases among non-URM students. OLS difference-in-difference coefficient estimates of the change in four URM applicant outcomes relative to non-URM applicants, compared to the 1997 baseline. Outcomes include six-year Bachelor's degree attainment in the NSC, graduate degree attainment in the NSC, average annual conditional (omitting 0's) log California covered wages 6-19 years after UC application, and the number years (6-19 years after UC application) in which California covered wages exceed $75,000. Bars show 95-percent confidence intervals from robust standard errors. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Panel (a) restricts the sample to the bottom AI quartile as measured among '96-97 URM UC applicants. Source: UC Corporate Student System, National Student Clearinghouse, and California Employment Development Department.

Figure A-17: Difference-in-Difference Estimates of URM UC Enrollees' STEM Outcomes by Ethnicity



Note: Difference-in-difference WLS regression coefficient estimates of UCB, UCSB, UCD, UCSC, and UCR enrollees' introductory STEM course performance or persistence, differencing across URM status following Equation 3 and interacting β_t with Black and Hispanic indicators to separately identify outcomes by URM ethnicity, relative to 1997. In Panels (a)-(c) each observation is a CA-resident freshman student-course pair in an introductory biology, chemistry, physics, or computer science course (see Appendix H) taken within 2.5 years of matriculation, stacking over courses and weighted evenly across observed students. SAT percentile is the fraction of other 1994-2002 freshman CA-resident peers who have lower SAT scores than the student; persistence indicates completing the subsequent course in the introductory STEM course sequence; and course grade is the grade points received in completed courses. In Panel (d) each observation is a student; the outcome indicates completing any UC STEM degree. Models include high school fixed effects, ethnicity indicators, and the components of UC's Academic Index (see footnote 21). UCSC is omitted from the GPA model because it did not mandate letter grades in the period. 95-percent confidence intervals are two-way clustered by student and course sequence level (e.g. second chemistry course). Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018).

Figure A-18: Difference-in-Difference Changes in Inst. Value-Added and Outcome by AI Quantile



Note: This figure plots unadjusted difference-in-difference averages for both VA and actual degree attainment and early-30s wages, showing that the two lines poorly mirror each other, suggesting both that VA poorly-explains and substantially underestimates the observed labor market effects of Prop 209. Raw difference-in-difference statistics of average six-year degree attainment, early-30s wages, and corresponding "CFSTY" institutional value-added measures from students' first enrollment institution, differenced among UC freshman applicants between 1998-1999 and 1996-1997 and by URM status for each percentile of academic index (AI) measured among 1996-1999 URM UC applicants. Statistics are smoothed with a triangular kernel with bandwidth 15. First enrollment measured in NSC up to six years after UC application; university groups partition possible enrollments. See note to Table II for value-added definition. Average wages measured as mean observed wages between 12 and 16 years after UC application, when most students are 30-34; VA wages are measured 15 years after UC application. Six-year degree attainment measured in the union of UC and NSC degree attainment. Source: UC Corporate Student System, National Student Clearinghouse, and the California Employment Development Department.

Table A-1: STEM Majors in Main NSC Sample

Major	#	Major	#
BIOLOGICAL SCIENCES	8,008	EXERCISE BIOLOGY	267
BIOLOGY	6,382	ZOOLOGY	264
COMPUTER SCIENCE	6,113	STRUCTURAL ENGINEERING	251
ELECTRICAL ENGINEERING	5,110	MATERIALS SCIENCE AND ENGINEERING	250
MECHANICAL ENGINEERING	4,942	AQUATIC BIOLOGY	238
MOLECULAR AND CELL BIOLOGY	3,505	ECOLOGY BEHAVIOR & EVOLUTION	227
MATHEMATICS	3,076	INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH	225
CIVIL ENGINEERING	2,649	EARTH SCIENCES	222
CHEMISTRY	2,516	INFORMATION SYSTEMS	221
COMPUTER ENGINEERING	2,347	NUTRITIONAL SCIENCES	216
BIOCHEMISTRY	2,167	PHARMACOLOGICAL CHEMISTRY	216
PHYSICS	1,624	COMPUTER INFORMATION SYSTEMS	209
MANAGEMENT SCIENCE	1,578	CONSTRUCTION MANAGEMENT	203
GENERAL BIOLOGY	1,537	APPLIED ECOLOGY	201
CHEMICAL ENGINEERING	1,509	ASTROPHYSICS	201
ELECTRICAL ENGINEERING AND COMPUTER SCIENCES	1,502	BIOCHEMISTRY AND MOLECULAR BIOLOGY	195
BIOCHEMISTRY AND CELL BIOLOGY	1,487	MATHEMATICS/ECONOMICS	186
INFORMATION AND COMPUTER SCIENCE	1,481	COMPUTER INFO SYSTEMS	170
PSYCHOLOGY AND SOCIAL BEHAVIOR	1,462	BIOLOGICAL SYSTEMS ENGINEERING	167
PSYCHOBIOLOGY	1,451	COMPUTER ENGINEERING AND COMPUTER SCIENCE	167
INTEGRATIVE BIOLOGY	1,263	ECOLOGY AND EVOLUTION	166
COGNITIVE SCIENCE	1,088	MATERIALS ENGINEERING	165
PHYSIOLOGICAL SCIENCE	1,006	CELL AND DEVELOPMENTAL BIOLOGY	160
MICROBIOLOGY	879	ENVIRONMENTAL ENGINEERING	160
ANIMAL PHYSIOLOGY & NEUROSCI	833	BIOMEDICAL SCIENCES	159
NEUROSCIENCE	810	PHYSIOLOGY	144
MOLECULAR CELL AND DEVELOPMENTAL BIOLOGY	803	EVOLUTION AND ECOLOGY	141
BIOENGINEERING	786	MOLECULAR ENVIRONMENTAL BIOLOGY	139
APPLIED MATHEMATICS	750	ARCHITECTURAL ENGINEERING	137
AEROSPACE ENGINEERING	718	PHARMACOLOGY	136
HUMAN BIOLOGY	712	MECHANICAL ENGINEER	133
NEUROBIOPHYSIOLOGY & BEHAVIOR	639	COGN SCI W/SPECIALIZ NEUROSCI	130
GENETICS	582	ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	128
COMPUTER SCIENCE AND ENGINEERING	570	GEOLOGICAL SCIENCES	127
COMPUTER SCIENCE & ENGINEERING	472	NUTRITION SCIENCE	126
BIOCHEM & MOLECULAR BIOLOGY	445	MATHEMATICS-COMPUTER SCIENCE	124
MICROBIOLOGY IMMUNOLOGY AND MOLECULAR GENETICS	403	ENGINEERING PHYSICS	122
ENGINEERING	387	BIOENGINEERING (BIOTECHNOLOGY)	119
MOLECULAR BIOLOGY	387	CLINICAL NUTRITION	117
BIOMEDICAL ENGINEERING	382	HEALTH SCIENCES	116
MATHEMATICS/APPLIED SCIENCE	350	COGN SCI W/SPEC HUM COMP INTER	115
MARINE BIOLOGY	348	ECONOMICS-MATHEMATICS	111
GEOLOGY	334	NEUROBIOLOGY	111
BIOTECHNOLOGY	332	NEUROSCIENCE AND BEHAVIOR	107
BIOLOGICAL SCIENCE	331	BIOLOGY-PHYSIOLOGY	105
INDUSTRIAL ENGINEERING	300	NATURAL SCIENCE	102
STATISTICS	295	MGMT SCI & ENGINEERING	99
BIOENGINEERING: PRE-MEDICAL	289	INDUSTRIAL AND SYSTEMS ENGINEERING	91
MICROBIOLOGY AND MOLECULAR GENETICS	288	MATHEMATICAL SCIENCES	87
BIOCHEMISTRY/CHEMISTRY	287	GENERAL ENGINEERING	85

