BERKELEY'S COMPREHENSIVE REVIEW METHOD FOR MAKING FRESHMAN ADMISSIONS DECISIONS: AN ASSESSMENT

A Report to the Committee on Admissions, Enrollment, and Preparatory Education (AEPE) and the Associate Vice Chancellor – Admissions & Enrollment
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1. Abstract

This study analyzes the University of California, Berkeley freshman admissions process for the 2004-05 academic year. In making freshman admission decisions, Berkeley uses "comprehensive review" to evaluate its applicants. Comprehensive review is supposed to balance measures of achievement – high school grades scored in several ways, five scholastic achievement tests, and scores on advanced placement exams (if any) – while considering the context in which each applicant lives and learns. Readers from the Office of Undergraduate Admissions (OUA) give each applicant a "read score" that summarizes their assessment of the applicant. The average of two read scores determines admission or denial for the vast majority of applicants. My charge was to assess how comprehensive review worked in 2004 with a special focus on 1) estimating the weight readers gave each factor in assigning an applicant's read score and 2) the distribution of ethnic identities in the applicant pool and in the freshman class admitted to Berkeley. To fulfill this charge, I supervised a "re-reading" of a sample of cases that quantified information in the applications such as extracurricular activities, work experience, obstacles to achievement, and the contents of the personal essay. I merged that new information with the standard admissions database of grades, test scores, high school information, and family information. From the merged data I developed statistical models of the steps in the admissions process: assigning read scores, conducting augmented review, and breaking ties.

My statistical results reveal that comprehensive review conformed to most aspects of policy guidelines. Academic considerations predominated. Readers gave applicants' grades the most weight in assigning read scores. They also considered how difficult the courses were and scores on SATs. Readers also fulfilled the policy guidelines that instruct them to consider applicants in their local context by giving some weight (less than the weight they gave to academics) to the barriers to achievement that some applicants face. Ethnic identity played a very small role in read scores. The read scores of Asian American and Latino/Native American applicants differed by a statistically significant amount among in-state applicants, but the difference is the statistical equivalent of getting a B instead of an A in one or two courses over the whole three or four years of high school. Subjective aspects of the comprehensive review –

judgments about applicants' leadership potential and character – matter for admissions decisions, but do not correlate with ethnic identity.

My only policy or procedural recommendations concern the 11% of admissions decisions made through the tie-breaking and augmented review processes. I recommend that faculty and administrators who supervise the admission process apply the concepts and factors to be used in the tie-breaking and augmented review processes with the same rigor used in guiding the scoring procedures that make up most of comprehensive review.

2. Introduction: The origins and results of comprehensive review

The University of California, Berkeley offered admission to about 30% of its freshman applicants for 2004-05 – 10,955 offers to 36,041 freshman applicants.[1] More than two out of three applicants must receive "no" for an answer. Few applicants could be ruled out as unqualified; 92% of the applicants for 2004-05 met the UC admissions requirements. The Berkeley Office of Undergraduate Admissions (OUA) had to make thousands of tough choices among a highly self-selected pool of qualified applicants.

Selecting freshmen from among a surplus of qualified applicants is not exactly new at Berkeley. Beginning in the mid-1980s, applications exceeded admissions by bigger and bigger margins in recent years. Population growth, a greater tendency of high school graduates to go on to college, and changes in UC rules combined to pump up applications for admission.[2] From 1984 to 2004, the number of applications tripled while the admissions target increased by only 74%. In 1984, 12,381 young men and women applied, and 6,900 were offered admission to the freshman class of 1984-85. In 1994, 20,814 applicants hoped to be one of 9,100 freshmen. As noted above, Berkeley received over 36,000 applications for 11,000 spots in 2004. Twenty years ago a majority of applicants – 56% – were admitted to Berkeley; last year 32% were.

The University of California Regents traditionally have delegated to the faculty responsibility for deciding which students to admit. A UC system-wide faculty committee writes

[1] Berkeley received a total of 36,775 applications; of these 734 were cancelled or withdrawn. The university expects 42% of the admitted applicants to enroll, netting a freshman class of approximately 4,600.

[2] The most significant rule change came in 1986 when Regents rescinded the requirement that applicants apply to only one UC campus. In fact, the increase from 12,000 to 20,000 applications noted in the text was almost all in one year – 1986 – when the number of applications jumped from 11,900 to 20,291.

guidelines for the campuses. At Berkeley, the Admissions, Enrollment, and Preparatory Education (AEPE) committee of the Academic Senate oversees and advises OUA.

Policy evolved through a succession of documents known as the Karabel Report (1989), the Grubb Report (1992), the Leonard Report (1993), and the Moore Report (2002). A full history of the practices and procedures governing Berkeley admissions is beyond my charge.[3] However, UC Regents' resolutions SP-1in 1995 and statewide ballot initiative Proposition 209 in 1996 are relevant here. SP-1 banned affirmative action in university admissions while Proposition 209 outlawed "preferences" in a broad array of state matters that included admissions. To ensure that each application was thoroughly evaluated, starting in 1998, Berkeley admissions implemented a more holistic review of applications, where readers gave each applicant a score for academic achievement and a separate "comprehensive" score that took account of social and personal obstacles and challenges. Then in 2001, the UC faculty created comprehensive review as "the process by which students applying to UC campuses are evaluated for admission using multiple measures of achievement and promise while considering the context in which each student has demonstrated academic accomplishment." In implementing comprehensive review at Berkeley starting in 2002, scoring was streamlined to a single "read score" that ranks applicants on all criteria.

My charge is to assess how comprehensive review at Berkeley is working out with a special focus on 1) the factors that determine an applicant's read score and 2) the distribution of ethnic identities in the applicant pool and in the freshman class admitted to Berkeley. Do the factors that should affect the admissions process make a difference? Are factors that should not matter kept out? To fulfill that charge I have done statistical analysis of the administrative database maintained by the OUA. In addition, I have supervised, with the advice and professional services of project director Livier Bejinez of OUA, her team of experienced readers, other OUA staff, Robert McCarthy of the Survey Research Center, and Professor David Stern of AEPE, a "re-reading" of a sample of cases. The re-reading focused on quantifying information in the applications that readers take into account when assigning a read score, but do not enter into the admissions database. I will refer to this new information as the "previously unrecorded

[3] Consult the Moore Report (2002) and its sources for background.

variables" or "PUVs" for short. The PUVs include some of the information and reader judgments that give the current policy its comprehensiveness. Readers who participated in the re-reading evaluated each case just as they did for the official assessment, but this time, instead of assigning a single read score, they recorded 59 separate PUVs. The PUVs cover academics, extracurricular activities, work experience, obstacles to achievement, and the contents of the personal essay and statement of purpose. Readers recorded most PUVs by counting items listed in the application; others required them to synthesize information or make a judgment.[4]

I find that in 2004 comprehensive review worked pretty much as designed. Academic achievement outweighed all other factors in the selection process. Applicants' grades influenced readers the most. Applicants who took advanced placement (AP) and other rigorous courses, scored high on AP tests and SATs got better read scores than those who did not. Students who overcame obstacles to achievement got special consideration – fulfilling the policy guidelines that instruct readers to consider applicants in their local context. Ethnic identity played almost no role in read scores. The read scores completely determine about 89% of admissions decisions.[5] Differences among ethnic-identity groups in the other 11% of decisions – tie-breaking decisions and augmented review (AR), in particular – increase the representation of African Americans, Latinos, and Native Americans among admittees. The read scores of Asian American and Latino/Native American applicants differed by a small but statistically significant amount among in-state applicants. Exactly how small? An Asian American applicant would have had to raise her or his high school grades only four or five percentiles (say from the 75th or 76th percentile to the 79th) in order to offset the difference between Asian American applicants and ones with a Latino or Native American ethnic identity (the Asian-Latino gap is the largest ethnic gap in the final model).[6]

[4] Examples of transcribed items: readers counted the number of high schools the applicant attended, the number of hours applicants worked during the school year, and the number of As, Bs, Cs, etc., they earned in A-G courses. Examples of judgments: "Are items 47-51 [extracurricular activities] considered to be strong relative to the Berkeley applicant pool? [1=No or 2=Yes]" "Applicant will likely contribute to campus life. [1=Strong yes; 2=Average yes; 3=Not really]." The full PUV schedule is appended.

[5] Of 36,040 applications, 4,066 were decided by a method other than read scores.

[6] These calculations use the pooled model for all in-state applicants' read scores. That model does not factor in differences among colleges in the weight readers assign to all the variables. But the full analysis does not alter the conclusion that ethnic differences are negligible. In fact ethnic differences do not meet conventional criteria

Mine is a statistical analysis that uncovers key elements of the process but does not explain everything. The differences that may occur between what models predict and what the OUA decides reflect limits to my methodology and should not be read as "errors" on the part of OUA.

Most reports on admissions compare the actual numbers of admittees from different groups with counterfactuals of one sort or another. My approach does not translate neatly into that metric and I am not stressing it in this report. Indeed I counsel caution to anyone who would use any of the over/under counts in circulation. Those calculations take the coefficients for grades, test scores, and other factors as a fixed feature of the admissions system. Some interpretations of state law and university policy imply a specific value (zero) for the ethnic variable, but policy sets the other parameters only in the most general terms. Academics are to be pre-eminent. But what quantity does that imply? Grade point averages (GPAs) weighted to give extra credit for AP and honors courses were most important in both 2003 and 2004. But the coefficients increased by about 25% (a statistically significant increase) in that one year. Which value is correct? Test scores also mattered more in 2004 than in 2003. If these parameters had not changed – that is, if grades and tests had the same impact on admission decisions in 2004 as they had in 2003 – then the over-admit / under-admit calculations for ethnic identities would have yielded smaller disparities. If the baseline for comparison is not fixed, I (for one) have trouble making sense of the over/under counts that other observers find so compelling.

My only recommendations concern the roughly 4,000 admissions decisions (out of 36,000) that come about through the tie-breaking, by-school, and augmented review processes. The scoring procedures that guide comprehensive review are explicit. Norming sessions reinforce them and assure their uniform application. But at the point when the last few admissions decisions are being made, all the applicants being considered have the same scores – thus the name "tie-breaking" – or special circumstances that make the standard approach hard to apply. Guidelines for how to break the ties are not very explicit. I recommend that the appropriate campus or system-wide committee review tie-breaking and provide more guidance to the Office of Undergraduate Admissions. Likewise, OUA should make more explicit the

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for statistical significance within any college; only by pooling all in-state applicants is the sample large enough to reduce the margin of error enough to make it smaller than the largest ethnic difference.

definition of how to refer candidates to Augmented Review (AR), a process reserved for applications that seem to be competitive for admission but lack information or present unique circumstances that might make the difference between admission and denial. Experienced readers speak of "AR-ness." In addition to the socio-economic factors and local context variables I have considered, there appears to be some other factor or factors that defines AR-ness. It is correlated with ethnic identity and contributes to the ethnic coefficients I report in Table 11. If readers or staff could articulate AR-ness we might be able to measure it. Marking what it is and how that correlates with ethnic identity could explain what appear here as ethnic effects.

3. Evaluating Comprehensive Review

The UC Academic Senate, through its Board of Admissions and Relations with Schools (BOARS) implemented the Regents' Resolution RE-28 with eight principles and fourteen criteria for freshman admission. These are spelled out in a document entitled "Guidelines for Implementation of University Policy on Undergraduate Admissions." Each Berkeley admissions reader received a copy of these guidelines with instruction and training on how to follow them. The Berkeley Division's Admissions, Enrollment, and Preparatory Education (AEPE) committee implemented the guidelines in the form of six "guiding principles" and six "freshmen criteria" in a document approved November 14, 2003. There is, appropriately, great overlap between the BOARS and the AEPE expressions of principles and criteria. The AEPE principles are:

Berkeley Admissions Principles

1. *The admissions process honors academic achievement and accords priority to students of exceptional academic accomplishment. At the same time, the decision-making process employs a broad and multifaceted definition of merit, including an assessment of contributions that a student will make to the intellectual, cultural, or other aspects of campus life.*
2. *Each applicant is judged individually and comprehensively and all achievements are evaluated in the context in which the student learned and lived, as well as the opportunities available to the student and how he or she responded to challenges. In keeping with Berkeley's status as a public institution, ability to pay fees and expenses is never a criterion in the admission decision.*
3. *The admission process should select students of whom the campus will be proud, and who give evidence that they will use their education to make contributions to the intellectual, cultural, social, and political life of the State and the Nation.*

4. *The admissions process should further the Regents' Policy that each campus should enroll a "...student body ... that encompasses the broad diversity of backgrounds characteristic of California." The process must also comport with state law, including Proposition 209.*
5. *The admissions process should select only those students whose academic preparation ensures a strong likelihood that they will persist to graduation.*
6. *The process should consider each applicant fairly, given the information available to the campus, and should seek to be perceived as fair by the various publics of the campus.*

The AEPE freshman criteria are:

Berkeley Freshman Selection Criteria

1. *The applicant's full record of achievement in college preparatory work in high school, including the number and rigor of courses taken and grades earned in those courses. Consideration will be given to completion of courses beyond the University's A-G minimums; strength of the senior year course load; and performance in honors, college-level, Advanced Placement, and International Baccalaureate Higher Level (IBHL) courses, to the extent that such courses are available to the applicant. In assessing achievement levels, consideration will be given to individual grades earned, to the pattern of achievement over time, and to an applicant's achievement relative to that of others in his or her high school, including whether he or she is among those identified as Eligible in the Local Context.*
2. *Personal qualities of the applicant, including leadership ability, character, motivation, tenacity, initiative, originality, intellectual independence, responsibility, insight, maturity, and demonstrated concern for others and for the community.*
3. *Likely contributions to the intellectual and cultural vitality of the campus. In addition to a broad range of intellectual interests and achievements, admission officers will seek diversity in personal background and experience.*
4. *Performance on standardized tests, including the three required SAT II tests, the SAT I (or ACT), and any Advanced Placement or IBHL examinations the applicant may have taken. Applicants who have not had the opportunity to take Advanced Placement or IBHL courses or who have chosen not to take the examinations for these courses will not be disadvantaged. Test scores will be evaluated in the context of all other academic information in the application and preference will be given to tests that show a demonstrable relationship to curriculum and to Academic Senate statements of competencies expected of entering college students. Documented imprecision and other known weaknesses of standardized tests will be taken into account. Under no circumstances does Berkeley employ minimum scores or "cut-offs" of any kind.*
5. *Achievement in academic enrichment programs, including but not limited to those sponsored by the University of California. This criterion will be measured by time and depth of participation, by the academic progress made by the applicant during that participation, and by the intellectual rigor of the particular program.*
6. *Other evidence of achievement. This criterion will recognize exemplary, sustained achievement in any field of intellectual or creative endeavor; accomplishments in the performing arts and*

> *athletics; employment; leadership in school or community organizations or activities; and community service.*
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> *All achievements, both academic and non-academic, will be considered in the context of the opportunities an applicant has had, any hardships or unusual circumstances the applicant has faced, and the ways in which he or she has responded to them. In evaluating the context in which academic accomplishments have taken place, evaluators will consider the strength of the high school curriculum, including the availability of honors and advanced placement courses and the total number of college preparatory courses available, among other indicators of the resources available within the school. When appropriate and feasible, they would look comparatively at the achievements of applicants in the same pool who attended the same high school and therefore might be expected to have similar opportunities and challenges. They will also consider other contextual factors that bear directly on the applicant's achievement, including linguistic background, parental education level, and other indicators of support available in the home.*
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> *The admissions evaluation should also recognize a wide range of talent and creativity that is not necessarily reflected in traditional measures of academic achievement but which, in the judgment of the reader, is a positive indicator of the student's ability to succeed at Berkeley and beyond; to contribute meaningfully and uniquely to intellectual and social interchanges with faculty and fellow students, both inside and outside the classroom; and to make a special contribution to our society and culture. In applying the criteria above, readers should carefully consider evidence provided in the personal statement, as well as in the academic record and list of honors and achievements. For example, the essay may reveal a level of maturity and ability to reflect on one's life experience in relation to the larger world that indicates a high potential to benefit from and contribute to the richness of the intellectual life of the campus. Or it may reveal special qualities of leadership and initiative that indicate unique potential to contribute to the community and to society in an important way through political, social, or other forms of service.*

In evaluating comprehensive review at Berkeley, I have tried to develop measures of each selection criterion and to incorporate as many of the principles as possible into my statistical analysis. In addition, I have kept the two paragraphs that follow the selection criteria in mind as I designed the PUV study, explained the variables to the readers, and carried out the statistical analysis.

In the principles, criteria, and surrounding text, I saw three things that may not occur to readers who do not translate words into statistical relationships for a living. First, the emphasis on academic achievement *in context* suggests to me that rank-in-class, i.e., the applicant's grade point average (GPA) relative to other students in the same high school who applied to UC would be more appropriate than the raw GPA. Preliminary analysis bore that out; percentile rank in class according to weighted GPA is more closely correlated than other grades-based measures

with both the read scores students received from their comprehensive review and with the ultimate admission decision.[7]

Second, the surplus of qualified applicants and the emphasis on academic performance imply a GPA queue for admission. Nearly all the top applicants from good schools will get into Berkeley, and it probably does not matter if they are in the 90th, 95th, or 99th percentiles of those schools. As top applicants fill the freshman class, they quickly use up the available slots in the freshman class. At some point in the GPA queue the probability of scoring well enough to gain an admission offer starts to drop quickly, then it bottoms out and stays uniformly low. This queuing phenomenon implies more variation in the effect of GPA across its range than simple statistical models can accommodate. I added more statistical terms to give the model enough flexibility to capture variation throughout the data range. The same logic implies similar adjustments to the relationship between test scores and read scores, too. In building a useful statistical model, I used three terms to achieve this kind of flexibility (a tool known as a spline function). The main effect applies throughout the range of the GPAs and test scores, a low-end effect allows for different (presumably weaker) effect for students who rank below the 20th percentile of that variable, and a high-end effect allows for different (presumably weaker) effect for students who rank above the 80th percentile of that variable.

