Admissions Tests Discriminate Against College Admission of Minority and Low-Income Students at Selective Colleges

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By Mark Kantrowitz

SAT and ACT admission test scores follow a normal distribution, also known as a Bell Curve. Artifacts of a normal distribution contribute to discrimination against minority and low-income students at the most selective colleges and universities.

In particular, shifting the location of the bell curve due to changes in average combined SAT test scores magnifies differences at the extremes much more so than differences at the mean. Skew in the distribution can yield a similar effect. These problems are more likely to occur at two or more standard deviations beyond the mean, such as when the combined SAT test scores are 1400 or more and ACT test scores are 31 or more.

This means that small differences in average SAT and ACT test scores among any two student populations will lead to big differences in the percentage of students with high test scores among those populations, yielding big differences in college admissions rates at the most selective colleges.

A discussion of the theoretical background illustrates the nature of the problem, and is followed by real data that demonstrates that the actual magnitude of the problem is consistent with the theoretical analysis.

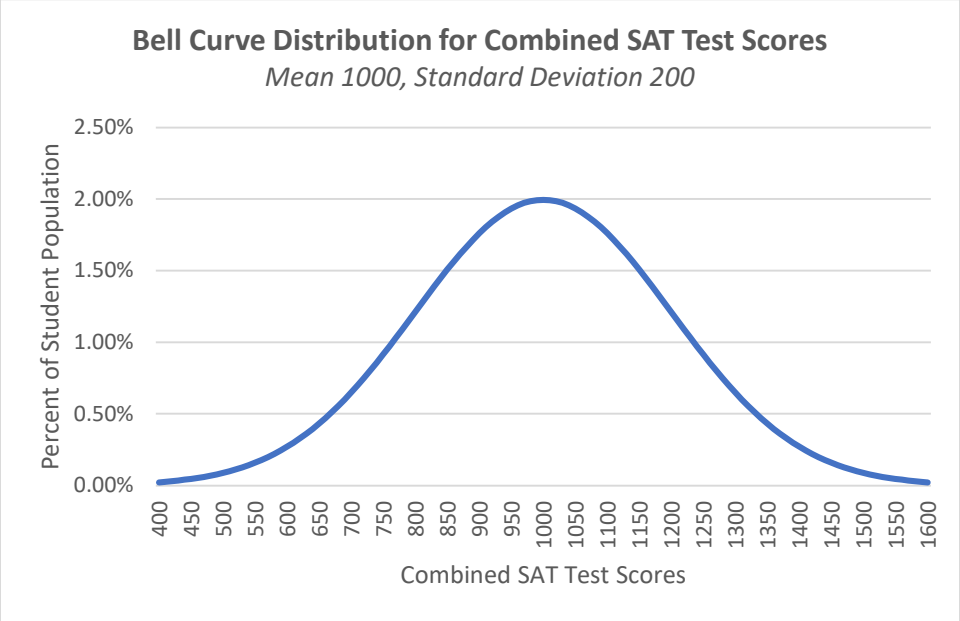
This paper not only demonstrates that the SAT and ACT tests contribute to discrimination against the college admission of minority and low-income students at selective colleges, but also articulates the mechanism through which this discrimination occurs.

Theoretical Background

The SAT involves math and verbal tests each of which is scored on a scale of 200 to 800. The two test scores are added to yield a combined SAT test score on a scale of 400 to 1600.

Chart 1 shows a theoretical normal distribution for combined SAT test scores, assuming a mean combined SAT test score of 1000 with a standard deviation of 200. Even though the x axis is in increments of 50, the underlying data is in increments of 10.