Note: This table shows the 100 most common STEM majors earned by 1994-2002 freshman UC applicants. The 100 most common majors categorized as STEM (following the procedure described in footnote 13) among those earned by 1994-2002 freshman UC applicants at any four-year institution as reported to the National Student Clearinghouse, and the number of in-sample students who report that major. Each student is permitted up to three majors. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-2: Non-STEM Majors in Main NSC Sample

Major	#	Major	#
PSYCHOLOGY	22,896	ASIAN AMERICAN STUDIES	729
BUSINESS ADMINISTRATION	17,406	COMMUNICATIONS	709
POLITICAL SCIENCE	15,964	DESIGN	699
ECONOMICS	14,652	WOMEN'S STUDIES	682
SOCIOLOGY	12,560	LINGUISTICS	676
ENGLISH	11,634	GOVERNMENT	663
HISTORY	10,216	SOCIAL WELFARE	654
COMMUNICATION	6,964	COMPARATIVE LITERATURE	632
BUSINESS ECONOMICS	4,939	POLITICAL ECONOMY OF INDUSTRIAL SOCIETIES	626
LIBERAL STUDIES	3,878	ART STUDIO	623
ANTHROPOLOGY	3,423	INTERNATIONAL BUSINESS	622
SPANISH	3,196	ETHNIC STUDIES	576
PHILOSOPHY	2,683	ACCOUNTANCY	542
HUMAN DEVELOPMENT	2,493	RHETORIC	525
INTERNATIONAL RELATIONS	2,171	BIOPSYCHOLOGY	517
COMMUNICATION STUDIES	2,154	AMERICAN LITERATURE AND CULTURE	511
NURSING	1,966	DRAMA	497
ART	1,923	GENERAL STUDIES	493
FINANCE	1,819	ENVIRONMENTAL SCIENCES	485
MARKETING	1,786	CINEMA-TELEVISION	483
MANAGERIAL ECONOMICS	1,781	DANCE	472
ACCOUNTING	1,587	VISUAL ARTS (MEDIA)	461
INTERNATIONAL STUDIES	1,552	POLITICAL SCI/INTNTL RELATIONS	456
ARCHITECTURE	1,534	SOCIAL ECOLOGY	456
MUSIC	1,480	ENVIRONMENTAL ANALYSIS AND DESIGN	445
ART HISTORY	1,404	SOCIAL WORK	441
AMERICAN STUDIES	1,358	THEATRE ARTS	437
CRIMINOLOGY LAW AND SOCIETY	1,302	FILM AND TELEVISION	435
GLOBAL STUDIES	1,212	PHARMACY	435
LIBERAL ARTS	1,208	THEATER	416
LEGAL STUDIES	1,199	AGRICULTURAL BUSINESS	414
LAW AND SOCIETY	1,167	BUSINESS ADMINISTRATION (MARKETING)	414
SOCIAL SCIENCE	1,166	EXERCISE SCIENCE	412
ENVIRONMENTAL STUDIES	1,156	CREATIVE STUDIES	404
INTERDISCIPLINARY STUDIES	1,129	GRAPHIC DESIGN	398
MASS COMMUNICATIONS	1,097	INTERDISC COMPUTING & THE ARTS	381
KINESIOLOGY	1,070	CRIMINAL JUSTICE ADMINISTRATION	368
THEATRE	1,032	INTERNATIONAL DEVELOPMENT STUDIES	367
FILM STUDIES	999	SOCIAL SCIENCES	366
JOURNALISM	953	ECONOMICS/INTERNATIONAL AREA STUDIES	365
CRIMINAL JUSTICE	910	LATIN AMERICAN STUDIES	352
MANAGEMENT	906	CHICANO STUDIES	332
GEOGRAPHY	895	DRAMATIC	325
POLITICS	894	JAPANESE	319
FRENCH	882	LAW	312
ANIMAL SCIENCE	813	FILM AND DIGITAL MEDIA	306
BUSINESS MANAGEMENT ECONOMICS	780	LANDSCAPE ARCHITECTURE	302
RELIGIOUS STUDIES	778	HISTORY OF ART	297
STUDIO	764	SPEECH COMMUNICATION	294
CHILD DEVELOPMENT	745	INDUSTRIAL TECHNOLOGY	291

Note: This table shows the 100 most common Non-STEM majors earned by 1994-2002 freshman UC applicants. The 100 most common majors **not** categorized as STEM (following the procedure described in footnote 13) among those earned by 1994-2002 freshman UC applicants at any four-year institution as reported to the National Student Clearinghouse, and the number of in-sample students who report that major. Each student is permitted up to three majors. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-3: Descriptive Statistics of 1990s UC Admissions by Ethnicity

	Application			Admission			Enrollment		
	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9
Panel A: Non-URM Applicants									
Average Number or Percent of Applicants									
Berkeley	14,452	17,478	19,814	37.3	32.3	30.8	15.1	14.0	13.8
UCLA	16,738	20,272	23,965	44.3	37.3	33.9	15.3	13.3	13.5
San Diego	15,787	19,072	23,008	63.0	60.0	48.3	15.3	12.9	12.2
Davis	13,434	15,131	17,189	71.1	72.0	67.7	18.8	19.7	17.9
Irvine	11,734	13,198	16,134	76.2	71.2	64.1	19.8	19.4	17.5
Santa Barbara	12,946	14,819	18,750	84.5	74.9	57.7	18.5	18.4	14.7
Santa Cruz	7,506	8,174	9,984	85.3	85.4	81.0	16.7	18.8	17.5
Riverside	6,996	7,480	10,211	82.0	85.6	88.0	14.7	17.9	17.4
All UCs	33,602	37,972	42,268	84.8	83.5	83.9	49.6	49.4	49.6
Average SAT Score									
Berkeley	1250	1255	1262	1371	1375	1368	1344	1348	1338
UCLA	1209	1214	1228	1316	1333	1343	1262	1283	1299
San Diego	1212	1213	1222	1274	1298	1307	1224	1250	1260
Davis	1180	1184	1187	1232	1231	1230	1171	1176	1169
Irvine	1146	1151	1161	1185	1194	1213	1127	1137	1159
Santa Barbara	1141	1144	1166	1162	1182	1224	1122	1156	1189
Santa Cruz	1156	1154	1157	1177	1173	1180	1152	1151	1154
Riverside	1114	1114	1119	1137	1134	1136	1095	1091	1092
All UCs	1182	1187	1194	1207	1212	1216	1196	1208	1217
Panel B: URM Applicants									
Average Number or Percent of Applicants									
Berkeley	3,570	3,892	3,944	54.7	48.7	23.9	19.7	19.2	10.4
UCLA	4,872	5,152	5,395	55.8	42.8	24.8	21.5	16.8	11.3
San Diego	3,088	3,296	3,976	59.7	57.9	32.5	12.1	11.8	8.3
Davis	2,586	2,616	2,822	84.1	83.7	62.5	21.9	18.5	17.2
Irvine	2,884	2,752	3,238	73.4	62.7	54.8	15.7	12.9	14.3
Santa Barbara	3,197	3,542	4,008	77.0	77.2	54.3	16.3	18.1	15.4
Santa Cruz	2,235	2,096	2,291	83.7	81.3	72.9	16.0	14.5	15.6
Riverside	2,222	2,304	3,222	79.5	77.1	79.5	19.7	18.3	20.2
All UCs	9,478	9,498	9,922	81.3	79.4	73.4	47.0	44.3	39.6
Average SAT Score									
Berkeley	1072	1087	1102	1151	1168	1200	1130	1138	1143
UCLA	1030	1048	1066	1119	1155	1185	1089	1118	1140
San Diego	1059	1069	1082	1124	1151	1196	1088	1118	1163
Davis	1048	1056	1067	1083	1091	1108	1050	1070	1067
Irvine	996	1012	1025	1042	1071	1097	1004	1026	1062
Santa Barbara	1008	1021	1042	1045	1059	1102	999	1023	1075
Santa Cruz	1011	1017	1030	1033	1042	1059	990	1013	1039
Riverside	958	968	982	983	996	1009	963	960	968
All UCs	1025	1039	1048	1054	1071	1081	1052	1071	1077