Finally, freshman applicants to Berkeley apply to one of five different colleges. The colleges may emphasize different basic requirements. Engineering and Chemistry require more mastery of mathematics in the first semester of the freshman year than the other colleges do, so the quantitative portion of SAT-I and the math part (especially Math 2C) of SAT-II ought to matter more for those colleges than for the others. I report analyses that pool all the applicants, regardless of which college they applied to, but supplement that with calculations within colleges.

[7] Data on the school's distribution of GPAs was missing for 6,171 applicants – all but 1,687 of them out-of-staters. In order to use this variable, I had to make a statistical estimate of the likely percentile in the GPA rank for these students and substitute that likely percentile for their missing data. For most students with missing data on their school's GPA distribution, I substituted the average percentile rank in school among applicants with the same GPA and known percentiles. For some students, I had another useful piece of information – their school's Academic Performance Index (API). I regressed percentile rank (transformed to avoid predicting ranks above 100 and below 0) on GPA and the school's API for students with complete data and then used the coefficients from that regression to estimate percentile rank for the applicants with known APIs.

4. The applicant pool

Berkeley applicants include the cream of California secondary education and a self-selected group of other very talented young people from California private schools, other states, and even other countries. They have far better grades and test scores than a random sample of California high school graduates. Their accomplishments stand out, too, in that the Berkeley applicants took more academically challenging courses and more advanced placement courses than usual. Most complemented their academic accomplishments by contributing to their high schools and communities, often in leadership roles. The California applicants are drawn disproportionately from the state's academically strongest public high schools.

The social composition of Berkeley's applicants echoes the inequities of California secondary education. Many Berkeley applicants have benefited from advantages like college-educated parents, a comfortable family income, a stable family life, and a safe neighborhood, and their accomplishments are, by no means, automatic or guaranteed by their resources. But as the university attempts to level its playing field, it is appropriate to acknowledge that the practice field is far from level. Few of these resources directly affect the read score or the ultimate application decision, but they all correlate significantly with both read score and admission when we ignore grades and test scores. That means that students who have socioeconomic advantages get better grades and test scores and, consequently, better read scores and admissions decisions. Put another way, grades and test scores reflect not only academic achievements but also differential opportunities to achieve.

Table 1 presents some elemental data about the Berkeley applicant pool. The top panel reports the counts of 2004 applicants by gender, ethnic identity,[8] and official residence.[9] The

[8] Item 137 on the UC admission form gives applicants the option to "indicate your ethnic identity by checking the appropriate boxes." There are 14 boxes. Most applicants checked one or more boxes; 2,589 left item 137 blank. I reduced the 14 to eight categories to simplify the presentation in Table 1 by aggregating the American Indians and Alaskan natives into one category and the various Asian and Pacific Islander groups into another. I put all the foreign applicants in a distinct category regardless of the ethnic identity they may have checked. In subsequent tables I further simplified the presentation by reporting the three groups that have received the most public comment – African Americans, other under-represented minorities (Chicanos, Latinos, American Indians, and Alaskan natives), and Asian Americans (including Pacific Islanders) – plus whites and pooling all the other groups (including "declined to state") together. I refer to this classification as "ethnic identity" throughout this report to keep in mind the term the applicants saw when they made their choice. Had the form used another term – e.g., "race" or "national origin" –some applicants might have checked a different box.

readers who evaluated the application did not know the applicant's gender or ethnic identity – at least they did not know what the applicant checked on items 136 (gender) and 137 (ethnic identity) because those two items were whited out on the copies of the applications the readers saw.[10]

Table 1. Applicants by Ethnic Identity, High School Grades, Gender, and California Residency, 2004

	Official Residence				
	California		Elsewhere[c]		
Characteristic	Male	Female	Male	Female	Total
Ethnic Identity					
Native[a]	69	90	7	19	185
African American	533	871	55	92	1,551
Chicano / Latino	1,968	2,571	117	159	4,815
Asian American[b]	5,543	6,329	970	809	13,651
White	4,727	4,814	1,042	973	11,556
Other	256	337	31	46	670
Declined to state	1,140	1,095	177	157	2,569
Foreign	--	--	952	826	1,778
Total	14,236	16,107	3,351	3,081	36,775
High School Grades					
Below 3.00	10%	6%	5%	3%	7%
3.00 to 3.33	20%	16%	13%	9%	17%
3.34 to 3.66	31%	30%	26%	23%	30%
3.67 to 3.99	31%	37%	40%	45%	36%
Perfect 4.00	8%	10%	15%	19%	11%
Total	100%	100%	100%	100%	100%

a- Includes American Indians and Alaskan natives.
b- Includes Pacific Islanders.
c- Includes foreign nationals living in California.

Looking to the California residents first, we see that female applicants outnumber male applicants overall and in every ethnic group. Young men are less likely to declare an ethnic identity, though, so males outnumber females in the "decline to state" category. The gender

[9] Some of the foreign applicants attended California high schools and were, presumably, living in California when they applied.

[10] Names, which might give readers clues about gender or ethnic identity, are visible to readers.

difference is significantly greater for African Americans than for other groups; 62% of the African American applicants are young women. The proportion of women to men is smallest among whites than among the other groups.

Berkeley applicants were very successful in high school. In the courses they took prior to their senior year, 93% maintained a B average or better; 11% had perfect 4.0s. The GPA formula that UC uses gives extra weight to honors and advanced placement (AP) classes. The weighted GPAs will come into play later in this report, but for Table 1, I used the simple (unweighted) GPA. Female applicants had higher GPAs than males. Out-of-state applicants were even more successful in high school than in-staters. Almost one-fifth of out-of-state female applicants had perfect 4.0 GPAs.

Table 2 reports grades, type of school (public versus private), and high school academic performance by ethnic identity. The ethnic differences in grades are small in an absolute measure, but statistically significant and ultimately important for admissions differentials. Unweighted GPAs range from 3.29 for African American applicants to 3.60 for the "other" group. Latinos and Native Americans score about one-tenth of a grade point above African Americans, and Asian Americans score one-fourth of a grade point higher. These differences, though modest, are statistically significant on the statistical base of 30,654 in-state applicants.

Table 2. Applicants by High School Grades, Type of High School, Quality of High School, and Ethnic Identity: California Residents only, 2004

	Ethnic Identity				
Characteristic	African American	Chicano / Latino / Native[a]	Asian American	All other[b]	Total
High School Grades					
Below 3.00	21%	12%	8%	5%	8%
3.00 to 3.33	30%	22%	17%	15%	18%
3.34 to 3.66	29%	32%	31%	30%	31%
3.67 to 3.99	17%	28%	35%	38%	34%
Perfect 4.00	3%	6%	9%	11%	9%
Total	100%	100%	100%	100%	100%
Mean GPA	3.29	3.45	3.55	3.60	3.54
Type of High School					
Public	78%	84%	88%	75%	82%
Private	22%	16%	12%	25%	18%
Total	100%	100%	100%	100%	100%
Academic Performance of High School[c]					
Bottom 20%	24%	33%	6%	2%	10%
Rank 21st-40th	24%	20%	12%	8%	13%
Rank 41st-60th	17%	15%	12%	14%	13%
Rank 61st-80th	17%	13%	18%	23%	19%
Rank 81st-90th	6%	8%	14%	17%	14%
Top 10%	12%	10%	37%	36%	31%
Total	100%	100%	100%	100%	100%

a- Includes Native Americans and Alaskan natives.
b- Includes applicants who declined to state an ethnic identity.
c- Restricted to California high schools that received a rating.

Asian American and Latino / Native applicants attended public schools more often than African American or other applicants did; 22% of African American and 25% of other applicants attended private high schools.

Applicants who attended public schools went to the better ones. The California Department of Education uses standardized tests given to all students to compute an Academic Performance Index (API) for the state's public high schools. UC ranks the schools into deciles

according to the API. Approximately one-tenth of California seniors attend the schools in the lowest decile, ten percent attend the schools in the second decile, and so on. The shares are not exact tenths because the deciles refer to schools, not students. If Berkeley drew applicants from schools at every level in proportion, then we would see 20% in each pair of deciles (or, in other words, in each quintile). Instead, 10% of applicants attended schools in the bottom two deciles, 13% attended schools in the third and fourth deciles, and 13% attended schools in the fifth and sixth deciles; that is, each is about equally under-represented. The seventh and eighth deciles approximate proportional representation (19% attending). The ninth decile is slightly over-represented with 14% (instead of 10%). A whopping 31% (instead of 10%) attended schools in the top tier of California's public high schools.

Under-represented minority applicants attended high schools with lower APIs. One-fourth of African American applicants attended schools in the bottom two deciles; 33% of Latino/Native applicants attended the schools with the lowest API tiers. These minorities are proportionally represented in the top schools – around 10% – but those are low percentages compared with Asians (37%) and others (36%).

In Table 3 we see the resources that many applicants bring with them. Their parents are educated, most have comfortable incomes, and some are quite affluent. Seventy-six percent of applicants have at least one parent who graduated from college; almost half (46%) have two. One-fourth report parental income of $100,000 per year. Six-figure incomes are typical of earners as well educated as applicants' parents are, but they are not typical of California households in general. Another 28% decline to state their parents' income. I compared the students who reported their parents' income with those who did not on parental education and API and found that the applicants who did not report a family income more closely resembled the families with incomes over $100,000 than the families with less (details not shown but available upon request).

Table 3. Applicants by Parents' Education and Income and Applicants' Ethnic Identity: California Residents only, 2004

	Ethnic Identity				
Parents' Educations	African American	Chicano / Latino / Native[a]	Asian American	All other[b]	Total
	A. Parents' Education				
Mother Not High School Graduate					
Father same[c]	2%	30%	9%	2%	9%
Father more	3%	7%	4%	1%	3%
Mother High School Graduate					
Father less	3%	7%	2%	1%	2%
Father same[c]	25%	14%	10%	6%	9%
Father more	28%	20%	23%	22%	23%
Mother College Graduate					
Father less	6%	4%	5%	4%	5%
Father same[c]	8%	5%	16%	15%	13%
Father more	6%	3%	13%	15%	12%
Mother Advanced Degree					
Father less	8%	4%	4%	10%	6%
Father same[c]	11%	7%	13%	24%	17%
Total	100%	100%	100%	100%	100%
	B. Parents' Income				
Missing	20%	15%	21%	38%	28%
< $30,000	28%	32%	20%	7%	17%
$30,000- $59,999	21%	26%	18%	10%	16%
$60,000- $99,000	16%	15%	17%	14%	16%
$100,000-$149,000	8%	8%	12%	13%	12%
$150,000 or more	6%	5%	11%	16%	12%
Total	100%	100%	100%	100%	100%

a- Includes American Indians and Alaskan natives.

b- Includes applicants who declined to state an ethnic identity.

c- Includes applicants with missing data on father's education.

Ethnic differences in parental income are larger than the differences in education. About 30% of applicants who identify with one of the under-represented minority groups come from a home with less than $30,000 income: 28% of African Americans and 32% of other minorities. At the other end of the income spectrum, 14% of minority applicants report six-figure parental

incomes; that is high compared to California families in general but low compared with Berkeley applicants from other ethnic backgrounds. The Asian American applicants have an income profile most like the applicant pool as a whole – 20% below $30,000 and 23% $100,000 and over. Among applicants from other ethnic backgrounds or who decline to state, only 7% report a parents' income below $30,000, 13% report an income of $100-to-$149,999, 16% say their parents' income is $150,000 or more, and 38% decline to state an income.[11]

I refer to the educations and incomes of the applicants' parents as "resources" because the research in education, sociology, and labor economics shows that parents use them that way. [12] Educated parents teach their children things they know, especially grammar and reading at young ages. Educated parents are also better equipped to help with homework, especially in advanced or technical subjects. In addition to preparing their children better for college work, educated parents' own experiences help navigate the application process. Applicants whose parents' educations stop with secondary school have to rely on resources provided by their schools or extended families. Many parents with high incomes use their money to buy advantages for their children. They buy houses in good school districts or pay tuition for private schools. They buy books, computers, after-school tutoring, and SAT coaching. Also important is the fact that the children of affluent parents are under less pressure to find part-time jobs to help finance their own educations.

The advantages associated with parents' educations and incomes shows up in higher grades and test scores, and often in academic and leadership activities as well. Accordingly the people who read the Berkeley applications are instructed to view low-income and after-school work to meet non-discretionary expenses as obstacles to educational success. I included parents' educations and incomes as factors in my statistical analyses. For the most part, their effects were indirect. Socioeconomic resources improved grades and test scores, which, in turn, improved read scores and admission chances.

[11] The 16% with incomes of $150,000 or more is 26% of those reporting incomes.

[12] The consequences of parents' educations and incomes for their children are well-researched in all of these disciplines. Steven Brint's *Schools and Society* (1998) provides a comprehensive introduction. Also see Annette Lareau, *Unequal Childhoods* (University of California Press, 2003).

5. Read scores

The key outcome of the comprehensive review is the "read score." Two readers independently examine each and every application. They begin by reading a summary sheet that contains the student's grades and test scores, information about his or her family, and information about the high school the student is currently attending.[13] They then read the entire application, assessing the number, intensity, and quality of extra-curricular activities, work experiences, enrichment and outreach, and, the strength of the applicant's overall academic program and the senior year in progress. Finally they read the personal statement and essay. The reader then assigns a unitary score of 1, 2, 2.5, 3, 3.5, 4, or 5 or marks the applicant "N: not eligible" – a score of 1 is best. The other reader does the same. The two scores are averaged unless they differ by more than 1.0; in which case they receive a third reading by an experienced reader known as a "lead reader" who substitutes her or his score for one of the original reader's scores (this happened in 2.2% of cases this year). Admission decisions are based on the average of the two scores.

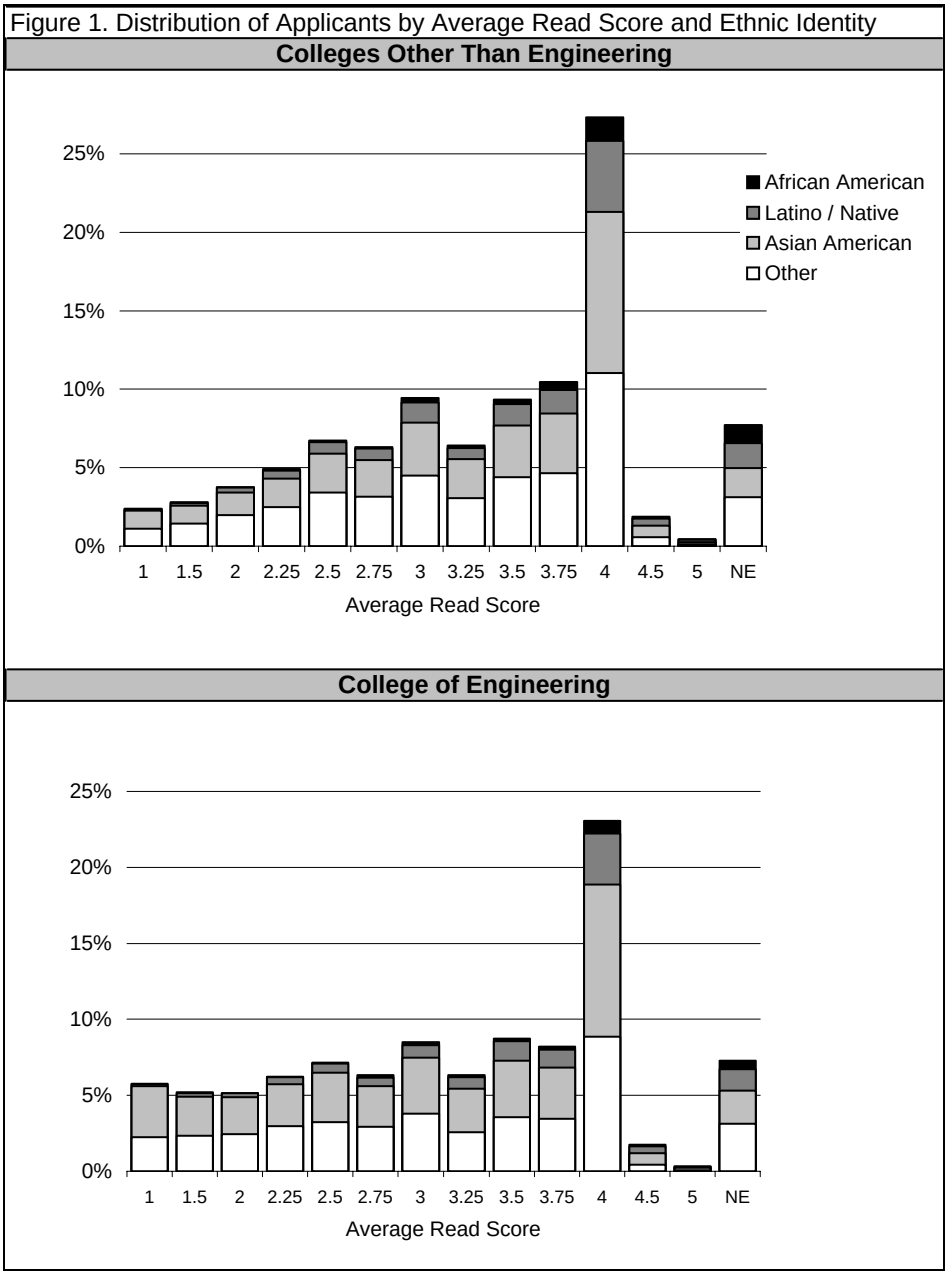
Figure 1 shows the distribution of applicants by average read score, ethnic identity, and college (Engineering or other).[14] The modal score is 4 (by a large margin); 27% of L&S, Natural Resources, Environmental Design, and Chemistry applicants receive this score while 23% of Engineering applicants do. A score of 4 means "UC-qualified but not Berkeley-qualified." Therefore, very few 4s get admitted to Berkeley. Seven percent of applicants are score "not eligible" (NE). The score pattern of the College of Engineering is more uniform than that of the other colleges. Between 5% and 9% of Engineering applicants got each score from 1 to 3.75; 4.5 and 5 are very rare. Scores less than 2.5 are not as common in the other colleges as they are in Engineering; 3.5, 3.75, and 4 are all more prevalent in the other colleges than in Engineering. The paucity of scores less than 2 and at 4.5 or 5 created some statistical difficulties in

[13] The order of reading the parts of the applications differs from year-to-year. Here I describe the front-to-back sequence that readers were instructed to follow in 2003-04. In the past they have been instructed to read back-to-front (i.e., read the essay first) and to start on page 3.