Chart 1



These assumptions are close to the actual mean combined SAT test scores and standard deviations in recent years, as shown in Table 1, which is based on Table 226.40 from the 2019 Digest of Education Statistics[1] and the College Board's SAT Suite of Assessments Annual Reports.[2] The SAT was initially designed with these assumptions, and the College Board recentered the test with a mean of 1000 and a standard deviation of 200 in 1995, fitting it to a normal distribution.[3]

Table 1

Year	Mean Combined SAT Test Score	Standard Deviation
2020	1051	211
2019	1059	210
2018	1068	204
2017	1060	195

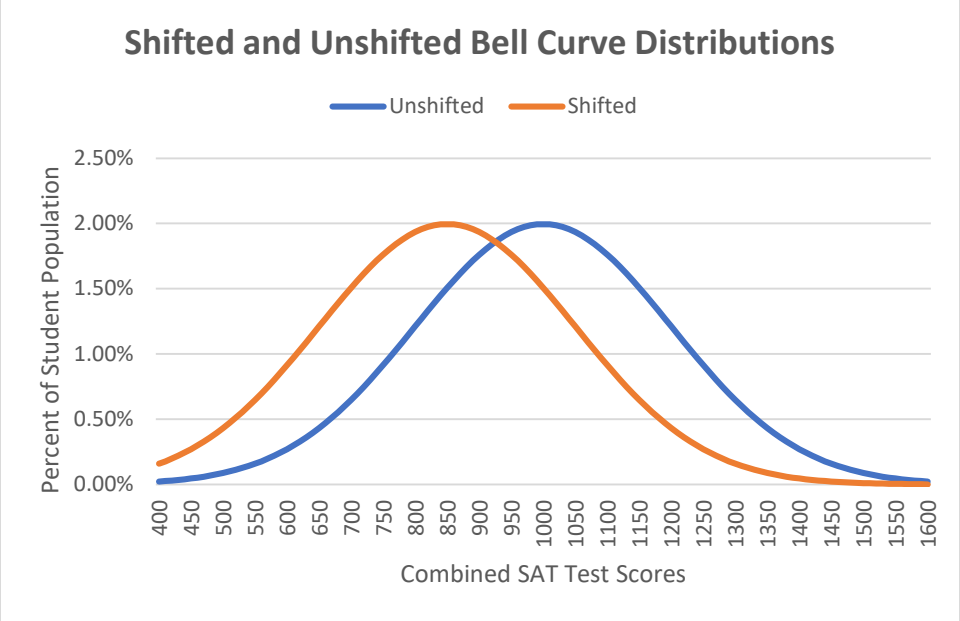
[1] https://nces.ed.gov/programs/digest/d19/tables/dt19_226.40.asp

[2] The College Board's mean scores for verbal and math were calculated separately and then added, as opposed to calculating an average for the total score, as used in the NPSAS:16 data, which may yield a different result.

[3] https://www.ets.org/Media/Research/pdf/RR-02-04-Dorans.pdf

Chart 2 shows what happens when the location of the Bell Curve is shifted to the left by 100 points.

Chart 2



The number of people with scores at the mean combined SAT test score of 1000 is 13% higher among the unshifted distribution than among the shifted distribution, a relatively small difference. At a combined SAT test score of 1400, however, the number of people in the unshifted distribution is more than triple the number of people in the shifted distribution (an increase of 208%). At a combined SAT test score of 1500, it is four times higher (an increase of 296%) and, at a combined SAT test score of 1600, it is five times higher (an increase of 408%).

Table 2 shows the relative impact of a 100 point shift at various combined SAT test scores.

Table 2

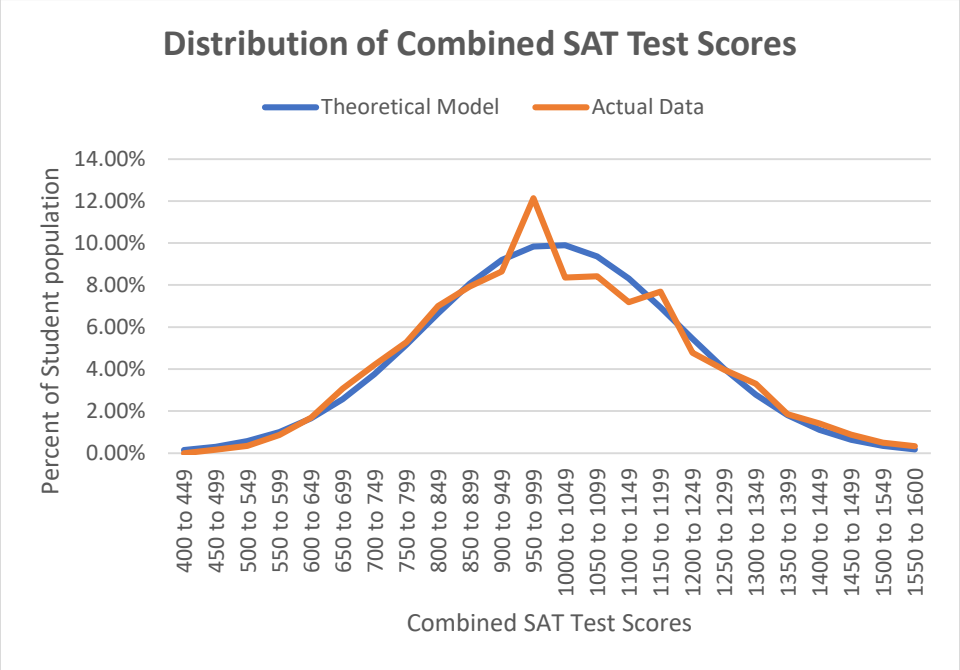
Combined SAT Test Score	Multiple	Increase
1000	1.13	13%
1100	1.45	45%
1200	1.87	87%
1300	2.40	140%
1400	3.08	208%
1500	3.96	296%
1600	5.08	408%

