G ONLINE APPENDIX

G.1 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:

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

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.[89] 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.[90] 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 Equation G-1 replacing the outcome with applicants' high school GPAs (on a weighted 5 point scale). GPAs

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[89]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.

[90]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 G-1: 1995-1997 Value-Added Estimates for Public California Universities

Inst.	6-Yr. Grad.			Wages in Early 30s					High School GPA			Sample Size
	Raw All	MH All	CFSTY All	Raw All	MH All	CFSTY All	CFSTY Black	CFSTY Hisp.	Raw All	MH All	CFSTY All	
Panel A: University of California System												
Berkeley	34.5	19.8	24.0	30,100	12,900	16,800	3,800	4,400	0.66	0.04	0.37	9,078
UCLA	35.7	20.1	25.8	24,900	8,900	14,900	5,200	4,100	0.61	0.01	0.39	8,270
San Diego	36.3	20.4	25.5	21,800	8,500	11,100	15,300	4,800	0.62	0.03	0.38	5,647
Santa Barbara	29.1	19.2	19.7	12,800	7,600	6,900	1,300	-1,500	0.24	-0.00	0.10	8,104
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	29.2	18.0	20.7	14,800	7,100	7,000	16,400	1,300	0.37	0.01	0.22	5,727
Santa Cruz	21.7	14.6	12.9	-2,600	-1,900	-9,000	-1,100	-10,500	0.19	-0.02	0.04	3,975
Riverside	33.2	25.2	28.1	9,000	6,400	4,700	11,700	900	0.21	0.01	0.12	1,204
Panel B: California State University System												
Cal Poly	21.8	12.8	12.4	25,600	19,100	19,500	21,900	10,600	0.34	0.06	0.20	2,626
Cal Poly Pom.	0.5	0.4	-2.7	7,100	6,500	3,800		-1,000	0.02	0.00	-0.03	1,030
CSU Chico	21.5	18.1	13.3	7,700	7,100	2,800		100	0.01	0.03	-0.04	370
CSU DH	-8.1	-8.6	0.2	-5,400	-6,400	3,700	-1,400	-1,300	-0.10	-0.15	0.03	137
CSU EB	5.6	2.9	4.8	5,700	1,100	5,200	-7,600		0.07	-0.06	0.07	216
CSU Fr.	9.4	4.8	9.4	6,700	2,600	5,000		2,500	0.19	0.03	0.21	311
CSU Fu.	4.2	5.2	3.7	1,400	1,800	900	2,800	-1,100	-0.05	-0.02	-0.06	835
CSU LB	0	0	0	0	0	0	0	0	0	0	0	1,285
CSU MB	10.1	10.9	8.6	-6,700	-2,800	-6,100			-0.10	-0.04	-0.09	60
CSU N	-3.8	-4.0	-2.3	-900	-700	-700	-5,600	-3,500	-0.09	-0.05	-0.05	994
CSU Sac.	5.5	2.2	2.6	13,100	8,900	10,400		10,800	0.11	-0.00	0.06	452
CSU SB	-0.7	-0.8	2.0	100	1,900	3,900		-0	-0.01	0.00	0.03	270
CSU SM	2.4	0.4	-0.3	-3,900	-4,100	-6,400		-3,900	0.08	0.00	0.07	112
CSU Stan.	8.1	2.9	2.9	7,800	3,500	5,900			0.20	0.01	0.13	69
HSU	2.3	-1.2	-5.0	-11,300	-10,900	-15,300			0.10	0.02	-0.02	204
SDSU	3.4	2.2	1.5	400	-200	500	1,000	-3,700	-0.02	-0.01	-0.04	1,676
SFSU	-0.1	-0.2	-3.8	3,000	1,300	300	-4,100	-2,300	-0.03	-0.05	-0.07	918
SJSU	-0.6	-1.0	-3.1	16,800	14,700	13,700	-6,300	14,600	-0.03	-0.04	-0.05	728
SSU	12.3	8.8	1.5	-4,800	-7,100	-8,100			0.06	-0.00	-0.03	86

Note: This table shows value-added estimates for the University of California and California State University public university systems. Value-added estimates from Equation G-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.

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 G-1, G-2, and G-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 G-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 G-1 shows that the students who enroll at UC campuses are 20-40 percentage points 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 earnings than LB enrollees by 25 to 30 thousand dollars, though about half

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

| | 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
Allan H.	-17.6	-13.6	-6,100	-3,300		61	LA Valley	-20.0	-17.0	-300	-1,500		51
Am. River	-17.1	-16.9	-7,300	-5,000		85	MiraCosta	-2.6	-1.8	5,100	500		86
Cabrillo	-25.7	-29.4	7,700	9,100		63	Moorpark	-5.8	-8.2	6,200	4,800		168
Canada	5.9	0.0					Mt SA	-14.5	-13.9	-2,000	-3,800	-7,600	448
Cerritos	-21.0	-15.5	-4,200	-2,300	-10,200	185	Mt SJ	-15.6	-13.3	1,600	2,500		69
Chabot	-1.2	-0.4	8,000	9,000	2,600	173	Ohlone	-9.0	-12.2	16,600	13,500		94
Chaffey	-20.3	-17.2	-12,100	-9,000	-4,900	81	Or. Coast	-31.2	-34.0	-12,200	-16,900		65
SF	3.0	-0.5	6,900	4,300	-9,200	405	Palomar	-10.8	-13.6	-4,100	-7,700		105
San Mat.	1.9	-2.5	17,400	15,200		258	Pasadena	-14.4	-14.7	-3,200	-6,300	-13,300	366
C. of Des.	-18.5	-9.4	-1,100	6,300	6,400	67	Riverside	-11.4	-4.9	1,500	3,100	-600	581
Crafton H.	-15.2	-12.5					Sac.	-15.4	-9.9	-100	2,800		174
Cuesta	-14.4	-18.2	400	-1,500		129	Saddleback	-6.6	-11.2	5,100	2,200		212
Cypress	-14.5	-14.5	-2,700	-7,200		112	SB Valley	-2.7	7.3	2,200	6,000	700	77
De Anza	-0.6	-2.3	15,000	12,600	13,700	651	SD	-25.6	-25.8	-17,700	-16,200		55
Diab. Vall.	0.4	-3.3	9,400	8,800	1,400	479	SD Mesa	-12.5	-12.2	-900	-2,400	-8,000	294
East LA	-32.5	-23.3	-9,800	-6,300	-12,500	50	SD Mir.	-11.0	-10.5	3,000	1,600		75
El Camino	-18.1	-16.4	-6,200	-5,600	-7,700	307	SJ Delta	-20.2	-22.0	-3,500			
Foothill	-3.4	-4.9	10,200	9,700		257	Santa Ana	-18.6	-17.6	-5,700	-3,600	-7,800	155
Fresno	-23.4	-23.3	-13,500	-14,900		87	S. Barb.	-28.9	-33.8	-8,100	-10,700		72
Fullerton	-11.8	-11.7	-5,900	-7,800	-11,200	154	S. Monica	-12.7	-12.9	-1,000	600	-9,200	671
Hartnell	-14.4	-7.5	4,400	5,600	6,500	56	S. Rosa	-6.1	-8.3	-5,000	-4,200		91
Irv. Vall.	-11.6	-17.2	1,200	-1,900		213	Sierra	-14.6	-15.7	-3,000	-2,600		108
Laney	-4.2	-3.8	4,500	4,000		86	Skyline	4.8	3.0	17,800	17,800		138
Las Positas	-10.7	-14.2	6,600	7,900		55	Solano	-4.4	0.2	28,100	31,400		52
L. Beach	-20.4	-18.9	-2,900	-1,900	-7,600	184	Ventura	-15.0	-9.6	-3,500	-2,500	-2,100	101
LA Pierce	-15.1	-17.0	-4,600	-8,400		75							

Note: This table shows value-added estimates for estimable California Community Colleges. Value-added estimates from Equation G-1 using 1995-1997 UC CA-resident freshman fall applications, excluding colleges with fewer than 50 in-sample enrollees. 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.

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 substantially above-average at half of UC campuses.

The final columns of Table G-1 show that there is very 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 Institute (Cal Poly), a teaching-oriented university in the CSU system. Panel B of Table G-1 shows that most CSU campuses had degree and wage VA estimates similar to CSU Long Beach, substantially 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-

Inst.	6-Yr. Grad.		Wages in Early 30s			Samp. Size	Inst.	6-Yr. Grad.		Wages in Early 30s			Samp. Size
	MH All	CFSTY All	MH All	CFSTY All	Hisp.			MH All	CFSTY All	MH All	CFSTY All	Hisp.	
American	32.4	27.5	27,500	22,600		52	Pomona	28.9	32.9	13,400	14,300	6,200	299
Arizona	6.7	-0.1	7,900	3,700		101	Port. St.	1.2	-0.6				
AZ State	22.3	21.0					Princeton	32.2	35.9	36,700	35,800		166
Azusa Pac.	25.6	25.9	-2,300	-600		84	Rice	10.3	12.5				
Biola	24.2	23.3	-14,500	-15,300		101	St. Mary's	26.4	25.3	11,700	12,700	4,300	333
Boston C.	-20.8	-20.0	12,500	13,000		127	Santa Clara	32.2	31.7	31,000	31,400	27,700	545
Boston U.	23.2	21.0	3,200	400		245	Scripps	28.4	28.3	3,700	-2,300		92
Brandeis	27.8	29.3	8,200	7,400		58	Smith	33.0	32.4	-3,400	-8,100		69
BYU	-10.3	-11.1	400	2,200		159	S. Meth.	26.3	23.3				
Bryn Mawr	27.8	30.4					Spelman	34.2	46.0			-7,300[†]	
CA Luth.	25.0	23.8	12,500	7,500		86	Stanford	28.2	32.0	37,100	36,700	23,300	1,116
Carleton	28.4	29.1					Swarthmore	33.1	35.7				
CMU	19.7	18.8					Syracuse	30.5	30.0	19,300	20,600		113
Clar. Mc.	28.3	30.5	27,700	25,900	11,800	239	Tufts	28.9	29.9	4,900	500		80
Col. St. U.	24.8	21.3	6,700	4,300		50	Tulane	28.9	27.6	20,000	17,500		80
Columbia	23.9	27.6	12,000	12,600		189	Colorado	24.9	20.3	17,700	14,900		472
Cornell	26.3	28.8	18,300	19,200		320	Illinois	27.4	24.0				
Creighton	26.7	24.0	26,800	22,500		59	Michigan	30.2	30.9	29,500	31,800		99
Dartmouth	-57.8	-55.5	26,600	24,500		119	Nevada	10.8	8.5				
Duke	-21.1	-18.5	40,900	43,500		166	Notre Dame	18.7	19.9				
Georgetown	29.2	33.3	37,400	40,200	18,000	169	Oregon	26.2	18.7	2,100	-6,300		253
Gonzaga	27.7	25.9					U. Penn.	28.0	30.8	38,300	39,700		271
Grinnell	32.1	31.4					Puget Sound	24.6	22.0	700	-5,600		90
H. Mudd	24.5	26.7	27,500	27,100		109	Redlands	28.6	29.2	-600	-2,700	1,900	157
J. Hopkins	22.1	25.3	25,500	26,100		121	USF	27.2	24.3	12,100	12,600	9,400	460
La Sierra	5.0	8.0	-100	-4,500		75	USC	20.8	21.7	17,400	18,100	5,800	3,192
Lew&Clk	30.7	25.6	-2,400	-12,200		62	U. Pacific	24.2	25.6	26,200	26,300	6,900	421
Loyola M.	22.1	21.7	11,800	12,800	9,700	852	Virginia	32.6	33.2				
Mills	29.3	27.6	-9,200	-10,300		72	Washington	24.9	25.7				
Mt. St. M.	23.9	28.2	4,300	6,800	1,900	129	Wisconsin	24.0	23.3	5,800	3,400		106
NYU	23.6	22.2	-7,600	-10,300		241	Vanderbilt	28.4	29.8	16,800	19,300		101
N. Arizona	24.7	17.1	4,500				Wash. in SL	21.8	24.8				
Northwest.	24.4	27.6	20,100	20,900		210	Wellesley	30.0	33.9	9,100	11,900		88
Oberlin	0.9	-0.0					Wesleyan	36.2	35.5				
Occidental	33.6	34.4	1,800	3,800	-4,200	194	Whitman	32.7	33.1				
Penn. St.	21.8	17.6					Whittier	26.2	29.3	6,900	9,600	5,500	147
Pepperdine	29.3	27.2	4,700	5,900	3,100	316	Williams	33.0	35.1				
Pitzer	30.6	31.2	-800	-2,200	-3,400	113	Woodbury	-41.6	-36.8				
P. L. Naz.	20.9	16.7	-6,900	-9,300		87	Yale	29.0	33.8	39,100	39,200	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 G-1 using 1995-1997 UC CA-resident freshman fall applications, excluding colleges with fewer than 50 in-sample enrollees. 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.

campus GPA variation.

Table G-2 shows that California's community colleges have estimated degree VA substantially 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 G-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 substantially

Table G-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	-2.6	2,335	-796	3.0	-3.2	3,318	-1,114	2.9	-2.7	3,273	-771	1.5	-2.0	4,748	-817
	(0.1)	(0.4)	(102)	(573)	(0.1)	(0.5)	(105)	(638)	(0.1)	(0.4)	(107)	(576)	(0.1)	(0.4)	(138)	(628)
URM × Prop 209	-0.5	-0.4	-572	-2,287	-1.2	0.1	-1,462	-2,059	-0.9	-0.4	-1,091	-2,243	-0.2	-0.0	-153	-2,405
	(0.2)	(0.5)	(125)	(691)	(0.2)	(0.6)	(130)	(771)	(0.2)	(0.5)	(131)	(696)	(0.2)	(0.6)	(167)	(756)
Obs.	176,976	176,976	135,616	135,616	145,539	145,539	110,274	110,274	175,624	175,624	135,022	135,022	160,405	160,405	120,662	120,662
Panel B: Estimates of URM × Prop 209 ($\beta_{\cdot 98-99}$) by AI Quartile																
Bottom Quartile	-1.5	-3.6	-839	-2,303	-2.3	-3.7	-1,040	-1,561	-1.7	-3.6	-848	-2,212	-1.1	-2.8	-579	-1,990
	(0.5)	(1.6)	(274)	(1,578)	(0.5)	(1.8)	(328)	(1,824)	(0.5)	(1.6)	(296)	(1,593)	(0.6)	(1.8)	(427)	(1,789)
Second Quartile	-0.4	-0.3	-606	-1,496	-1.4	-0.1	-2,340	-16	-1.2	-0.2	-1,444	-1,455	-0.2	0.2	91	-1,175
	(0.4)	(1.3)	(258)	(1,453)	(0.4)	(1.4)	(283)	(1,601)	(0.4)	(1.3)	(293)	(1,464)	(0.4)	(1.4)	(370)	(1,562)
Third Quartile	0.1	1.8	-569	-2,291	-0.6	2.1	-2,060	-2,679	-0.4	1.9	-1,625	-2,301	0.8	2.4	143	-2,129
	(0.3)	(1.1)	(243)	(1,452)	(0.3)	(1.2)	(255)	(1,605)	(0.3)	(1.1)	(273)	(1,457)	(0.3)	(1.1)	(329)	(1,546)
Top Quartile	-0.5	0.1	-461	-2,616	-0.5	0.4	-1,170	-2,633	-0.6	-0.1	-802	-2,625	-0.1	-0.3	571	-2,349
	(0.3)	(0.9)	(317)	(1,647)	(0.2)	(1.0)	(296)	(1,795)	(0.3)	(0.9)	(306)	(1,649)	(0.3)	(0.9)	(349)	(1,744)

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 44). 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.

higher than UC, though there is a great deal of variation.[91] 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 very 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 3 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 2.

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 G-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 enrollment's estimated value-added statistics yield relatively-accurate predictions of the decline in degree attainment by AI quartile, but substantial 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. Future analysis will evaluate the remaining selection bias in available value-added statistics.

G.2   Selection on Unobservables in Arcidiacono et al. (2014)

The baseline estimates presented in Tables 3 and A-12 show that Prop 209 caused a small and statistically-noisy decline in six-year Bachelor's degree attainment among URM UC applicants relative to academically-comparable non-URM applicants, with a relatively-precise null effect among UC enrollees. Arcidiacono et al. (2014) (hereafter AACH) present a near-opposite finding, arguing that Prop 209 increased the likelihood with which URM UC enrollees earned university degrees within five years. There are several differences in the research design used in these two studies, the most consequential being a difference in available data. AACH employ a highly-censored UC *enrollee* database with binned years (by 3; e.g. 1995-1997), binned high school GPA (4 bins) and SAT scores (7 bins each, with no SAT II scores) and no high school information. They do observe a continuous weighted average of HSGPA and SAT scores referred to as students' "Academic Index", though it differs from UC's contemporaneous AI; I will refer to this index as AI'.[92] Using these data, AACH present a summary table that they argue provides direct evidence that Prop 209 increases URM graduation rates. They employ a single-difference design estimated separately for URM and white 1995-2000 UC freshman California-resident enrollees:

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[91] 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.

[92] $AI' = (SAT - 400)/2.4 + (HSGPA \times 102.459)$, which results in an index with 500 points each from SAT I and HS GPA. The difference between "academic indices" results from an anachronism: Arcidiacono et al. (2014) use data provided by the University of California in 2008, by which time "academic index" generally referred to AI' instead of the AI of the 1990s.

Table G-5: Replication of Table 3 in Arcidiacono et al. (2014) with New Specifications: *"Pre- to Post-Prop 209 Changes in Graduation Rates: Without & with Controls"*

Dep. Var:	Estimates Reported in AACH (2014)				Replication			
	POST	POST× Q1(AI')[1]	POST× Q2(AI')	POST× Q3(AI')	POST	POST× Q1(AI')	POST× Q2(AI')	POST× Q3(AI')
Panel A: Underrepresented Minority								
No Controls	0.044**				0.044**			
AACH Controls[2]	0.030**				0.031**			
Add AI Comp.[3]					0.008			
AACH Controls	0.005	0.035*	0.037**	0.035**	0.005	0.032*	0.037**	0.035**
Add AI Comp.					-0.010	0.014	0.027*	0.034**
Panel B: White								
No Controls	0.025**				0.025**			
AACH Controls	0.014**				0.015**			
Add AI Comp.					0.007†			
AACH Controls	0.011†	-0.002	0.001	0.002	0.011†	0.002	0.014†	0.001
Add AI Comp.					0.006	-0.002	0.009	-0.006
Panel C: Non-URM								
No Controls					0.028**			
AACH Controls					0.018**			
Add AI Comp.					0.011**			
AACH Controls					0.008†	0.008	0.018**	0.011*
Add AI Comp.					0.005	0.003	0.015**	0.005

Note: Single-difference OLS regression coefficient estimates across all 1995-2000 UC undergraduate enrollees (excluding transfer and out-of-state students), differencing across post-1998. The outcome is an indicator for earning a UC degree within five years of admission (measured in UC data). Models are estimated independently by ethnicity category and include listed covariates. Coefficients by AI' quartile are estimated simultaneously relative to the top quartile. Students with missing standardized test scores are omitted. This table replicates and augments Table 3 in Arcidiacono et al. (2014). [1]As in Arcidiacono et al. (2014), AI' quartiles are based on pre-Prop 209 enrollees and are subgroup-specific. See footnote 92 for the definition of AACH's AI'. [2]The same as "Extended Controls 2" in Arcidiacono et al. (2014): controls include AI' interacted with parental education indicators, binned family income indicators, and indicators for intended major. [3]The same controls as in *AACH Controls*, adding the components of UC's Academic Index (see footnote 44). Statistical significance: † 10 percent, * 5 percent, ** 1 percent. Source: UC Corporate Student System.

$$GRAD_{iy} = \alpha + \beta_{q_i} POST_y + \gamma X_i + \epsilon iy \qquad \text{(G-2)}$$

where $GRAD_{iy}$ indicates five-year graduation and $POST_y$ indicates 1998 or later entry to university (after Prop 209). AACH present estimates in their Table 3 for various specifications of X_i, from null up to their "Full AACH Controls" (referred to in AACH as "Extended Controls 2") in which X_i contains binned intended major indicators, binned family income indicators, and the parental education index all interacted with AI'. They present estimates for a uniform q_i and allowing q_i to indicate AI' quartiles, with the first through third quartiles estimated relative to the top quartile. Quartiles are defined separately for each ethnicity.