[14] The percentages sum to 100% within colleges.

preliminary analyses, so most multivariate analysis ignores the distinctions below 2.25 and the distinction among 4s, 4.5s, and 5s.[15]

Figure 1. Distribution of Applicants by Average Read Score and Ethnic Identity



[15] The ability to make statistical inferences depends on this simplification. Using the full range of scores in an ordered logit regression analysis yielded coefficients for the key independent variables that were very close in magnitude to those reported here for the smaller set of scores. But the statistical procedures failed to obtain asymptotic standard errors (ASEs) for the estimates based on all possible scores – the correspondence between factors like perfect GPAs and ELC and getting scores below 2.25 is so strong that the ASE algorithm ran into tolerance limits. Dropping some key variables from the model yielded ASEs for the remaining coefficients, but, unfortunately, those coefficients are biased by the exclusion of the variables that had to be dropped.

Asian Americans are the largest group among Engineering applicants, and they are proportionately represented at each score except 5 and NE. There are 100 fewer others than Asians; they too are proportionately represented everywhere except 5 and NE. African American applicants to Engineering, on the other hand, score poorly and 22% of them are NE.

Asian Americans, Latino / Natives, and African Americans together outnumber the other ethnicities among the applicants to the other four colleges, but the "others" are the largest single ethnic group in this pool of applicants. Asians and others scored better than the Latino / Natives and the African Americans.

Figure 1 also shows how few African American students apply to Berkeley. The slim black lines at the top of each bar in the figure is slimmer than would be expected from the composition of the California high school graduating class of 2004.

6. After read the read score is assigned

Augmented Review

If a reader concludes that an applicant is "close to being competitive for admission but whose application is particularly challenging or lacking essential information that would confirm for the reader that the applicant should receive a score likely to result in admission," then the reader can refer that application to "Augmented Review" (AR).[16] An experienced staff member, known as a "lead reader," assesses the case and decides whether the application warrants AR or not. Applicants who are getting an AR receive a detailed questionnaire that collects additional information about the student's background, environment, and readiness for academic work at the level expected of Berkeley students. They are also asked to submit letters of recommendation. Most applicants who have disabilities are also referred to AR; they get a different questionnaire that focuses on their circumstances.

The new material is read and scored. The AR score, which is on a different scale and uses additional criteria, is used instead of the original read score as the basis for admission or denial.

[16] The quote is from "Reader Guidelines for Referral to Augmented Review, 2004." That document also cautions readers, "the fact that an applicant comes from a low-income family and/or has parents who did not graduate from college is not enough to warrant an applicant being referred to the Augmented Review pool."

Admissions Decisions

Berkeley admits applicants in batches defined by read scores. Fall regular admission is the preferred outcome for most applicants and those decisions are made first. L&S and Engineering applicants who are denied fall admission next compete for spring admission. Then lead readers review the outcomes school-by-school to ensure that applicants from the same school (and from the same family) are treated in a consistent manner. This process yields between 450 and 500 "by high school" admissions. Most are L&S applicants who get shifted from spring admission to fall admission because some classmates with the same or weaker academic records earned fall admission. The remaining one-third of the by-high-school admits are applicants with read scores that implied denial but who are granted a spring admission because classmates with weaker academic records are being admitted. After they receive a spring admission or denial, a few applicants appeal that decision. Some of them win on appeal and either get upgraded from spring to fall or admitted after an initial denial.

Applicants that have been referred to AR proceed on that track, receive an AR score and are admitted or denied admission based on the AR score instead of the original read score.

OUA fills the freshman quota for each college starting with the applicants who scored a 1 and then moves up to the higher scores until the college's quota is filled. There is almost always a point at which some – but not all – applicants with a particular score can be admitted. The applicants at that score are "tied" – there is no variation in their read scores to determine who is to be admitted and who is not. Their applications are examined again in the "tie-breaking" process. Senior OUA staff break the tie by creating a more fine-grained ranking of applicants who have identical read scores. In Engineering and L&S, applicants who are not selected for fall admission in tie-breaking are then the first applicants considered for spring admission. A subsequent tie-breaking process usually also occurs for spring for Engineering and L&S.

Admission Rates

The competition varies by college. The most competitive colleges reach their quotas at lower read scores than the less competitive colleges. However, no college admits all of the eligible applicants. The College of Engineering offered regular fall admission to 20% of its applicants, as shown in Table 4. The regular fall admission rates for the other colleges ranged

from 21% for Letters & Science (L&S) to 38% for Chemistry. Engineering and L&S also offer spring admission; Engineering admitted 1% of its applicants for spring enrollment and L&S admitted 6% that way. Review by high school upgraded 1.4% of L&S applicants from spring to fall admission and 0.6% from rejection to spring admission. By-high-school admissions to the other colleges total just 17 cases. Tagged athletes were 1% of the applicants. Within the College of Engineering, 1% of applicants were denied admission to the major they applied to but offered a place in another major within the college. One percent of applicants were admitted after AR. Finally, 30 applicants (less than 0.1%) were admitted after successful appeal.

Table 4. Admissions Outcomes by College and Official Residence, 2004

	College					
Outcome	Engin-eering	L&S	CNR	Env. Design	Chem-istry	Total
	A. California Residents					
Admitted						
Regular: Fall[a]	20%	21%	26%	25%	38%	22%
Regular: Spring[a]	1%	6%	0%	0%	0%	5%
By High School[b]	0%	2%	0%	0%	1%	1%
Tagged Athlete	0%	1%	1%	1%	0%	1%
Engineering Redirect	1%	0%	0%	0%	0%	0%
Augmented Review[b]	0%	2%	1%	1%	1%	1%
On Appeal[b]	0%	0%	0%	0%	0%	0%
Not Admitted	78%	68%	72%	73%	61%	70%
	B. Numbers of Decisions and Withdrawals					
Decisions Made	5,552	26,594	2,102	950	844	36,042
Neither admitted nor denied						
Application withdrawn	76	433	15	5	8	537
Requested dual admission	32	134	7	13	10	196

a- Includes tie-breaking.
b- Combines fall and spring.

The applicant pools of the five colleges differ in quality and preparation, and the programs differ in the level and kind of preparation they expect. This results in differences in how the scores are given to applicants to Engineering versus the other colleges, and where the different colleges draw the lines for admission. Table 5 shows this. Admission standards are higher for foreign and out-of-state applicants so the table focuses on California residents to show

how the system works for them. Engineering admitted all its 1s and 1.5s, but even some of the 2s and 2.25s were denied regular admission. Some 2s and 2.25s were admitted in tie-breaking. The rest, and many 2.5s, were offered admission to other Engineering majors. Engineering has separate admissions targets for each major, so some anomalies crop up when we ignore which major an applicant chose. Bioengineering and Electrical Engineering filled before all the 2.5s from California were admitted. Meanwhile, Mechanical and Nuclear Engineering accepted all their in-state applicants who scored 3 or better.

Table 5. Admissions Outcomes by Average of Original Read Scores and College: California Residents Only, 2004

	College					
Score	Engin-eering	L&S	CNR	Env. Design	Chemistry	Total
	A. Regular and By-high-school Admissions					
1	100%	100%	100%	100%	100%	100%
1.5	100%	100%	100%	100%	100%	100%
2	91%	100%	100%	100%	100%	98%
2.25	86%	100%	100%	100%	100%	98%
2.5	49%	100%	100%	100%	100%	93%
2.75	27%	97%	100%	100%	100%	88%
3	21%	52%	100%	100%	19%	52%
3.25	0%	2%	4%	2%	2%	2%
3.5	0%	1%	1%	0%	0%	1%
3.75	0%	0%	0%	1%	0%	0%
4	0%	0%	0%	0%	1%	0%
4.5	0%	0%	0%	0%	0%	0%
5	0%	0%	0%	0%	0%	0%
Not eligible	0%	0%	0%	0%	0%	0%
	B. All Admissions					
1	100%	100%	100%	100%	100%	100%
1.5	100%	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%	100%
2.25	99%	100%	100%	100%	100%	100%
2.5	63%	100%	100%	100%	100%	95%
2.75	28%	100%	100%	100%	100%	90%
3	22%	57%	100%	100%	25%	56%
3.25	1%	7%	5%	4%	11%	6%
3.5	1%	5%	4%	5%	0%	5%
3.75	0%	4%	4%	1%	0%	3%
4	0%	2%	1%	1%	2%	2%
4.5	0%	0%	0%	3%	0%	0%
5	0%	1%	0%	0%	0%	1%
Not eligible	0%	0%	1%	3%	0%	0%

The other four colleges are strictly by the numbers. All L&S applicants who rated a 2.75 or lower were admitted (3% of the 2.75s by AR). Just over half of the 3s (57%) gained admission. These figures hide some of the dynamics. The applicants with scores of 2.5 or better were offered regular fall admission, 36% of the 2.75s were offered fall admission after tie-break, the other 64% of 2.75s and 57% of the 3s were offered spring admission. Almost none of the applicants with scores of 3.25 or higher were offered admission to L&S; 2% were admitted after AR, a few (0.4%) by high school, and a few more on appeal. Most of the successful ARs had an original read score of 3.25.

Natural Resources and Environmental Design admitted everyone with a score of 3 or better and almost no one with a worse score. Chemistry came very close to filling its quota with applicants who scored 2.75 or less. It offers no spring admissions. A quarter of the 3s were admitted through by-high-school review (5%), tie-break (14%), and AR (7%).

Table 6 gives a more detailed view of L&S admissions broken out by original read score, residency, and outcome. The top panel shows what happened to California residents, the second shows the outcomes of out-of-staters, and the bottom panel shows the foreign applicants' outcomes. Bold boxes outline the cells that contain 0.5% or more of the 26,000 L&S applicants. A dashed horizontal line divides scores of 2.75 or better from those 3 and above – 99.95% of Californians above that line were admitted, compared with just 9.91% of Californians below it.

Table 6. Relationship between Read Score and Admission Category by Residency

Average Read Score	Regular or tie-break		Not admitted	Reviews by School		Augmented Review		Appeals	
	Fall	Spring		Fall	Spring	Fall	Spring	Fall	Spring
A. California Residents									
²2	1,918								
2.25	1,075			1					
2.5	1,477								
2.75	498	760	3	71		35		1	
3		747	900	182	153	105		1	6
3.25			1,316	29		64		1	11
3.5			2,038	14	3	89	2	2	6
3.75			2,337	7	2	64	2		11
4+			6,812	5		102		2	8
NE			1,358			4			1
B. Out-of-state Residents									
²2	472								
2.25	138	67		1					
2.5		105	175			1			
2.75			237		1	3		1	
3			292			4			
3.25			226			3			
3.5			289			1			
3.75			248	1					
4+			466		1	1			
NE			391					1	1
C. Foreign Applicants									
²2	96		6						
2.25			59						
2.5			82						2
2.75			69					1	1
3			100			1		1	
3.25			58						1
3.5			84						
3.75			84			1			
4+			210						
NE			192						

A score of 2.5 or better almost guaranteed Californians regular fall admission; the one exception was upgraded from spring to fall during by-school review. Out-of-state and foreign applicants had to score 2.25 or better to assure themselves regular fall spots.[17] That left about 750 openings for fall and over 2,300 applicants with scores below 3 to fill them. Tie-breaking procedures admitted 498 Californians with scores of 2.75 and 138 out-of-staters with 2.25s. Most

[17] Six foreign applicants with scores of 2 were denied admission.

spring spots were filled by the remaining Californians who scored 2.75 but did not "win" the tie-break, which included 747 of the 1,647 Californians with 3s, and 172 out-of-staters who scored 2.25 or 2.5. Review by high school upgraded 182 applicants with 3s and 55 Californians with higher scores to fall admission and another 158 to spring admission. Of the 1,852 AR cases from L&S, 482 were admitted (478 to fall semester; 4 to spring). An additional 59 applicants successfully appealed and were granted admission – 11 for fall and 48 for spring.

Much public discussion of Berkeley admissions addresses the prospects for admissions among California applicants with different ethnic identities. Table 7 breaks out the admission data for Californians who applied to L&S and Engineering by read score. In both colleges, read scores are far more important than ethnic identity. As we already saw in Table 6, every L&S applicant with a read score below 3.0 was admitted; almost everyone with a read score above 3.25 was denied admission. There is no margin for substantial ethnic disparity below 3 and above 3.25. At 3.0 and 3.25, applicants who identified with under-represented minorities were more likely than others to be admitted. Because of this disparity, much of my statistical analysis will be directed at figuring out (a) how applicants got their scores and (b) how decisions that occurred in AR and tie-break resulted in the association between ethnic identity and admission at scores 3 and 3.25.[18]

[18] As we saw in Table 6, applicants with scores of 3.0 are admitted either in tie-break or AR.

Table 7. Admissions by Average of Original Read Scores, Ethnic Identity, and College: California Residents Only, 2004

Average Read Score	*Ethnic Identity* African American	Chicano / Latino / Native[a]	Asian American	All other[b]	Total
	A. Letters & Science				
1	100%	100%	100%	100%	100%
1.5	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%
2.25	100%	100%	100%	100%	100%
2.5	100%	100%	100%	100%	100%
2.75	100%	99%	100%	100%	100%
3	78%	71%	53%	54%	57%
3.25	11%	16%	7%	5%	7%
3.5	14%	7%	4%	5%	5%
3.75	9%	7%	2%	3%	4%
4	4%	3%	1%	2%	2%
4.5	0%	1%	0%	1%	0%
5	0%	3%	0%	0%	1%
Not eligible	1%	0%	0%	1%	0%
	B. Engineering				
1	--	100%	100%	100%	100%
1.5	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%
2.25	100%	95%	100%	98%	99%
2.5	33%	59%	57%	73%	63%
2.75	13%	22%	26%	33%	28%
3	10%	29%	18%	26%	22%
3.25	0%	0%	1%	3%	1%
3.5	0%	3%	0%	0%	1%
3.75	0%	0%	0%	1%	0%
4	0%	0%	0%	0%	0%
4.5	0%	0%	0%	0%	0%
5	0%	0%	0%	0%	0%
Not eligible	0%	0%	0%	0%	0%

a- Includes American Indians and Alaskan natives.
b- Includes applicants who declined to state an ethnic identity.

Engineering has a much higher admissions bar. Californians who scored below 2.5 were admitted; those above 3.0 were denied admission. At 2.5, 2.75, and 3.0 there was uncertainty. The ethnic disparity in Engineering reverses that in L&S – in Engineering the underrepresented minorities have lower acceptance rates than other ethnic groups.

Engineering varies the bar for admission among different majors. Table 8 breaks out the Engineering admission data by read score and major. Bioengineering fills with applicants whose scores were 2.25 or better. Materials Science is near capacity with just 2.25s or better; it took less than half of the applicants who scored 2.5. Few undeclareds get in with scores above 2. Electrical Engineering fills once the 2.75s are admitted. Only Civil, Mechanical, and Nuclear Engineering take significant numbers of 3s.