This demonstrates that small differences in the average values can yield much greater differences at the extrema. Shifting the location of a normal distribution will magnify the impact at extreme values of the distribution, especially at 2 or more standard deviations above the mean.

Actual vs. Theoretical Combined SAT Test Score Distribution

Chart 3 compares the actual combined SAT test score distribution, based on data from the 2015-16 National Postsecondary Student Aid Study (NPSAS:16) with the theoretical model shown above, aggregated in increments of 50 points.[4] The distribution is similar, but with a spike in the number of people with combined SAT test scores of 950 to 999 and a reduction in the number of people with combined SAT test scores from 1000 to 1149.

Chart 3



The cause of this spike is unknown. It may be due to artificial centering of the distribution at a score of 1000. It may also be due to a combination of positive skew (right skew) of the distribution for Black or African-American and Hispanic or Latino students[5] and negative skew (left skew) of the distribution for White and Asian students, as will be discussed below.

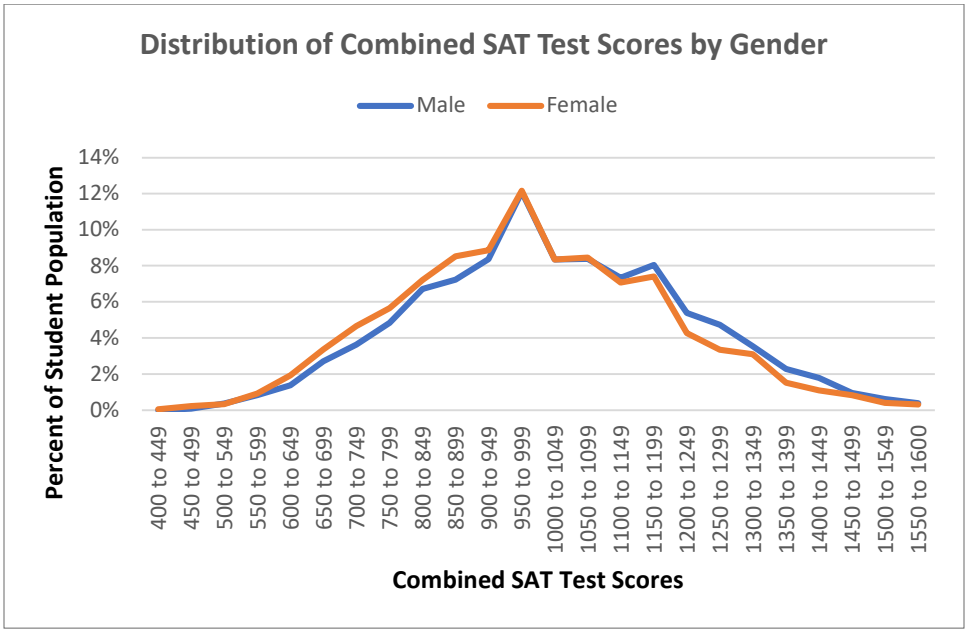
[4] This data is based on the TESATDER variable, which includes the ACT composite score converted to an estimated SAT combined score and the sum of the SAT verbal and math scores. The analysis in this report applies to both the SAT and ACT tests.