I replicate AACH's Table 3 in Table G-5.[93] AACH show that when X_i is null, URM students are estimated to graduate with 4.4% greater likelihood after 1998, while white students are estimated to graduate with 2.5% greater likelihood. These estimates fall once the full set of controls have been added, to 3.0% for URM and 1.4% for white, suggesting that URM students' likelihood of graduation increased more than that of white students after Prop 209. Finally, when split by AI' quartile, they show that these graduation gains are

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[93]Unfortunately, I do not observe the specific weighted high school GPA used to produce AI', and instead construct a highly-similar index (with the same weights between HS GPA and SAT score) using my observed weighted GPA. The resulting estimates closely replicate those presented in AACH.

enjoyed by only the bottom three quartiles of URM students, but by all four quartiles of white students, which AACH suggest reflects "students in the lower quartiles are attending campuses that better match their levels of preparation" after 1998.

Table G-5 adds a new specification to those discussed in AACH, replacing AI' in X_i with the components of AI (as in the main specification above), without otherwise adjusting the interacted effects. This change substantially attenuates the estimates – to 0.8 percent for URM and 0.7% for white students – and eliminates the ethnicity gap. I also re-estimate the model by AI' quartile, showing that the top and bottom quartiles of URM students face no change in graduation rate, though some evidence of relative increases for the third quartile of URM students remains.[94] Finally, I estimate the same model for *all* non-URM students, including Asian students and students who decline to report ethnicities, obtaining a β estimate of 1.1 percent.

While these estimates remain importantly different from my preferred specification shown in Equation 1 – which include high school fixed effects, restricts the analyzed years to 1996-1999, and expands the sample to all UC applicants (and the outcome to degree attainment at *any* NSC-covered university) – the comparison between the resulting URM versus non-URM estimates here appears highly similar to those reported in Panel D of Table A-10, with a tightly-estimated null effect of Prop 209 on graduation among URM UC enrollees. The increase in UC enrollees' degree attainment can be largely explained by students' greater academic preparedness, reflecting the positive selection of URM students after Prop 209 as well as UC's increasing selectivity in the period.[95]

G.3   Selection into Application: Reanalyzing Card and Krueger (2005)

Figure 8 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.[96] 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 G-6 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.[97]

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[94]Following AACH, AI quartiles are estimated separately by ethnicity, prohibiting cross-ethnicity coefficient comparisons.

[95]Chingos (2013) also points out that selection on observables may explain the correlations presented by AACH.

[96]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.

[97]See Tables A-20 and A-21. Table A-22 shows that score-sending to Berkeley and UCLA became a poor proxy for URM students'

Table G-6: 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"*

Dep. Var.:	All UC Campuses			Berkeley and UCLA Only		
	Send	Send	Apply	Send	Send	Apply
URM $\times$ 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 $\times$ 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 $\times$ 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 $\times$ 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 $\times$ 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 $\times$ 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 $\times$ 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.

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 8, which shows a decline in high-AI URM 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).

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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.

G.4 Explaining Estimation Differences with Arcidiacono, Aucejo, and Hotz (2016)

Arcidiacono, Aucejo, and Hotz (2016), hereafter AAH, present a structural model estimated on highly-censored University of California applicant data to argue that under UC's affirmative action policies, "less prepared minorities at higher ranked campuses had lower persistence rates in science ... [and] less prepared minority students at top ranked campuses would have had higher science graduation rates had they attended lower ranked campuses". They restrict the applicant sample to 1995-1997 freshman UC enrollees and estimate a model of binary major choice (Science or Nonscience) in which students of two types – also "Science" and "Nonscience", determined by the intended major reported on their UC application – are endowed with major-specific academic preparation and decide on their degree attainment by optimizing rewards from degree attainment and costs from switching to the other major type. Both returns and costs vary by student type and academic preparation, and returns include a campus-specific linear term in academic preparation: different campuses provide differently-scaling returns to higher- or lower-preparation students by type. AAH estimate this model in a nested logit framework and present simulations suggesting that low-preparation science students are more likely to persist at less-selective UC campuses, implying that the end of racial preferences would increase science persistence among URM UC students.

These conclusions stand in stark contrast with the STEM persistence and attainment results presented in Sections 6 and 4.2 above, for several reasons. First, AAH restrict their estimation to UC campuses and do not observe STEM major choice at the other institutions where URM students enrolled after Prop 209; however, Table A-10 shows that STEM degree attainment did not rise even among academically-comparable URM UC enrollees following Prop 209. Second, AAH estimate their model strictly on pre-1998 data, putting substantial weight on their model's structural assumptions, and do not validate the model using post-1998 data despite those data's availability; institutional changes (like changed peer effects after Prop 209) could partly explain the discrepancy.

There is also an important difference in the definition of science "persistence" between the two studies. AAH define persistence by the science degree attainment rate among UC students whose "initial major" (to use their term) is in the sciences. However, this notion of persistence relies on a misunderstanding of the nature of UC's "initial major". Better termed a "prospective major", applicants listed these majors on their college application to each UC campus. More than one-third of 1995-2000 UC enrollees listed their prospective major as "Undeclared," a category which AAH include in their definition of Nonscience. This was permissible because most prospective majors were non-binding; except for some engineering and professional fields, enrolled students' prospective majors did not limit (or play any role in) their eventual major choice. Prospective majors *did* play a role in admissions, however; they were included in the summarized information provided to application readers to determine admission at each campus.

As a result, while prospective majors may have signaled applicants' intended major choice in some cases, many applicants likely provided strategic responses to 'game' admission to UC campuses. For example, about one-quarter of 1995-2000 UC enrollees reported prospective STEM majors at one campus and prospective non-STEM majors at another campus. A majority – and perhaps a large majority – of UC enrollees did not earn degrees in their prospective majors. Given the important role of ethnicity in UC campuses' admissions before 1997, incentives around strategic reporting of prospective majors may have differed by ethnicity and campus.

This highlights three additional important differences between the AAH analysis and the present study. The first is potential misspecification in the AAH structural model arising from cross-student variation in the strategic use of prospective major choice. Table G-7 extends AAH's Table 2 – used by AAH to emphasize that "nonminorities who begin in the sciences are much more likely to graduate with a degree in the sciences than minorities" – adding information on which students enrolled in introductory STEM courses at several UC campuses. While URM prospective STEM majors were less likely to earn STEM majors than their non-URM peers, that difference masks an important difference between URM and non-URM prospective STEM majors who do not earn STEM degrees. Among such URM students, less than half took *any* introductory STEM

Table G-7: Share of Students Graduating in Five Years (Percent) by Intro. STEM Course Enrollment

	Enr. In STEM?	URM Students						Non-URM Students					
		UCB	UCSB	UCD	UCSC	UCR	All 5	UCB	UCSB	UCD	UCSC	UCR	All 5
Prospective STEM Majors													
STEM	Y	19.9	17.9	16.2	12.1	16.0	17.0	46.2	24.3	32.8	17.6	29.4	32.6
Degree	N	1.9	1.1	3.4	3.5	0.8	2.1	6.3	1.9	5.5	3.0	1.2	4.2
Non-STEM	Y	21.0	18.2	15.9	9.8	18.6	17.4	21.2	23.3	20.2	17.0	21.6	20.9
Degree	N	23.1	19.0	16.6	24.4	19.0	19.9	10.5	18.3	13.3	24.4	9.3	14.1
No	Y	19.3	30.7	21.8	21.6	23.3	23.3	11.4	24.8	16.3	21.2	29.5	19.0
Degree	N	14.9	13.1	26.1	28.6	22.3	20.3	4.3	7.5	11.9	16.8	9.0	9.2
Annual Stud.		720	636	820	315	511	3,002	3,301	2,583	4,346	1,260	1,817	13,307
Prospective Non-STEM Majors													
STEM	Y	2.4	1.0	3.9	2.6	2.2	2.2	12.1	3.7	11.3	3.2	4.9	7.2
Degree	N	1.1	0.2	1.4	1.2	0.6	0.9	2.0	0.8	1.2	2.0	0.9	1.3
Non-STEM	Y	6.7	5.7	10.2	4.5	2.8	6.0	16.0	10.4	18.8	5.5	8.2	12.4
Degree	N	57.1	53.7	40.9	50.7	51.3	52.1	54.7	57.7	46.0	53.7	43.4	52.3
No	Y	4.3	6.7	8.6	5.3	3.6	5.5	4.7	5.9	7.3	4.8	10.0	6.2
Degree	N	28.4	32.7	35.0	35.7	39.5	33.2	10.6	21.5	15.5	30.7	32.6	20.6
Annual Stud.		1,508	1,203	697	661	778	4,847	3,730	5,435	4,125	3,015	1,911	18,216

Note: This table presents UC students' degree attainment by ethnicity and whether the student is a prospective STEM major and/or took an introductory STEM course in their first year. It reveals that URM prospective STEM majors were about twice as likely to not take an introductory STEM course as non-URM prospective STEM majors, and that more than a quarter of STEM degrees are awarded to prospective non-STEM majors. The share of prospective STEM and non-STEM URM and non-URM UC students at five UC campuses partitioned by whether they earned a degree in STEM, earned a degree in non-STEM, or did not earn a degree within five years of UC matriculation and whether they enrolled in an introductory STEM course in their freshman year. The sample is restricted to 1995-1997 UC enrollees at the five campuses where detailed course data are available: UC Berkeley, UC Santa Barbara, UC Davis, UC Santa Cruz, and UC Riverside. Percentage points sum to 100 for each campus-ethnicity-prospective major group. 'Annual students' reports the average 1995-1997 student population in each group. Following AAH, students are defined as prospective STEM majors if they reported prospective STEM majors to at least half of the UC campuses to which they applied. Introductory STEM courses are defined in Appendix F. STEM degree-earners who did not take introductory STEM courses are largely engineering and mathematics majors who tested out of the introductory mathematics curriculum. Source: UC-CHP Database (Bleemer, 2018b).

courses in their first year, whereas more than 60 percent of such non-URM prospective STEM majors did so.[98] URM prospective STEM students were almost twice as likely to never enroll in a freshman introductory STEM course as non-URM prospective STEM students, overall and at UC Berkeley.[99] This suggests that URM students may have been reporting strategic prospective STEM majors to a greater degree than non-URM students, implying that the AAH model likely selectively misclassifies URM students as "initial STEM majors" when they may have never actually had such intentions.

The second difference is highlighted in the bottom half of Table G-7. While prospective non-STEM majors are much less likely to earn STEM degrees than prospective STEM majors, they are also substantially more numerous, with almost twice as many URM prospective non-STEM majors (including "undeclared" students) as URM prospective STEM majors. As a result, it would be easy to miss that more than 25 percent of STEM degrees are awarded to prospective *non-STEM* majors. A full accounting of changes in STEM major completion should include these degrees, but AAH do not report changes in STEM major completion among

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[98]Introductory STEM courses are defined in biology, chemistry, physics, mathematics, or computer science; see Appendix F.

[99]"Enrollment" entails earning a letter grade in the course, including failing grades but excludes students who withdrew from the course before each campus's 'add/drop' date.

prospective non-STEM majors.

Finally, the present study defines persistence by students' continuing to enroll and complete courses along introductory STEM sequences at UC campuses, rather than conditioning on UC applicants' selecting a STEM field as their (non-binding) prospective major. It shows that URM Berkeley students' observed STEM persistence (relative to academically-comparable non-URM students at that campus, or in comparison with other campuses) decreases following the end of UC's affirmative action policy.

These five differences in sample, research design, and outcome measures likely explain why AAH argue that affirmative action appears to decrease low-preparation URM students' science persistence and attainment, whereas the present study shows that *ending* affirmative action had a negligible effect on URM students' science persistence but decreased their undergraduate and graduate STEM attainment, especially among low-preparation URM students.

G.5   Prop 209 in *Mismatch: How Affirmative Action Hurts Students It's Intended to Help, and Why Universities Won't Admit It* (Basic Books: Sander and Taylor (2012))

Mismatch (Sander and Taylor 2012) presents a comprehensive argument favoring the "Mismatch Hypothesis" in higher education.[100] The book's centerpiece is a before-after analysis of Prop 209, with chapters devoted to the politics leading up to and following the proposition (7 and 10), changes in URM application and matriculation rates (8), and changes in first-year grades, STEM degree attainment, and graduation (9).

Because several of ST's conclusions are contradicted by this study's baseline analysis, this appendix carefully considers each of ST's empirical claims as they relate specifically to applicant and student outcomes of Prop 209.

G.5.1   Chapter 8: The Warming Effect

Chapter 8 of ST presents evidence of increased application and yield rates among URM students to argue that "black and Hispanic students would like to have choices among elite colleges that use smaller preferences or none at all" (142). Their argument for increased yield rates, which draws heavily on Antonovics and Sander (2013), is consistent with the findings discussed above (and presented in Table A-5). Their argument for increased application rates among Black and Hispanic students is inconsistent with the findings above. They present five pieces of evidence to support their conclusion:

1. Black and Hispanic UC applications increased 1 and 7 percent, respectively, in 1998 (relative to 1997). Total applications increased by 7 percent (133).

2. "Black applications rose at seven of the eight UC campuses, and Hispanic applications rose at all eight" (133).

3. The proportion of high-SAT Black Berkeley applicants, and Black Berkeley applicants with a high likelihood of being admitted to Berkeley (based on SAT scores), increased in 1998 (133).

4. Card and Krueger (2005) "robustly" showed that "after the ban on racial preferences took effect, applications to UC schools from these very highly qualified blacks and Hispanics rose slightly, relative to whites and Asians" (136).

5. "From 1995-1997 to 1998-2000, score sending by academically gifted, out-of-state Hispanics to UC schools went up 12 percent. The number of gifted blacks sending scores went up 48 percent" (139).

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[100]In those authors' words, the Mismatch Hypothesis states that affirmative action leads targeted students to "learn less ... than had they gone to less competitive but still quite good schools ... [driving] these students to drop out of school, flee rigorous courses, or abandon aspirations to be scientists or scholars" (4).

Table G-8: Context for the Growth of UC URM Students and Degrees after Prop 209 Reported in *Mismatch*

	Cohort Years Initial	Final	URM Sample	Change for URM	Non-URM	Page in *Mismatch*
Chapter 9 Summary Statistics						
Freshman UC Enrollees	95-97	00-03	Black Hisp.	**-2%** **+22%**	+30%	154
UC Degrees	98-01[1]	04-07[1]	Black Hisp.	**+11%** **+33%**	+33%	154
Freshman UC Four-Year Degrees Freshman UC Four-Year STEM Deg. Freshman UC Four-Year >3.5 GPA Deg.	95-97	01-03	All All All	**+55%** **+51%** **+63%**	+70% +70% +85%	154
Additional Statistics						
UC Degrees	93-97	98-02	All	**~0%**	+26%	8
In-State Freshman Applicants	1997	1998	Black Hisp.	**+1%** **+7%**	**+7%**	133
Out-of-State Freshman High-*AI* Appl.	95-97	98-00	Black Hisp.	**+48%** **+12%**	+63%	139
Freshman UC Four-Year Degrees	92-94	98-00	Hisp.	**+78%**	+78%	147
UCLA Degrees	98-01[1]	2006[1]	Black All	**-20%** **~0%**	+29%	162

*Note: Only the estimates in **bold** were reported in* Mismatch.

Note: While the number of URM UC applicants, enrollees, and degree recipients of various subgroups increased after Prop 209, as reported by ST, the number of such *Non-URM* students usually grew at even higher rates (as a result of broad UC expansion), suggesting that URM growth may have been higher if not for Prop 209. Percent changes in the number of UC applicants, enrollees, or degree recipients by subgroup after the 1998 implementation of Prop 209. Bolded statistics are as reported in *Mismatch*, and most can be closely replicated; non-bolded statistics measured by the author. "Chapter 9 Summary Statistics" includes the full set of summary statistics presented to conclude ST's chapter on post-209 student outcomes, while "Additional Statistics" catalogs other presented statistics; the last column indicates the page on which the statistic was reported. Following ST, "URM" refers only to Black and Hispanic students, but I define "non-URM" as all students who are not Black, Hispanic, or Native American. 'Initial' and 'final' years indicate the pre- and post-209 comparison cohorts. "STEM" follows the definition of STEM used in the UC data analyzed by ST. I define High-*AI* (referred to as "academically gifted" by ST) by *AI* at or above 620, the 95-97 URM median. "On-time" freshman degrees are earned within four years. "> 3.5" indicates that graduates earned college grades above a 3.5 GPA; because of data availability, the non-URM estimate uses a 3.4 threshold. [1]These are the years the degrees were *awarded*, not the cohorts of degree recipients. Source: Sander and Taylor (2012) and UC Corporate Student System.

Points (1) and (2) note that URM applications rose at UC in 1998, which should be expected as a result of California's population growth and the increased popularity of UC enrollment throughout the 1990s.[101] But the number of Hispanic CA high school graduates grew by 7 percent in 1998, compared to 4 percent among all other groups, suggesting that UC applications could have been expected to grow *more* among Hispanic students than among non-URM students. As shown in Figure 7 in the main text, which accounts for changes in the composition of California high school graduates by ethnicity and academic index, the number of Black and Hispanic UC applicants declined by over 1,000 in 1998 (compared to 1994-1995) relative to what would have been expected given the steadily-growing number of non-URM UC applications.[102]

Points (3) and (4) rely on proxying UC applications with data showing which SAT-takers sent their stan-

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[101]The number of CA high school graduates increased by 5 percent from 1997 to 1998, and the percent of graduates who applied to UC increased by 2 percent. The number of Hispanic graduates increased from 82,000 to 88,000 from 1997 to 1998.