Note: This table shows campus-specific descriptive statistics mirroring Table I. Count and mean average descriptive statistics of 1994-1999 California-resident freshman UC applicants who are or are not underrepresented minorities (URM). URM includes African-American, Hispanic, Chicano/a, and Native American applicants. SAT score includes the Math and Verbal components and was on the 1600 scale. Percent admitted and percent enrolled are conditional on applying to that campus. Source: UC Corporate Student System.

Table A-4: Descriptive Statistics of 1990s UC Admissions by Ethnicity

	Application			Admission			Enrollment		
	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9
Panel A: Black Applicants									
Average Number or Percent of Applicants									
Berkeley	1,020	1,078	1,048	50.2	50.1	23.2	17.7	20.6	10.3
UCLA	1,230	1,318	1,234	53.1	40.6	23.8	20.5	15.7	11.0
San Diego	600	681	802	50.6	53.3	23.7	8.5	9.0	5.1
Davis	608	660	666	76.6	75.5	52.9	19.1	14.7	13.7
Irvine	540	546	605	65.6	50.9	46.3	11.9	9.6	12.1
Santa Barbara	523	608	710	76.3	71.8	48.6	17.6	17.5	12.5
Santa Cruz	364	376	386	78.8	76.5	64.3	13.7	11.0	13.1
Riverside	486	490	703	74.2	67.1	71.4	19.2	16.5	18.6
All UCs	2,104	2,130	2,116	75.2	72.1	64.0	42.8	40.9	34.0
Average SAT Score									
Berkeley	1031	1049	1068	1122	1131	1157	1084	1088	1074
UCLA	1013	1027	1050	1103	1142	1176	1073	1106	1121
San Diego	1031	1040	1056	1119	1136	1210	1072	1104	1188
Davis	1009	1015	1030	1058	1064	1092	998	1015	1042
Irvine	978	994	1005	1031	1074	1090	986	1014	1048
Santa Barbara	983	999	1026	1018	1044	1096	967	979	1045
Santa Cruz	1000	1008	1027	1028	1036	1062	980	990	1019
Riverside	951	963	979	978	1006	1014	958	959	967
All UCs	1006	1018	1032	1043	1062	1078	1032	1052	1056
Panel B: Hispanic Applicants									
Average Number or Percent of Applicants									
Berkeley	2,406	2,684	2,763	55.8	47.6	24.2	20.0	18.5	10.4
UCLA	3,512	3,682	3,987	56.0	43.1	25.1	21.5	16.9	11.6
San Diego	2,338	2,470	3,006	60.8	58.3	34.8	12.7	12.1	9.2
Davis	1,821	1,830	2,002	86.3	86.3	65.6	22.3	19.2	18.2
Irvine	2,257	2,123	2,529	74.8	65.5	56.6	16.5	13.9	14.8
Santa Barbara	2,512	2,754	3,110	76.9	78.2	55.6	16.1	17.9	16.0
Santa Cruz	1,760	1,620	1,796	84.7	82.2	74.5	16.3	15.0	16.0
Riverside	1,690	1,763	2,440	81.0	79.9	81.6	19.9	18.9	20.8
All UCs	6,984	7,000	7,416	82.8	81.2	75.9	47.8	44.8	41.2
Average SAT Score									
Berkeley	1083	1098	1110	1158	1180	1212	1141	1158	1164
UCLA	1031	1051	1066	1121	1156	1184	1090	1117	1143
San Diego	1060	1072	1084	1120	1152	1189	1084	1117	1153
Davis	1054	1064	1072	1083	1094	1106	1056	1075	1069
Irvine	995	1013	1025	1039	1067	1094	1001	1025	1061
Santa Barbara	1007	1020	1040	1044	1057	1099	1001	1028	1076
Santa Cruz	1006	1012	1024	1028	1036	1052	982	1004	1036
Riverside	956	966	979	981	991	1005	962	958	965
All UCs	1025	1040	1048	1052	1068	1077	1051	1071	1077

Note: This table shows separate descriptive statistics for Black and Hispanic UC applicants, showing that the former make up only 20 percent of URM students and tend to have somewhat lower average test scores. Count and mean average descriptive statistics of 1994-1999 California-resident freshman Black and Hispanic UC applicants. SAT score includes the Math and Verbal components and was on the 1600 scale. Percent admitted and percent enrolled are conditional on applying to that campus. Source: UC Corporate Student System.

Table A-5: Descriptive Statistics of 1990s UC Admissions for White and Asian Applicants

	Application			Admission			Enrollment		
	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9	'94-5	'96-7	'98-9
Panel A: White Applicants									
Average Number or % of Applications									
Berkeley	5,928	7,244	7,440	39.9	34.1	31.9	13.9	12.4	12.2
UCLA	6,612	8,294	9,156	43.9	38.0	33.1	13.9	13.5	13.2
San Diego	7,586	9,137	9,887	61.8	59.7	47.4	15.1	12.9	11.9
Davis	6,876	7,576	7,675	73.4	74.8	69.8	18.8	19.8	18.1
Irvine	3,671	3,916	4,392	79.9	74.7	69.9	14.8	15.0	15.1
Santa Barbara	7,780	9,541	10,444	86.6	75.7	59.0	21.5	21.3	17.3
Santa Cruz	4,527	5,015	5,169	88.0	87.9	83.9	19.6	21.8	20.4
Riverside	2,152	2,280	3,186	84.2	87.1	91.8	17.0	19.4	15.7
All UCs	17,060	19,486	19,304	85.4	83.0	83.8	44.9	45.4	45.1
Average SAT Score									
Berkeley	1267	1271	1277	1361	1367	1365	1332	1340	1333
UCLA	1224	1224	1239	1318	1324	1341	1268	1280	1302
San Diego	1221	1218	1229	1281	1298	1307	1248	1265	1273
Davis	1202	1202	1206	1245	1238	1242	1211	1203	1204
Irvine	1166	1169	1176	1193	1200	1208	1161	1169	1170
Santa Barbara	1160	1158	1180	1177	1196	1232	1138	1169	1196
Santa Cruz	1183	1179	1183	1198	1193	1200	1174	1169	1173
Riverside	1136	1132	1141	1151	1147	1151	1125	1120	1128
All UCs	1197	1198	1206	1217	1221	1226	1209	1217	1228
Panel B: Asian Applicants									
Average Number or % of Applications									
Berkeley	7,516	8,955	11,041	35.6	31.1	30.1	16.0	15.3	15.0
UCLA	8,970	10,548	13,200	44.8	36.8	34.3	16.4	13.0	13.7
San Diego	7,182	8,703	11,752	64.2	60.3	49.0	15.6	13.1	12.6
Davis	5,690	6,558	8,464	69.1	69.4	65.9	19.0	20.2	17.6
Irvine	7,211	8,237	10,577	74.4	69.6	61.7	22.3	21.6	18.6
Santa Barbara	4,489	4,550	7,432	81.5	73.7	56.2	13.8	13.1	11.4
Santa Cruz	2,558	2,694	4,296	81.2	81.4	78.0	11.9	13.9	14.6
Riverside	4,240	4,502	6,217	80.7	84.8	86.3	13.4	17.3	18.5
All UCs	14,488	16,148	20,548	84.4	84.3	84.1	55.1	54.1	53.6
Average SAT Score									
Berkeley	1238	1245	1254	1379	1382	1370	1352	1354	1341
UCLA	1199	1209	1223	1314	1340	1344	1258	1283	1298
San Diego	1202	1207	1218	1266	1295	1306	1201	1236	1249
Davis	1156	1166	1172	1214	1221	1219	1125	1147	1139
Irvine	1136	1143	1155	1181	1190	1215	1115	1127	1157
Santa Barbara	1112	1117	1150	1139	1156	1214	1080	1116	1177
Santa Cruz	1113	1114	1131	1139	1137	1158	1099	1102	1129
Riverside	1102	1105	1109	1128	1126	1129	1072	1074	1079
All UCs	1167	1177	1184	1196	1203	1209	1184	1198	1210