[5] The terms "Black or African-American" and "Hispanic or Latino" are the terms used by the National Center for Education Statistics (NCES), the source of the data used in this report.

Combined SAT Test Score Distribution by Gender

Chart 4 shows a slight negative skew for combined SAT test scores by male students as compared with female students, with the blue line above the orange line on the right side of the graph and below on the left side of the graph. Male students are 42% more likely to have combined SAT test scores in the 1400 to 1600 range than female students. The average combined SAT test score is 1020 for men and 990 for women.[6]

Chart 4



Combined SAT Test Score Distribution by Race

These is a much more dramatic difference in the distribution of combined SAT test scores by race.

Chart 5 and Table 3 demonstrate a shift in location of the distribution for both Black or African American and Hispanic or Latino students, as compared with White and Asian students. There's also positive skew (skew of the tail to the right) for these students. Positive skew can occur when there is effectively an upper bound on a distribution, limiting the ability of the population to obtain high test scores.

This kind of shift in combined SAT test score distribution tends to magnify differences at the extremes. White students are only 25% more likely than Black or African-American students to have combined SAT test scores around the average (950 to 1050), but three times more likely (an increase of 204%) to have combined SAT test scores of 1400 and above. Similarly, White students are only 9% more likely than Hispanic or Latino students to have average combined SAT test scores, but more than twice as likely (an increase of 146%) to have combined SAT test scores of 1400 or more. (Asian students are 229% more

[6] The difference may be due to SAT math test scores. The average SAT math score is 34 points higher for men while the average SAT verbal test score is 2 points lower, based on the National Education Longitudinal Study of 1988.

likely than White students to have combined SAT test scores of 1400 or more and 17% less likely to have combined SAT test scores around the average.)

The average combined SAT test score is 1042 for White students, 899 for Black or African-American students, 942 for Hispanic or Latino students and 1070 for Asian students.

Chart 5

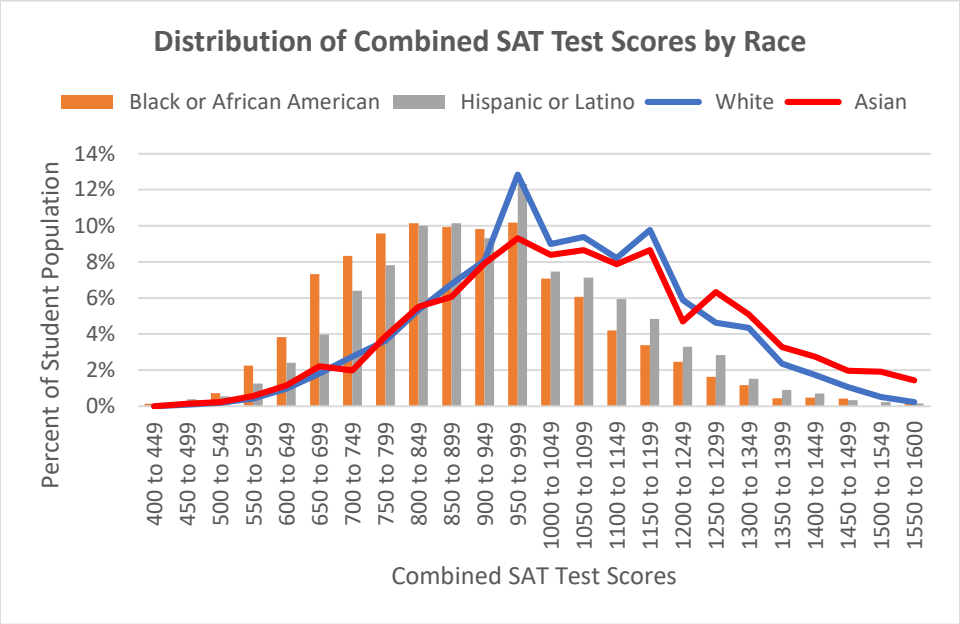


Table 3

Race	Combined SAT Test Scores of 400 to 949	Combined SAT Test Scores of 950 to 1050	Combined SAT Test Scores of 1051 to 1399	Combined SAT Test Scores of 1400 to 1600
White	30.0%	23.0%	43.5%	3.5%
Black or African American	62.3%	18.4%	18.2%	1.2%
Hispanic or Latino	52.3%	21.0%	25.2%	1.4%
Asian	29.7%	19.1%	43.2%	8.1%

The differences in the distribution of combined SAT test scores by race may be partially explained by differences in the distribution of combined SAT test scores by family income, as will be discussed below. Table 4 shows that the average family AGI for White and Asian students is higher than the average family AGI for Black or African-American students and Hispanic or Latino students.