[102]Hadley (2005) similarly underestimates the effect of Prop 209 URM UC enrollment by ignoring UC campuses' overall growth in the late 1990s and early 2000s.

dardized test scores to UC. While 'score sends' are a necessary step in applying to UC, they are not sufficient, and the decision to send scores is typically made before actual college application. As shown in Appendix G.3, 'score sends' proved an unreliable measure of university applications in the years after Prop 209, and the results presented by Card and Krueger (2005) do not hold when 'score sends' are replaced with actual applications: in fact, the relative likelihood of high-testing URM SAT-takers applying to at least one UC campus declined in 1998.

Point (5) ignores that the number of *non-URM* out-of-state UC applications increased by 63 percent over the same period, part of a steady increase in out-of-state UC applications as UC's national reputation improved and American college applicants warmed to out-of-state universities (Hoxby, 2009). Table G-8 catalogs several similarly-misleading cases in which ST report changes in URM student growth without comparison to the observed change for non-URM students. Many such changes over time are better explained by longer-run ethnicity-neutral trends (like the steady growth of UC campuses) than by Prop 209.

I conclude that Black and Hispanic application rates declined following Prop 209, suggesting that URM applicants did not broadly 'warm' to UC campuses after Prop 209.

G.5.2   Chapter 9: Mismatch and the Swelling Ranks of Graduates

Chapter 9 of ST presents evidence of several apparently-positive trends for URM UC students following Prop 209: increased numbers of URM graduates, improved first-year grades, increased graduation rates and STEM degree attainment, and decreased time to degree. While short sections discuss UC transfer students' admission and graduation rates after Prop 209, the chapter largely focuses on the California-resident freshman-admit student body analyzed in the present study. ST's conclusions regarding graduation rates and STEM degree attainment conflict with this study's baseline findings, and are discussed below in turn.[103]

ST provide four sets of statistics supporting their conclusion that Prop 209 increased URM students' likelihood of graduation:

1. "The total number of black and Hispanic students receiving bachelor's degrees was the same for the five classes after Prop 209 as for the five classes before" (8).

2. UC URM graduation rates increased after Prop 209. "Even though the number of black freshmen in the UC system fell almost 20 percent from 1997 to 1998, the number of black freshmen who obtained their degrees in four years barely dipped for this class, and the entering class of 2000 produced, four years later, a record number of blacks graduating on time" (146).

3. The number of Hispanic freshman on-time graduates increased from 2,005 total in 92-94 to 3,577 in 98-00 (147).

4. Arcidiacono et al. (2014) show an increase in URM graduation rates relative to academically-similar non-URM graduation rates (147).

Point 4 is discussed in detail in Appendix G.2, and can be explained by selection bias: Black and Hispanic graduation rates appeared to increase because lower-AI URM students were excluded from UC after Prop 209, mechanically increasing average UC URM graduation rates. Points 1, 2, and 3 can be explained by ethnicity-neutral growth in UC's student body, generally-improved UC student outcomes, and selection bias. For example, Table G-8 shows that while the number of URM UC degrees awarded in 98-02 was similar to the number awarded in 93-97, the number of non-URM UC degrees awarded in that period increased by 26

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[103]ST also state that "Before Prop 209, racial preferences at Berkeley at UCLA were very large (and close to national norms), whereas preferences at the less elite UC campuses were generally modest" (145). Figure 1 suggests otherwise, though it confirms ST's claim that URM students maintained an admissions advantage relative to similar-AI non-URM students following Prop 209 (ST 145).

percent, suggesting that URM degree attainment would have likely substantially increased absent Prop 209. The number of 1998 Black UC freshmen who earned degrees in four years increased by 3 percent from 1997 to 2000, but the number of non-URM UC freshmen who did so increased 42 percent. Table G-8 shows similar patterns for several other related statistics.

ST provide four sets of statistics supporting their conclusion that Prop 209 increased URM students science persistence:

1. "UC-wide, the number of black and Hispanic students graduating with STEM degrees steadily increased after the admissions reforms of 1998, and the number of science-interested students never graduating steadily fell" (150).

2. "The share of black and Hispanic students majoring in STEM fields rose as well" (150).

3. "Marc Luppino, Roger Bolus, and one of us (Sander) completed an analysis of the UCOP data ... [and] measured substantial mismatch effects for a variety of science outcomes" (150).

4. "The number of UC black and Hispanic freshmen who went on to graduate in four years with STEM degrees rose 51 percent from 1995-1997 to 2001-2003" (154).

Points 1, 2, and 4 each follow the same patterns described in the previous paragraphs, and likely result from UC's 1990s growth and general improvement and selection bias among URM students. For example, the number of *non-URM* UC freshmen who earned STEM degrees in four years rose 70 percent from 95-97 to 01-03, compared to a 51 percent increase among URM students (see Table G-8). Point 3 cannot be confirmed – I am unaware of any study by Luppino, Bolus, and Sander and it does not appear to be publicly available – but its estimates likely exhibit selection bias as a result of data censorship in their available UCOP data (as in Arcidiacono et al. (2014)).

Table A-18 shows that URM students' grades in introductory UC Berkeley courses improved following Prop 209, though this improvement can be wholly explained by differential selection (with the remaining students having higher AIs). In sum, I conclude that the evidence presented in Sander and Taylor (2012) provides no reason to doubt that Prop 209 *decreased* URM UC students' degree attainment and STEM major choice, as evidenced in the main text, as opposed to ST's Mismatch Hypothesis claiming the opposite.

G.6   URM and Non-URM Admissions by UC Campus and AI, 1994-2001
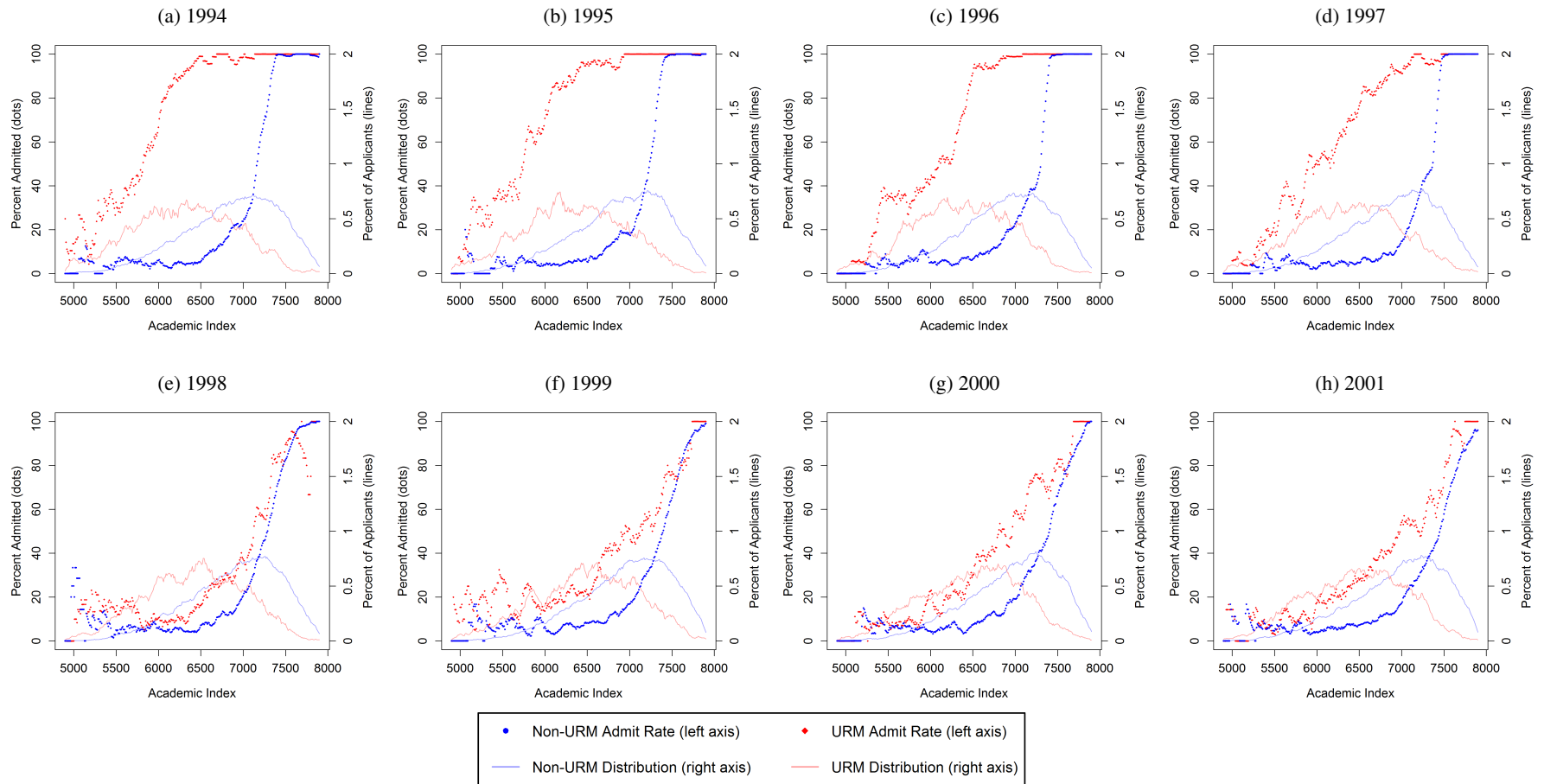
The figures below show the raw admissions likelihood and application distribution of URM and non-URM applicants to each UC campus by Academic Index from 1994 to 2001. The figures clarify how affirmative action was practiced by different UC campuses before 1998, and how Prop 209 changed the admissions likelihood of URM applicants (and, to some degree, non-URM applicants).[104] 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 1.

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

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[104]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-2). They are omitted from the figures in this Appendix.

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.

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

(a) 1994   (b) 1995   (c) 1996   (d) 1997

(e) 1998   (f) 1999   (g) 2000   (h) 2001

- Non-URM Admit Rate (left axis)   ◆ URM Admit Rate (left axis)

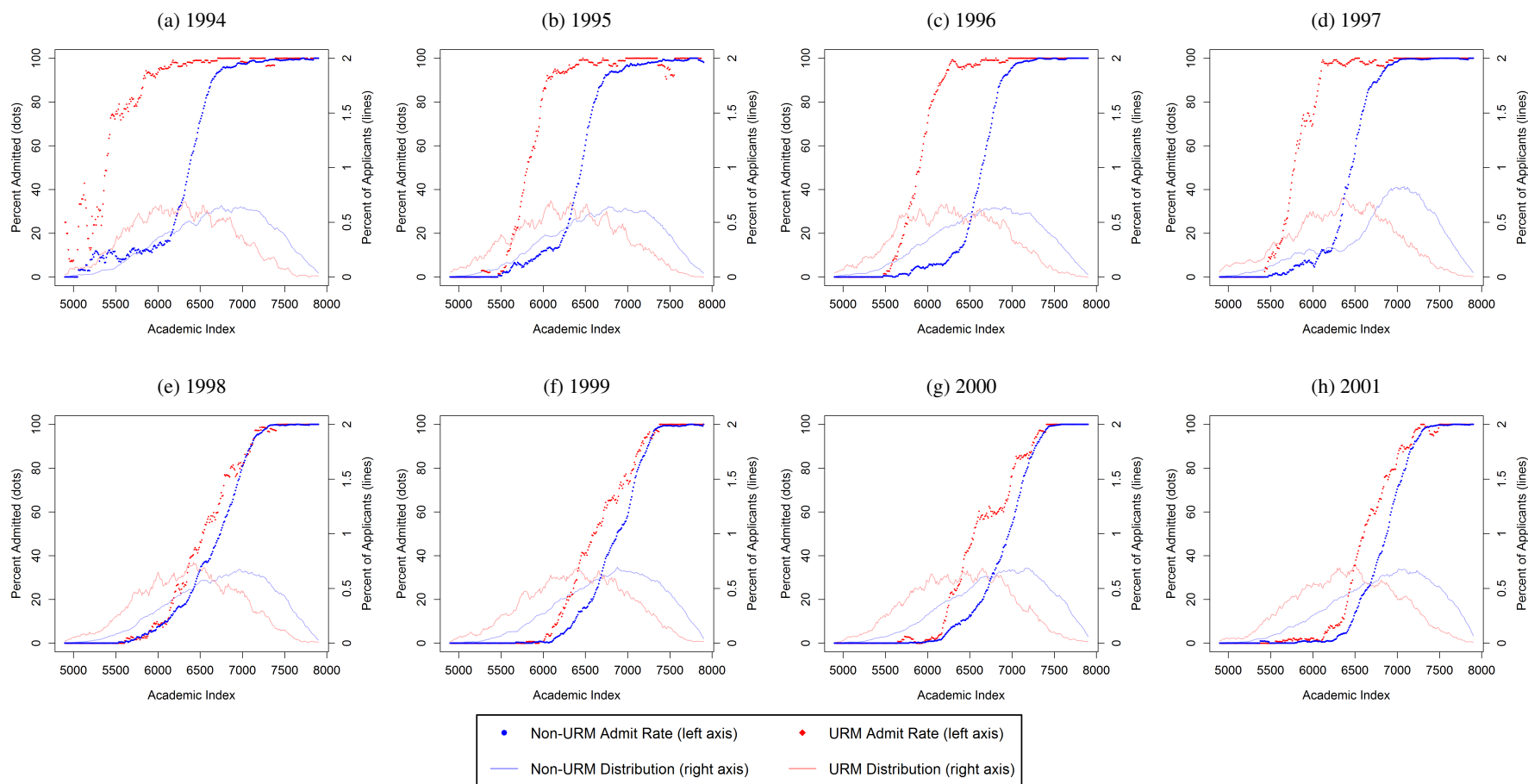 Non-URM Distribution (right axis)   URM Distribution (right axis)

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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

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Figure G-2: Annual "Normal" Admissions at UCLA
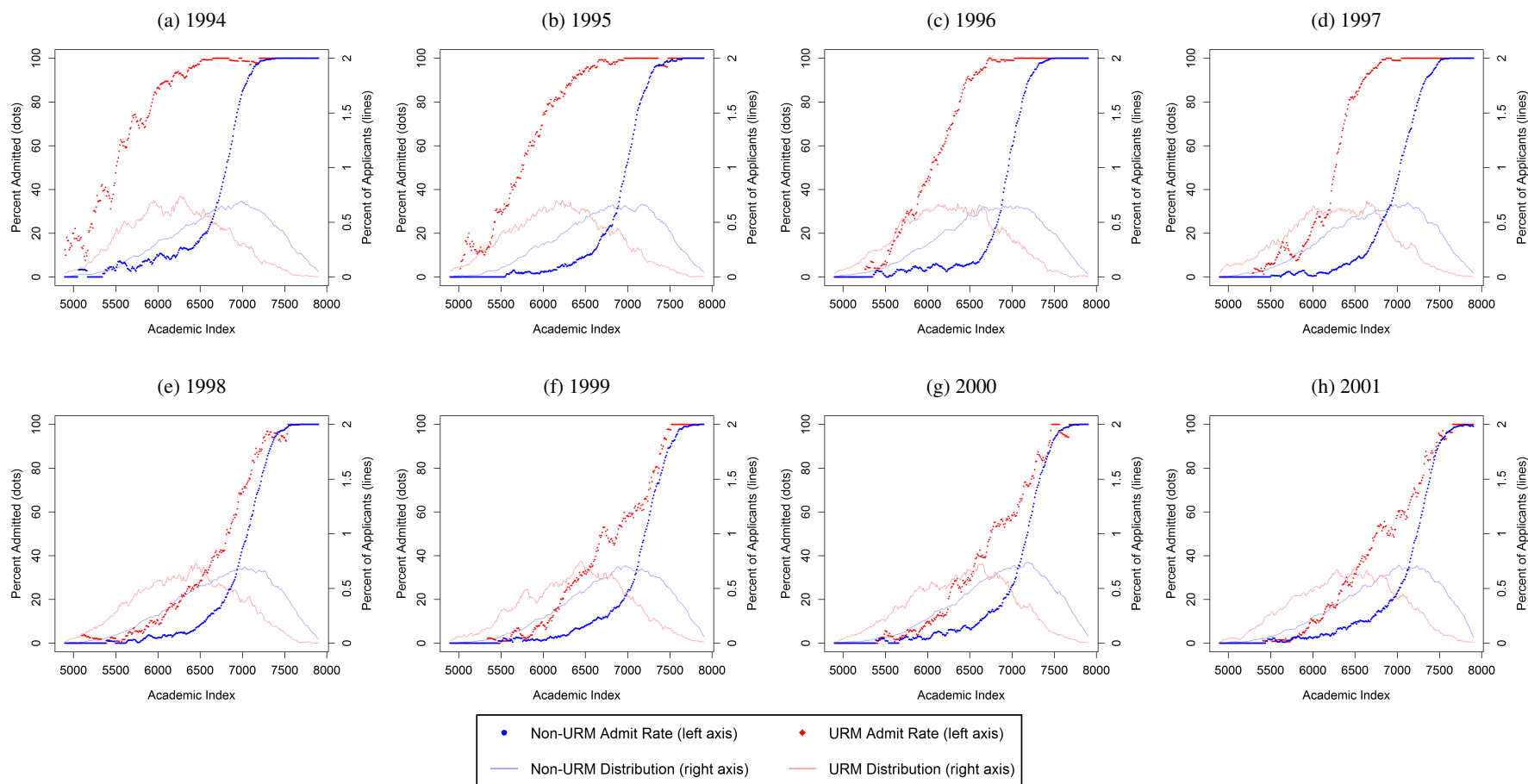
Note: This figure shows the 1994-2001 annual UCLA admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UCLA applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UCLA by Academic Index (AI) – the sum of (top-censored) 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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure G-3: Annual "Normal" Admissions at UC San Diego

(a) 1994   (b) 1995   (c) 1996   (d) 1997

(e) 1998   (f) 1999   (g) 2000   (h) 2001

- Non-URM Admit Rate (left axis)
- URM Admit Rate (left axis)
- Non-URM Distribution (right axis)
- URM Distribution (right axis)