Note: This table shows descriptive statistics for white and Asian UC applicants before and after Prop 209, showing minimal evidence of differential trends among the two groups after Prop 209 (though Asian applicants' SAT scores were lower but rising faster throughout the period). Count and mean average descriptive statistics of 1994-1999 California-resident freshman non-URM UC applicants who report being either white or Asian. SAT score includes the Math and Verbal components and was on the 1600 scale. Percent admitted and percent enrolled are conditional on applying to that campus. Source: UC Corporate Student System.

Table A-6: Difference-in-Difference Estimates of Post-1998 URM Application and Enrollment by UC Campus

Campus:	UCB	UCLA	UCSD	UCSB	UCI	UCD	UCSC	UCR	Total
Application conditional on UC application (%)									
URM	11.4	8.7	-3.7	-4.8	-9.8	-4.3	-2.9	-6.3	
	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.3)	
URM × Prop 209	-2.2	-3.8	0.7	-1.0	0.4	0.7	0.3	3.5	
	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.4)	
$\bar{Y}$	45.3	55.0	49.5	41.3	35.4	37.9	22.6	23.3	
Obs.	199,321	199,321	199,321	199,321	199,321	199,321	199,321	199,321	
Enrollment conditional on application (%)									
URM	13.6	8.0	2.4	0.7	-5.4	0.2	-4.9	-4.1	3.6
	(0.6)	(0.4)	(0.5)	(0.6)	(0.6)	(0.6)	(0.7)	(0.7)	(0.4)
URM × Prop 209	-9.3	-5.9	-3.3	1.6	2.8	0.2	2.1	1.8	-5.8
	(0.6)	(0.5)	(0.5)	(0.7)	(0.7)	(0.8)	(0.9)	(0.8)	(0.5)
$\bar{Y}$	16.8	14.1	12.3	16.8	17.8	18.9	17.8	18.1	50.1
Obs.	90,254	109,566	98,705	82,240	70,643	75,518	45,087	46,434	199,321
Enrollment conditional on **admission** (%)									
URM	-16.9	-17.0	-16.9	-8.1	-15.9	-14.9	-8.5	-7.0	-1.5
	(1.1)	(0.9)	(0.8)	(0.7)	(0.8)	(0.8)	(0.8)	(0.9)	(0.5)
URM × Prop 209	7.3	6.5	9.9	5.8	6.5	9.1	4.7	4.4	-2.2
	(1.5)	(1.3)	(1.2)	(1.0)	(1.1)	(1.1)	(1.1)	(1.0)	(0.6)
$\bar{Y}$	44.9	39.1	24.9	25.6	27.0	27.4	21.7	21.7	60.6
Obs.	28,755	38,037	48,268	53,513	46,299	51,777	36,850	38,581	163,967

Note: This table shows that URM students were discouraged from applying to Berkeley and UCLA after Prop 209 (though remained more likely than similarly-academically-prepared non-URM students), that URM applicants' likelihood of enrollment declined at the more-selective UCs and increased at the less-selective UCs, and that URM yield rates increased at all UCs after Prop 209 (as shown in Antonovics and Sander (2013)). OLS coefficient estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, a difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' UC applications and enrollment compared to non-URM applicants after the 1998 end of UC's affirmative action program. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21), and are estimated independently by campus or "Total" (all applicants to any UC campus). Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-7: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Enrollment

	UC Campuses by Selectivity				Comm.		CA	Non-CA	Not in
	Most	Middle	Least	CSU	Coll.	Ivy+	Priv.	Univ.	NSC
Panel A: Difference-in-Difference Coefficients									
URM	10.4	-4.6	-2.8	-3.6	-3.7	2.5	1.3	-0.2	0.7
	(0.4)	(0.3)	(0.2)	(0.3)	(0.3)	(0.1)	(0.3)	(0.2)	(0.2)
URM × Prop 209	-7.6	1.8	1.8	1.9	1.1	0.3	0.8	1.1	-0.9
	(0.4)	(0.4)	(0.3)	(0.4)	(0.4)	(0.2)	(0.3)	(0.3)	(0.3)
$\bar{Y}$	21.9	19.6	6.5	13.8	12.1	2.7	9.3	8.5	6.2
Obs.	199,321	199,321	199,321	199,321	199,321	199,321	199,321	199,321	199,321
Panel B: Estimates of URM × Prop 209 by AI Quartile									
Bottom Quartile	-1.7	-4.9	-0.6	3.4	2.2	-0.1	1.4	0.4	-0.0
	(0.6)	(0.9)	(0.8)	(1.4)	(1.2)	(0.1)	(0.8)	(0.7)	(0.8)
Second Quartile	-12.6	4.4	3.2	3.1	1.0	-0.1	1.5	2.3	-2.4
	(0.8)	(1.1)	(0.8)	(1.0)	(0.9)	(0.1)	(0.8)	(0.6)	(0.6)
Third Quartile	-16.8	13.0	2.2	-1.4	0.3	-0.1	1.6	1.3	-0.0
	(1.0)	(1.0)	(0.6)	(0.7)	(0.7)	(0.2)	(0.8)	(0.6)	(0.6)
Top Quartile	-4.5	1.0	0.5	0.3	0.4	1.1	0.6	0.3	0.1
	(1.1)	(0.7)	(0.4)	(0.5)	(0.5)	(0.6)	(0.7)	(0.6)	(0.6)
Panel C: Difference-in-Difference Coefficients (versus 1995)									
URM	10.2	-4.4	-1.8	-5.2	-2.6	2.9	0.8	-1.1	1.3
	(0.5)	(0.5)	(0.3)	(0.4)	(0.4)	(0.2)	(0.3)	(0.3)	(0.4)
URM × Prop 209	-7.8	1.5	0.9	3.7	0.4	-0.1	1.3	2.0	-1.7
	(0.5)	(0.5)	(0.3)	(0.5)	(0.4)	(0.2)	(0.4)	(0.4)	(0.4)
$\bar{Y}$	22.0	19.4	6.4	14.0	11.7	2.8	8.8	8.6	6.8
Obs.	148,980	148,980	148,980	148,980	148,980	148,980	148,980	148,980	148,980

Note: This table summarizes URM UC applicants' changed university enrollment following Prop 209, with aggregate flows from the more-selective UC campuses cascading to all other sectors of higher education, particularly among second- and third-AI-quartile applicants, and slightly larger flows compared to the '94-95 baseline. Estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' enrollment outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as the first institution of enrollment by college or university type within six years of graduating high school, as measured in the NSC. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Panel C omits the years 1996-1997 because some universities preemptively curtailed their affirmative action programs in those years. "Ivy+" universities include the Ivy League, MIT, Stanford, and the University of Chicago; private and non-CA universities exclude those institutions. Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-8: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Enrollment, cont.