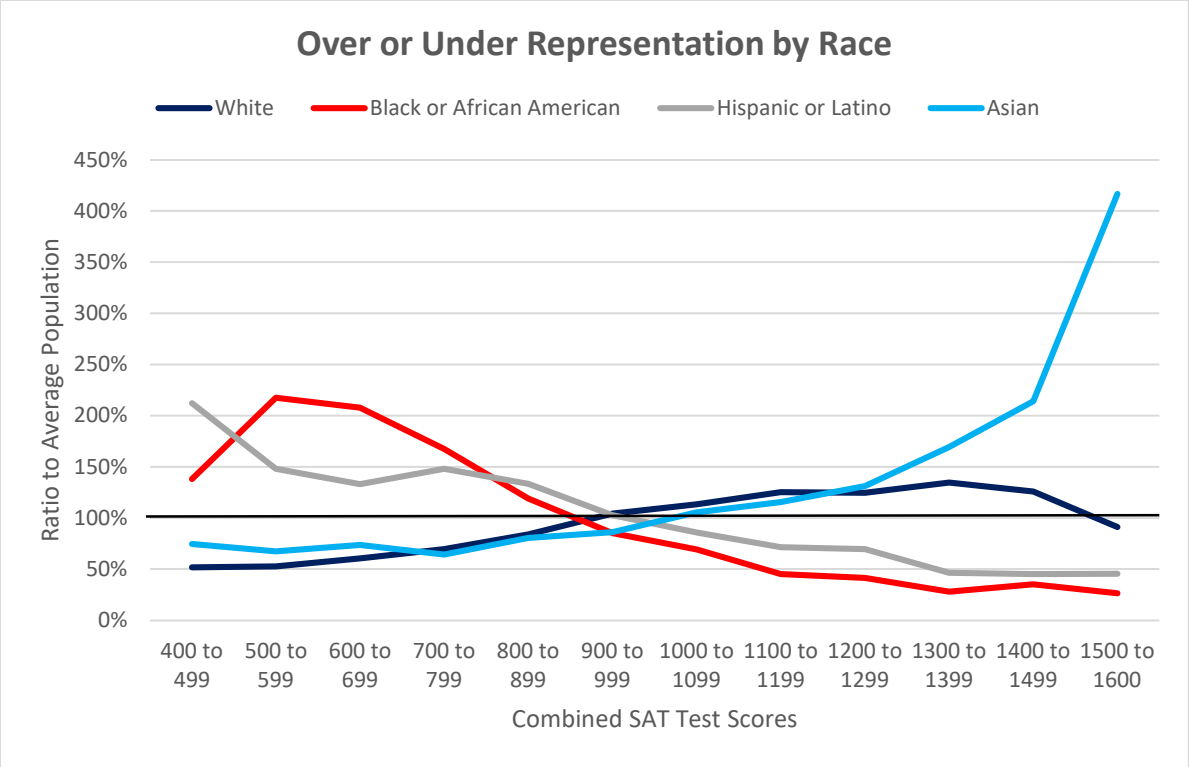
Table 4

Race	Average Family AGI	Family AGI < $25,000	Family AGI < $50,000
White	$75,497	29%	48%
Black or African American	$40,690	49%	75%
Hispanic or Latino	$46,788	42%	70%
Asian	$64,905	38%	58%

The combined SAT test scores for Black or African-American students and Hispanic or Latino students with family income of $100,000 or more occur at 51% and 90%, respectively, of the difference between the average combined SAT test scores for these students and for White students. Thus, the majority of the difference in combined SAT test scores by race is eliminated for students from higher-income families.