Table 8. Regular and By-school Admissions by Average of Original Read Scores, and Intended Major: College of Engineering Applicants from California, 2004

	Intended Major					
Average Read Score	Nuclear	Mechanical	Civil	Industrial & Operations[a]	Engineering Math & Statistics	Engineering Physics
1	100%	100%	100%	100%	--	100%
1.5	100%	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%	100%
2.25	100%	95%	100%	100%	100%	89%
2.5	100%	100%	92%	100%	100%	100%
2.75	100%	96%	96%	100%	100%	100%
3	100%	98%	88%	0%	0%	0%
3.25	0%	0%	0%	0%	0%	0%
3.5	0%	0%	0%	0%	0%	0%
3.75	0%	0%	0%	0%	0%	0%
4	0%	0%	0%	0%	0%	0%
4.5	0%	0%	0%	0%	0%	0%
5	--	0%	0%	0%	--	--
NE	0%	0%	0%	--	0%	0%
Total	30%	37%	27%	37%	24%	25%

	Intended Major						
Average Read Score	Environ-mental	Computa-tional	Electrical Engineering & Computer Science	Materials Science & Engineering	Bio	Undeclared	All majors
1	100%	--	100%	100%	100%	100%	100%
1.5	--	100%	100%	100%	100%	100%	100%
2	100%	--	100%	100%	97%	100%	99%
2.25	--	--	100%	100%	100%	100%	99%
2.5	--	100%	100%	63%	2%	31%	63%
2.75	100%	67%	0%	0%	0%	0%	27%
3	0%	0%	1%	0%	2%	0%	22%
3.25	0%	0%	1%	0%	0%	0%	0%
3.5	0%	0%	1%	0%	0%	0%	0%
3.75	0%	0%	1%	0%	0%	0%	0%
4	0%	0%	0%	0%	0%	0%	0%
4.5	0%	0%	0%	--	0%	0%	0%
5	--	--	0%	--	0%	0%	0%
NE	--	0%	0%	--	0%	0%	0%
Total	25%	10%	27%	44%	27%	21%	27%

a-Also includes manufacturing engineering.
Note: NE=Not eligible.

Because read scores determine so much of the admissions process, most of my statistical analysis focused on modeling the scoring process. I also analyzed who was assigned to AR, their revised (AR) scores, and, ultimately, who was admitted through tie-break and AR.

7. A statistical model of reader scores

Readers are instructed to evaluate applicants' academic achievements and extracurricular activities in the context of the opportunities and obstacles that they encountered at home, in school, and in their wider communities. These factors are gleaned from over 100 pieces of information on the applicant's form,[19] three essays, and a "read sheet" that contains administrative data about the applicant and her/his school. For my analysis I considered all the factors enumerated in the principles and guidelines plus the supposedly irrelevant factors of gender and ethnic identity. The factors that I figured in my analysis included: residency (California or elsewhere); college; grades; college-prep coursework; scores on the verbal and quantitative portions of SAT-I and the composition, math, and optional portions of SAT-II; the ELC (eligible in local context) designation; the API decile of the applicant's high school; how many classmates applied to UC; participation in minor, major and UCB-sponsored outreach programs; parents' educations and income; whether the applicant's grades were on an upward or downward trend; overall strength of the senior year; major and minor extracurricular activities; leadership in school and community; how many obstacles the applicant encountered; and whether her / his personal statement showed intellectual maturity, "spark," or evidence not found elsewhere in the application.

In addition, at various points in the analysis I considered a dozen or so other factors that bore no net relationship to the average read score the applicant received. Among the factors I considered were which SAT II optional test the student took, whether she / he took the harder or easier math component of SAT II (scores are normed to reflect the degree of difficulty and indeed I found no difference net of the test score itself), size of high school, size of place of residence, details about parents occupations and educations, and variants of the grade measure I eventually chose. My main conclusions do depend to some extent on the factors in the final model. Drop out some important variables (e.g., grades, SAT-II math scores, or ELC) and the conclusions about other variables would be different than the conclusions I reach. Adding any of

[19] The form enumerates 138 pieces of information. Some are irrelevant for freshman admission (items 112-124 are for transfer applicants), and some are administrative fields like the list of scholarships the applicant would like to be considered for, his/her address, or her/his signature. Others are constants for this analysis – most notably "Berkeley" has to be one of the campuses selected in item 125.

these null variables to the analysis, however, will only cloud issues by inflating standard errors and making it hard to see all but the most dominant patterns in the data.

Picking the variables to consider was just the first step. I then had to figure out the best statistical model of how best to capture each variable's relationship to the average read score. The read score is constructed by having each reader assign one of eight ranked outcomes (1, 2, 2.5, 3, 3.5, 4, 5, or NE). Averaging them across readers' results in 14 discrete outcomes. I chose ordered logistic regression (OLR) as the relevant statistical model because it compactly expresses in a single number the relationship between each factor and read scores – provided that the data conform to certain assumptions.

To see how OLR works, imagine for a minute a much- simpler admissions system in which two readers distinguish "excellent" from "poor" applicants. Suppose further that in this simpler world, readers decide who is excellent by looking at their grades. Now, for a moment ignore one reader and think of the logistic regression of the other reader's score on grades; we get a logistic regression coefficient (β_1) expressing that relationship. Now repeat it for the other reader and get another logistic regression coefficient (β_2). Combining the two readers' judgments would yield a new variable with three categories: excellent on both, excellent on one, and excellent on neither. An OLR with the new three-category variable as the dependent variable and grades as the independent variable would yield a regression coefficient (β^*) that is the average of β_1 and β_2. If β_1 and β_2 are not significantly different from each other, then β^* is statistically equivalent to both and better than either because it is more efficient; it captures how both readers' judgments respond to grades in a single number. Give the readers more choices and OLR will average across those choices as well as across readers. The less variation in β*s* across readers and across scores, the better the OLR model. Later, once a reasonable model has been specified, I will test the assumption that β^* does not vary by reader or score.

Technical Aside

Formally the OLR model is:

$$\ln\left(\frac{\Pr(y_i > m \mid \mathbf{x})}{\Pr(y_i \le m \mid \mathbf{x})}\right) = -\tau_m + \mathbf{x}\beta \qquad [1]$$

for *i*=1,...*N* applicants and *m* =1, ..., *M* scores (*M* is the number of readers times the number of scores minus one). The key assumption is that β does not vary by *m*.

While the AEPE guidelines prescribe what the readers consider as they decide on a read score, they leave it up to the readers to figure out how much weight each factor gets. The β coefficients in the OLR model disclose after the fact the average weight each factor got. Of course, averages can be misleading if they mask substantial variation. Therefore I have attempted to include the most relevant variation in the model.[20]

Grades top the list of relevant factors. Readers have access to a wealth of information about each applicant's grades: the application itself contains the applicant's own report of her / his grades in each required (a-g) course, the total GPA in a-g courses and her / his GPA with extra credit for honors and advanced placement courses ("weighted GPA"), the number of perfect 4.0 GPAs (unweighted) among applicants from that school, and, for each of these reports, a percentile ranking relative to Berkeley applicants from the same high school in the past three years, all Berkeley applicants in the current year, and all applicants to any UC campus in the current year. After some preliminary experimenting and consulting with other researchers who used the data from previous years, I settled on the applicant's percentile rank among Berkeley applicants from the same school as the best measure of the applicant's grades. For applicants from California high schools, it has the largest simple correlation with the read score.

[20] The model must also be complete in the sense that it includes all the relevant factors (or at least all the ones correlated with the factors included). It must also specify the correct functional form.

Technical Aside

Unfortunately, GPA as a percentile among Berkeley applicants from the same school is missing for 1,469 of the 30,000 applicants from California high schools and 4,700 of the 6,000 applicants from elsewhere. I used the roughly 28,500 valid cases from California high schools to devise an equation that would allow me to predict rank in the Berkeley pool from the applicant's weighted GPA and the API for her / his school. I then used that equation to attribute the missing rank for California applicants who had valid data on weighted GPA and API. For students from outside California and for Californians with missing API scores, I predicted rank from weighted GPA alone. This variable – the applicant's GPA weighted with extra credit for honors and AP courses ranked against other Berkeley applicants from the same school or its predicted value if the rank is missing – is my main "grades" variable in the multivariate analysis.

I calculated the predicted weighted GPA percentile among Berkeley applicants from the same school (SPGPA) in four steps. First, for cases with valid SPGPA, I transformed the observed percentile into a logit transformation of it in order to avoid the problem of out-of-bounds predictions:

$$LSPGPA = \ln\left(\frac{SPGPA}{100 - SPGPA}\right). \qquad [2]$$

Then I regressed LSPGPA on the applicant's weighted GPA (PGPA) and dummy variables representing the deciles of API (for schools with API scores). From that regression I calculated an expected LSPGPA for the applicants with missing SPGPA but valid PGPA and API. To get an expected LSPGPA for the applicants with missing API as well as SPGPA, I assumed that their school was in the sixth decile of API if it was a public school or the ninth decile if it was private. From the expected LSPGPA ($\hat{L}$) I calculated expected SPGPA ($\hat{S}$) by reversing the logit transformation:

$$\hat{S} = 100\left(\frac{\exp(\hat{L})}{1+\exp(\hat{L})}\right). \qquad [3]$$

The path from simple GPAs to percentile ranks among Berkeley applicants from the same school can contain some surprises for people not used to these data. To follow the path for one California public high school, consider the 30 applicants listed in Table 9. Their unweighted GPAs range from 2.78 to 4.00; after adding in bonus points for honors and AP courses, that range goes up and spreads slightly: 3.21 to 4.64. The two students who have perfect 4.0 unweighted GPAs have different weighted GPAs because they took different courses en route to their 4.0s. Applicant 30 was at the top of the distribution (99th percentile) of all applicants to Berkeley from this high school in the past three years; her 4.64 weighted GPA implies that 64% of her courses were honors or AP. Applicant 29 also got all As but ranks in the 83rd percentile; despite taking honors or AP in 41% of her courses, because six other applicants got ahead of her. The grades at this school show just how competitive Berkeley admissions are. Only one regular

admittee had a weighted GPA below 4.5, and she (applicant 29) had all As. Now look at applicant 20. She had an unweighted GPA of 3.70 but was not admitted. Crucial in that decision was her relatively low weighted GPA of 4.03 (44th percentile). She did well in the courses she took, but other students took more honors and AP courses and surpassed her. Applicant 19 originally got a negative decision, too, but was admitted on appeal. Applicant 16 had a lower unweighted GPA than Applicant 20, but was admitted in spring tie-break, in part, because his weighted GPA was 4.14 (57th percentile). Applicants 14 and 15 both have unweighted GPAs of 3.54; their weighted GPAs are also 3.54 – indicating that they took no honors or AP courses. For that reason, eight of the 13 applicants with lower unweighted GPAs ranked above them. Indeed, Applicant 15 got the lowest read score among the eligible applicants from that high school.

Table 9. Illustrative Cases from One California High School

		GPA			Read Score	
Case	Sex	Unweighted	Weighted	%ile	(average)	Decision
1.	M	2.78	3.21	5	4	Not admitted
2.	M	3.04	3.43	11	NE	Not admitted
3.	F	3.22	3.77	32	4	Not admitted
4.	M	3.29	3.51	14	4	Not admitted
5.	M	3.33	3.47	11	4	Not admitted
6.	M	3.34	3.65	28	4	Not admitted
7.	F	3.34	3.88	36	3.75	Not admitted
8.	F	3.36	3.56	24	4	Not admitted
9.	M	3.36	4.16	61	4	Not admitted
10.	M	3.41	4.08	51	3.25	Not admitted
11.	M	3.42	3.68	30	NE	Not admitted
12.	M	3.50	3.85	35	4	Not admitted
13.	M	3.50	4.14	57	3.75	Not admitted
14.	M	3.54	3.54	23	4	Not admitted
15.	F	3.54	3.54	23	4.5	Not admitted
16.	M	3.57	4.14	57	3	Spring: Tie-break
17.	M	3.65	4.03	44	3.5	Not admitted
18.	F	3.66	4.08	51	3.25	Not admitted
19.	F	3.67	4.03	44	3.75	Spring: Appeal
20.	F	3.70	4.03	44	3.25	Not admitted
21.	M	3.78	4.39	79	2.75	Spring: Regular
22.	M	3.78	4.50	89	1.5	Fall: Regular
23.	M	3.85	4.50	89	2.25	Fall: Regular
24.	F	3.88	4.19	68	3	Spring: Tie-break
25.	F	3.90	4.54	93	3	Fall: Regular
26.	F	3.92	4.50	89	2.25	Fall: Regular
27.	F	3.92	4.53	91	2.25	Fall: Regular
28.	F	3.92	4.53	91	2	Fall: Regular
29.	F	4.00	4.41	83	2	Fall: Regular
30.	F	4.00	4.64	99	1	Fall: Regular

The students with perfect 4.0 GPAs get special attention from readers and the public, so I will look at the impact of having all As on read scores and admissions decisions.

The strength of the high school curriculum varies in ways that are not completely captured by the difference between weighted and unweighted GPA. My observation of norming sessions suggested that readers use the number of "a-through-g" courses as their first indicator of strength. The term "a-g" is a reference to the codes for UC requirements; the "a" courses are history, the "b" English, the "c" math, the "d" science, the "e" foreign language, the "f" arts, and

"g" electives. The "a-g" count is available for all students. Readers further examine the complete list of courses. Taking college prep courses instead of, say, typing or physical education, shows commitment to academic work commensurate with the Berkeley expectations.[21] One reader's judgment of overall and senior-year strength is one of the PUVs available for re-read sample cases.

All five parts of the SAT are relevant. Former UC President Atkinson sparked some controversy about the relative weight of SAT-I and SAT-II, but for this analysis I will include all five and let the data tell me their relative weights. The guidelines do prescribe more emphasis on the two math tests for applicants to the Colleges of Engineering and Chemistry, so I will check that.

Technical Aside

Regression-type models allow one parameter for the relationship between each independent variable and the outcome of interest. The OLR model specifies that outcome of interest as the log-odds of a higher versus lower score. The read scoring system gives more qualified students lower scores, so the expectation is that those log-odds will fall as applicants' grades and test scores rise. But nothing about the system specifies in advance that the fall-off will be steady enough to be captured by a single parameter. To allow for a closer fit between the expectations of the statistical model and the actual patterns in the data, I used spline functions with knots at the 20th and 80th percentiles for the grade measure and for each SAT component. If one parameter is sufficient, then the statistical estimates of the other two will be close to zero. I allowed for a special non-linearity by counting the number of SAT scores of 750 or higher. Dummy variables for having 4 or 5 scores of 750-plus turned out to be insignificant in most specifications.

The ELC – "eligible in local context – concept is important for read scores and admissions. Being ELC guarantees the applicant UC admission, although it does *not* guarantee Berkeley admission. I entertained the possibility that ELC students are treated differently by estimating one version of the model for ELC and non-ELC students separately. That exploration suggested that grades count less for ELC students – the ELC designation having already accounted for some of the effect grades have on read scores. Ultimately the pattern was adequately captured by a statistical interaction term for being ELC and having a perfect 4.0 GPA. I also allowed for interactions between ELC and ethnic identity to measure the extent to which the ELC program differentially affected ethnic groups. The data revealed no evidence of differential impact, so I dropped those interactions from the model.

[21] I initially thought that grades might count more for applicants who completed more a-f courses. But tests for a GPA-by-curriculum interaction were null. Apparently, giving more weight to honors and AP courses suffices to capture that aspect of the readers' assessments.

In-state residents can be admitted with higher read scores than out-of-state and foreign applicants have to obtain to gain admission. They may also be treated differently by readers. So in most analyses I split the sample into in-state and out-of-state sub-samples.

Applicants who face significant social obstacles are supposed to get special consideration. The reasoning in support of this policy goes like this. Take two applicants, one who has had significant advantages in life and the other who has faced significant obstacles to achievement. If they accomplish the same academic record, then the student who compiled that record despite obstacles to achievement merits more consideration than the one who had advantages in reaching that destination. I considered several obstacles: low income, parents who had never been to college, family break-up, moving from one high school to another, attending a low-achieving school, and having few peers who applied to UC. As noted in discussing Table 2, income data is missing for 29% of applicants. I treat "missing income" as a separate variable in the statistical analysis.

Policy also prescribes that success in a university-sponsored outreach program deserves some consideration. The database records participation, not success. I include dummy variables for what are considered to be minor outreach programs, major outreach programs, and UCB-sponsored programs. As it turned out, the Berkeley programs were particularly important in lowering applicants' read scores, all else being equal.

The foregoing variables are, in principle, known for all applicants. GPA rank within school, API, and income turn out to be missing for a significant number of applicants. Eliminating the cases with missing data might introduce biases into the analysis, so I worked out ways to get proxies for the missing information. I already addressed how I handled missing GPA rank within school and missing family income. Lacking a good proxy for a missing API, I assigned all applicants with missing API data to the ninth, figuring that most were from private schools or out-of-state schools that were significantly better than the average California public school. Of course I did not realistically know how much better. I just guessed at the ninth decile. To correct for the error in my guessing, I added a dummy variable for missing API to each regression. It will allow the data to adjust itself for whatever error I introduced by assigning all

the applicants with missing APIs to the ninth decile. It cannot adjust for unobserved heterogeneity among the applicants with missing APIs, but it does get the mean right.

Many features of comprehensive review are not captured by these administrative variables. To get at the rest, we undertook a re-reading of a sample of applications. Experienced readers – after an additional eight hours of training – read almost 8,000 applications and coded 59 new variables for each. I refer to these 8,000 cases as the "re-read" sample. All African American applicants, one-third of the Latinos and Native Americans, and one-fourth of the remaining applicants were included in the re-read sample. The imbalance is due to the relative numbers of applicants and the statistical power we desired for the re-read analysis. The instructions we gave to the readers who did the re-reading are displayed in Appendix A.