	UC Campuses by Selectivity				Comm.		CA	Non-CA	Not in
	Most	Middle	Least	CSU	Coll.	Ivy+	Priv.	Univ.	NSC
Panel D: Estimates with Separate Coefficients for Black and Hispanic Applicants									
Black	17.0	-7.6	-4.7	-6.2	-8.1	3.7	0.9	4.3	0.8
	(0.7)	(0.5)	(0.3)	(0.6)	(0.5)	(0.3)	(0.5)	(0.5)	(0.5)
Hispanic	7.9	-3.8	-2.2	-2.6	-2.1	2.1	1.8	-1.8	0.8
	(0.4)	(0.4)	(0.2)	(0.4)	(0.3)	(0.2)	(0.3)	(0.2)	(0.3)
Black × Prop 209	-10.6	1.9	1.8	3.2	0.5	0.7	1.7	2.5	-1.5
	(0.8)	(0.7)	(0.5)	(0.8)	(0.7)	(0.4)	(0.7)	(0.7)	(0.6)
Hispanic × Prop 209	-6.3	1.8	1.9	1.4	0.9	0.1	0.4	0.8	-0.9
	(0.5)	(0.5)	(0.3)	(0.5)	(0.4)	(0.2)	(0.4)	(0.3)	(0.3)
$\bar{Y}$	21.9	19.6	6.5	13.8	12.1	2.7	9.3	8.5	6.2
Obs.	197,804	197,804	197,804	197,804	197,804	197,804	197,804	197,804	197,804
Panel E: Estimates of Black × Prop 209 by Black AI Quartile									
Bottom Quartile	-1.2	-5.9	-0.7	5.7	2.7	0.0	1.3	1.1	-2.3
	(1.4)	(1.6)	(1.3)	(3.0)	(2.4)	(0.0)	(1.6)	(2.0)	(1.6)
Second Quartile	-12.4	2.0	3.7	4.8	-2.3	-0.6	0.1	3.9	0.8
	(1.8)	(2.1)	(1.5)	(2.0)	(1.7)	(0.4)	(1.7)	(1.6)	(1.2)
Third Quartile	-23.4	15.1	1.2	0.4	-1.2	0.2	4.7	4.5	-0.9
	(2.2)	(2.0)	(1.2)	(1.3)	(1.3)	(0.6)	(1.7)	(1.6)	(1.1)
Top Quartile	-14.5	3.2	2.1	-0.0	2.3	2.9	4.6	1.7	-1.9
	(2.3)	(1.4)	(0.8)	(0.9)	(1.0)	(1.5)	(1.5)	(1.6)	(1.2)
Panel F: Estimates of Hispanic × Prop 209 by Hispanic AI Quartile									
Bottom Quartile	-1.3	-5.0	0.1	2.9	2.0	-0.0	0.7	0.9	-0.2
	(0.6)	(1.0)	(0.9)	(1.5)	(1.3)	(0.0)	(0.8)	(0.6)	(0.9)
Second Quartile	-11.2	6.0	3.0	1.8	1.3	0.0	1.3	1.2	-3.0
	(0.9)	(1.2)	(0.9)	(1.1)	(1.0)	(0.1)	(0.9)	(0.6)	(0.7)
Third Quartile	-14.9	11.7	2.5	-1.2	0.1	0.2	0.8	0.9	-0.1
	(1.1)	(1.2)	(0.7)	(0.9)	(0.8)	(0.2)	(0.9)	(0.6)	(0.6)
Top Quartile	-2.8	1.0	0.5	0.2	-0.1	0.3	0.3	-0.4	0.8
	(1.2)	(0.9)	(0.4)	(0.6)	(0.6)	(0.7)	(0.8)	(0.7)	(0.7)

Note: This table shows that Black UC applicants were more likely to exit the more-selective UC campuses than Hispanic applicants following Prop 209, though they were also more likely to instead enroll at Ivy+ and non-California universities, especially among higher-AI applicants. This table extends Table A-7. Estimates of β_0 and $\beta_{\cdot 98-99}$ from an extension Equation 1 splitting the URM indicator into separate Black and Hispanic indicators interacted with post-209. The model is an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' enrollment outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes defined as the first institution of enrollment by college or university type within six years of graduating high school, as measured in the NSC. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Models omit Native American applicants. "Ivy+" universities include the Ivy League, MIT, Stanford, and the University of Chicago; private and non-CA universities exclude those institutions. Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined separately for each ethnicity by the AI distribution of 96-97 URM UC applicants. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-9: Estimated Change in UC URM Enrollment, ‘94-95 to ‘98-99

	Change in App. Pool	Change in Adm. and Yield		
UC Campus	Decrease	Increase†	Decrease†	Total
Berkeley	-93	4	-327	-415
UCLA	-122	0	-496	-618
San Diego	-35	127	-41	50
Santa Barbara	-32	341	-25	284
Irvine	-36	150	-50	64
Davis	-53	91	-140	-103
Santa Cruz	-46	11	-85	-119
Riverside	-38	103	-7	61
Total	-456	827	-1173	-800

Note: This table exploits year-over-year changes in URM and non-URM UC application and enrollment at each UC campus by AI bin to estimate that URM UC enrollment fell by 450 students as a result of application dissuasion and 350 students as a result of changes in UC campuses’ URM admissions and yield rates (with particularly-large declines at Berkeley and UCLA), resulting in a net decline in URM UC enrollment of 800 students, or 14 percent of UC’s ‘98-99 URM enrollment. **Change in App. Pool**: For each campus, these estimates show the sum across 200-point AI bins of the positive (increase) and negative (decrease) products of (1) the change in the number of UC applicants by AI bin (see Figure VII) and (2) the raw difference-in-difference in URM UC applicants’ enrollment at each campus by AI bin (smoothed across bins as in Figure III), where post-209 enrollment is set to 0 (since these students did not apply to UC). **Change in Adm. and Yield**: The sum across AI centiles of the positive (increase) and negative (decrease) products of (1) the number of ‘98-99 URM UC applicants in each bin, and (2) the raw difference-in-difference in URM UC applicants’ enrollment at each campus by AI bin, smoothed across bins. **Both**: Baseline is defined as ‘94-95 applicants and post-209 defined as ‘98-99 applicants, with 1994 omitted from the difference-in-difference estimates since ‘94 NSC data are unreliable. Estimates reported as annual changes in ‘98-99. The first column is always 0 because URM UC applications declined in every relevant AI bin, resulting in enrollment increases at no campuses. † Estimates of increased and decreased URM enrollment should be interpreted as lower-bound estimates biased toward 0 by overlap in the AI distribution between students exiting and entering each campus. Source: UC Corporate Student System, National Student Clearinghouse, and the California Department of Education.