Chart 6 shows the extent to which each race is over- or under-represented within each score range, as compared with the average (100%).

Chart 6



Combined SAT Test Score Distribution by Family Income

Chart 7 and Table 5 demonstrate two phenomena. First, the combined SAT test score distribution shifts and skews to the left (negative skew) as family income increases. Second, the distribution flattens out as family income increases, especially for students whose families have adjusted gross income (AGI) greater than $50,000.

Students with a family AGI of $100,000 or more are 2.4 times more likely to have combined SAT test scores of 1400 or more than students with a family AGI less than $25,000 and 3.5 times more likely than students with a family AGI of $25,000 to $49,999.

Chart 7

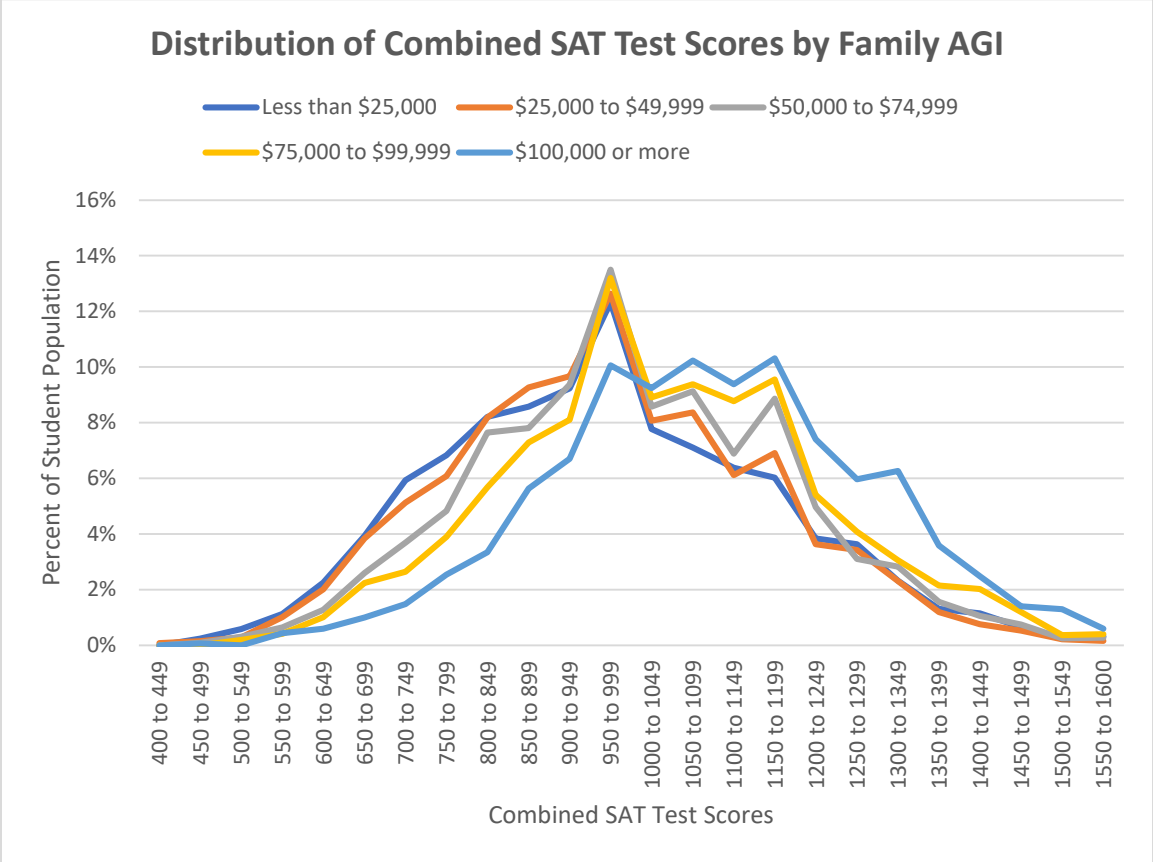
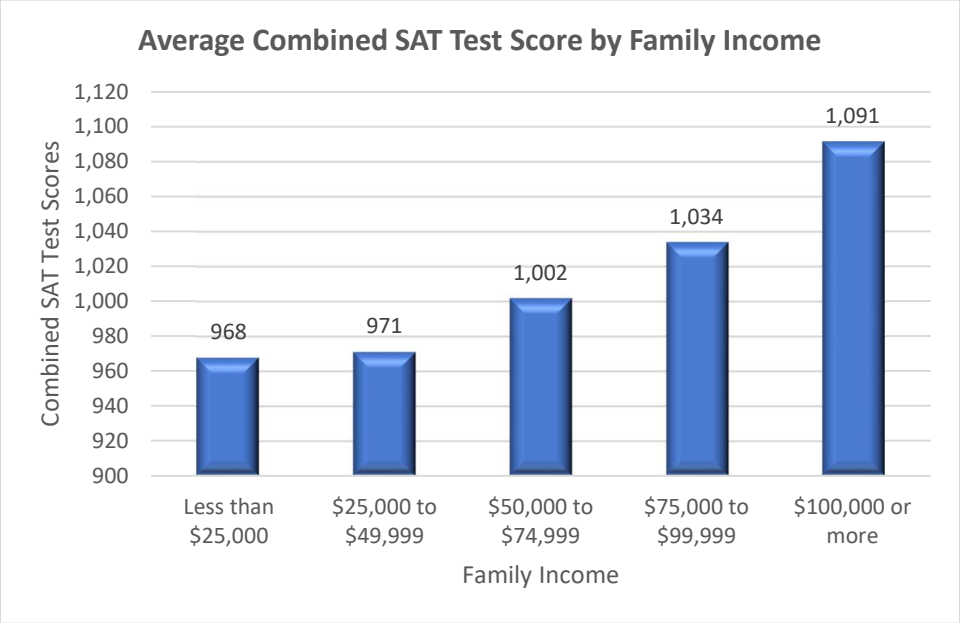