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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.
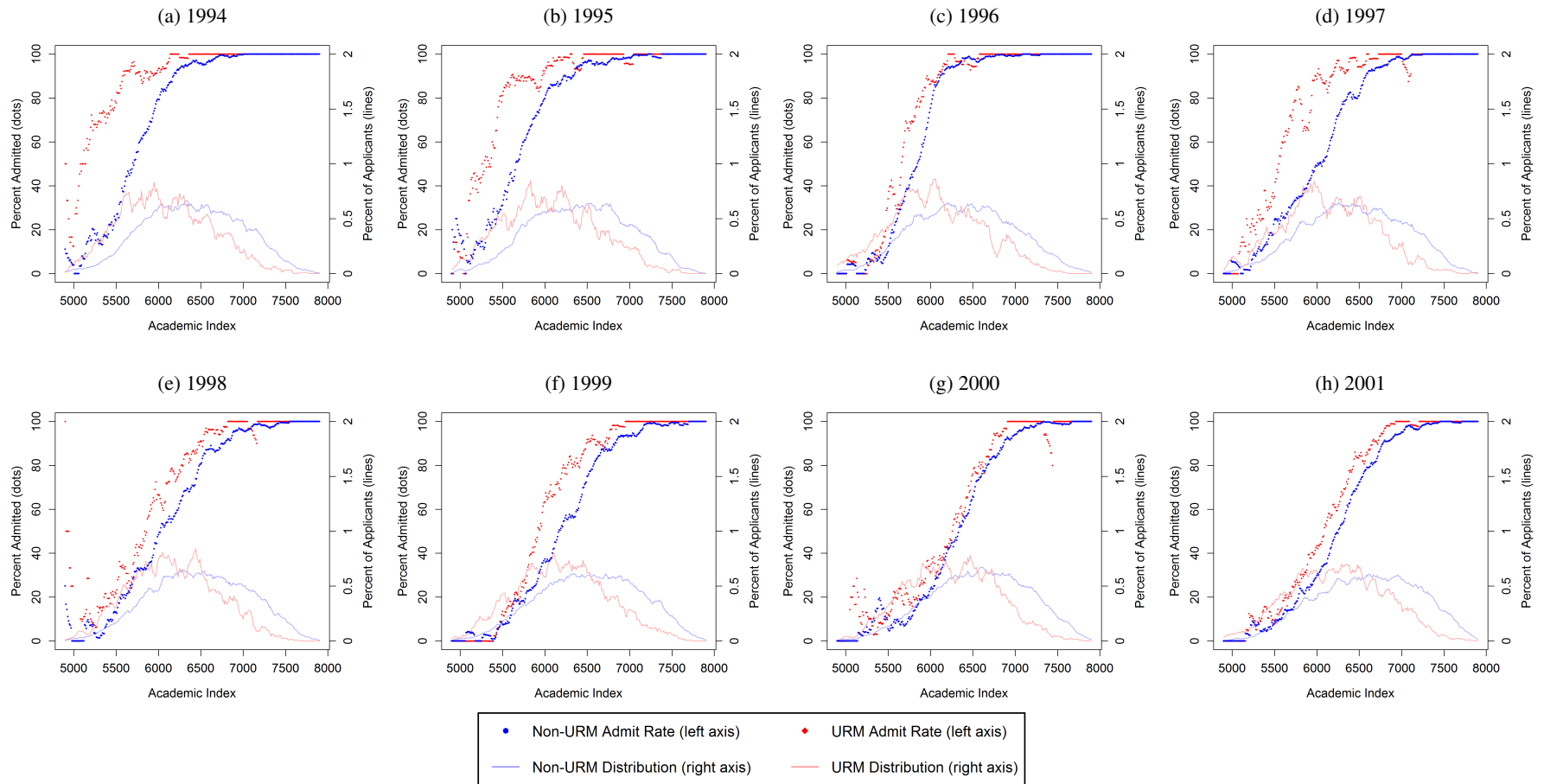
Figure G-4: Annual "Normal" Admissions at UC Santa Barbara
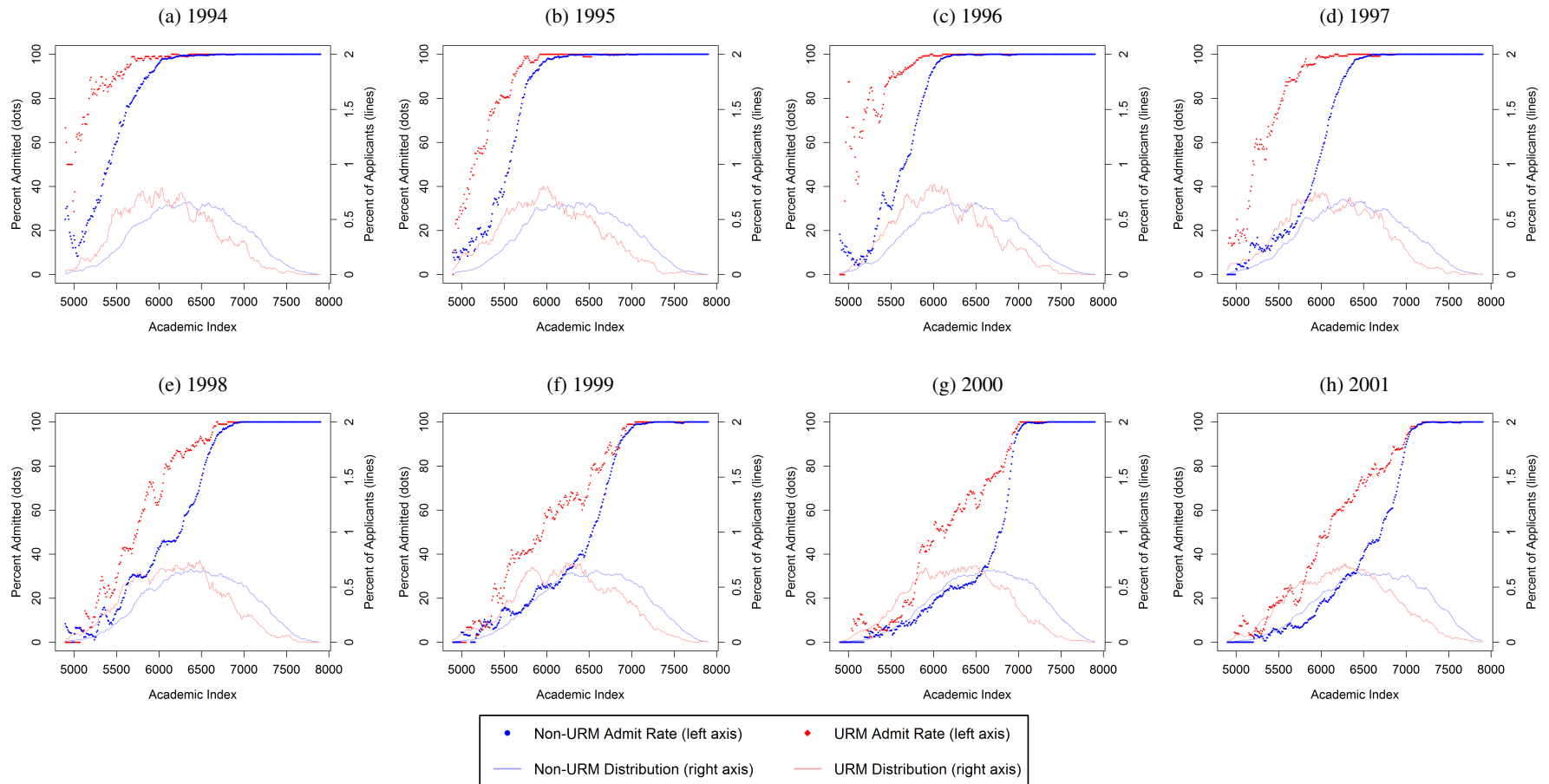
Note: This figure shows the 1994-2001 annual UC Santa Barbara admissions rate for URM and non-URM applicants by Academic Index, as well as the annual distribution of UC Santa Barbara applicants by Academic Index and ethnicity. Raw percent of URM and non-URM students admitted to UC Santa Barbara by Academic 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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure G-5: Annual "Normal" Admissions at UC Irvine

(a) 1994 | (b) 1995 | (c) 1996 | (d) 1997

(e) 1998 | (f) 1999 | (g) 2000 | (h) 2001

- Non-URM Admit Rate (left axis)
- URM Admit Rate (left axis)
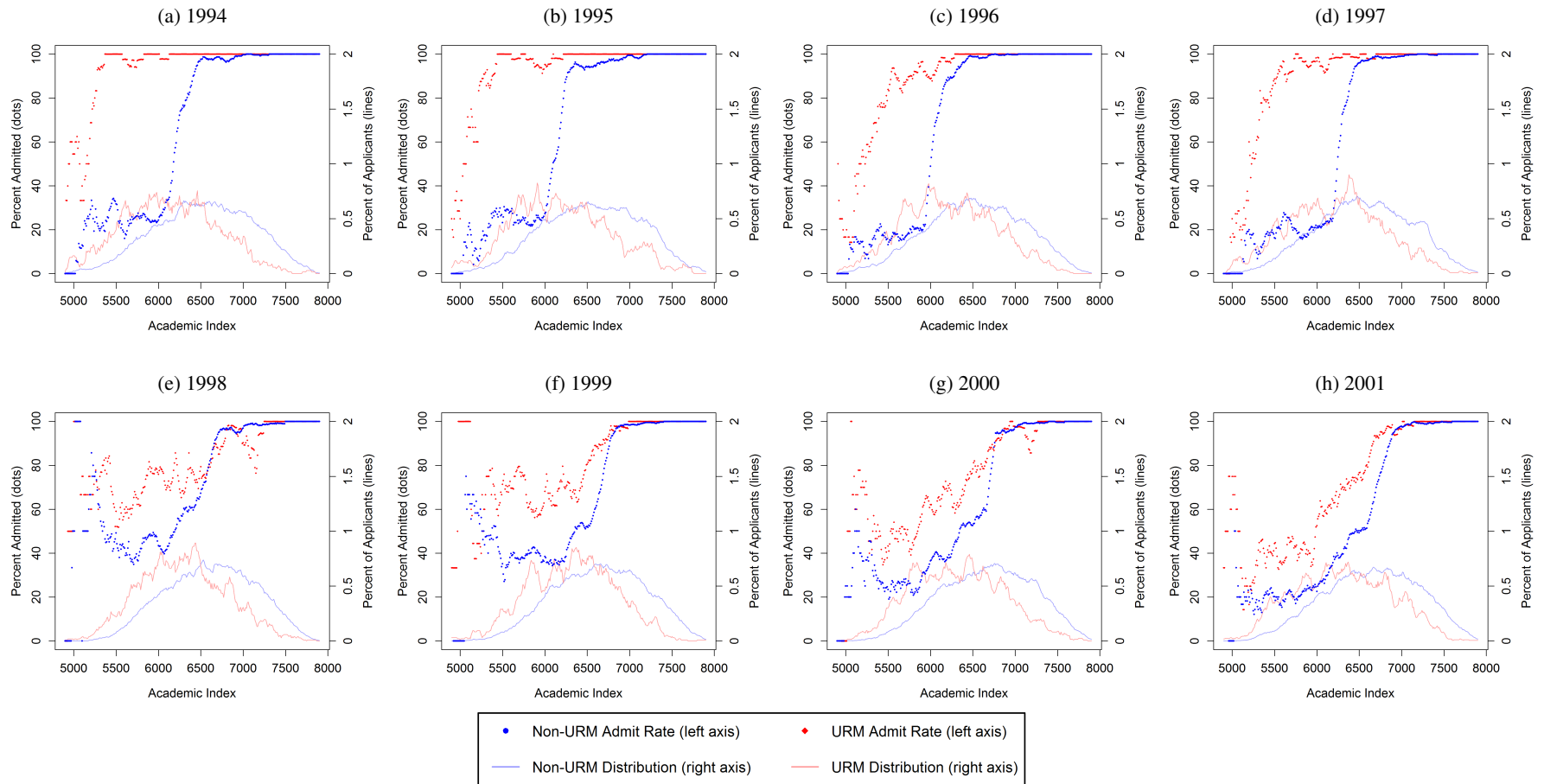- Non-URM Distribution (right axis)
- URM Distribution (right axis)

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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure G-6: Annual "Normal" Admissions at UC Davis

(a) 1994   (b) 1995   (c) 1996   (d) 1997

(e) 1998   (f) 1999   (g) 2000   (h) 2001

Legend:
- Non-URM Admit Rate (left axis)
- URM Admit Rate (left axis)
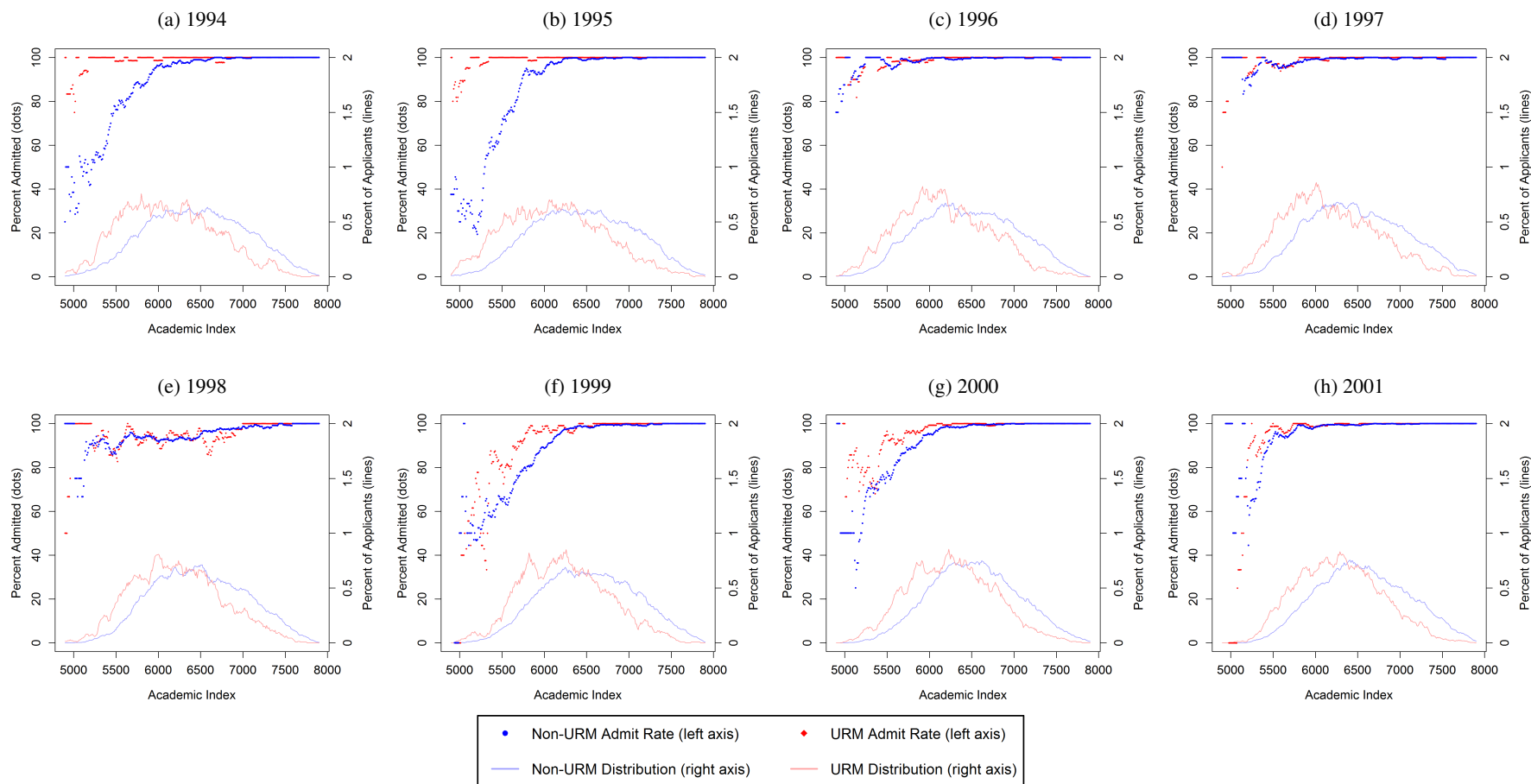- Non-URM Distribution (right axis)
- URM Distribution (right axis)

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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.

Figure G-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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.
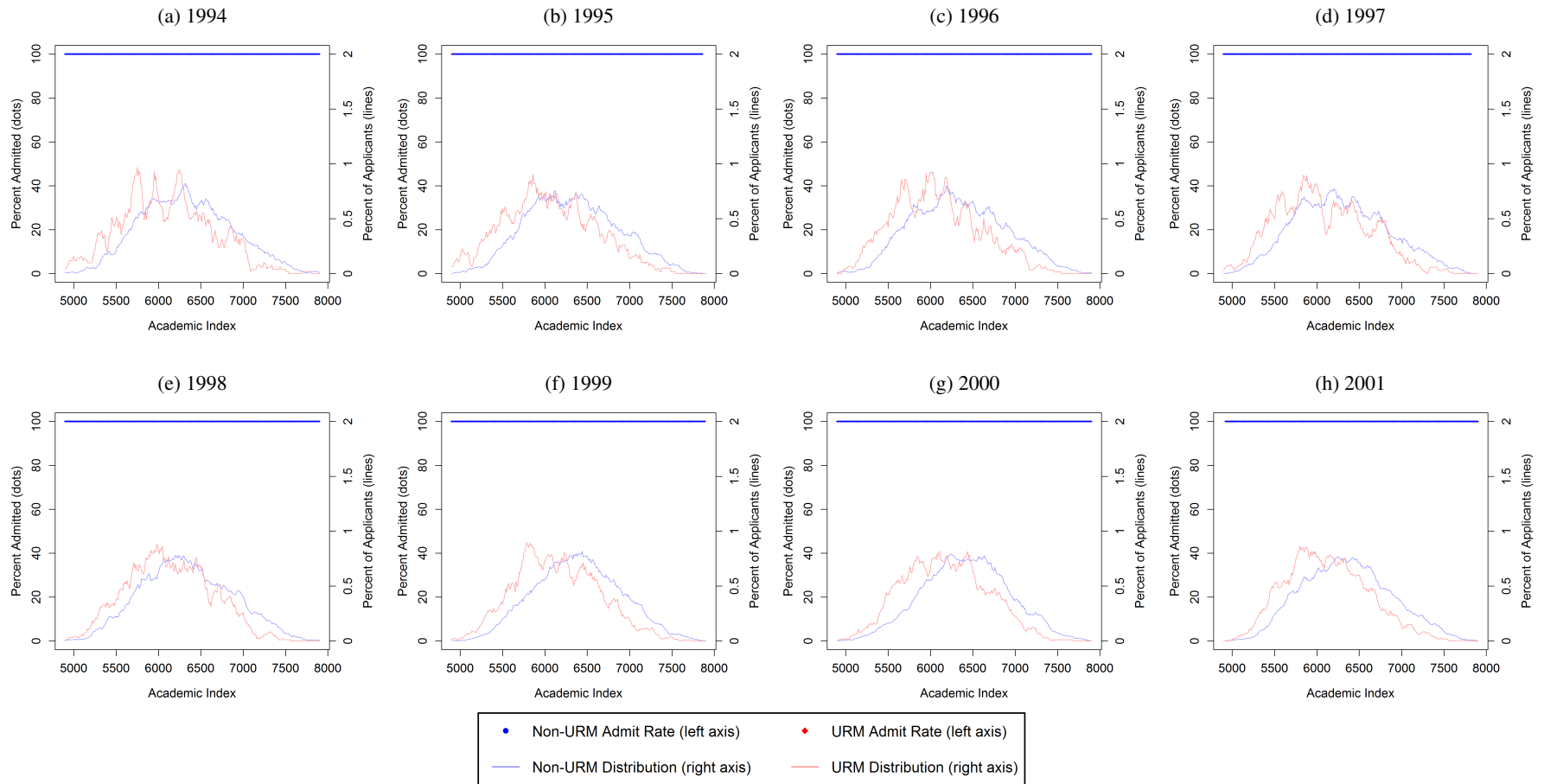
Figure G-8: Annual "Normal" Admissions at UC Riverside