Table A-10: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Univ. Characteristics

	First Four-Year Institution			First Institution of Enrollment			
				"MH" VA[1]		"CFSTY" VA[1]	
	Adm. Rate (%)	Avg. SAT	6 Yr. Rate (%)	BA (%)	Earn ($)	BA (%)	Earn ($)
Panel C: Difference-in-Difference Coefficients (versus 1995)							
URM	-7.2	39.8	4.1	1.7	1,910	2.8	2,923
	(0.3)	(1.5)	(0.2)	(0.2)	(101)	(0.2)	(115)
URM × Prop 209	3.9	-24.1	-2.5	-0.5	-463	-1.1	-1,085
	(0.3)	(1.7)	(0.2)	(0.2)	(114)	(0.2)	(130)
$\bar{Y}$	51.0	1,188	68.3				
Obs.	128,957	127,138	125,319	131,214	128,628	130,261	128,417
Panel D: Estimates with Separate Coefficients for Black and Hispanic Applicants							
Black	-11.0	52.8	5.4	3.4	3,149	5.2	4,815
	(0.3)	(2.1)	(0.3)	(0.2)	(142)	(0.2)	(154)
Hispanic	-6.1	31.6	2.9	1.5	1,560	2.1	2,305
	(0.2)	(1.2)	(0.2)	(0.1)	(85)	(0.1)	(95)
Black × Prop 209	4.6	-24.7	-2.6	-0.8	-455	-1.5	-1,128
	(0.5)	(2.9)	(0.4)	(0.3)	(197)	(0.3)	(214)
Hispanic × Prop 209	3.3	-17.9	-1.4	-0.5	-328	-0.7	-811
	(0.3)	(1.5)	(0.2)	(0.2)	(103)	(0.2)	(117)
Obs.	172,661	170,293	168,684	176,026	172,571	174,769	172,290

Note: This table shows that the impact of Prop 209 on proxies of UC URM applicants' university quality are generally somewhat larger when compared to the '94-95 baseline, and that Black and Hispanic UC applicants faced similar-magnitude declines in proxies of university quality after Prop 209. This table extends Table II. **Panel C**: Estimates of β_0 and $\beta_{'98-99}$ from Equation 1, a difference-in-difference model of 1995 and 1998-1999 URM UC freshman California-resident applicants' outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. The years 1996-1997 are omitted in Panel C because some universities preemptively curtailed their affirmative action programs in those years. **Panel D**: Estimates of β_0 and $\beta_{'98-99}$ from an extension Equation 1 splitting the URM indicator into separate Black and Hispanic indicators interacted with post-209. The model is an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Models omit Native American applicants. **All**: For details on outcomes and specification, see Table II. Robust standard errors in parentheses. Source: UC Corporate Student System, National Student Clearinghouse, the California Employment Development Department, and the Integrated Postsecondary Education Data System (IPEDS).

Table A-11: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Educational Outcomes

	Earn Bach. Degree		Earn STEM Degree		Earn Grad. Degree		
	5-Year	6-Year	Uncondit.	Condit.	All	STEM	JD
Panel C: Difference-in-Difference Coefficients (versus 1995)							
URM	-1.15	-2.46	0.09	-0.46	5.48	1.43	1.18
	(0.55)	(0.55)	(0.42)	(0.58)	(0.36)	(0.13)	(0.15)
URM × Prop 209	-1.84	-0.91	-0.61	0.25	-3.51	-2.06	-1.03
	(0.62)	(0.62)	(0.47)	(0.65)	(0.48)	(0.18)	(0.19)
$\bar{Y}$	47.33	74.23	22.37	27.43	27.99	4.30	3.76
Obs.	148,980	148,980	148,980	110,588	190,540	190,540	190,540
Panel D: Estimates with Separate Coefficients for Black and Hispanic Applicants							
Black	2.06	-0.77	3.63	4.10	12.87	1.45	3.24
	(0.74)	(0.75)	(0.53)	(0.75)	(0.78)	(0.27)	(0.38)
Hispanic	-3.14	-3.08	-0.71	-0.90	2.15	0.39	0.17
	(0.47)	(0.46)	(0.35)	(0.47)	(0.48)	(0.19)	(0.20)
Black × Prop 209	-0.83	-0.15	-1.54	-1.05	-1.50	-0.05	-0.56
	(0.99)	(1.01)	(0.70)	(1.00)	(1.05)	(0.38)	(0.49)
Hispanic × Prop 209	-0.82	-0.79	-0.62	-0.37	-1.02	-0.73	-0.06
	(0.58)	(0.57)	(0.43)	(0.58)	(0.59)	(0.23)	(0.23)
Obs.	197,804	197,804	197,804	147,795	197,804	197,804	197,804

Note: This table shows that the impact of Prop 209 on URM UC applicants' educational outcomes generally appears somewhat larger when compared to the '94-95 baseline, and that Black and Hispanic UC applicants faced similar relative declines in educational outcomes following Prop 209. This table extends Table III. Estimates of β_0 and $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 (or, in Panel C, 1995 and 1998-1999) URM UC freshman California-resident applicants' educational outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. For details on outcomes and specification, see Table III. The years 1996-1997 are omitted in Panel C because some universities preemptively curtailed their affirmative action programs in those years; 1994 is omitted because NSC records from that year are unreliable. Panel D interacts the two coefficients with Black and Hispanic coefficients to separately estimate effects for each group; Native American applicants are omitted. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-12: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Educational Outcomes

	Earn Bach. Degree		Earn STEM Degree	
	5-Year	6-Year	Uncondit.	Condit.
Panel E: Coefficients measured with only NSC data				
URM	-0.98	-1.33	0.34	0.12
	(0.41)	(0.41)	(0.28)	(0.46)
URM × Prop 209	-1.01	-1.06	-0.93	-0.43
	(0.51)	(0.51)	(0.35)	(0.57)
$\bar{Y}$	45.86	71.60	18.36	28.93
Obs.	199,321	199,321	199,321	126,481
Panel F: Coefficients in UC data, condit. on UC enrollment				
URM	-5.99	-2.31	0.26	0.24
	(0.63)	(0.57)	(0.52)	(0.60)
URM × Prop 209	-1.02	0.07	-0.50	-0.27
	(0.82)	(0.74)	(0.68)	(0.77)
$\bar{Y}$	46.81	80.39	29.31	29.81
Obs.	94,469	94,469	94,469	75,943

Note: This table shows that the impact of Prop 209 on URM UC applicants' undergraduate degree attainment generally appears somewhat larger when measured in NSC alone, as a result of imperfect UCSC reporting, and shrinks when the sample is restricted to UC enrollees before and after Prop 209 measured only in UC data). This table extends Table III. Estimates of β_0 and $\beta_{'98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' educational outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. For details on outcomes and specification, see Table III. Outcomes are measured in NSC alone in Panel D and in UC administrative data alone in Panel E (excluding applicants who do not enroll at a UC campus). Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-13: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Earned Majors