The 59 separate variables were combined into 16 measures of the main aspects of comprehensive review. Eight variables – a few single-item measures but most indexes composed of two or more items – proved to be statistically significant in at least some analyses. Readers coded whether the applicant's grade showed a significant upward or downward trend. The results were asymmetrical; only a downward trend affected average read scores. Readers also coded whether applicants had "strong" or "light" senior years planned.[22] A scale that scored applicants +1 for strong, 0 for neither strong nor light, and –1 for light was important for read scores. Similarly, readers rated extra-curricular participation as strong or light, and I created an "activities" scale with the same –1 to +1 range. Additionally, applicants fill in lots of details about work experience. Having a job that combines academic content, responsibility, and/ or special skill improved the odds of gaining a good read score, as did working because the family needed money. The "good job" scale is the sum (ranging from 0 to 4) of these attributes.[23] Readers identified students who contributed to their high school or hometown community, ones who would likely contribute to Berkeley campus life, and students who demonstrated "spark, pluck, energy, grit, insight, maturity, or originality, relative to the Berkeley applicant pool." The

[22] In observing norming sessions, we noted that readers used this asymmetrical language of "strong" and "light" instead of other possibilities, most obviously "strong" and "weak" or "heavy" and "light." We repeated the readers' vernacular in our coding scheme because we wanted to render visible the invisible process that had gone on in the first read (and, by inference, in the reads done since comprehensive review began).

[23] Applicants who did not work scored zero on the good job scale as did applicants who worked at jobs that had no academic content, gave them no responsibility, required no special skill, and merely facilitated discretionary spending.

"character" scale ranges from 0 to 3 – a point each for contributing in the past, being likely to contribute to Berkeley, and for "spark, etc." Readers also assessed whether applicants taught themselves an academic subject or skill; this is a single item that is coded 1 for "yes" and 0 for "no." Readers answered questions about the applicant's personal statement: whether it showed evidence of academic accomplishments, leadership, and / or non-academic achievements not found elsewhere in the application, and whether it showed that the applicant sought out challenging academic coursework or academic challenges outside the classroom. I made an "Essay: New evidence" scale that ranges from 0 to 5 and gives a point for each of these. Readers also counted the number of obstacles to achievement that the applicant described and assessed whether they limited opportunities for academic and extracurricular achievement. The product of these two items affected some outcomes.

Finally, as tables already presented make clear, applying to one college instead of another matters. The College of Engineering is more selective, and readers may weight factors differently when considering Engineering applicants. In case the average scores differ, even after adjusting for other variables, I include dummy variables for college in the pooled analyses (using L&S as the basis of comparison).

8. Read score results

The results of the OLR analysis are in Table 10. The first column shows the pooled results for in-state applicants to all colleges, the next three show the results for in-state applicants to L&S, Engineering, and the other three colleges (in that order), and the last column shows the result for non-resident applicants. The OLR coefficients are the main numbers in the table; they quantify the impact of each independent variable on the log-odds of a higher versus a lower score. Since low scores favor admission, a positive coefficient indicates that that variable, by increasing the chances of a higher score, reduces the chances of admission. In the complementary way, a negative coefficient indicates that that variable lowers the score and increases the chances of admission. The metric is a difficult one, even for researchers who frequently use these kinds of statistics, so I will present graphical displays of key results. The numbers in parentheses are standard errors – measures of the precision with which the model

estimates the relationship. A statistically significant coefficient is 1.96 times larger than its standard error.

Table 10. Read Score Model: Ordered Logistic Regression Coefficients, by Residency, College (for California Residents)

	California Residents				
Variable	All	L&S	Engin-eering	CNR, Env. Design, & Chemistry	Non-Residents
Ethnic Identity					
African American	-.034	-.036	.028	.171	-.106
	(.143)	(.159)	(.440)	(.582)	(.380)
Latino / Native	-.056	-.051	-.133	.066	-.675
	(.133)	(.148)	(.420)	(.554)	(.399)
Asian American	**.295**	.247	.406	.793	-.157
	(.126)	(.140)	(.372)	(.541)	(.300)
White	.129	.113	.187	.407	-.162
	(.125)	(.138)	(.384)	(.539)	(.295)
Previously Unrecorded Variables					
AP tests: Number of 3s	-.049	-.047	-.052	-.058	-.009
	(.038)	(.044)	(.129)	(.133)	(.100)
AP tests: Number of 4s	**-.120**	**-.141**	-.112	.023	-.033
	(.043)	(.050)	(.106)	(.165)	(.088)
AP tests: Number of 5s	**-.279**	**-.281**	-.198	**-.425**	**-.320**
	(.052)	(.059)	(.139)	(.201)	(.085)
Grades trend down	**.423**	**.396**	.313	**.881**	.249
	(.071)	(.081)	(.215)	(.228)	(.172)
Difficulty of senior program	**-.219**	**-.245**	**-.332**	-.014	-.066
	(.043)	(.051)	(.121)	(.132)	(.112)
Good job	**-.055**	**-.065**	-.063	.030	-.073
	(.028)	(.032)	(.081)	(.099)	(.064)
Active	**-.149**	**-.179**	.030	-.213	-.057
	(.045)	(.051)	(.139)	(.160)	(.104)
Contributes	**-.123**	**-.119**	-.064	**-.235**	-.066
	(.026)	(.030)	(.076)	(.080)	(.059)
Effective essay	-.033	-.029	-.056	-.043	**-.097**
	(.020)	(.023)	(.056)	(.067)	(.047)
Limits to achievement	**-.113**	**-.136**	-.020	.075	-.029
	(.046)	(.052)	(.151)	(.176)	(.103)
High School Grades					
Main	**-.079**	**-.078**	**-.097**	**-.081**	**-.052**
	(.003)	(.003)	(.008)	(.008)	(.005)
Spline: 20th %ile	**-.052**	**-.053**	-.032	**-.082**	-.019
	(.014)	(.017)	(.054)	(.039)	(.043)
Spline: 80th %ile	.002	-.001	.014	.005	-.019
	(.009)	(.011)	(.025)	(.031)	(.020)
Perfect 4.0 GPA	**-1.436**	**-1.453**	**-1.339**	**-1.735**	**-1.708**
	(.130)	(.152)	(.338)	(.451)	(.233)

Table 10 (continued). Read Score Model: Ordered Logistic Regression Coefficients, by Residency, College (for California Residents)

	California Residents				
Variable	All	L&S	Engin-eering	CNR, Env. Design, & Chemistry	Non-Residents
College-prep Coursework[a]					
Main	**-.069**	**-.078**	-.051	-.032	-.065
	(.018)	(.021)	(.052)	(.062)	(.051)
Spline: 20th %ile	-.025	-.011	-.165	-.041	-.163
	(.112)	(.135)	(.291)	(.381)	(.230)
Spline: 80th %ile	-.133	-.134	-.076	-.094	-.261
	(.085)	(.096)	(.256)	(.300)	(.157)
SAT-I[a]					
Verbal main	-.012	-.009	**-.045**	.014	**-.070**
	(.008)	(.010)	(.023)	(.027)	(.020)
Spline: 500	-.021	**-.060**	**.158**	-.013	.072
	(.020)	(.023)	(.051)	(.045)	(.060)
Spline: 750	**-.091**	**-.104**	.006	-.147	.039
	(.024)	(.027)	(.060)	(.095)	(.046)
Quant main	-.016	-.014	-.017	-.039	-.009
	(.010)	(.011)	(.035)	(.028)	(.024)
Spline: 500	-.015	.003	-.113	-.011	-.013
	(.026)	(.029)	(.109)	(.076)	(.167)
Spline: 750	-.042	-.049	-.058	-.012	-.032
	(.022)	(.027)	(.063)	(.101)	(.043)
SAT-II[a]					
Composition main	**-.051**	**-.054**	-.027	-.041	-.016
	(.008)	(.009)	(.023)	(.024)	(.017)
Spline: 500	**.059**	**.074**	-.111	.075	-.059
	(.022)	(.027)	(.062)	(.053)	(.062)
Spline: 750	.013	.018	-.041	.078	-.007
	(.020)	(.023)	(.056)	(.084)	(.043)
Math main	**-.023**	**-.024**	-.032	-.040	-.011
	(.009)	(.010)	(.030)	(.030)	(.023)
Spline: 500	**-.091**	**-.108**	.030	-.065	.039
	(.024)	(.027)	(.097)	(.062)	(.100)
Spline: 750	**-.056**	-.031	-.089	-.060	**-.124**
	(.020)	(.024)	(.051)	(.084)	(.044)
Optional: main	.005	.002	.009	.030	-.006
	(.007)	(.008)	(.023)	(.023)	(.017)
Spline: 500	-.037	-.021	-.141	-.086	.008
	(.022)	(.025)	(.085)	(.061)	(.085)
Spline: 750	-.020	-.008	-.035	-.067	.004
	(.018)	(.020)	(.055)	(.055)	(.038)

Table 10 (continued). Read Score Model: Ordered Logistic Regression Coefficients, by Residency, College (for California Residents)

	California Residents				
Variable	All	L&S	Engin-eering	CNR, Env. Design, & Chemistry	Non-Residents
<u>High School Variables</u>					
Eligible in Local Context (ELC)	**-.779**	**-.804**	**-.706**	**-.775**	
	(.088)	(.102)	(.246)	(.311)	
School quality (API)	.004	.019	-.047	-.055	
	(.017)	(.019)	(.051)	(.056)	
API missing	.115	.122	-.028	.282	
	(.086)	(.096)	(.270)	(.342)	
< 10 applicants	-.157	-.245	-.107	.497	**.689**
	(.126)	(.149)	(.427)	(.370)	(.189)
In California					.251
					(.341)
<u>Outreach Program</u>					
Minor	.095	.097	.239	.186	-.066
	(.080)	(.090)	(.255)	(.275)	(.175)
Major	.073	-.011	-.100	**.752**	-.433
	(.111)	(.127)	(.284)	(.364)	(.337)
UC Berkeley	**-.696**	**-.813**	-.403	-.327	
	(.263)	(.285)	(1.000)	(.712)	
<u>Socioeconomic Status</u>					
Low income	**-.224**	**-.238**	-.364	-.119	-.169
	(.098)	(.114)	(.298)	(.302)	(.338)
Income missing	-.002	-.057	.337	-.014	.038
	(.076)	(.088)	(.217)	(.260)	(.163)
Neither parent college	-.068	-.021	-.073	-.527	.025
	(.102)	(.121)	(.301)	(.292)	(.346)
Parents' education missing	.126	.094	.197	.355	.189
	(.153)	(.176)	(.466)	(.530)	(.437)
Gender (Woman = 1)	**-.140**	-.148	-.148	.138	-.062
	(.069)	(.079)	(.234)	(.236)	(.157)
Citizenship (Foreign = 1)					-.275
					(.401)
<u>Disability</u>					
Self-reported	-.282	-.119	-.757	-.997	-.180
	(.310)	(.407)	(.485)	(.827)	(.360)
State-certified	**-.580**	**-.561**			
	(.251)	(.285)			

Table 10 (continued). Read Score Model: Ordered Logistic Regression Coefficients, by Residency, College (for California Residents)

		California Residents			
Variable	All	L&S	Engin-eering	Design, & Chemistry	Non-Residents
College					
Natural Resources	-.026			.024	-.230
	(.136)			(.284)	(.375)
Environmental Design	-.032			.089	-.685
	(.186)			(.312)	(.393)
Chemistry	-.098				-.284
	(.221)				(.431)
Engineering	.178				.046
	(.095)				(.177)
Intercepts					
logit(2.25+ / ²2.00)	**-22.651**	**-23.175**	**-28.417**	**-21.847**	-12.954
	(1.350)	(1.542)	(4.684)	(3.659)	(6.806)
logit(2.50+ / ²2.25)	**-21.373**	**-21.842**	**-27.298**	**-20.562**	-11.938
	(1.348)	(1.540)	(4.678)	(3.660)	(6.804)
logit(2.75+ / ²2.50)	**-20.361**	**-20.830**	**-26.301**	**-19.378**	-11.144
	(1.347)	(1.538)	(4.673)	(3.645)	(6.802)
logit(3.00+ / ²2.75)	**-19.066**	**-19.527**	**-25.147**	**-17.765**	-10.317
	(1.343)	(1.532)	(4.666)	(3.621)	(6.802)
logit(3.25+ / ²3.00)	**-18.229**	**-18.734**	**-24.057**	**-16.775**	-9.655
	(1.340)	(1.528)	(4.659)	(3.615)	(6.798)
logit(3.50+ / ²3.25)	**-17.074**	**-17.541**	**-22.785**	**-15.851**	-8.724
	(1.339)	(1.525)	(4.655)	(3.618)	(6.794)
logit(Ineligible / Eligible)	**-10.500**	**-10.993**	**-15.287**	**-9.001**	-5.520
	(1.264)	(1.430)	(4.405)	(3.398)	(6.778)
Model statistics					
Number of cases	6,140	4,652	805	683	898
Log-likelihood: null	-10,783.61	-8,206.68	-1,400.80	-1,131.35	-1,739.70
Log-likelihood: model	-6,329.65	-4,844.39	-757.15	-669.43	-1,233.41
Degrees of freedom	60	56	56	58	58
BIC	13,182.65	10,161.70	1,888.99	1,717.40	2,861.22

Note: Significant ($p < .05$) coefficients shown in **bold** typeface.

a- Coefficients for these variables multiplied by 10 to make more significant digits visible.

The coefficients in Table 10 imply that ethnic identity plays a very small and (for the most part) statistically insignificant role in the scoring process.[24] Ethnic identity contributes 0.1% of the variance in expected scores for in-state applicants.[25] Another way of assessing the substantive significance of ethnic identity in the reading and admissions process is to express the ethnic difference in the metric of some more important variable. Grades – scored as the percentile rank of the applicant in relation to other Berkeley applicants from the same school over the past three years – are the most important factor in read scores. We can ask how far up the grade ranks an applicant with the least advantageous ethnic coefficient (an Asian applicant) would have to move in order to overcome the ethnic identity effect. The answer is the ratio of the coefficient for being Asian American to the one for grades. In the all-colleges formulation, that amounts to 4.4 ranks – rising, on average, from the 74th or 75th to the 79th percentile.

Two important findings emerge from the previously unrecorded variables (PUVs). First the harder-to-observe judgments that make comprehensive review comprehensive strongly affected read scores. Activities – evaluated as major and minor, strong and light – affected scores (all else being equal) and so did contributions to community (and predictions about future contributions to Berkeley) and evidence of obstacles to achievement that appeared only in the personal statements. Supplementary analyses not in Table 10 show that these factors do *not* interact with ethnic identity. The ethnic coefficients in the final models shown in Table 10 are virtually identical to the coefficients obtained in models that are similar in all respects save the presence of PUVs. That invariance under the inclusion or exclusion of PUVs implies that the subjective elements of the comprehensive review affected read scores but did not introduce ethnic disparities into the scores.

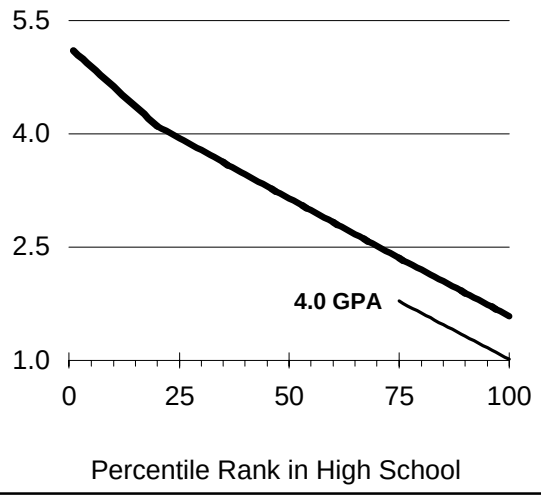
Academic achievement (as measured by grades and tests) dominates the scoring process, and other factors – specified to be relevant by university policy – weigh in.

[24] While neither the Asian American coefficient nor the Latino / Native coefficient is significantly different from zero in the L&S regression, they are significantly different from one another.

[25] I obtained this estimate by calculating the latent read score implied by the model for each case. I then regressed that predicted score on all the variables in the OLR model except the four ethnic identity dummy variables. The resultant R-square was .9993; I rounded off the 100x(1-.9993) to 0.1%.