(a) 1994 (b) 1995 (c) 1996 (d) 1997

(e) 1998 (f) 1999 (g) 2000 (h) 2001

Legend:
- Non-URM Admit Rate (left axis)
- URM Admit Rate (left axis)
- Non-URM Distribution (right axis)
- URM Distribution (right axis)

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-2) and are omitted from these figures; URM includes American Indian, African American (Black), and Chicano applicants. Source: UC Corporate Student System.
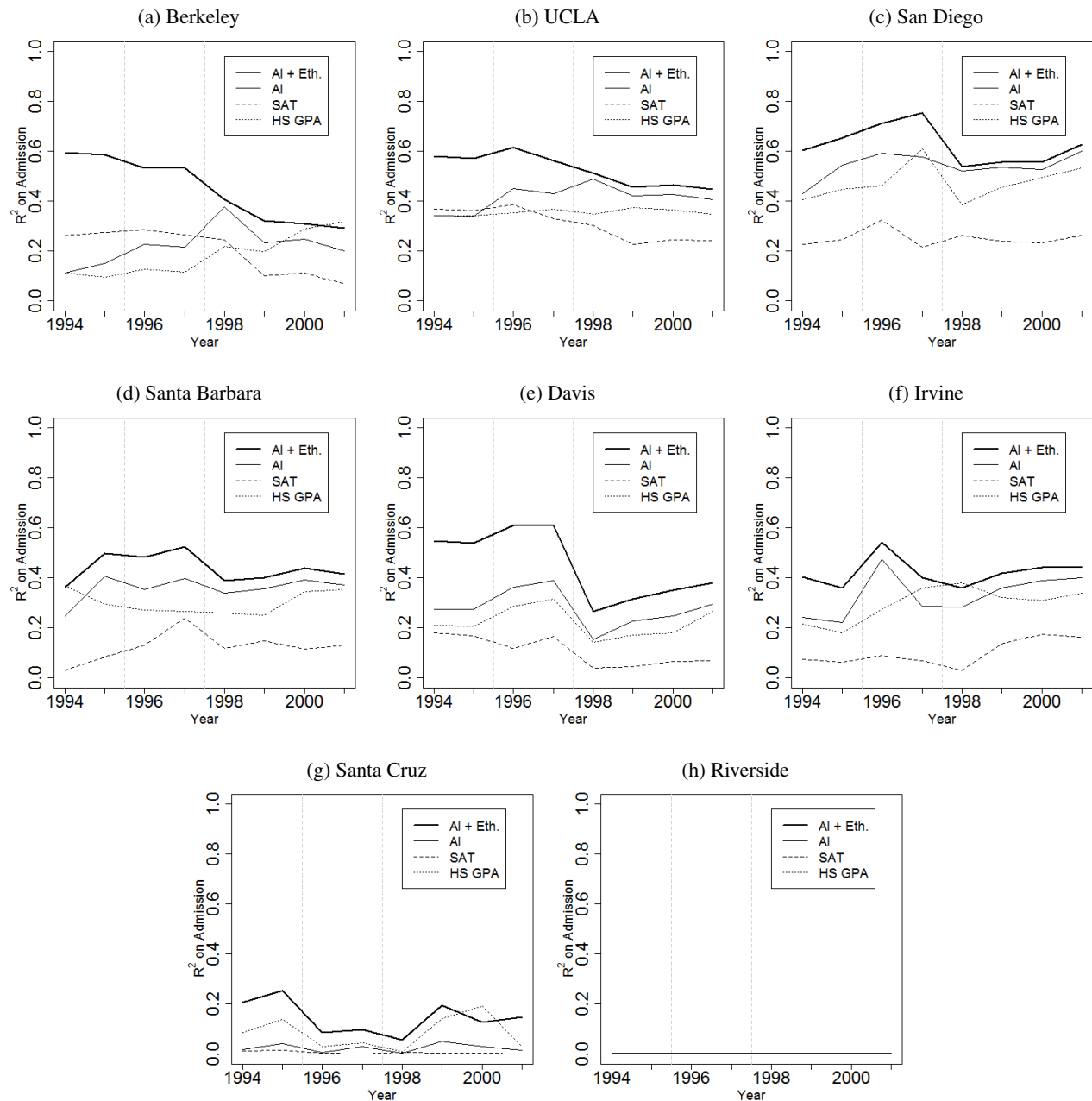
G.7 Other Appendix Tables and Figures

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

(a) Berkeley (b) UCLA (c) San Diego

(d) Santa Barbara (e) Davis (f) Irvine

(g) Santa Cruz (h) Riverside

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-4 shows the differences between the first and second line for each campus. Source: UC Corporate Student System.

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.
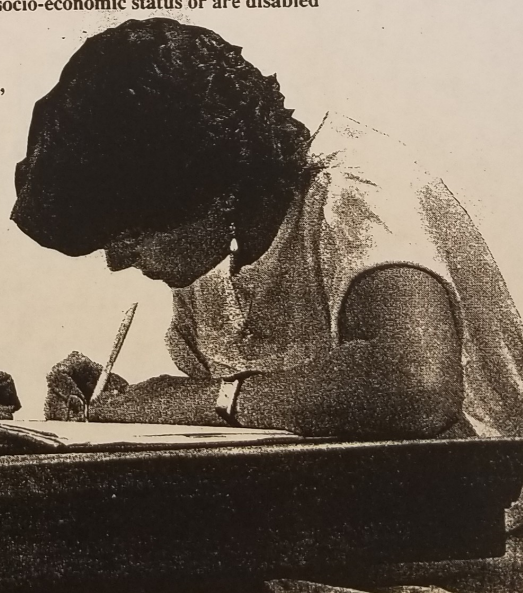
Figure A-3: Annual Difference-in-Difference Estimates of Post-1998 URM Admissions by UC Campus

Panel A: More-Selective UC Campuses

(a) Admission

(b) Enrollment
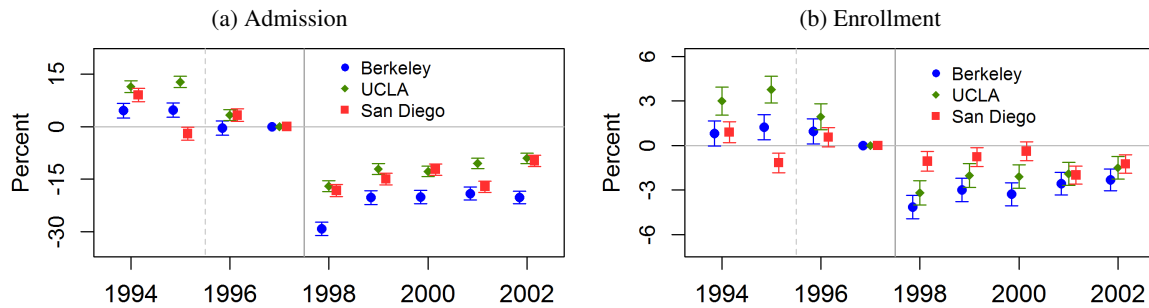
Panel B: Selectivity UC Campuses

(c) Admission

(d) Enrollment
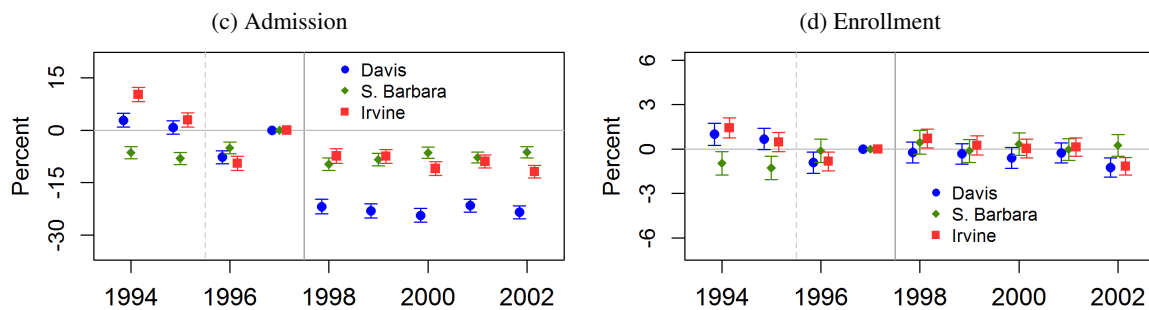
Panel C: Less-Selective UC Campuses

(e) Admission

(f) Enrollment
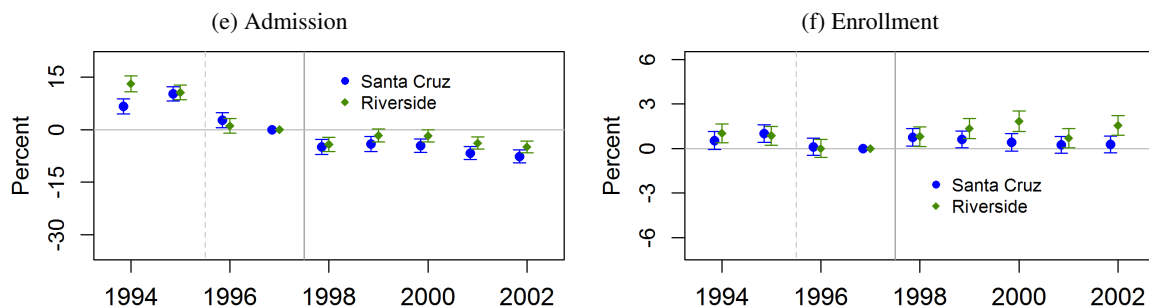
Note: This figure shows that URM UC applicants' admissions likelihood sharply and persistently declined at every UC campus in exactly 1998, but that some campuses also exhibited declines in 1996. OLS difference-in-difference coefficient estimates of the change in URM applicants' likelihood of admission 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 44). 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-4: Estimated Annual First-Order Contribution of Ethnicity to UC Campuses' Admissions Decisions
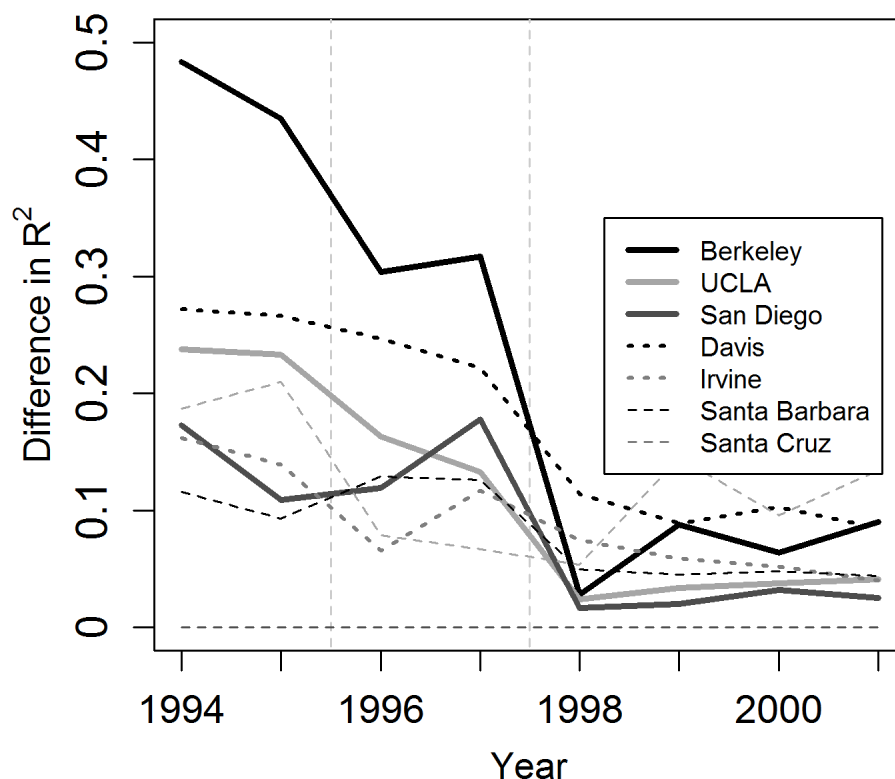
Note: This figure shows that the share of variation in admissions at each UC campus that could be explained by ethnicity (above that explained by AI) fell across all campuses in 1998, though it had begun to fall at some campuses by 1996. Each point measures the difference in R^2 coefficients between 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.

Table A-1: 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	14,384	17,398	19,722	37.4	32.3	30.9	15.1	14.0	13.9
UCLA	16,648	20,178	23,859	44.4	37.4	33.9	15.3	13.3	13.5
San Diego	15,710	18,992	22,905	63.1	60.1	48.3	15.3	12.9	12.2
Santa Barbara	12,888	14,760	18,672	84.5	74.9	57.7	18.5	18.4	14.7
Irvine	11,663	13,136	16,060	76.2	71.3	64.2	19.8	19.4	17.5
Davis	13,363	15,063	17,094	71.1	72.0	67.7	18.8	19.7	17.8
Santa Cruz	7,466	8,142	9,936	85.3	85.4	81.1	16.7	18.8	17.6
Riverside	6,954	7,433	10,166	82.0	85.7	88.0	14.7	17.9	17.4
All UCs	33,415	37,792	42,066	84.9	83.6	83.9	49.7	49.4	49.6

Average SAT Score

Berkeley	1250	1256	1263	1371	1375	1368	1345	1349	1339
UCLA	1209	1215	1228	1316	1333	1343	1262	1283	1299
San Diego	1212	1213	1223	1274	1298	1307	1224	1250	1260
Santa Barbara	1141	1144	1166	1162	1183	1224	1122	1156	1190
Irvine	1146	1151	1161	1186	1194	1213	1127	1137	1159
Davis	1181	1184	1187	1232	1231	1230	1171	1176	1169
Santa Cruz	1156	1154	1157	1177	1173	1180	1153	1151	1155
Riverside	1115	1115	1119	1137	1134	1136	1095	1091	1092
All UCs	1183	1188	1194	1207	1212	1216	1196	1208	1217

Panel B: URM Applicants

Average Number or Percent of Applicants

Berkeley	3,638	3,972	4,036	54.1	48.1	23.8	19.6	19.0	10.4
UCLA	4,962	5,245	5,501	55.4	42.5	24.8	21.4	16.7	11.3
San Diego	3,166	3,376	4,080	59.4	57.5	32.6	12.2	11.8	8.4
Santa Barbara	3,256	3,602	4,086	77.1	77.0	54.4	16.4	18.0	15.4
Irvine	2,956	2,814	3,311	73.5	62.6	54.8	15.8	13.0	14.2
Davis	2,656	2,684	2,918	83.2	83.2	62.7	21.8	18.6	17.9
Santa Cruz	2,276	2,128	2,338	83.6	81.2	72.9	16.0	14.5	15.5
Riverside	2,264	2,351	3,266	79.6	77.1	79.6	19.7	18.3	20.2
All UCs	9,665	9,678	10,124	81.1	79.2	73.4	47.0	44.2	39.8

Average SAT Score

Berkeley	1073	1089	1104	1153	1169	1202	1132	1139	1146
UCLA	1032	1049	1068	1121	1156	1188	1091	1119	1142
San Diego	1062	1070	1084	1127	1152	1198	1092	1120	1165
Santa Barbara	1010	1022	1044	1046	1059	1105	1002	1024	1076
Irvine	999	1014	1027	1045	1072	1100	1006	1028	1064
Davis	1050	1057	1069	1084	1092	1111	1052	1073	1076
Santa Cruz	1012	1018	1032	1035	1043	1061	992	1014	1039
Riverside	960	969	984	986	997	1011	965	961	969
All UCs	1027	1040	1050	1056	1072	1083	1054	1073	1079

Note: This table shows campus-specific descriptive statistics mirroring Table 1. 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-2: 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-3: 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-4: Difference-in-Difference Estimates of Post-1998 Black and Hispanic Application by UC Campus

Campus:	UCB	UCLA	UCSD	UCSB	UCI	UCD	UCSC	UCR	Total
Admission conditional on application (%), Black									
Black	49.8	44.4	28.8	22.8	23.8	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	-25.5	-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	-13.5	-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: This table shows that Black and Hispanic UC applicants generally faced similar declines in UC admissions likelihood after Prop 209, with Black applicants facing larger declines at some campuses. OLS coefficient estimates of β_0 and $\beta_{\cdot98-99}$ 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. Hispanic students are dropped from the sample in Panel A, and Black students are dropped from Panel B; Native American students are dropped from both panels. Models include high school fixed effects and the components of UC's Academic Index (see footnote 44), and are estimated independently by campus or "Total" (all applicants to any UC campus). Robust standard errors in parentheses. Source: UC Corporate Student System.