Major	Baseline	$\beta_{\cdot 98-99}$	(s.e.)	Major	Baseline	$\beta_{\cdot 98-99}$	(s.e.)
Biology	4.4	0.62	(0.25)	Economics	2.0	-0.39	(0.17)
Other Humanities	2.7	0.30	(0.18)	History	2.4	-0.32	(0.17)
International Stud.	1.2	0.23	(0.14)	Mathematics	0.9	-0.29	(0.11)
Film	0.9	0.22	(0.11)	Electrical Eng.	0.8	-0.23	(0.11)
English	3.3	0.18	(0.20)	Law	0.7	-0.20	(0.09)
Biochemistry	0.5	0.17	(0.09)	Sociology	5.0	-0.20	(0.24)
Architecture	0.3	0.15	(0.08)	Computer Science	0.7	-0.18	(0.12)
Criminology	1.0	0.14	(0.11)	Political Science	4.2	-0.18	(0.23)
Chemistry	0.4	0.13	(0.08)	Communications	2.5	-0.17	(0.18)
Environmental Stud.	0.3	0.08	(0.07)	Computer Eng.	0.3	-0.17	(0.07)

Note: This table shows the fields of study that relatively increased and decreased with greatest likelihood among URM UC applicants after Prop 209, with a mix of STEM and non-STEM fields both increasing and decreasing. Estimates of $\beta_{\cdot 98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 URM UC freshman California-resident applicants' unconditional likelihood (in percentage points) of earning a major in each major group compared to non-URM outcomes after Prop 209. The ten major groups with the largest and smallest $\beta_{\cdot 98-99}$ estimates are presented, along with the "baseline" proportion of 1996-1997 URM UC applicants who earned a major in each group. Major choice is measured only in NSC. NSC majors are categorized by the author; full categorization available upon request. The sum across all major groups' baseline values is 61.1 (reflecting URM UC applicants' likelihood of degree attainment); the sum across all major groups' $\beta_{\cdot 98-99}$ estimates is -1.24, reflecting the change in NSC-measured graduation after 1998. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-14: Difference-in-Difference Est. of URM UC Applicants' Post-1998 CA Wage Outcomes, cont.

	Average 6-16 Years after UC App.				Average 12-16 Years after UC App.			
	# Years CA Emp.	Total Wages	Log Wages	# > \$100K Wages	# Years CA Emp.	Total Wages	Log Wages	# > \$100 Wages
Panel C: Estimates of URM × Prop 209 by AI Quartile								
Bottom Quartile	-0.02 (0.11)	-1,095 (995)	-0.06 (0.03)	0.06 (0.06)	0.00 (0.06)	-1,964 (1,430)	-0.09 (0.04)	0.00 (0.04)
Second Quartile	0.10 (0.10)	-1,824 (936)	-0.05 (0.03)	-0.11 (0.06)	0.03 (0.05)	-1,935 (1,361)	-0.04 (0.03)	-0.09 (0.04)
Third Quartile	0.02 (0.09)	-1,595 (935)	-0.03 (0.02)	-0.14 (0.06)	0.02 (0.05)	-2,077 (1,374)	-0.02 (0.03)	-0.09 (0.04)
Top Quartile	-0.10 (0.09)	-1,468 (1,041)	-0.02 (0.02)	-0.06 (0.06)	-0.04 (0.05)	-2,024 (1,553)	-0.03 (0.03)	-0.05 (0.04)
Panel D: Difference-in-Difference Coefficients (versus 1995)								
URM	0.19 (0.04)	343 (391)	0.04 (0.01)	-0.00 (0.02)	0.11 (0.02)	-387 (580)	0.01 (0.01)	0.02 (0.01)
URM × Prop 209	-0.22 (0.05)	-2,555 (462)	-0.08 (0.01)	-0.19 (0.03)	-0.11 (0.02)	-3,184 (676)	-0.07 (0.01)	-0.15 (0.02)
$\bar{Y}$	7.05	61,107	10.69	1.39	3.07	79,331	10.90	0.95
Obs.	190,540	158,989	158,989	190,540	190,540	136,341	136,341	190,540

Note: This table shows that the labor market deterioration faced by URM UC applicants following Prop 209 was somewhat-larger among low-AI applicants and somewhat-larger when estimated relative to the '94-95 baseline. This table extends Table IV. Estimates of β_0 and $\beta_{'98-99}$ from Equation 1, an OLS difference-in-difference model of 1996-1999 (or, in Panel D, 1994-1995 and 1998-1999) URM UC freshman California-resident applicants' educational outcomes compared to non-URM outcomes after the 1998 end of UC's affirmative action program. Outcomes are defined as number of years of non-zero California wages, average wages and log wages across years with non-zero wages, and number of years with wages above \$100,000, among the years 6-16 or 12-16 years after initial UC application. Outcomes measured in the California Employment Development Department database, which includes employment covered by California unemployment insurance. The years 1996-1997 are omitted in Panel D because some universities preemptively curtailed their affirmative action programs in those years. Models include high school fixed effects and the components of UC's Academic Index (see footnote 21). Academic Index (AI) is defined in footnote 6; models by AI quartile are estimated independently, with quartiles defined by the AI distribution of 96-97 URM UC applicants. Annual wages CPI-adjusted to 2018 and winsorized at top and bottom 1 percent. Robust standard errors in parentheses. Source: UC Corporate Student System and the California Employment Development Department.

Table A-15: 1994-2001 Change in UC Application Rates in Public CA High Schools by Ethnicity

		All Campuses				Most-Selective Campuses		
		Unweighted	Weighted			Unweighted	Weighted	
Black	1995	0.034	0.023	0.014		0.021	0.016	0.011
		(0.021)	(0.014)	(0.014)		(0.019)	(0.013)	(0.013)
	1996	-0.024	-0.005	-0.012		-0.038	-0.011	-0.011
		(0.021)	(0.015)	(0.015)		(0.019)	(0.013)	(0.013)
	1997	-0.011	-0.016	-0.020		-0.014	-0.025	-0.033
		(0.022)	(0.015)	(0.015)		(0.020)	(0.014)	(0.013)
	1998	-0.013	-0.008	-0.014		-0.029	-0.031	-0.031
		(0.021)	(0.014)	(0.014)		(0.019)	(0.013)	(0.013)
	1999	0.003	-0.024	-0.026		-0.034	-0.054	-0.053
		(0.022)	(0.016)	(0.015)		(0.020)	(0.014)	(0.013)
	2000	-0.005	-0.013	-0.012		-0.018	-0.037	-0.035
		(0.021)	(0.015)	(0.015)		(0.019)	(0.013)	(0.013)
	2001	-0.000	-0.019	-0.023		-0.025	-0.051	-0.051
		(0.021)	(0.016)	(0.015)		(0.019)	(0.013)	(0.013)
Hispanic	1995	0.006	-0.004	-0.004		0.002	-0.005	-0.009
		(0.013)	(0.011)	(0.010)		(0.012)	(0.009)	(0.009)
	1996	-0.016	-0.020	-0.026		-0.011	-0.010	-0.012
		(0.013)	(0.011)	(0.011)		(0.012)	(0.010)	(0.009)
	1997	-0.018	-0.033	-0.035		-0.014	-0.029	-0.036
		(0.014)	(0.011)	(0.011)		(0.013)	(0.009)	(0.009)
	1998	-0.021	-0.026	-0.022		-0.031	-0.029	-0.027
		(0.014)	(0.011)	(0.010)		(0.012)	(0.009)	(0.009)
	1999	-0.036	-0.040	-0.037		-0.051	-0.048	-0.046
		(0.014)	(0.011)	(0.011)		(0.012)	(0.009)	(0.009)
	2000	-0.021	-0.028	-0.029		-0.037	-0.039	-0.036
		(0.014)	(0.011)	(0.011)		(0.013)	(0.010)	(0.009)
	2001	-0.029	-0.026	-0.024		-0.027	-0.029	-0.029
		(0.014)	(0.012)	(0.011)		(0.012)	(0.010)	(0.010)
Asian	1995	0.046	0.018	0.018		0.023	0.002	0.009
		(0.016)	(0.012)	(0.011)		(0.014)	(0.010)	(0.010)
	1996	0.010	0.022	0.021		0.019	0.025	0.026
		(0.017)	(0.012)	(0.011)		(0.014)	(0.010)	(0.010)
	1997	0.018	0.021	0.020		0.029	0.014	0.015
		(0.016)	(0.012)	(0.012)		(0.014)	(0.010)	(0.010)
	1998	0.036	0.025	0.024		0.035	0.009	0.015
		(0.017)	(0.012)	(0.012)		(0.015)	(0.011)	(0.010)
	1999	0.032	0.016	0.009		0.023	-0.004	-0.000
		(0.017)	(0.012)	(0.011)		(0.015)	(0.011)	(0.010)
	2000	0.042	0.017	0.025		0.045	0.004	0.015
		(0.017)	(0.012)	(0.011)		(0.015)	(0.011)	(0.010)
	2001	0.043	0.026	0.029		0.052	0.024	0.025
		(0.017)	(0.012)	(0.012)		(0.015)	(0.012)	(0.011)
HS×Eth.		X	X	X		X	X	X
HS×Year		X	X	X		X	X	X
by Eth.×Gender				X				X
R^2	0.72	0.90	0.82		0.72	0.90	0.83	
Obs.	20,311	20,311	37,622		21,191	21,191	39,008	