First consider grades. Applicants who scored in the bottom half of their class got very high (unacceptable) read scores – 90% of them got 4s or worse. The probability of getting a bad read score fell most rapidly as grades rose from the bottom to the 20th percentile, then leveled off by a slight but statistically significant amount above the 20th percentile.[26] A perfect 4.0 GPA merited a significantly lower score, all else (even GPA percentile) being equal. A perfect GPA was worth about .58 read-score points. Figure 2 shows the relationship between grades and read score – the sharp down-sloping main effect and the supplementary effect of a 4.0 GPA.[27]

Figure 2. Latent Read Score by High School Grades (Percentile Rank in High School of Weighted GPA) and Bonus for Perfect 4.0 GPA



Test scores add significantly to our ability to explain read scores, but they count less than grades.[28] Figure 3 repeats the calculation I used in Figure 2, substituting test scores for grades. The down-sloping lines illustrate the effect of each type of SAT on read score. Because all the graphs in Figures 2 and 3 use the same scale for the y-axis, the differences in the slopes of the lines are proportional to the differences in how much these variables affect read scores. The test with the greatest weight is SAT-II mathematics; predicted read scores span the range from 4.4 to

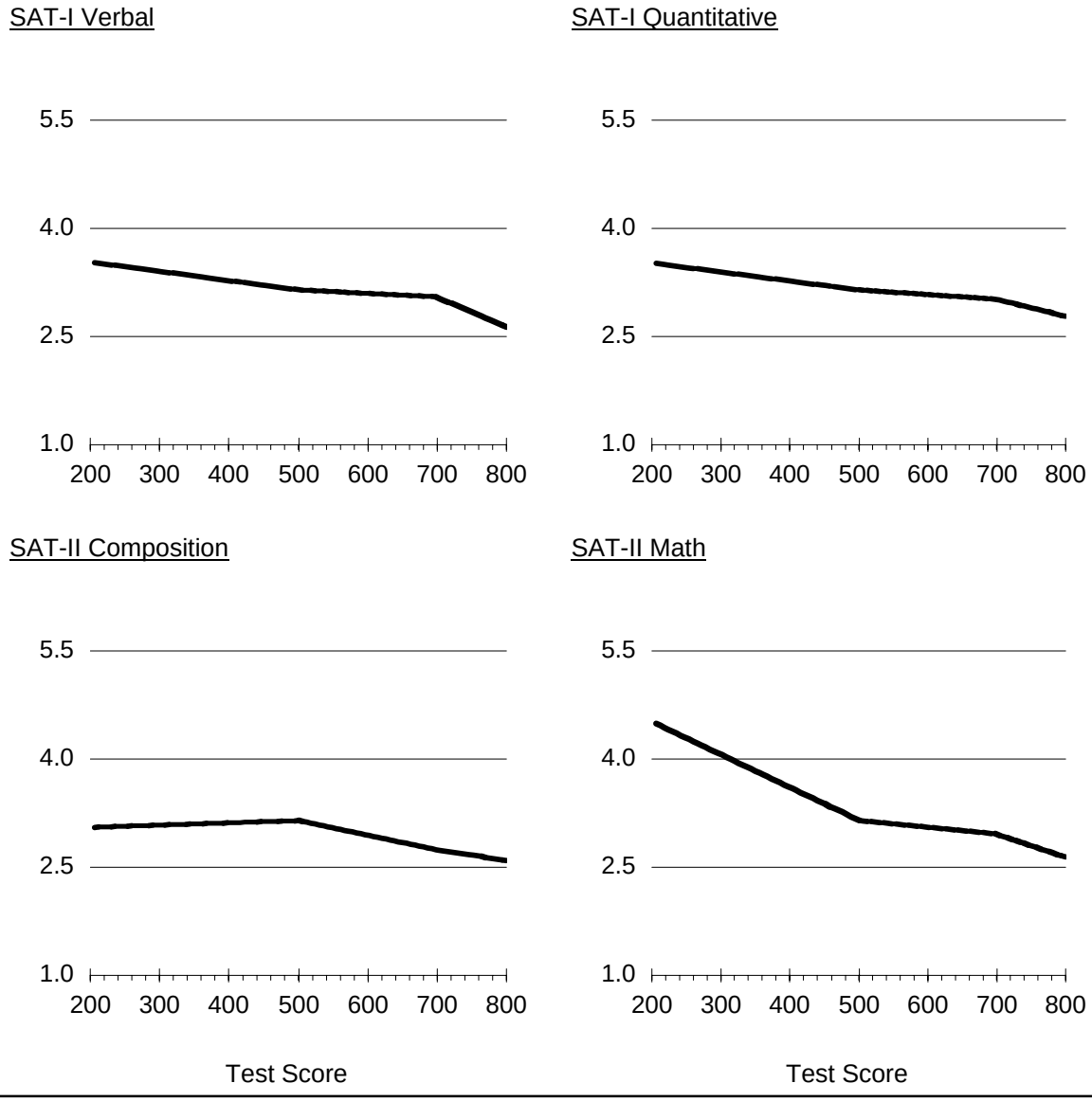
[26] This tendency for little differentiation below the 50th percentile and above the 80th shows up in the model as significant squared and cubed terms and (less obviously) in the interactions between grades and test scores.

[27] I only show the 4.0 GPA difference for the 75th percentile and above because less than 10 percent of 4.0s are found below the 75th overall percentile.

[28] All five blocks of test score variables are significant even when the individual coefficients are not.

2.6. But the effect of SAT-II math is much weaker above 500 than below it. As only 20% of Berkeley's applicants score below 500 on SAT-II math, few applicants are actually affected by this sizable effect. Most have scores above 500, and are subject to the milder effect that is more commensurate with the effects of the other tests.[29]

Figure 3. Latent Read Score by Scores on SATs

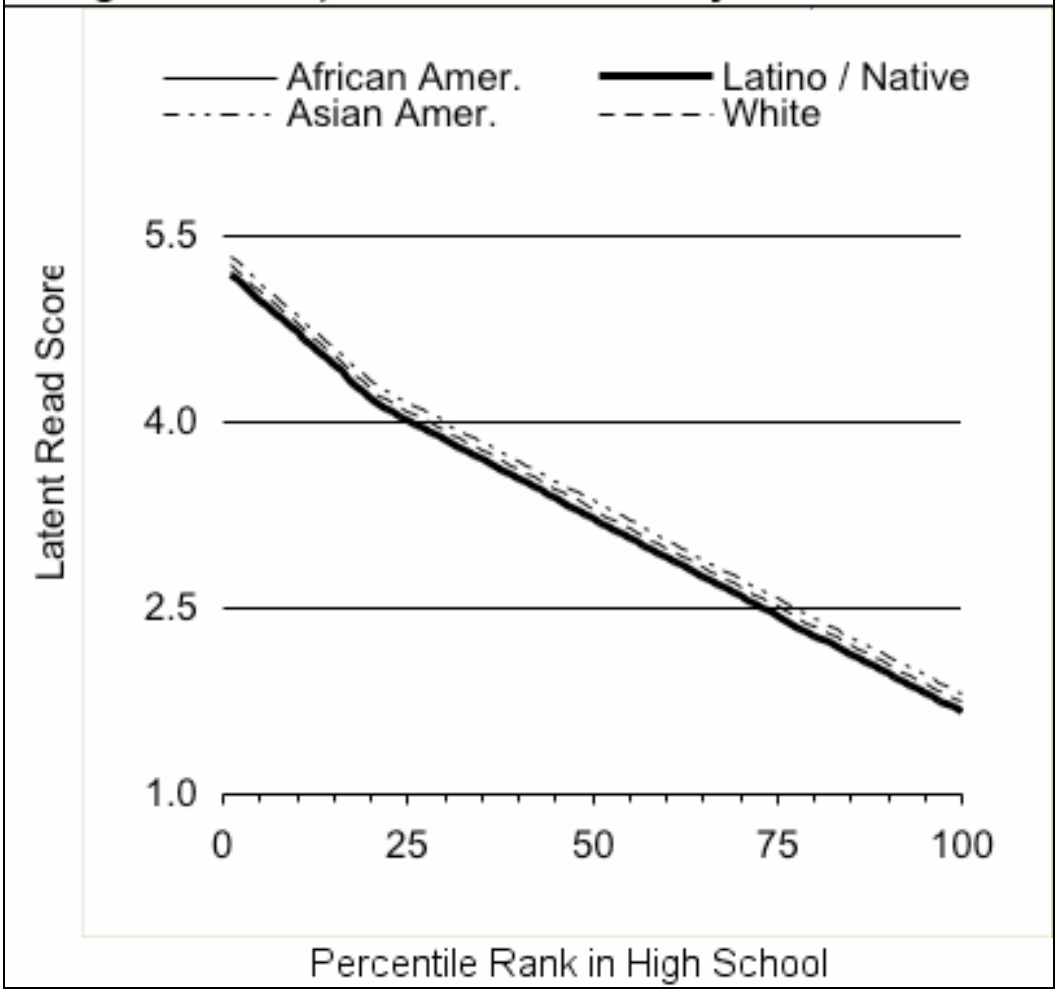


[29] The apparent weakness of test scores relative to grades is a real feature of the admissions data and cannot be dismissed as an illusion brought out by tricky graphics. Any reasonable technique for comparing the magnitudes of these effects will reach the same conclusion – grades are the most important determinant of read scores.

The OLR model also validates the ELC and outreach programs. Those designations and programs identify qualified students and bring them to readers' attention. School quality, as gauged by the state's Academic Performance Index (API), did not have a significant effect on read scores.

The coefficients for Latino/ Native and Asian American reveal differences between Latinos and whites and between Latinos and Asian Americans. The differences, though statistically significant, pale in comparison with the much stronger effects of grades and test scores. Figure 4 shows the expected probability of a read score by GPA percentile and ethnic identity. All other variables are set equal to their average among white applicants. Grades dominate the picture, even though the differences among ethnic groups are statistically significant. Is the figure misleading? No, grades so dominate scoring that an Asian American applicant – the ethnic group described by the top line – could catch up with a Latino or Native applicant by improving her grades in a single course in one semester. Asian American and Latino / Native applicants with identical probabilities of scores over 3 were just 2-4 percentiles apart in the GPA rankings. This is the horizontal difference between the group-specific lines; the conventional view emphasizes the vertical distance. But if we phrase the question of ethnic differences in terms of how much higher grades or test scores would have to be in order to offset them, we see how very small they are.

Figure 4. Latent Read Score by High School Grades (Percentile Rank in High School of Weighted GPA) and Racial Identity



Engineering applications are read according to a slightly different formula. Grades and math scores predominate, as they do with applicants to other colleges. But verbal scores on the SAT-I carry significantly more weight in setting the read scores for Engineering applicants. Looking only at statistical significance exaggerates the difference between the Engineering read scores and the read scores of other applicants in the sense that most of the coefficients in the equation for Engineering applicants that turn out to be insignificantly different from zero are also not significantly different from the corresponding coefficient as it applies to applicants from other colleges.

Technical Aside

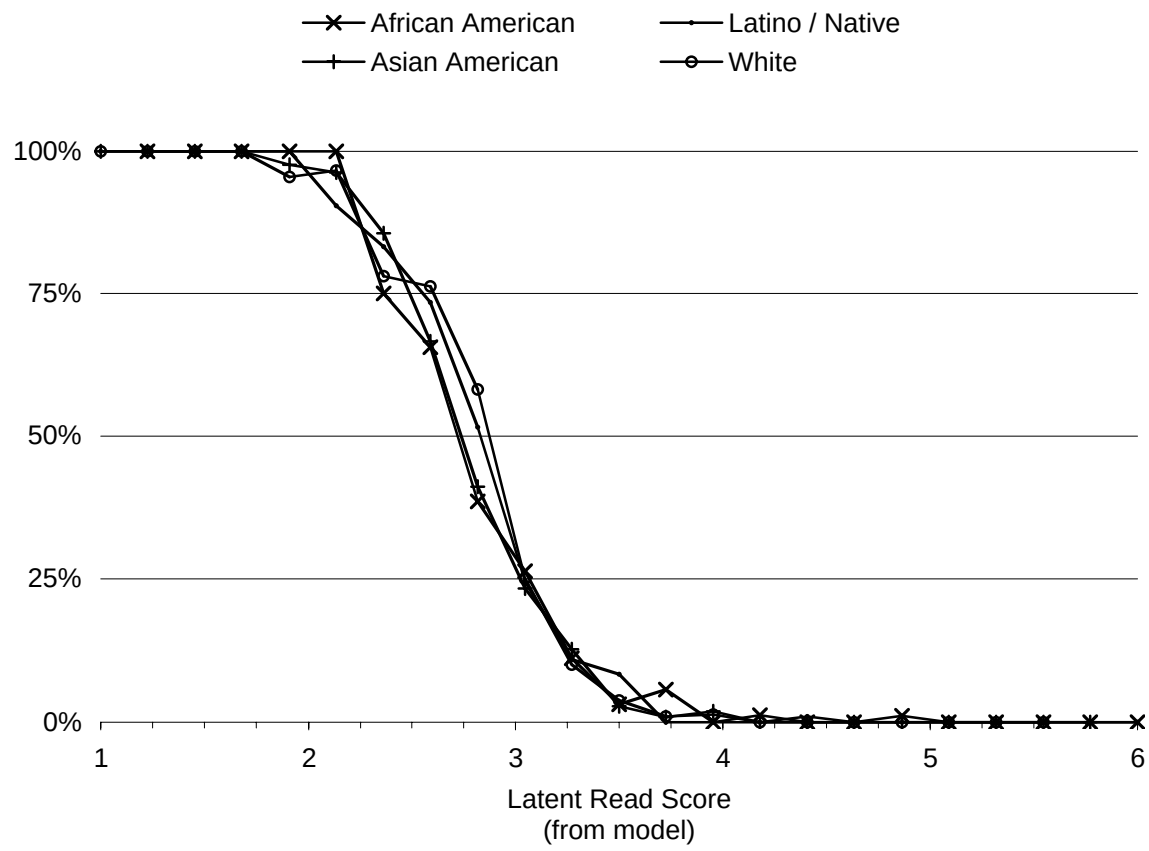
Most of this section has been based on OLR results. As noted above, the OLR model assumes that both readers weight the variables the same way and that they do not vary from one read score to the next. To test the first assumption, I analyzed the scores that the first two readers gave in separate OLRs. I then combined them as "seemingly unrelated regressions." A Hausman test failed to reject the null hypothesis of identical regressions (79.08; df = 63; p = .08). For the second assumption, a Brant test of the null hypothesis of the parallel logits is appropriate. Unfortunately, it failed to converge because some of the independent variables perfectly predict some read scores. A comparison between the OLR results and a generalized ordered logit regression (Gologit) with the same independent variables indicates that the African American disparity in the last contrast – that between ineligible applicants and all others – would prove to be different if the Brant test had worked. The African American coefficient for the "ineligible" equation has the wrong sign. Among eligible respondents, African American applicants' clustered closer around 3 than others' did, but African American applicants were also more likely to be scored ineligible than other otherwise comparable applicants. Perfect GPAs and SATs of 750 or more are so rare among the applicants that scored 4 or more that these factors also have effects that differ across scores. Finally, ELC cannot affect the last contrast because none of the ineligible applicants are ELC, by definition. Taking these departures from parallel logits into account throughout the analysis would add complexity, but not alter the substantive conclusions.

9. Regular admission

Shifting from the read score to the admission decision is, for the most part, trivial. For 89% of Berkeley's applicants, the read score leads directly to a decision – admit or deny. If my model is accurate enough to trust, then applicants' predicted scores should have the same correspondence to actual admissions decisions as the observed scores have. And they do, as it turns out. Furthermore, because ethnic identity is the focus of so much public comment regarding Berkeley admissions, I made all comparisons within categories of ethnic identity. Figure 5 arrays each ethnic group's actual admission rates for 24 evenly spaced categories of latent read scores.[30] If the model distorts the pattern of ethnicity-based selectivity, then the line for one group will lie consistently above the other lines. If the model is picking up the main pattern of ethnic difference well, then the lines will intertwine.

[30] The latent read scores are logits of linear combinations of the observed independent variables for each case and the coefficients in Table 10.

Figure 5. Regular Admission Rate by Latent Read Score and Ethnic Identity: In-state Applicants to L&S



The model is flawless at extremely high and extremely low expected scores. All applicants who have expected scores below 1.75 were, in fact, admitted, and no applicants who have expected scores greater than or equal to 4.0 got in. Some discrepancies arise in the zone of difficult admissions decisions between 2.25 and 3.0. African American applicants had lower admission rates than other groups in that range of expected read scores. The pattern suggests that the model's coefficient for African American overstates the difference between them and the other groups in the range where the important decisions are made. Above 2.5 the admission rates of African Americans and Asian Americans are indistinguishable, suggesting that the read-score model overstates that difference in particular. White applicants stand out in a complementary way – their admission rates were noticeably higher than that of African Americans who had expected read scores in the 2.5-3.0 range. This implies that the model's baseline is too low in this range.