Figure A-5: Average Family Income of Berkeley and UCLA Students by Ethnicity Before and After Prop 209

(a) Distribution of Incomes

(b) Change in Distributions After Prop 209
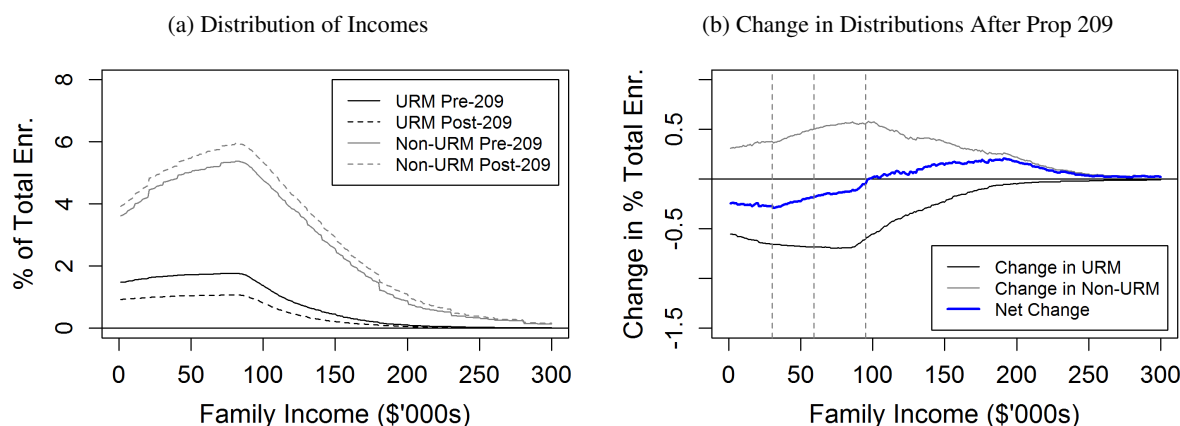
Note: This figure shows that the URM students who enrolled at UC Berkeley and UCLA under affirmative action had substantially lower average incomes than the non-URM students who crowded into those campuses following Prop 209, leading to a substantial net shift of students from the bottom three income 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-6: 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

(a) UC Berkeley   (b) UCLA   (c) UC San Diego

(d) Selective UCs   (e) Less-Selective UCs

URM ——   Non-URM - - -
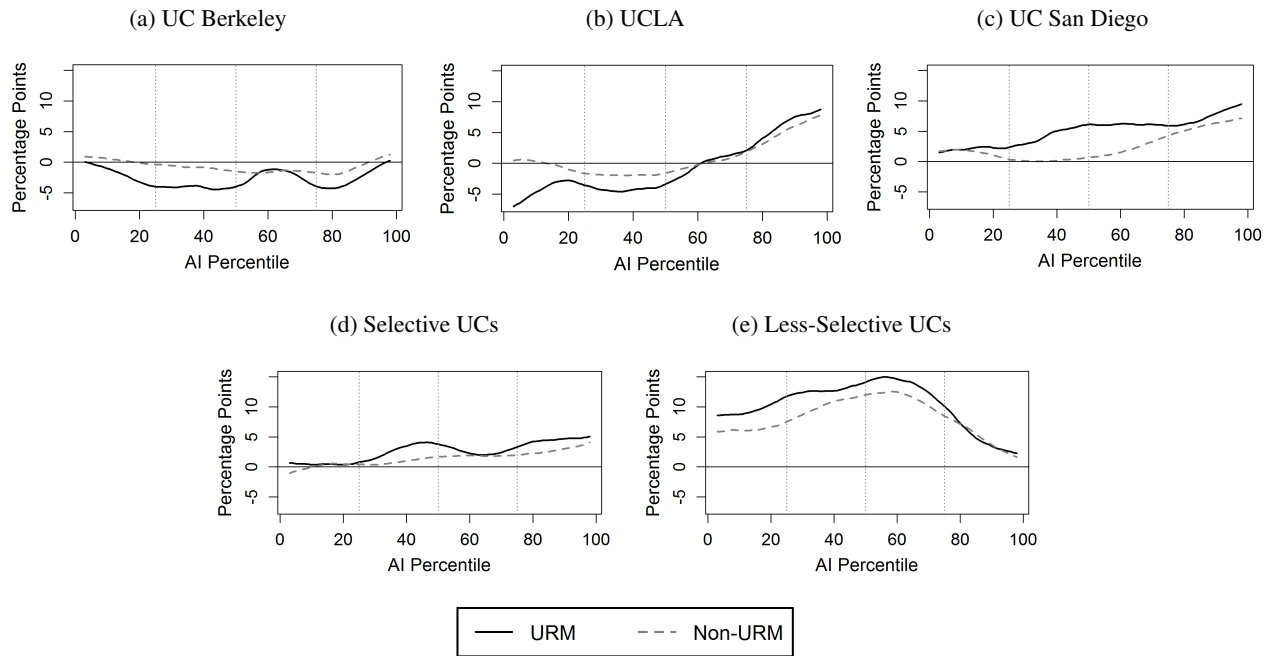
Panel B: Changes in UC Campus Admission Likelihood by *AI* and Ethnicity, Among Applicants

(f) UC Berkeley   (g) UCLA   (h) UC San Diego

(i) Selective UCs   (j) Less-Selective UCs

URM ——   Non-URM - - -
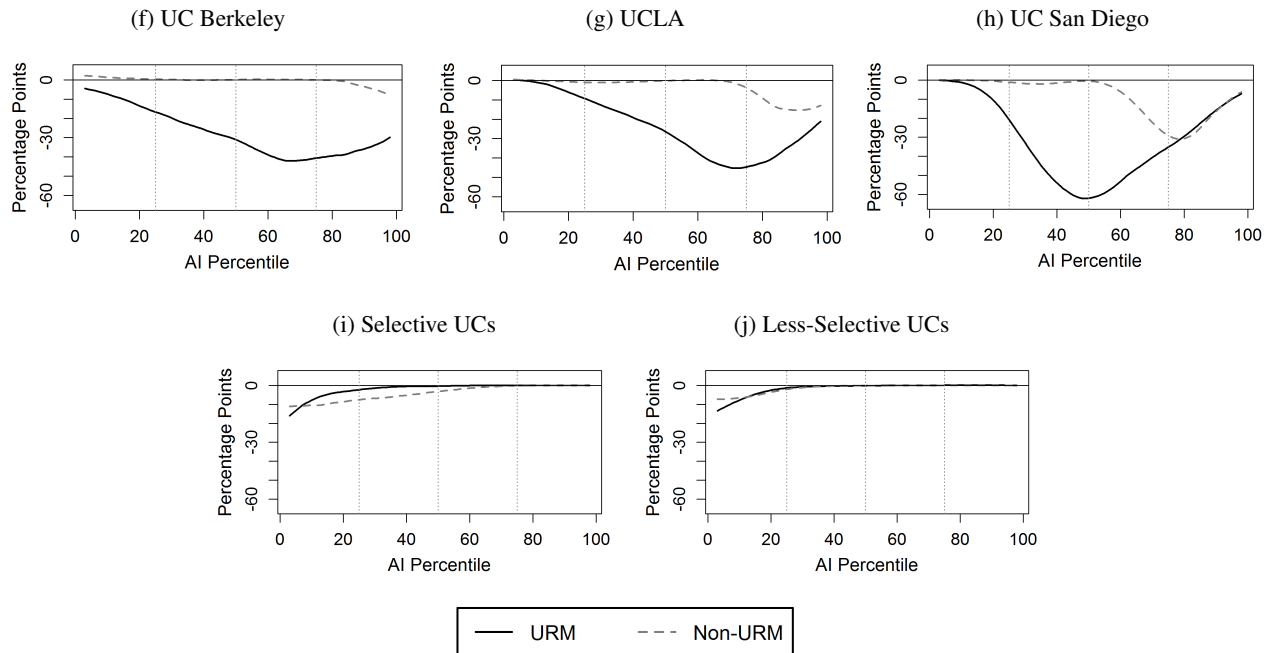
Note: This figure shows that changes in application patterns among URM UC applicants did not closely mirror changes in those applicants' UC admissions likelihood following Prop 209; for example, high-*AI* URM applicants were (relatively) no less likely to apply to UCLA after Prop 209 despite sharp declines 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.

Table A-5: 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	8.1	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	-9.2	-5.8	-3.3	1.6	2.7	0.2	2.3	1.8	-5.7
	(0.6)	(0.5)	(0.5)	(0.7)	(0.7)	(0.8)	(0.9)	(0.8)	(0.5)
$\bar{Y}$	16.7	13.9	12.2	16.6	17.7	18.8	17.6	18.0	49.7
Obs.	90,254	109,566	98,705	82,240	70,643	75,518	45,087	46,434	199,321
Enrollment conditional on **admission** (%)									
URM	-17.3	-17.1	-16.3	-8.5	-15.8	-15.1	-8.9	-8.0	-1.7
	(1.1)	(1.0)	(0.8)	(0.7)	(0.9)	(0.8)	(0.9)	(1.0)	(0.5)
URM × Prop 209	7.6	6.6	9.1	5.9	6.4	9.4	5.4	5.4	-2.1
	(1.5)	(1.3)	(1.2)	(1.0)	(1.1)	(1.1)	(1.1)	(1.1)	(0.7)
$\bar{Y}$	44.8	39.0	24.9	25.5	26.9	27.3	21.5	21.7	60.3
Obs.	28,437	37,716	47,718	51,906	45,346	50,316	34,968	35,752	156,338

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 $\beta_{'98-99}$ 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 44), and are estimated independently by campus or "Total" (all applicants to any UC campus). Robust standard errors in parentheses. Source: UC Corporate Student System.

Table A-6: 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	10.5	-4.5	-2.8	-3.6	-3.8	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	1.0	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	6.4	13.8	11.9	2.7	9.3	8.5	6.3
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	3.5	2.2	-0.1	1.5	0.3	-0.0
	(0.6)	(0.9)	(0.8)	(1.4)	(1.2)	(0.1)	(0.8)	(0.7)	(0.8)
Second Quartile	-12.6	4.3	3.2	3.0	0.8	-0.1	1.5	2.2	-2.2
	(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	0.2	-0.1	1.6	1.3	-0.1
	(1.0)	(1.0)	(0.6)	(0.7)	(0.7)	(0.2)	(0.8)	(0.6)	(0.6)
Top Quartile	-4.5	1.0	0.6	0.3	0.6	1.1	0.5	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	-4.3	-1.8	-5.2	-2.8	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	1.9	-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	6.3	14.0	11.4	2.8	8.8	8.6	6.9
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 $\beta_{.98-99}$ 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 44). 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 22; 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-7: Estimated Change in UC URM Enrollment, '94-95 to '98-99

UC Campus	Change in App. Pool		Change in Adm. and Yield		
	Increase	Decrease	Increase[†]	Decrease[†]	Total
Berkeley	0	-93	4	-327	-415
UCLA	0	-122	0	-496	-618
San Diego	0	-36	127	-41	50
Santa Barbara	0	-32	341	-25	284
Irvine	0	-36	150	-50	64
Davis	0	-53	91	-140	-103
Santa Cruz	0	-46	11	-85	-119
Riverside	0	-38	105	-7	61
Total	0	-455	830	-1172	-797

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 7) and (2) the raw difference-in-difference in URM UC applicants' enrollment at each campus by AI bin (smoothed across bins as in Figure 3), 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 substantially 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-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	-7.5	-4.7	-6.2	-8.2	3.7	0.9	4.3	0.7
	(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	-2.2	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	0.4	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	-0.8
	(0.5)	(0.5)	(0.3)	(0.5)	(0.4)	(0.2)	(0.4)	(0.3)	(0.3)
$\bar{Y}$	21.9	19.5	6.4	13.8	11.9	2.7	9.3	8.5	6.3
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	-0.8	5.7	2.9	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	4.7	-2.1	-0.6	0.1	4.0	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	1.3	0.4	-1.5	0.2	4.8	4.7	-1.1
	(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	2.2	2.9	4.6	1.7	-2.0
	(2.3)	(1.4)	(0.8)	(0.9)	(0.9)	(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	0.2	3.0	1.8	-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	1.1	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	2.6	-1.1	0.0	0.2	0.8	0.8	-0.1
	(1.1)	(1.2)	(0.7)	(0.9)	(0.8)	(0.2)	(0.9)	(0.6)	(0.6)
Top Quartile	-2.7	1.0	0.5	0.2	0.2	0.3	0.2	-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-6. 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 44). 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 22; 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: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Univ. Characteristics

| | First Four-Year Institution | | | First Institution of Enrollment | | | | URM Share | |
	Adm. Rate	Avg. SAT	6 Yr. BA Rate	"MH" VA[1] BA 6	"MH" VA[1] Earn 30s	"CFSTY" VA[1] BA 6	"CFSTY" VA[1] Earn 30s	Contemp.	Fixed '95
Panel C: Difference-in-Difference Coefficients (versus 1995)									
URM	-5.4	48.1	3.7	1.8	1,915	2.9	2,930	0.9	1.5
	(0.3)	(2.2)	(0.2)	(0.2)	(101)	(0.2)	(115)	(0.2)	(0.2)
URM × Prop. 209	3.0	-30.2	-2.8	-0.5	-470	-1.0	-1,096	0.9	0.3
	(0.3)	(2.5)	(0.2)	(0.2)	(114)	(0.2)	(130)	(0.2)	(0.2)
$\bar{Y}$	48.7	1,773.5	74.7					19.3	21.6
Obs.	112,477	110,659	112,660	130,981	128,618	129,979	128,407	136,789	136,669
Panel D: Estimates with Separate Coefficients for Black and Hispanic Applicants									
Black	-8.3	55.7	4.0	3.5	3,148	5.3	4,811	4.3	4.9
	(0.4)	(3.3)	(0.3)	(0.2)	(142)	(0.2)	(154)	(0.3)	(0.3)
Hispanic	-4.7	38.8	2.7	1.6	1,554	2.2	2,295	0.2	0.4
	(0.2)	(1.8)	(0.2)	(0.1)	(85)	(0.1)	(96)	(0.1)	(0.1)
Black × Prop 209	3.2	-24.1	-2.2	-0.6	-455	-1.4	-1,133	0.6	0.2
	(0.5)	(4.5)	(0.4)	(0.3)	(197)	(0.3)	(214)	(0.5)	(0.5)
Hispanic × Prop 209	2.9	-22.9	-1.8	-0.4	-326	-0.7	-810	0.9	0.3
	(0.3)	(2.2)	(0.2)	(0.2)	(104)	(0.2)	(117)	(0.2)	(0.2)
$\bar{Y}$	48.8	1,772.6	74.7					19.3	21.7
Obs.	150,512	148,121	150,748	175,642	172,536	174,306	172,255	183,089	182,907

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 2. **Panel C**: Estimates of β_0 and $\beta_{\cdot 98-99}$ 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 $\beta_{\cdot 98-99}$ 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' 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 2. 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-10: 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	0.35	0.13
	(0.41)	(0.41)	(0.28)	(0.46)
URM ×	-1.01	-1.06	-0.93	-0.44
Prop 209	(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	-5.98	-2.31	0.25	0.24
	(0.63)	(0.57)	(0.52)	(0.60)
URM ×	-1.02	0.07	-0.50	-0.27
Prop 209	(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 substantially when the sample is restricted to UC enrollees before and after Prop 209 measured only in UC data). This table extends Table 3. 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 3. 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 44). Academic Index (AI) is defined in footnote 22. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-11: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Earned Majors

Major	Baseline	$\beta_{\text{'}98-99}$	(s.e.)	Major	Baseline	$\beta_{\text{'}98-99}$	(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 $\beta_{\text{'}98-99}$ 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 $\beta_{\text{'}98-99}$ 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' $\beta_{\text{'}98-99}$ estimates is -1.24, reflecting the change in NSC-measured graduation after 1998. Source: UC Corporate Student System and National Student Clearinghouse.

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

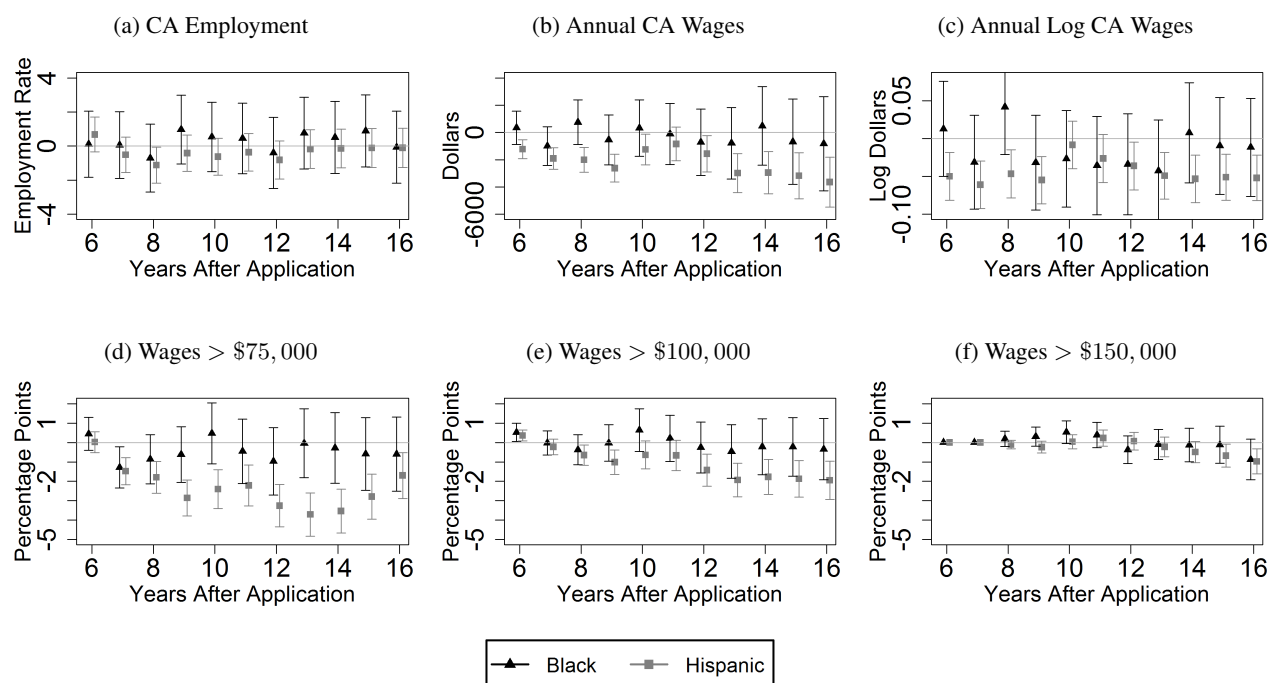| | Earn Bach. Degree | | Earn STEM Degree | | Earn Grad. Degree | | |
	5-Year	6-Year	Uncondit.	Condit.	All	STEM	JD
Panel C: Difference-in-Difference Coefficients (versus 1995)							
URM	-1.15	-2.45	0.09	-0.46	5.48	1.43	1.18
	(0.55)	(0.55)	(0.42)	(0.58)	(0.36)	(0.13)	(0.15)
URM × Prop 209	-1.84	-0.91	-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	2.07	-0.76	3.63	4.11	12.87	1.45	3.24
	(0.74)	(0.75)	(0.53)	(0.75)	(0.78)	(0.27)	(0.38)
Hispanic	-3.15	-3.09	-0.70	-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	-1.56	-1.06	-1.50	-0.06	-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)
$\bar{Y}$	47.90	74.72	22.28	27.10	36.05	5.46	4.87
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 3. 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 3. 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 44). Academic Index (AI) is defined in footnote 22. Robust standard errors in parentheses. Source: UC Corporate Student System and National Student Clearinghouse.

Table A-13: Difference-in-Difference Est. of URM UC Applicants' Post-1998 CA Wage Outcomes, cont.