Note: This table provides the underlying regression statistics (estimated at the annual level) behind Figure VII, showing that URM application rates following Prop 209 declined by between 4 and 6 percent of all UC-eligible URM public high school graduates while Asian application rates remained unchanged after Prop 209 in the main 'weighted' specifications. Estimates of the change in the proportion of California public high school graduates by ethnicity who applied to UC or to UC's more-selective Berkeley and UCLA campuses, relative to 1994. Coefficients are estimates of $\beta_{e,y,a}$ from different specifications Equation 2, with annual coefficients and across all AI bins. Columns 1 and 4 are unweighted, columns 2 and 5 are weighted by the number of graduates in each high-school-year (main specification), and columns 3 and 6 disaggregate observations by gender (as well as school-year-ethnicity) and weight by number of graduates. Standard errors in parentheses clustered by high school. Source: UC Corporate Student System and the California Department of Education.

Table A-16: Difference-in-Difference Estimates of URM Students' Post-1998 STEM Grades and Persistence

	SAT %tile	GPA	Persist.	STEM Deg.	SAT %tile	GPA	Persist.	STEM Deg.
URM	-19.0	-0.42	-11.2	-10.3	-7.3	-0.06	-2.0	0.1
	(1.7)	(0.06)	(1.5)	(0.6)	(1.2)	(0.05)	(1.6)	(0.6)
URM $\times$ Prop 209	2.7	0.02	1.5	1.2	4.0	-0.01	0.6	-0.1
	(1.4)	(0.05)	(1.7)	(0.9)	(0.9)	(0.04)	(1.5)	(0.8)
AI Cov. And HS FE					X	X	X	X
$\bar{Y}$	48.9	2.59	59.3	26.0	48.9	2.59	59.3	26.0
# of Obs.	109,489	105,550	85,206	56,160	109,489	105,550	85,206	56,160

Note: This table shows that URM students across five UC campuses had lower STEM class rank, performance, persistence, and STEM major completion before Prop 209, but that these latter three gaps are fully explained by the students' prior academic opportunities and preparation; ending affirmative action had no estimable impact on any of them. Difference-in-difference WLS regression coefficient estimates of 1996-1999 UC enrollees' introductory STEM course rank, performance, or persistence, differencing across URM status and post-1998 following Equation 3. In all but the 'STEM Deg' columns, each observation is a student-course pair in an introductory biology, chemistry, physics, or computer science course (see Appendix H) taken within 2.5 years of matriculation, stacking over courses and weighted evenly across observed students. SAT percentile is the fraction of other 1994-2002 freshman CA-resident peers who have lower SAT scores than the student; persistence indicates completing the subsequent course in the introductory STEM course sequence; and course grade is the grade points received in completed courses. In the 'STEM Degree' models each observation is a student; the outcome indicates completing any UC STEM degree. Academic preparation covariates include high school fixed effects, and the components of UC's Academic Index (see footnote 21); all models include cohort fixed effects. The sample is restricted to CA-resident freshmen students at UCB, UCSB, UCD, UCSC, or UCR. UCSC is omitted from the GPA model because it did not mandate letter grades in the period. Standard errors (in parentheses) are two-way clustered by student and course, or robust ('STEM Deg'). Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018).

Table A-17: Difference-in-Difference Estimates of URM UC Enrollees' Post-1998 STEM Outcomes

	Chemistry				Biology		Physics		Comp. Science		
	1	2	3	4	1	2	1	2	1	2	3
Grade in Course (if earned grade)											
URM	0.06	-0.11	-0.22	-0.09	-0.02	-0.18	-0.06	0.04	-0.11	0.15	0.12
	(0.02)	(0.04)	(0.05)	(0.06)	(0.04)	(0.06)	(0.04)	(0.07)	(0.09)	(0.15)	(0.15)
URM × Prop 209	-0.09	0.08	0.27	0.07	-0.02	0.09	-0.00	-0.18	-0.02	-0.29	0.01
	(0.03)	(0.05)	(0.07)	(0.08)	(0.05)	(0.08)	(0.06)	(0.09)	(0.13)	(0.22)	(0.22)
Acad. Prep.	X	X	X	X	X	X	X	X	X	X	X
$\bar{Y}$	2.53	2.54	2.49	2.65	2.46	2.65	2.73	2.91	2.57	2.61	2.89
Obs.	22,330	14,415	10,632	7,610	12,436	7,639	11,719	6,059	6,027	3,708	2,975
Indicator for Persistence to Next Course (%)											
URM	-1.7	5.1	-10.2		-4.1		-6.3		-8.4	4.1	
	(1.4)	(1.7)	(2.1)		(1.9)		(2.1)		(3.5)	(5.0)	
URM × Prop 209	1.5	-2.9	8.7		-0.9		5.1		-3.2	-2.9	
	(1.8)	(2.3)	(2.9)		(2.5)		(2.7)		(4.6)	(6.9)	
Acad. Prep.	X	X	X		X		X		X	X	
$\bar{Y}$	59.9	64.6	68.1		54.0		48.5		55.3	68.7	
Obs.	23,384	14,933	10,954		12,858		12,291		6,638	4,148	

Note: This table shows course-specific regression coefficients mirroring the sixth and seventh columns of Table A-16, showing that URM students at the five observed UC campuses tended to earn lower grades in most STEM courses following Prop 209, with both positive and negative estimates on persistence across different courses. Difference-in-difference OLS regression coefficient estimates across 1996-1999 CA-resident freshman UCB, UCSB, UCD, UCSC, or UCR enrollees' introductory STEM courses, differencing across URM status and post-1998 using Equation 3. Persistence indicates completing the subsequent course in the introductory STEM course sequence; course grade is the grade points received in completed courses. Academic covariates include high school fixed effects and the components of UC's Academic Index (see footnote 21). Standard errors (in parentheses) are robust. The specific courses comprising each sequence can be seen in Appendix H; courses taken after the first 2.5 years of matriculation are omitted. UCSC is omitted from the GPA model because it did not mandate letter grades in the period. Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018).