Table 5

Family Income	Combined SAT Test Scores of 400 to 949	Combined SAT Test Scores of 950 to 1050	Combined SAT Test Scores of 1051 to 1399	Combined SAT Test Scores of 1400 to 1600
Less than $25,000	46.9%	21.1%	29.6%	2.4%
$25,000 to $49,999	45.7%	21.9%	30.8%	1.7%
$50,000 to $74,999	38.3%	23.1%	36.3%	2.3%
$75,000 to $99,999	31.5%	23.4%	41.1%	4.0%
$100,000 or more	21.8%	20.8%	51.7%	5.8%

Chart 8 shows that the average combined SAT test score increases as family income increases beyond $50,000.

Chart 8



The wealthy do not have a monopoly on intelligence. But, higher-income students tend to live in better public-school districts[7] and can afford to enroll in private schools and to pay for SAT test prep classes.

[7] Public schools are funded through local taxes, as opposed to being funded on a state or national per capita basis. This causes low-income students to be segregated into underfunded school districts.

Impact of Combined SAT Test Scores on the Most Selective Colleges

Based on data from the 2019 Integrated Postsecondary Education Data System (IPEDS), 24 colleges have 25th percentile combined SAT test scores of 1400 or more. This means that at least 75% of the students at these colleges have a 1400 or higher SAT. Thus, the phenomena discussed in this paper will have a disproportionate impact on the admission of minority and low-income students at these colleges. These colleges are listed in Table 6.

Table 6

College Name (State)	25th Percentile SAT Verbal	25th Percentile SAT Math	25th Percentile SAT Composite
California Institute of Technology (CA)	740	790	1530
Massachusetts Institute of Technology (MA)	730	780	1510
University of Chicago (IL)	730	770	1500
Harvey Mudd College (CA)	710	780	1490
Duke University (NC)	720	760	1480
Washington University in St Louis (MO)	720	760	1480
Rice University (TX)	720	750	1470
Harvard University (MA)	710	750	1460
Princeton University (NJ)	710	750	1460
Yale University (CT)	720	740	1460
Carnegie Mellon University (PA)	700	760	1460
Franklin W Olin College of Engineering (MA)	700	760	1460
Johns Hopkins University (MD)	710	750	1460
Vanderbilt University (TN)	710	750	1460
University of Pennsylvania (PA)	700	750	1450
Columbia University (NY)	700	740	1440
Brown University (RI)	700	740	1440
Stanford University (CA)	700	740	1440
Dartmouth College (NH)	710	730	1440
Northwestern University (IL)	700	740	1440
Williams College (MA)	700	710	1410
Webb Institute (NY)	680	730	1410
Cornell University (NY)	680	720	1400
University of Notre Dame (IN)	680	720	1400

All of these colleges claim to have need-blind college admissions. Need-blind admissions does not consider a student's financial situation when deciding whether to admit the student. Yet, the data presented in this paper demonstrates that SAT test scores discriminate against the admission of low-income students.