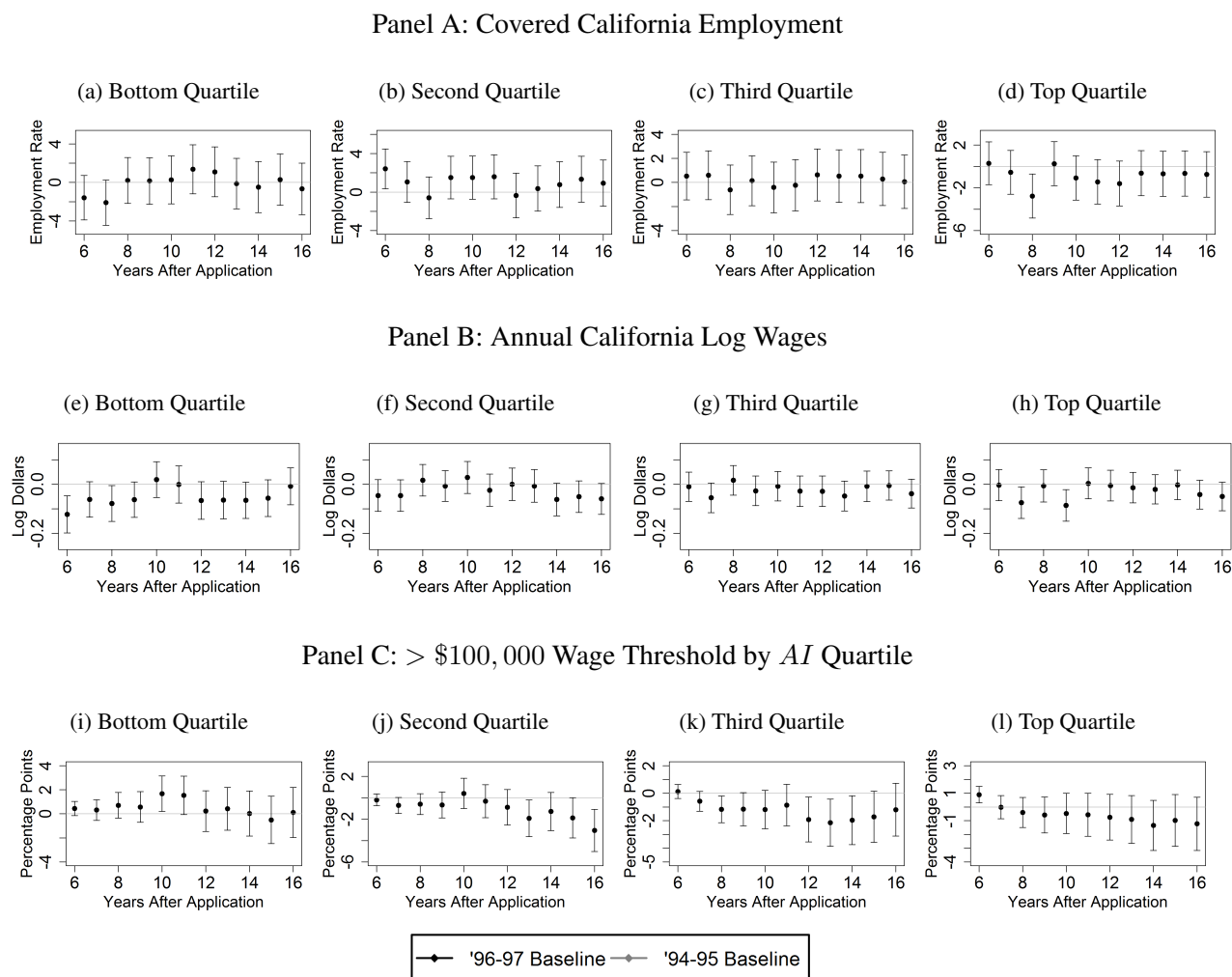|	Average 6-16 Years after UC App.				Average 12-16 Years after UC App.			
	# Years CA Emp.	Total Wages	Log Wages	# > \$100K Wages	# Years CA Emp.	Total Wages	Log Wages	# > \$100 Wages
Panel C: Estimates of URM × Prop 209 by AI Quartile								
Bottom Quartile	-0.02 (0.11)	-1,099 (995)	-0.06 (0.03)	0.06 (0.06)	0.00 (0.06)	-1,975 (1,430)	-0.09 (0.03)	0.00 (0.04)
Second Quartile	0.11 (0.10)	-1,823 (935)	-0.05 (0.02)	-0.11 (0.06)	0.03 (0.05)	-1,937 (1,361)	-0.04 (0.03)	-0.09 (0.04)
Third Quartile	0.02 (0.09)	-1,591 (935)	-0.03 (0.02)	-0.14 (0.06)	0.02 (0.05)	-2,068 (1,373)	-0.02 (0.03)	-0.09 (0.04)
Top Quartile	-0.10 (0.09)	-1,467 (1,040)	-0.02 (0.02)	-0.06 (0.06)	-0.04 (0.05)	-2,024 (1,552)	-0.03 (0.03)	-0.05 (0.04)
Panel D: Difference-in-Difference Coefficients (versus 1995)								
URM	0.19 (0.04)	340 (390)	0.04 (0.01)	-0.00 (0.02)	0.11 (0.02)	-390 (580)	0.01 (0.01)	0.02 (0.01)
URM × Prop 209	-0.22 (0.05)	-2,556 (462)	-0.08 (0.01)	-0.19 (0.03)	-0.11 (0.02)	-3,185 (676)	-0.07 (0.01)	-0.15 (0.02)
$\bar{Y}$	7.05	61,104	10.69	1.39	3.07	79,324	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 4. 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 44). Academic Index (AI) is defined in footnote 22; 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.

Figure A-7: Difference-in-Difference Estimates of Black and Hispanic UC Applicants' Post-1998 Wage Outcomes

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

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

Black   Hispanic

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 high school graduation are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 44). Academic Index (AI) is defined in footnote 22; 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-8: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Labor Market Outcomes

Panel A: Covered California Employment

(a) Bottom Quartile   (b) Second Quartile   (c) Third Quartile   (d) Top Quartile

Panel B: Annual California Log Wages

(e) Bottom Quartile   (f) Second Quartile   (g) Third Quartile   (h) Top Quartile

Panel C: $> \$100,000$ Wage Threshold by AI Quartile

(i) Bottom Quartile   (j) Second Quartile   (k) Third Quartile   (l) Top Quartile

'96-97 Baseline   '94-95 Baseline

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 $\beta_{'98-99}$ 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 earnings (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 high school graduation are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 44). Academic Index (AI) is defined in footnote 22; 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.
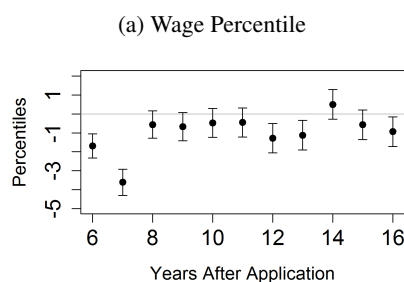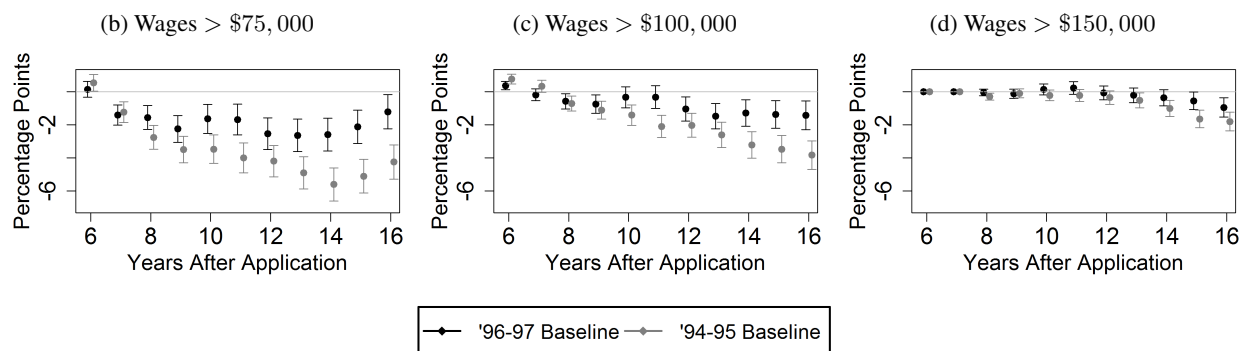
Figure A-9: Difference-in-Difference Estimates of URM UC Applicants' Post-1998 Labor Outcomes

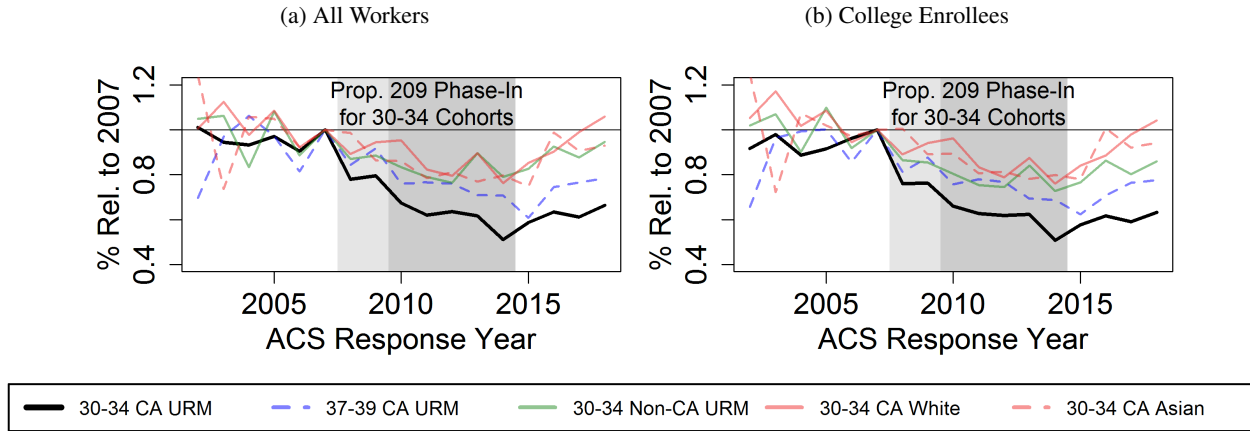Panel A: Annual Differences in Eth-Specific Wage Percentile

(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
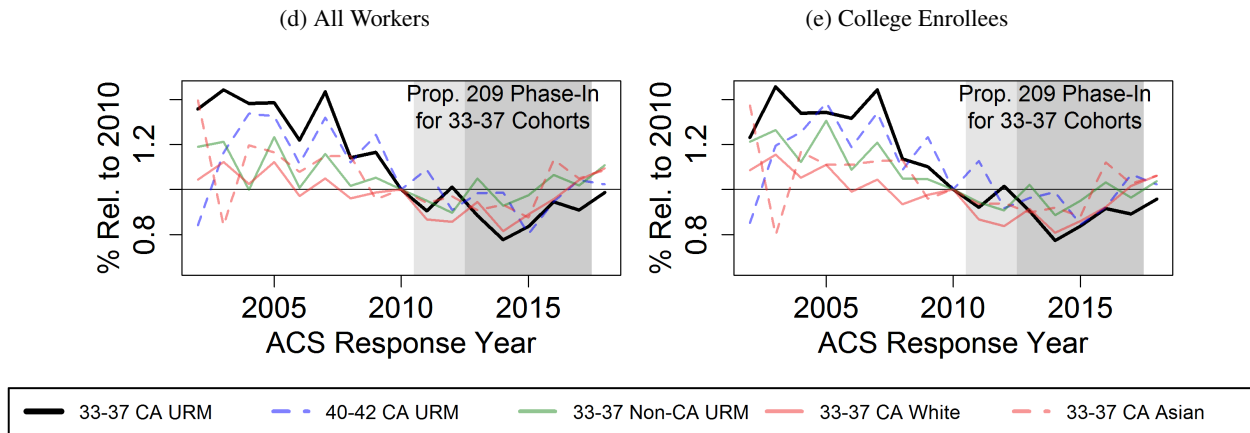

'96-97 Baseline   '94-95 Baseline

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 $\beta \cdot_{98-99}$ 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. 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 high school graduation are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 44). Academic Index (AI) is defined in footnote 22. 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-10: 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

| 30-34 CA URM | 37-39 CA URM | 30-34 Non-CA URM | 30-34 CA White | 30-34 CA Asian |

Panel B: Rolling Cohorts Age 33-37

(d) All Workers

(e) College Enrollees

| 33-37 CA URM | 40-42 CA URM | 33-37 Non-CA URM | 33-37 CA White | 33-37 CA Asian |

Note: This figure shows that early-career URM Californians ten to twenty years after Prop 209 were less likely to achieve high earnings 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)

Table A-14: 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	0.029 (0.028)	0.022 (0.019)	0.015 (0.017)	0.020 (0.026)	0.013 (0.018)	0.013 (0.016)
	1996	-0.017 (0.029)	-0.008 (0.021)	-0.016 (0.019)	-0.037 (0.026)	-0.011 (0.018)	-0.010 (0.016)
	1997	-0.030 (0.029)	-0.033 (0.020)	-0.039 (0.019)	-0.033 (0.026)	-0.038 (0.019)	-0.042 (0.017)
	1998	-0.041 (0.027)	-0.045 (0.019)	-0.048 (0.018)	-0.045 (0.024)	-0.053 (0.018)	-0.051 (0.016)
	1999	-0.018 (0.029)	-0.052 (0.021)	-0.055 (0.019)	-0.048 (0.026)	-0.070 (0.019)	-0.066 (0.017)
	2000	-0.024 (0.029)	-0.041 (0.021)	-0.041 (0.018)	-0.029 (0.026)	-0.054 (0.018)	-0.050 (0.016)
	2001	-0.024 (0.028)	-0.046 (0.022)	-0.053 (0.019)	-0.039 (0.025)	-0.068 (0.019)	-0.066 (0.016)
Hispanic	1995	0.005 (0.018)	-0.003 (0.014)	-0.010 (0.012)	0.001 (0.016)	-0.008 (0.012)	-0.010 (0.010)
	1996	-0.033 (0.018)	-0.030 (0.015)	-0.039 (0.013)	-0.013 (0.016)	-0.013 (0.013)	-0.016 (0.011)
	1997	-0.037 (0.019)	-0.049 (0.015)	-0.051 (0.013)	-0.024 (0.017)	-0.037 (0.013)	-0.041 (0.011)
	1998	-0.040 (0.018)	-0.054 (0.014)	-0.053 (0.013)	-0.042 (0.016)	-0.044 (0.012)	-0.041 (0.011)
	1999	-0.060 (0.018)	-0.063 (0.015)	-0.064 (0.013)	-0.060 (0.015)	-0.060 (0.012)	-0.057 (0.011)
	2000	-0.042 (0.019)	-0.053 (0.016)	-0.056 (0.013)	-0.045 (0.017)	-0.048 (0.013)	-0.046 (0.012)
	2001	-0.052 (0.019)	-0.052 (0.016)	-0.054 (0.014)	-0.036 (0.017)	-0.041 (0.013)	-0.042 (0.012)
Asian	1995	0.021 (0.020)	0.003 (0.014)	0.007 (0.012)	0.020 (0.018)	-0.003 (0.012)	0.000 (0.011)
	1996	-0.004 (0.021)	0.009 (0.014)	0.008 (0.012)	-0.003 (0.018)	0.013 (0.012)	0.012 (0.011)
	1997	0.003 (0.021)	0.008 (0.015)	0.010 (0.013)	0.018 (0.018)	0.006 (0.013)	0.003 (0.012)
	1998	0.022 (0.021)	0.015 (0.014)	0.017 (0.013)	0.018 (0.019)	-0.002 (0.012)	0.000 (0.011)
	1999	0.024 (0.022)	0.004 (0.014)	0.002 (0.012)	0.015 (0.019)	-0.015 (0.013)	-0.012 (0.011)
	2000	0.029 (0.021)	0.009 (0.015)	0.016 (0.013)	0.030 (0.020)	-0.006 (0.013)	0.002 (0.012)
	2001	0.018 (0.022)	0.022 (0.014)	0.023 (0.013)	0.024 (0.019)	0.005 (0.013)	0.009 (0.012)
HS×Eth.		X	X	X	X	X	X
HS×Year		X	X	X	X	X	X
by Eth.×Gender				X			X
R^2		0.71	0.89	0.81	0.69	0.89	0.81
N		20,777	20,777	38,442	21,333	21,333	39,319

Note: This table shows that URM application rates following Prop 209 declined by between 4 and 6 percent of all UC-eligible URM public high school graduates. 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, 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.

Figure A-11: 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
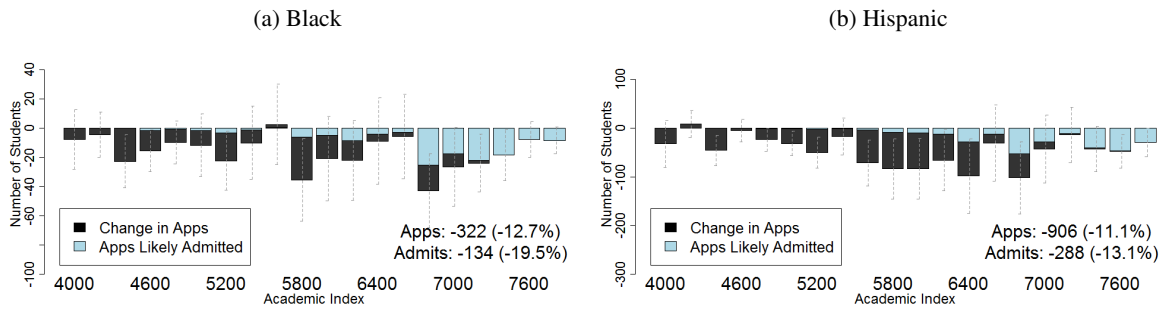
Panel B: Changes in UC-**In**eligible Application Likelihood to UC

(c) Black

(d) Hispanic

Panel C: Asian

(e) Any UC Campus

(f) Most-Selective Campuses
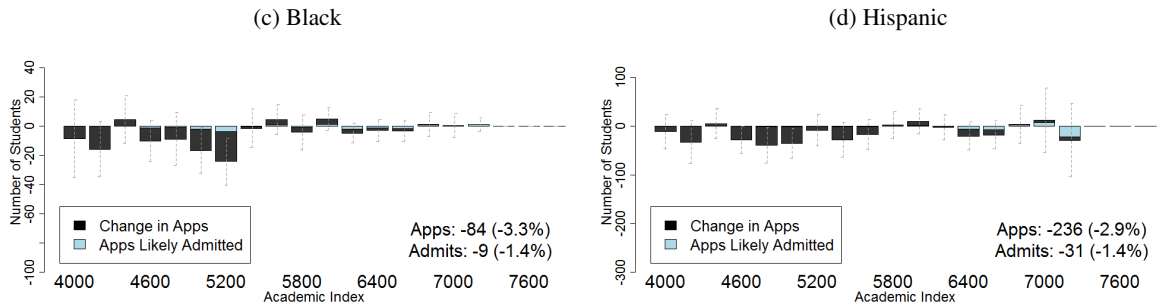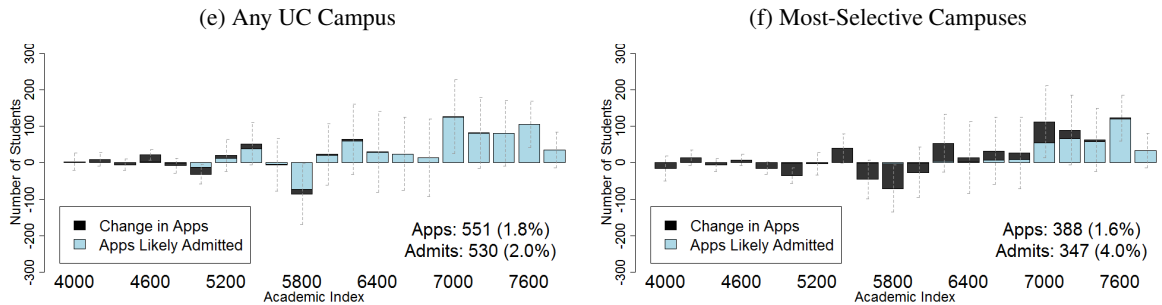
Note: This figure shows that URM application declines to the Berkeley and UCLA campuses can explain up to 20 percentage points of the decline in URM enrollment at those campuses, while application rates only slightly declined among UC-ineligible students and only slightly increased among Asian students 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-12: Difference-in-Difference Estimates of URM UC Enrollees' STEM Outcomes by Ethnicity

(a) SAT Percentile in STEM Class

(b) STEM Course Grade

(c) STEM Persistence

(d) STEM Major Completion
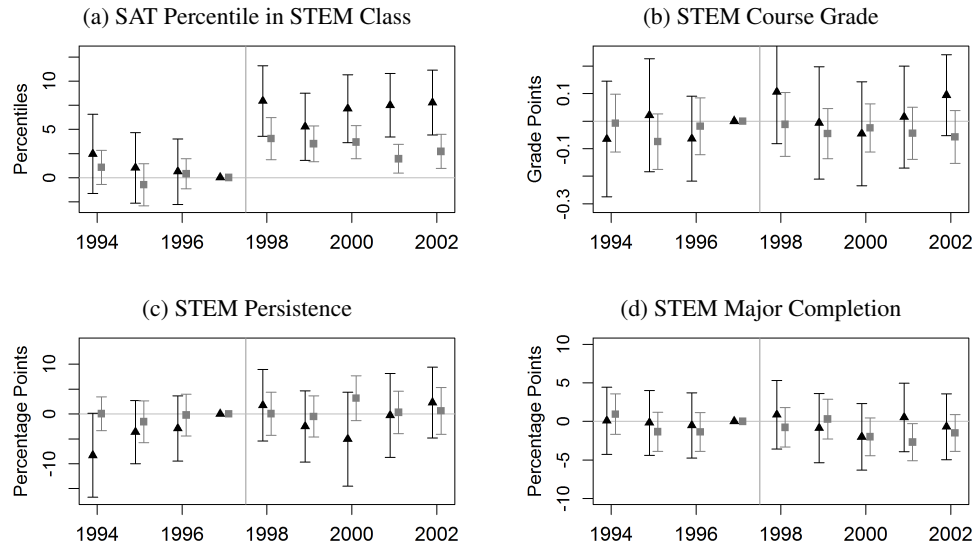
Note: Difference-in-difference WLS regression coefficient estimates of UCB, UCSB, UCD, UCSC, and UCR enrollees' introductory STEM course performance or persistence, differencing across URM status following Equation 3 and interacting β_t with Black and Hispanic indicators to separately identify outcomes 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 F) 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 44). 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, 2018b).