Figure 6. Regular Admission Rate by Latent Read Score: In-state Applicants to L&S

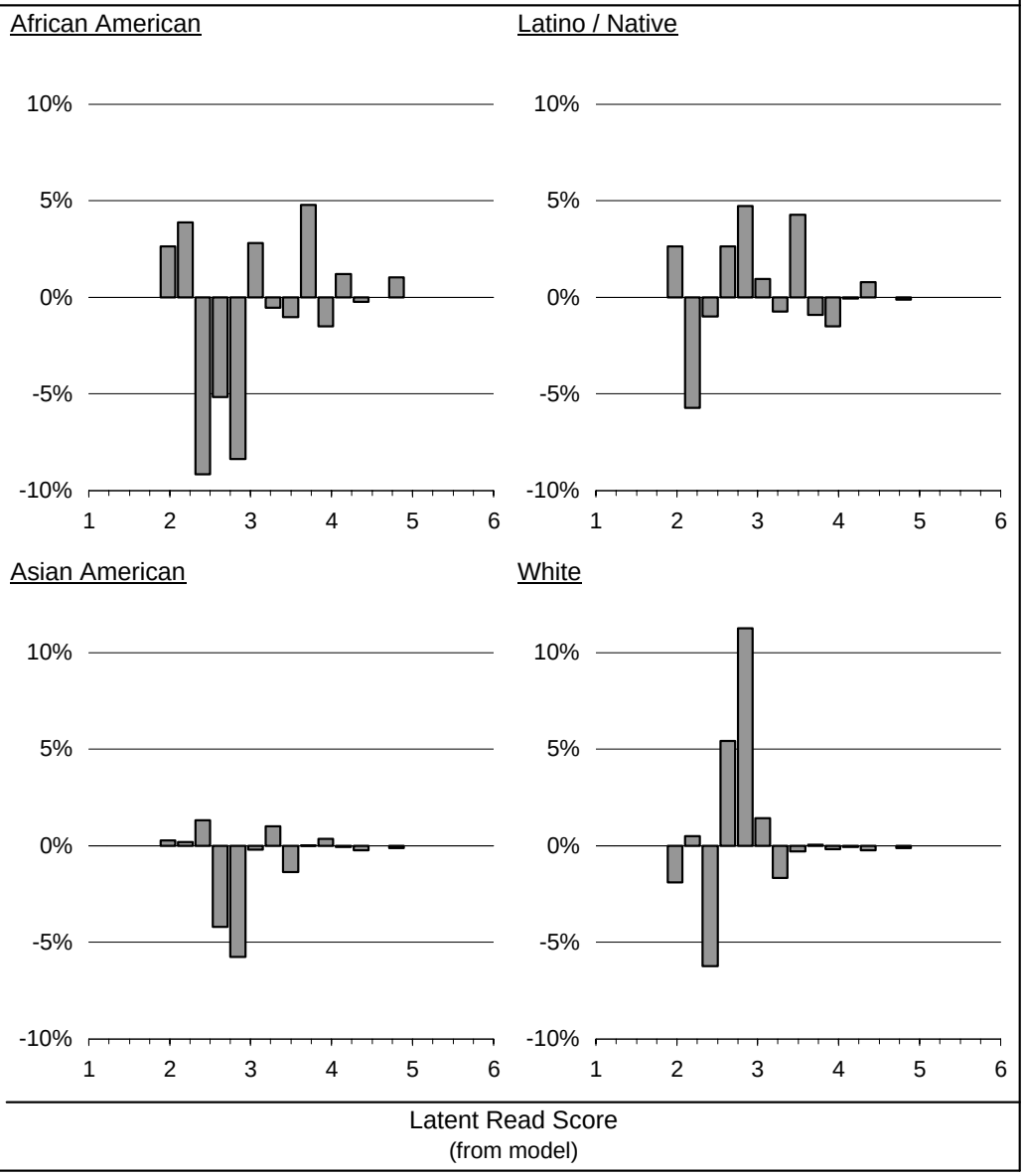


Figure 6 makes these differences easier to see by removing the strong relationship between predicted score and actual admission; it shows the difference between the groups in question and the average across all groups in each predicted score bin. Here the cluster of large negative residuals for African Americans and smaller cluster of smaller values for Asian Americans are easy to see, as are the large positive residuals for whites. These are mostly small errors. The few errors that exceed ±5% point to unexpectedly low rates for African Americans

with predicted scores between 2.25 and 3.0 and unexpectedly high rates for whites between 2.5 and 3.0.

10. Augmented review

About 6.3% of applications were referred to augmented review (AR). Engineering applicants were least likely (2.9%) and L&S applicants most likely (7.2%) to be referred (with the other three colleges in between). Of these 23% were admitted via AR, 10% were admitted by other channels (most notably athletics), and 67% were denied admission. In this section I will consider both who gets referred to AR and who gets admitted via AR.

As noted above, AR begins with a recommendation from one of the original readers. To be granted AR, an applicant must be close to being competitive for admission but lacking essential information or particularly challenging because of unique circumstances. If a supervisor approves the AR, then the OUA contacts the applicant and asks her or him to fill out a detailed questionnaire known as a Pre-Admission Questionnaire or PAQ (disabled students get one form of the questionnaire; applicants getting AR for some other reason get another form). AR also offers applicants the opportunity to submit seventh-semester grades and letters of recommendations from high school teachers or outreach program counselors familiar with the applicants' work. When these materials are returned, they are reviewed by senior admissions readers in a process similar to the regular reading process: two readers review each file and each assigns a unitary score, scores that differ by one point are averaged, and files that receive scores more than one point apart are sent to a third reader. Depending on the size of the AR pool and the distribution of scores, AR candidates may be subject to a tie-breaking process similar to that of the regular reading process.

Table 11 shows the regression results for both AR referral and AR read scores.[31] Models for both outcomes include the most important variables from the analysis of the original read scores plus the original read scores themselves. Applicants eligible for AR referral include anyone who was not admitted via regular fall admission or fall tie-break. The process includes disabled applicants, all of whom were referred to AR, but my analysis excludes them because the

[31] AR referral is a binary outcome so it the statistical model is basic logistic regression. The AR read score is an ordered outcome just like the original read score, so the OLR is, once again, the appropriate model.

statistical program automatically drops them due to the lack of variation (all are referred to AR). The pool for the second analysis – that of AR read scores – includes all applicants who were referred to AR and included in the re-read sample. Because disabled applicants have special requirements and a different PAQ than other applicants fill-out, I exclude the disabled applicants from this part of the analysis.

Experienced readers speak of a concept they think of as "AR-ness." This is, to some extent, the factors relating to socioeconomic background and community context that show up in the referral equation in Table 11. But it is obviously more or they would call it class or neighborhood. Importantly, AR-ness must correlate with ethnic identity in some way. Otherwise we would not observe the ethnic differences we see in the referral equation in Table 11. If readers could articulate AR-ness better, we could measure it and perhaps account for the ethnic differences. In the absence of that account, however, the statistical results point to unaccounted for differences between under-represented minorities and the other ethnic groups in the AR pool.

Table 11. Referral to Augmented Review and AR Read Scores: California Residents

Variable	*Augmented Review* Referral	Score
Original Read Score		
3.00	-.1405	.6270
	(.2910)	(.6848)
3.25	-.2395	.9889
	(.3169)	(.6701)
3.50	-.1097	1.1120
	(.3008)	(.6679)
3.75	-.3727	**1.5574**
	(.3172)	(.6842)
4.00	**-1.0259**	**1.9033**
	(.3407)	(.6705)
4.50	**-2.5181**	**3.0630**
	(.6206)	(1.1522)
Not eligible	**-2.9141**	**3.4795**
	(.6096)	(1.1205)
Ethnic Identity		
African American	**.7865**	-.5410
	(.2161)	(.3610)
Latino / Native	**.5714**	-.0260
	(.2184)	(.3703)
Asian American	.1744	.2564
	(.1877)	(.3711)
Declined to state	.1338	1.2400
	(.5205)	(.8117)
Previously Unrecorded Variables		
AP tests: Number of 3s	-.0239	.0251
	(.0844)	(.1461)
AP tests: Number of 4s	.0379	-.1949
	(.1048)	(.1845)
AP tests: Number of 5s	.1135	.0768
	(.1097)	(.1618)
Grades trend down	.1516	.2669
	(.1329)	(.2399)
Difficulty of senior program	.0759	-.0265
	(.0819)	(.1378)
Good job	.0626	-.0651
	(.0558)	(.0823)
Active	**-.4032**	.0419
	(.0978)	(.1728)
Contributes	**.2950**	-.1395
	(.0520)	(.0995)

Table 11 (continued). Referral to Augmented Review and AR Read Scores: California Residents

Variable	*Augmented Review* Referral	Score
Effective essay	**-.1375**	.0271
	(.0431)	(.0696)
Limits to achievement	**.4853**	-.1735
	(.0783)	(.1223)
Persist to graduation?		
Strong yes		**-1.2868**
		(.3010)
Average yes		**-.7028**
		(.3138)
High School Grades		
Main	-.0009	**-.0164**
	(.0043)	(.0058)
Perfect 4.0 GPA	-.2483	-.6887
	(.4164)	(.8675)
College-prep Coursework[a]		
Main	.0012	-.0011
	(.0023)	(.0038)
SAT-I[a]		
Verbal main	.0012	-.0015
	(.0011)	(.0019)
Quant main	-.0022	-.0041
	(.0014)	(.0025)
SAT-II[a]		
Composition main	-.0003	-.0020
	(.0012)	(.0019)
Math main	.0004	.0017
	(.0013)	(.0024)
Optional: main	.0001	.0003
	(.0007)	(.0011)
High School Variables		
Eligible in Local Context (ELC)	.0634	.2661
	(.1827)	(.2837)
School quality (API)	**-.0726**	.0121
	(.0299)	(.0484)
API missing	-.1715	.0845
	(.2197)	(.3977)
< 10 applicants	-.0704	-.0695
	(.2252)	(.3371)

Table 11 (continued). Referral to Augmented Review and AR Read Scores: California Residents

	Augmented Review	
Variable	Referral	Score
Outreach Program		
Minor	.0303	-.1610
	(.1738)	(.2856)
Major	**.4238**	**-.6478**
	(.1705)	(.3023)
UC Berkeley	**2.1041**	**-1.2194**
	(.2790)	(.3728)
Socioeconomic Status		
Parents' income (ln)	**-.7245**	.0550
	(.0836)	(.1685)
Income missing	-.0230	-.0217
	(.1909)	(.3790)
Neither parent college	**.6309**	-.4415
	(.1678)	(.2785)
Parents' education missing	-.0200	-.0396
	(.2595)	(.3370)
Gender (Woman = 1)	-.0207	.0313
	(.1429)	(.2358)
College		
Natural Resources	-.1910	-.1792
	(.2842)	(.4252)
Environmental Design	-.4216	.6465
	(.3929)	(.8260)
Chemistry	-.3605	.3713
	(.4545)	(.5071)
Engineering	**-1.3336**	.8138
	(.2743)	(.5567)
Intercepts		
logit(2.50+ / ²2.25)		**-6.2943**
		(1.4863)
logit(2.75+ / ²2.50)		**-4.9286**
		(1.4646)
logit(3.00+ / ²2.75)		**-4.4886**
		(1.4618)
logit(3.25+ / ²3.00)		**-3.0145**
		(1.4543)
logit(3.50+ / ²3.25)		**-2.9293**
		(1.4530)
logit(Ineligible / Eligible)		-2.0209
		(1.4523)
Admitted / Not	.1534	
	(.8952)	

Table 11 (continued). Referral to Augmented Review and AR Read Scores: California Residents

Variable	*Augmented Review* Referral	Score
Model statistics		
Number of cases	4,796	429
Log-likelihood: null	-1,055.20	-761.54
Log-likelihood: model	-757.50	-665.48
Degrees of freedom	46	53
BIC	1,904.88	1,652.21

Notes: Significant ($p < .05$) coefficients shown in **bold** typeface. Referral is a binary outcome; coefficients estimated by logistic regression. Read scores are an ordered outcome; coefficients estimated by ordered logistic regression.

a- Coefficients and standard errors for these variables multiplied by 10 for display.

By design, the original read scores are the main factor in AR referral. Applicants with good scores in the original reading were more likely than others to receive and AR referral. The differences were modest up to an original score of 3.75. Applicants who got original read scores of 4.0 or worse had little chance of AR referral.

African American and Latino / Native applicants were more likely than whites to be referred to AR, all else being equal. The coefficient of .79 translates into a 4.6-percentage-point difference; thus for students who were otherwise average for the AR pool, African American applicants had a 10.8% chance of being referred to AR compared with a 6.2% chance among white applicants. The coefficient of .57 among Latinos and Native Americans works out to a 3.3% difference and the (insignificant) coefficient of .17 for Asian Americans works out to a 1.0% difference.

Engineering applicants were significantly less likely than other applicants with the same score to get an AR referral. That is mostly because Engineering uses much higher score cut-offs for admission. At the high end of the read scores, eight of the nine AR referrals with scores less than 2.5 were Engineering applicants, 13 of the 26 2.5s were, and only 7% of those scoring higher were engineers.

Grades and test scores did not affect AR referral – net of their role in determining the original read scores.

Outreach and hardship affected AR referral far more than they affected the original read scores. Participants in UCB outreach programs in particular were likely to be referred to AR. All of the relevant hardships also increased the odds on being referred to AR. Low income, no college background at home, growing up with a single parent, and attending a poor school all affected AR referral. In the re-read data the sheer number of limiting obstacles that an applicant described in her / his essay also significantly increased the chance of being referred to AR. Some of these effects were very large. Another otherwise average low-income applicant had a 25% chance of being referred to AR; a similarly average applicant with a higher family income had a 14% chance of being referred – an 11 percentage-point difference.

Among applicants who went through AR, original read scores were an important factor predicting the AR read score (the overall correlation between original and AR read scores was .40). Otherwise, what the AR disclosed and how these judgments were made remain, for the most part, hard to interpret. The fit, as gauged by 1 – LL(model)/LL(null), was only .13. Good grades led to better AR scores, but not to the same extent as in the original read scores. Taking college-prep courses was just as effective as doing well in them. Test scores did not influence the AR outcomes. The reader's judgment as to whether the applicant could persist to graduation was a very important consideration. Ethnic identity did not affect AR read scores.

Once scored, AR admissions go by formula (with few exceptions). Table 12 summarizes the pattern. Engineering applicants had to score 1, 1.5, or 2 (depending on major) to be admitted after AR. Chemistry applicants were admitted with scores up to 2.25; 80% of the 2.5s were admitted through tie-break. L&S, Natural Resources, and Environmental Design applicants were admitted with scores of 2.5 or better. Only four L&S and Environmental Design applicants who were admitted despite AR read scores over 2.5 were admitted through the AR process; 33 were admitted in by-high-school review, and nine were admitted on appeal.

Table 12. Admission by AR Score and College: Applicants Who Went Through Augmented Review

			College			
AR Scores	Engineering	Chemistry	L&S	CNR	Env. Design	Total
1	100%	100%	100%			100%
1.5	67%	100%	100%	100%		96%
2	33%	100%	100%	100%		97%
2.25	56%	100%	94%	100%	100%	92%
2.5	33%	80%	96%	100%	100%	92%
2.75	10%	0%	7%	0%	0%	6%
3	3%	0%	6%	0%	9%	5%
3.25	0%		11%	0%		9%
3.5	4%	0%	2%	0%	0%	2%
3.75	0%	0%	0%	0%		0%
4	0%	0%	1%	0%	0%	1%
4.5	0%		0%	0%	0%	0%
5			0%			0%
Total	14%	23%	30%	19%	15%	28%

Note: Applicants whose AR score was 2.75 or higher may have been admitted by high school, as athletes, or on appeal.

Summary. The AR process identifies applicants who achieve at the cusp of Berkeley admission despite significant obstacles. Within the original read score range of 2.75 to 3.25, low-income, first generation applicants from poor schools and physically challenged students from all environments get further scrutiny. The additional information obtained during AR results in positive outcomes for 28% of the applicants who are reviewed through AR. The AR scoring is somewhat hard to interpret. Original read scores and many of the factors that influence original read scores also affect AR read scores, just not as much. And most of the variation in AR scores is not accounted for.

11. Tie breaking

Read scores and AR scores determined the vast majority of decisions – 94% in 2004. Nonetheless, there was inevitably a point in the admissions process where the freshman class was not quite filled up but there were not enough places to take all the applicants who had the lowest score among those not yet admitted. That point came at a read score of 2.75 for the decision about regular fall admissions and at a score of 3.0 for regular spring admissions. To resolve the issue, some 2.75s were admitted for fall and some for spring; some 3.0s were

admitted for spring and some were denied admission. These two decision points are known as fall tie-break and spring tie-break.

I analyzed only spring tie-break because that is the point at which people are accepted or denied to Berkeley; fall tie-break only determines which semester a subgroup of admitted students will begin classes. As a starting point, I took the model that explained the original read scores; I then modified it in light of the preliminary results. The coefficients for the final model of spring tie-breaking are in Table 13.

The spring tie-break pool for California residents in the re-read sample includes all students who had scores on the cusp of admission for their college – 323 in all. Applicants with different ethnic identities had different outcomes. The difference between African American and white applicants is statistically significant. Before making too much of this outcome, we should consider the scale of the decision involved – 40 African American applicants were considered in spring tie-break;[32] denying admission to 6 more of them would wipe out this seemingly very large disparity. That is, while the disparity documented here is statistically significant, it represents approximately six decisions.

Ties were broken in favor of applicants who had good grades, scored well on AP tests, were likely to contribute to campus life, and came from low-API schools (all else being equal).

[32] This is the total in the whole applicant pool as well as in the re-read sample (recall that all applications from African Americans were re-read).