Table A-15: 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	-0.37	-11.2	-10.3	-7.3	0.02	-2.0	0.1
	(1.7)	(0.06)	(1.5)	(0.6)	(1.2)	(0.03)	(1.6)	(0.6)
URM × Prop. 209	2.7	0.07	1.5	1.2	4.0	-0.05	0.6	-0.1
	(1.4)	(0.05)	(1.7)	(0.9)	(0.9)	(0.03)	(1.5)	(0.8)
Course FE		X				X		
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.	109,497	105,550	85,206	56,160	109,497	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 preparedness; 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 F) 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 44); 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, 2018b).

Table A-16: 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
Panel A: Conditional on Academic Preparation (Cross-Campus STEM Mismatch Hypothesis)											
Grade in Course (if earned grade)											
URM	0.12	0.02	-0.08	-0.01	0.02	0.00	0.01	0.10	-0.00	0.16	0.20
	(0.02)	(0.03)	(0.05)	(0.06)	(0.04)	(0.06)	(0.04)	(0.06)	(0.09)	(0.16)	(0.15)
URM × Prop. 209	-0.12	-0.04	0.12	0.05	-0.02	-0.09	-0.07	-0.20	-0.08	-0.26	0.04
	(0.03)	(0.05)	(0.07)	(0.08)	(0.05)	(0.08)	(0.05)	(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	
$\bar{Y}$	60.0	66.4	69.6		54.9		48.3		55.3	67.7	
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-15, 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 44). Standard errors (in parentheses) are robust. The specific courses comprising each sequence can be seen in Appendix F; 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, 2018b).

Figure A-13: Annual Single-Difference Estimates of URM UC Applicants' Post-1998 Outcomes

(a) Six-Year Degree Attainment, Bottom Q.

(b) Grad. Degree Attainment

(c) Avg. Annual Conditional Log Wages

(d) Number of Above-$100,000 Years in Early 30s

URM   Non-URM
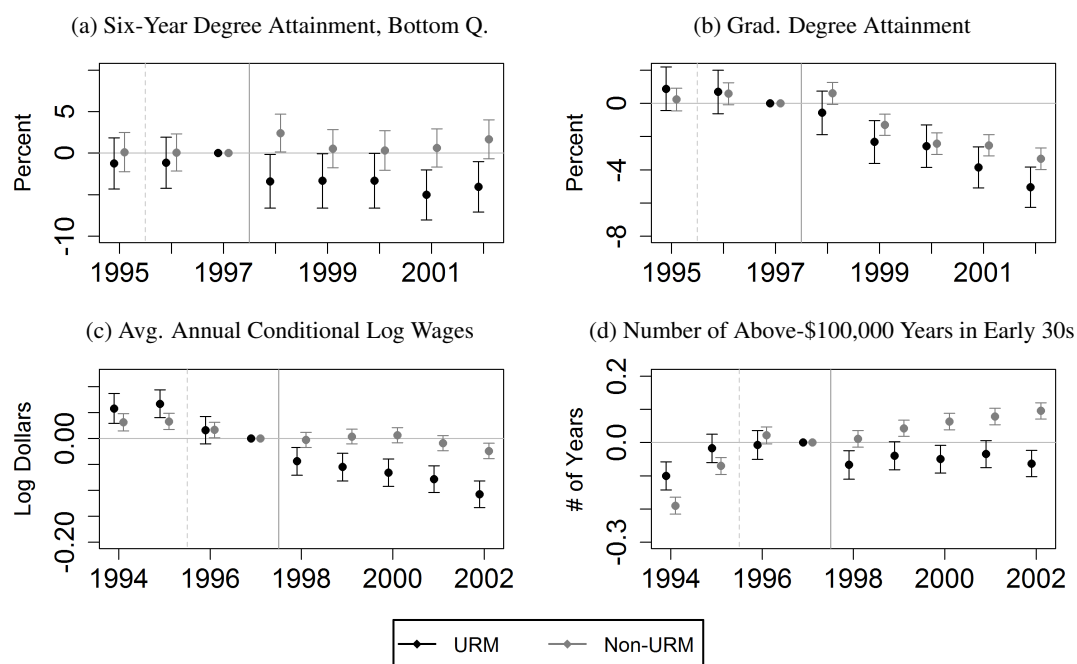
Note: This figure shows single-difference analogues to the baseline estimates, showing that the estimated effects are largely driven by 1998 declines among URM students, not 1998 increases among non-URM students. OLS difference-in-difference coefficient estimates of the change in four URM applicant outcomes 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 high school graduation, and the number years (6-19 years after high school graduation) 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 44). 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-14: Difference-in-Difference Changes in Inst. Value-Added and Outcome by AI Quantile

(a) Six-Year Degree Attainment

(b) Wages in Early 30s
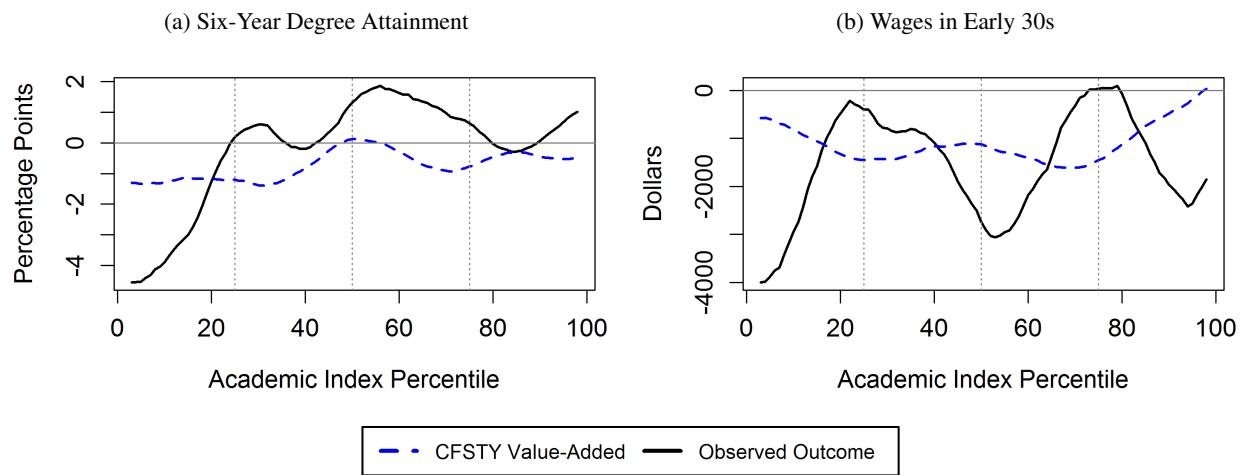
Note: This figure plots unadjusted difference-in-difference averages for both VA and actual degree attainment and early-30s wages, showing that the two lines poorly mirror each other, suggesting both that VA poorly-explains and substantially underestimates the observed labor market effects of Prop 209. 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 high school graduation; university groups partition possible enrollments. See note to Table 2 for value-added definition. Average wages measured as mean observed wages between 12 and 16 years after high school graduation, when most students are 30-34; VA wages are measured 15 years after high school graduation. 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-17: 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	20.2	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	-10.5	-2.2	2.9	-1.4	-4.3	-1.1	-4.6	-11.4
	(0.7)	(0.6)	(0.6)	(0.7)	(0.7)	(0.8)	(0.9)	(0.9)	(0.5)
$\bar{Y}$	16.4	14.7	12.9	16.3	17.9	18.6	17.0	17.2	49.4
Obs.	83,559	101,940	91,720	77,804	67,980	72,062	44,031	45,302	190,540
Enrollment conditional on **admission** (%)									
URM	-20.7	-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	9.3	10.7	5.2	5.2	6.2	3.4	0.7	-6.2
	(1.5)	(1.3)	(1.2)	(1.0)	(1.1)	(1.1)	(1.1)	(1.1)	(0.6)
$\bar{Y}$	42.7	38.4	24.6	24.1	26.5	27.2	20.7	21.0	59.5
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 44), and are estimated independently by campus or "Total" (all applicants to any UC campus). Robust standard errors in parentheses. Source: UC Corporate Student System.

Table A-18: Difference-in-Difference Estimates of URM Berkeley Students' Post-1998 STEM Outcomes

	Chemistry				Biology		Physics		Comp. Science			Combined
	1	2	3	4	1	2	1	2	1	2	3	

Panel A: Unconditional Difference-in-Difference

Grade in Course (if earned grade)

	1	2	3	4	1	2	1	2	1	2	3	Combined
URM	-0.70	-0.94	-0.96	-0.59	-0.94	-0.69	-0.77	-0.59	-0.53	-0.53	-0.01	-0.77
	(0.05)	(0.08)	(0.09)	(0.10)	(0.09)	(0.11)	(0.10)	(0.18)	(0.18)	(0.26)	(0.16)	(0.08)
URM × Prop. 209	0.12	0.25	0.30	0.21	0.32	0.08	-0.08	-0.06	-0.13	0.08	-0.53	0.14
	(0.08)	(0.14)	(0.15)	(0.17)	(0.14)	(0.21)	(0.15)	(0.28)	(0.30)	(0.37)	(0.44)	(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 (%)

	1	2	3	4	1	2	1	2	1	2	3	Combined
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)

	1	2	3	4	1	2	1	2	1	2	3	Combined
URM	0.16	0.01	0.04	0.13	-0.02	0.25	0.07	-0.02	-0.09	0.01	0.10	0.05
	(0.05)	(0.10)	(0.10)	(0.13)	(0.09)	(0.12)	(0.10)	(0.21)	(0.22)	(0.29)	(0.22)	(0.04)
URM × Prop. 209	-0.15	-0.16	-0.01	-0.03	0.01	-0.14	-0.21	-0.20	-0.19	-0.06	0.64	-0.08
	(0.07)	(0.15)	(0.16)	(0.21)	(0.13)	(0.21)	(0.15)	(0.34)	(0.32)	(0.56)	(0.54)	(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 (%)

	1	2	3	4	1	2	1	2	1	2	3	Combined
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 44). Standard errors (in parentheses) are robust. The specific courses comprising each sequence can be seen in Appendix F; courses taken after the first 2.5 years of matriculation are omitted. Source: UC Corporate Student System and UC-CHP Database (Bleemer, 2018b).

Table A-19: 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 | | Low SAT Scores | |
						High GPA	Low GPA	High GPA	Low GPA
URM	1.4	1.0	-3.6	0.6	6.1	-5.3	-4.9	7.3	12.4
	(4.4)	(2.7)	(1.4)	(2.2)	(2.0)	(4.2)	(4.3)	(7.8)	(2.9)
URM × Prop. 209	-0.3	-0.3	2.9	-1.0	-10.0	-5.4	12.6	-9.4	-9.0
	(4.6)	(1.8)	(2.0)	(3.7)	(2.7)	(5.5)	(5.4)	(10.1)	(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 F. Academic covariates include high school fixed effects and the components of UC's Academic Index (see footnote 44). 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, 2018b)

Figure A-15: 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

URM — Asian

Panel B: Minimum Wage Thresholds

(d) Wages $> \$75,000$

(e) Wages $> \$100,000$

(f) Wages $> \$150,000$

URM — Asian

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 substantially 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 high school graduation are estimated independently. Models include high school fixed effects and the components of UC's Academic Index (see footnote 44). Academic Index (AI) is defined in footnote 22; 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.

Table A-20: 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 (0.012)	-0.007 (0.014)	0.009 (0.011)	-0.002 (0.013)	-0.004 (0.013)
URM × 1996	-0.002 (0.004)	-0.033 (0.004)	0.016 (0.012)	-0.012 (0.014)	0.016 (0.011)	-0.029 (0.013)	-0.032 (0.012)
URM × 1997	-0.010 (0.004)	-0.040 (0.004)	0.011 (0.012)	-0.026 (0.014)	0.015 (0.011)	-0.006 (0.012)	-0.008 (0.012)
URM × 1998	-0.019 (0.004)	-0.044 (0.004)	-0.010 (0.012)	-0.054 (0.014)	0.009 (0.010)	-0.028 (0.012)	-0.029 (0.012)
URM × 1999	-0.020 (0.004)	-0.049 (0.004)	0.001 (0.012)	-0.027 (0.014)	0.015 (0.010)	-0.019 (0.012)	-0.022 (0.012)
URM × 2000	-0.022 (0.004)	-0.047 (0.004)	0.012 (0.012)	-0.030 (0.014)	0.013 (0.010)	-0.038 (0.012)	-0.040 (0.012)
URM × 2001	-0.028 (0.004)	-0.038 (0.004)	0.004 (0.012)	-0.014 (0.014)	0.006 (0.010)	-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 more-substantial 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 E 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.

Table A-21: 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)	-0.004 (0.003)	0.000 (0.014)	-0.013 (0.014)	0.011 (0.012)	-0.008 (0.013)	-0.006 (0.011)	-0.018 (0.012)	-0.019 (0.011)
URM × 1996	-0.005 (0.004)	-0.026 (0.003)	0.024 (0.014)	-0.006 (0.014)	0.015 (0.012)	-0.035 (0.013)	0.002 (0.011)	-0.021 (0.011)	-0.022 (0.011)
URM × 1997	-0.007 (0.004)	-0.030 (0.003)	0.012 (0.014)	-0.021 (0.014)	0.029 (0.012)	-0.007 (0.012)	-0.004 (0.010)	-0.035 (0.011)	-0.038 (0.011)
URM × 1998	-0.016 (0.004)	-0.032 (0.003)	-0.007 (0.014)	-0.047 (0.014)	0.011 (0.012)	-0.032 (0.012)	-0.007 (0.010)	-0.035 (0.011)	-0.037 (0.011)
URM × 1999	-0.018 (0.004)	-0.041 (0.003)	-0.005 (0.014)	-0.027 (0.014)	0.013 (0.012)	-0.032 (0.012)	-0.008 (0.010)	-0.075 (0.011)	-0.076 (0.011)
URM × 2000	-0.020 (0.004)	-0.033 (0.003)	0.016 (0.014)	-0.011 (0.014)	0.017 (0.012)	-0.037 (0.012)	-0.006 (0.010)	-0.028 (0.011)	-0.031 (0.011)
URM × 2001	-0.020 (0.004)	-0.027 (0.003)	0.021 (0.014)	-0.003 (0.014)	0.025 (0.012)	-0.001 (0.012)	0.014 (0.010)	-0.007 (0.011)	-0.007 (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 more-substantial 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 E 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.

Table A-22: The Relationship between SAT Send Rates and Most-Selective UC Application

		Coef.	St. Err.	p			Coef.	St. Err.	p
Send		0.371	(0.003)	0.000	Send×SAT		0.189	(0.003)	0.000
URM		0.020	(0.003)	0.000	URM×SAT		0.007	(0.003)	0.018
Norm. SAT		-0.001	(0.002)	0.564	Send×URM×SAT		-0.035	(0.005)	0.000
Send×URM		0.023	(0.005)	0.000					
Indicator	1995	-0.001	(0.002)	0.701	Send×URM×	1995	-0.005	(0.007)	0.480
	1996	0.002	(0.002)	0.439		1996	-0.032	(0.007)	0.000
	1997	0.003	(0.002)	0.183		1997	-0.041	(0.007)	0.000
	1998	0.002	(0.002)	0.219		1998	-0.042	(0.007)	0.000
	1999	0.008	(0.002)	0.000		1999	-0.058	(0.007)	0.000
	2000	0.007	(0.002)	0.000		2000	-0.052	(0.007)	0.000
	2001	-0.003	(0.002)	0.161		2001	-0.045	(0.007)	0.000
Send×	1995	0.032	(0.004)	0.000	Send×SAT×	1995	0.001	(0.004)	0.875
	1996	0.042	(0.004)	0.000		1996	0.009	(0.004)	0.014
	1997	0.026	(0.004)	0.000		1997	0.016	(0.004)	0.000
	1998	0.030	(0.004)	0.000		1998	0.012	(0.004)	0.000
	1999	0.042	(0.004)	0.000		1999	-0.002	(0.003)	0.589
	2000	0.046	(0.004)	0.000		2000	-0.001	(0.003)	0.755
	2001	0.080	(0.004)	0.000		2001	0.003	(0.003)	0.453
URM×	1995	0.001	(0.005)	0.915	URM×SAT×	1995	0.001	(0.004)	0.795
	1996	-0.004	(0.005)	0.450		1996	-0.001	(0.004)	0.755
	1997	-0.001	(0.005)	0.798		1997	0.001	(0.004)	0.856
	1998	0.000	(0.005)	0.960		1998	-0.003	(0.004)	0.552
	1999	-0.007	(0.005)	0.122		1999	-0.006	(0.004)	0.157
	2000	-0.001	(0.005)	0.892		2000	-0.002	(0.004)	0.640
	2001	0.002	(0.005)	0.596		2001	-0.000	(0.004)	0.978
SAT×	1995	-0.001	(0.002)	0.541	Send×URM×SAT×	1995	0.008	(0.007)	0.258
	1996	0.002	(0.002)	0.342		1996	0.015	(0.007)	0.037
	1997	0.003	(0.002)	0.204		1997	0.004	(0.007)	0.530
	1998	0.007	(0.002)	0.001		1998	0.000	(0.007)	0.953
	1999	0.012	(0.002)	0.000		1999	0.021	(0.007)	0.002
	2000	0.009	(0.002)	0.000		2000	0.021	(0.007)	0.002
	2001	-0.000	(0.002)	0.914		2001	0.029	(0.007)	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.