Table 13. Spring Tie-breaking Decisions: California Residents	
Variable	*Logistic regression coefficient*
Ethnic Identity	
African American	**1.4354**
	(.5202)
Latino / Native	.9539
	(.5207)
Asian American	.3641
	(.3589)
Declined to state	.0418
	(1.2042)
Previously Unrecorded Variables	
AP tests: Number of 3s	**.3763**
	(.1628)
AP tests: Number of 4s	.0730
	(.1751)
AP tests: Number of 5s	.2871
	(.2737)
Grades trend down	-.0803
	(.3360)
Difficulty of senior program	-.2236
	(.2275)
Good job	.1103
	(.1364)
Active	-.0866
	(.2131)
Contributes	**.3984**
	(.1260)
Effective essay	-.0376
	(.1080)
Limits to achievement	.0916
	(.2013)
High School Grades	
Main	**.0417**
	(.0123)
College-prep Coursework[a]	
Main	-.0287
	(.0608)

Table 13 (continued). Spring Tie-breaking Decisions: California Residents

Variable	*Logistic regression coefficient*
SAT-I[a]	
Verbal main	.0238
	(.0306)
Quant main	.0563
	(.0348)
SAT-II[a]	
Composition main	.0363
	(.0291)
Math main	.0483
	(.0334)
Optional: main	-.0171
	(.0210)
High School Variables	
Eligible in Local Context (ELC)	.4195
	(.3487)
School quality (API)	**-.1898**
	(.0835)
API missing	.2606
	(.4119)
< 10 applicants	.6765
	(.6374)
Outreach Program	
Minor	-.0845
	(.3651)
Major	.5165
	(.6868)
UC Berkeley	-.3000
	(.8780)
Socioeconomic Status	
Parents' income (ln)	.0286
	(.3136)
Income missing	-.2330
	(.3669)
Neither parent college	.5380
	(.5654)
Parents' education missing	.2626
	(.7899)
Gender (Woman = 1)	-.0943
	(.3420)

Table 13 (continued). Spring Tie-breaking Decisions: California Residents	
Variable	*Logistic regression coefficient*
College	
Engineering	-1.2234
	(.9104)
Intercept	**-13.7257**
	(2.9571)
Model statistics	
Number of cases	323
Log-likelihood: null	-223.65
Log-likelihood: model	-177.79
Degrees of freedom	36
BIC	563.57
Note: Significant ($p < .05$) coefficients shown in **bold** typeface.	
a- Coefficients and standard errors for these variables multiplied by 10 for display.	

12. Summary and conclusion

Comprehensive review for freshman admission at Berkeley is a complex process that seeks to assure fairness and equality of opportunity by weighing each applicant's mix of skills, accomplishments, and promise. In the comprehensive review of 2004-05 freshmen applicants, academic considerations predominated. Grades and test scores settled most decisions. Applicants who took more college-preparatory courses and did well in honors and advanced placement courses had a higher probability of getting into Berkeley than did students who took on few academic challenges in high school. Formal elements of the process like California residency, the amount of competition for specific majors (in the College of Engineering), and the prospect of spring as well as fall admission affected applicants' chances. Being designated "eligible in local context" (ELC) and participating in outreach programs, especially Berkeley's own outreach programs, improved the odds of admission. Performing well despite challenges like few family

resources or attending a high school with a low standard of academic performance or one where few other people apply to Berkeley had marginal but significant positive effects.

My assessment was prompted by the suspicion that, in addition to these relevant factors, ethnic identity influenced the odds of admission at Berkeley. My analysis shows that the centerpiece of comprehensive review – the process of assigning read scores – was mainly free of ethnic disparity. The largest difference (between Asian American and Latino / Native applicants) was statistically but not substantively significant – the statistical equivalent of the difference between the being in the 74th and 79th percentile of the GPA distribution. No disparity at all was found in the highly competitive College of Engineering. The vast majority of admissions decisions – 89% – were determined exactly by the average of two read scores. Augmented review increased the consideration of factors that limit opportunity and increased the representation of under-represented minorities in the process. AR referrals included a number of unarticulated factors correlated with ethnic identity, but the AR decisions themselves did not show any evidence of ethnic differences. The tie-breaking decisions among applicants with identical scores that determined the last 6% of admissions decisions resulted in disparities that were statistically significant but may not be large enough to affect the overall admissions process; reversing a mere six decisions would be enough to wipe out the difference between African American and white applicants, for example.

Thus, it is in AR referral and tie-breaking where ethnic identity plays a role in Berkeley's comprehensive review. AR referral involves a hard-to-articulate quality that experienced readers call AR-ness. I urge them to try to state more clearly what that quality is and to remove its correlation with ethnic identity. I recommend that the AEPE Committee make tie-breaking criteria more explicit and closely monitor the tie-breaking decisions.

Published reports have claimed that ethnic disparities affect as many as 200 applicants. My results suggest ethnic difference of much more modest proportion. Three differences between my approach and the approaches others have taken may account for the differences between my findings and those of others. First, I attempt to model the entire admission process and focused on the central decision in the comprehensive review – the read score. I built up to a complete accounting of admissions from there. Others jumped right to the final choices. Second,

I also generated new data by having a sample of applications re-read. These new data showed that the subjective aspects of the comprehensive review – long viewed with suspicion – do not generate ethnic disparity; the effective aspects of comprehensive review are weakly correlated with ethnicity. Finally, my model gave a more complete account of the relationship between the dominant variables – grades and test scores – and the outcomes (scores and tie-break decisions). Nonlinearities and interaction effects involving the academically relevant variables were important parts of my models of read scores. In addition, the influences of grades and test scores vary among the elements of the admissions process; others' modeling strategies tend to ignore those differences. By modeling how the weights of grades and tests vary among colleges and from original read scores to AR scores to tie-breaks, my modeling strategy gives a more accurate account of the whole process.

The portrait of comprehensive review here is more complete than previous attempts have been. In compiling a more complete portrait, I found that ethnic identity is inconsequential in the comprehensive review that decides most applicants' outcome, but that to the extent to which ethnicity affects Berkeley admissions, it does so in referrals to Augmented Review and in tie-breaking decisions that choose among applicants with identical comprehensive review scores.

APPENDIX A:
CODING VARIABLES AND INSTRUCTIONS

The following instructions will lead you through the application by indicating the various items that have been selected for coding. The instructions list the variable, the range of responses, which will be represented by numerical values, and on occasion a non-exhaustive list of examples describing the variable.

The instructions will begin with the first variable to be coded on page two on the application and proceed in page order concluding with the statement of purpose. The variables to be coded will appear in truncated form on the code sheet and proceed vertically and then by column. They will correspond numerically with the instruction sheet. Writing on the applications is permissible.

Educational History

1. NumHSatnd: Number of high schools attended (do not include summer school): Tally and indicate the number
2. InstOthEng: Instruction in language other than English: Indicate 1=Yes or 2=No

Major Awards and Activities

For variables 3-10 please consider the significance of the applicant's honors, activities, and service. Whether an honor, activity or service has major significance, is the distinguishing feature.
Major awards or honors include those in academic, athletic, artistic, or community service areas.

3. NumMajAwds: Number of major awards: Tally and indicate number

> **Examples of major awards include Bausch and Lomb, Renssalaer Scholarship, Westinghouse Science Competition (finalist or semi-finalist), Golden State Exam (GSE High Honors only), Brown/Yale/Harvard Book Awards, Siemans Award, school district, county, state, national science fair awards, AP Scholar (with distinction or honor), etc. They may also include an MVP distinction, or other athletic, artistic or service awards that signify distinction beyond the school site such as at a district, regional, state or national level (e.g., award in FFA or JSA, etc.).**

A major activity is an academic, athletic, artistic or service activity that meets one or more of the following four criteria:

a. Sustained participation (more than one year) in a major organization or group such as:

Academic examples include: Yearbook, school newspaper, literary magazine, Academic Decathlon, Science Olympiad, Brain Bowl, Math Competitions, Mock Trial, Speech and Debate, Model UN, National Forensics League (NFL), robotics club, published author, etc.

Other major activities include: youth symphony (district, county, state, etc.), visual art exhibited in a juried show, participation in an adult artistic organization or endeavor (adult symphony, professional actor), etc.

b. <u>Individual positions of significant responsibility</u>: Founder or co-founder, President (or other senior officer), Editor, Board of Directors, Team Captain (including cheerleading), CEO, soloist, lead acting role, concertmaster, composer, producer, director, choreographer, section leader, District Board of Directors, School Site Council, city/county youth council, WASC Council, HOBY, Girls/Boys State, Teen hotline/crisis hotline, student government officer, Mayor's Youth Advisory Board, Youth Commissioner (to school, principal or beyond, e.g. city or county), Eagle Scout, tutor for peers in an academic subject, internships (if high level of responsibility), etc.

c. <u>Sustained participation in less important organizations or groups that have achieved distinction or have competed beyond the school level:</u> such as a member of a regional or state championship team, etc.

d. <u>Participation in less important organizations or groups (including school sports teams) in which the applicant has been a founder or leader, or achieved individual distinction such as an MVP award.</u> For example, the following count as major activities only if the applicant exercises a leadership role or receives distinction: Young Entrepreneurs, FBLA, Future Farmers of America (FFA), 4-H, Distributive Education Clubs of America (DECA), Junior Statesmen of America (JSA), HOSA, ROTC, Kiwanis/Key Club, CSF, NHS, etc.

NOTE: Pop-culture and other social groups or organizations such as the anime club, hip hop club, pep club, chess club, etc. are NOT considered major activities EVEN IF the applicant holds a leadership position. But if the applicant is a founder of such a club it may be considered a major activity.

4. <u>NumMajActs</u>: Number of major activities: Tally and indicate number
5. <u>NumLeadActs</u>: In how many activities tallied in #4 did the applicant assume a leadership role? Tally and indicate number
6. <u>ActsAcas</u>: Are any of the activities tallied in **#4** <u>academic?</u>: 1=Yes or 2=No
7. <u>ActsArt</u>: Are any of the activities tallied in **#4** <u>artistic?</u>: 1=Yes or 2=No
8. <u>ActsAthl</u>: Are any of the activities tallied in **#4** <u>athletic?</u>: 1=Yes or 2=No
9. <u>ActsServ</u>: Are any of the activities tallied in **#4** <u>community service?:</u> 1=Yes or 2=No
10. Did the applicant assume a leadership role in an activity not tallied in #4 above? 1=Yes or 2=No

<u>JUDGEMENT</u>

11. <u>AcaEnrchActs</u>: Consider Item 50. Please indicate the overall strength of the applicant's participation in academic enrichment activities including the intensity of the special program and the duration of involvement: 1=significant or 2=less significant or 3=did not participate

<u>Employment (paid work)</u>

12. <u>EmplSchlYr</u>: Applicant is employed at least once during the sophomore or junior school year. 1=Yes or 2=No or 3=Can't determine

13. If **Yes** on #12, what is the maximum reported number of hours worked per week? Write the number.
14. EarnsnonDis: Applicant uses earnings for non-discretionary purposes: 1=Yes or 2=No or 3=Can't determine

    Non-discretionary purposes include earnings spent to help support family (including paying for personal items like gas, food, rent in order to reduce family financial hardship), paying for tests and applications, etc.
15. AcaPosition: Applicant holds a position with academic content: Indicate 1=Yes or 2=No or 3=Can't determine

For questions #16 and #17, please consider the stature or nature of the paid position. Positions such as lifeguard, camp counselor, teen crisis hotline staff, tutor, teacher, supervisor, team leader, programmer, child care provider, coach, league referee, translator, CEO, etc. have a high level of responsibility and require additional skills, talent, training, and/or maturity.

16. RespPosition: Applicant holds a responsible position: Indicate 1=Yes or 2=No or 3=Can't determine
17. SpecSkil: Applicant holds a position that requires special skill: 1=Yes or 2=No or 3=Can't determine

JUDGEMENT

18. StrngPg3: Are items 47-51 considered to be strong overall, relative to the Berkeley applicant pool? Indicate 1=Yes or 2=No

A strong page 3 constitutes sustained participation in a number of activities with significant leadership and honors.

19. LightPg3: Are items 47-51 considered to be light overall, relative to the Berkeley applicant pool? Indicate 1=Yes or 2=No

A light page 3 constitutes sparse or intermittent participation, generally without significant leadership or honors.

AP and IB

20. NumAPAttmps: Total number of AP tests taken or scheduled: Tally and indicate number
21. NumAP3: Number of AP tests with a score of 3: Tally and indicate number
22. NumAP4: Number of AP tests with a score of 4: Tally and indicate number
23. NumAP5: Number of AP tests with a score of 5: Tally and indicate number
24. NumAPwoSup: Number of AP tests taken prior to or without course support (as indicated on self-report of courses taken): Tally and indicate number
25. IBDiploma: Applicant has completed or plans to complete the IB diploma: 1=Yes or 2=No

Self-Report of Courses

JUDGEMENT

26. OvrCntHons: Coder suspects applicant has over counted Honors, AP, or IB courses: Indicate 1=Yes or 2=No

27. UndrCntHons: Coder suspects applicant has under counted Honors, AP, or IB courses: Indicate 1=Yes or 2=No

28. OvrCnta-g: Coder suspects applicant has over counted a-g courses: 1=Yes or 2=No

29. UndrCnta-g: Coder suspects applicant has under counted a-g courses: 1=Yes or 2=No

30. NumAGrds: Number of A grades reported by applicant: Tally and indicate number

31. NumBGrds: Number of B grades reported by applicant: Tally and indicate number

32. NumCGrds: Number of C grades reported by applicant: Tally and indicate number

33. NumDGrds: Number of D grades reported by applicant: Tally and indicate number

34. NumFGrds: Number of F grades reported by applicant: Tally and indicate number

JUDGEMENT

35. GrdTrndUp: Applicant's grade trend goes up: Indicate 1=Yes or 2=No

36. GrdTrndDn: Applicant's grade trend goes down: Indicate 1=Yes or 2=No

Senior Year Courses

37. NumTrmCrs: Total number of term courses taken senior year: Tally and indicate number

38. NumHonSen: Total number of AP, CL, H, IB courses taken senior year: Tally and indicate number

39. Numa-eSen: Total number of a-e courses taken senior year: Tally and indicate number

JUDGEMENT

Please consider the self-reported academic record and information from the read sheet.

40. OvralSenStr: Is the applicant's senior year strong? 1=Yes or 2=No

41. OvralSenLt: Is the applicant's senior year light? 1=Yes or 2=No

42. OvralProgStr: Is the applicant's overall academic program strong? 1=Yes or 2=No

43. OvralProgLt: Is the applicant's overall academic program light? 1=Yes or 2=No

Personal Statement

Please read the written responses in their entirety and then code for the following variables.

44. EvidAchvmnt: Is there evidence of academic achievement not mentioned elsewhere in the application? Indicate 1=Yes or 2=No

45. EvidLead: Is there evidence of leadership not mentioned elsewhere in the application (either new information or significant details about activities mentioned on p. 3)? Indicate 1=Yes or 2=No
46. EvidAccomp: Is there evidence of other non-academic accomplishments not mentioned elsewhere in the application (either new information or significant details about activities mentioned on p. 3)? Indicate 1=Yes or 2=No
47. EvidPassion: Is there evidence that the applicant pursued a passion? Indicate 1=Yes or 2=No
48. EfrtAcad: Is there evidence that the applicant made special effort to seek advanced academic coursework? Indicate 1=Yes or 2=No
49. EfrtAcaChal: Is there evidence that the applicant made special effort to seek other academic challenges? Indicate 1=Yes or 2=No
50. TaughtSlf: Is there evidence that the applicant taught self an academic subject or skill? Indicate 1=Yes or 2=No
51. TaughtOth: Is there evidence that the applicant taught others an academic subject or skill, including formal or informal tutoring? Indicate 1=Yes or 2=No

JUDGEMENT

52. SigContr: Is there evidence that the applicant contributed significantly to the school or community, relative to the Berkeley applicant pool? Indicate 1=Yes or 2=No

53. IntelMaturity: Personal statement shows intellectual maturity, relative to the Berkeley applicant pool: Indicate 1=Yes or 2=No

Significant Obstacles

Please consider the applicant's personal statement as well as information available from other parts of the application. Then code for significant obstacles that are apparent from the application. Examples of obstacles that may be significant include:

*Homelessness *Environment discouraged educational aspirations or participation in extracurriculars *Neglect or mistreatment by family member *Lives in dangerous neighborhood *Sibling caretaker *Home not suitable for homework (crowded or chaotic) *Commutes more than an hour to school	*Has lived apart from parents *Foster home *Divorce or separation *Death *Incarceration *Disruptive and frequent moves (multiple schools, homes, etc) *Low-income family in high income school *Contributes to family income *Must work for free in family business *Student must help parents (e.g., as translator, conducts business, pays bills, etc.)	*Parents have low English proficiency *Home language not English *Prior schooling not in English *Comes from a culture with no written language *Low-level or no experience with institutionalized education *Victim of discrimination *Stressful immigration experience	*Serious or chronic illness or injury *Physical Disability *Learning Disability *Pregnancy *Coming out *Victim of violence

54. EvidObs: Is there evidence of family, economic, personal, or social obstacles? Indicate 1=Yes or 2=No
55. NumMajObs: Number of obstacles: Tally and indicate number
56. LimitOps: Did the obstacles enumerated in #55 limit the applicant's ability to take advantage of opportunities for academic and extracurricular achievement that were available to others in his/her environment? 1= Yes or 2=No or 3=Can't determine
57. ImpctObs: Did the applicant live and learn in an environment with limited academic opportunities, relative to the Berkeley applicant pool? 1=Yes or 2=No

JUDGMENT

Please consider the overall strength of the application.

58. *DemSpark: Applicant demonstrates spark, pluck, energy, grit, insight, maturity, or originality, relative to the Berkeley applicant pool: Indicate 1=Strong yes or 2=Average yes or 3=Not really*

59. *ContrCampLf: Applicant will likely contribute to campus life: 1=Strong yes or 2=Average yes or 3=Not really*