The percentage of undergraduate students who are Black or African-American, Hispanic or Latino, and Federal Pell Grant recipients at these colleges are well below the national average, as shown in Table 7. Receipt of a Federal Pell Grant is a good proxy for low-income status.

Table 7

College Name (State)	% Black or African-American	% Hispanic or Latino	% Federal Pell Grant Recipients
California Institute of Technology (CA)	2%	17%	14%
Massachusetts Institute of Technology (MA)	6%	15%	18%
University of Chicago (IL)	6%	14%	11%
Harvey Mudd College (CA)	4%	19%	13%
Duke University (NC)	9%	10%	14%
Washington University in St Louis (MO)	10%	9%	13%
Rice University (TX)	7%	16%	15%
Harvard University (MA)	8%	12%	11%
Princeton University (NJ)	8%	10%	19%
Yale University (CT)	8%	14%	17%
Carnegie Mellon University (PA)	4%	9%	14%
Franklin W. Olin College of Engineering (MA)	2%	11%	10%
Johns Hopkins University (MD)	8%	15%	13%
Vanderbilt University (TN)	11%	10%	16%
University of Pennsylvania (PA)	8%	10%	13%
Columbia University (NY)	7%	14%	25%
Brown University (RI)	7%	11%	13%
Stanford University (CA)	7%	17%	17%
Dartmouth College (NH)	6%	10%	16%
Northwestern University (IL)	6%	12%	18%
Williams College (MA)	7%	13%	21%
Webb Institute (NY)	0%	4%	3%
Cornell University (NY)	7%	14%	17%
University of Notre Dame (IN)	4%	11%	10%
Table Average	**7%**	**12%**	**15%**

For comparison, among the 2,933 4-year colleges in IPEDS, 11% of the students are Black or African-American, 18% are Hispanic or Latino, and 35% are recipients of the Federal Pell Grant. (Among all 6,559 undergraduate institutions, the percentages are 12%, 21% and 35%, respectively.)

The low percentage of undergraduate students who are Federal Pell Grant recipients is particularly shocking because these colleges have large endowments sufficient to eliminate socioeconomic status as a barrier to college access and completion.

The SAT test score discrimination is not limited to just the most selective colleges with 25th percentile SAT test scores of 1400 or more. An additional 48 colleges have 25th percentile combined SAT test scores of 1300 to 1399, 69 colleges have 25th percentile combined SAT test scores of 1200 to 1299, and 140 colleges have 25th percentile combined SAT test scores of 1100 to 1199. All of these colleges rely on an admissions test that demonstrates bias against Black or African-American students, Hispanic or Latino students and low-income students.

Recommendations

There are several possible ways of addressing these phenomena.

Stop using the SAT and ACT admissions tests. During the Covid-19 pandemic, most colleges went test optional because of limited opportunities for students to take the tests. A test optional policy doesn't really address the problems, since wealthier students may be able to continue taking the tests, providing them with an unfair advantage. A test-optional admissions policy considers admissions tests if provided, but does not requirement them. A test-blind admissions policy ignored admissions tests even if they are provided. Colleges could decide to become test blind now and after the end of the pandemic to address the equity issues raised in this report.

The test publishers could also eliminate or modify questions that discriminate against racial groups as opposed to measuring academic ability. This may not be a perfect solution, since it may not be possible to eliminate the distortion caused by the advantages available only to wealthier students. Free test prep classes and sample tests are an inadequate remedy.

Add an adjustment to the SAT and ACT test scores of minority and low-income students. One approach would involve normalizing the distribution of SAT test scores within each demographic group, recentering on an average score of 1000 with a standard deviation of 200. This would address the shift in the normal distribution, but not the skew in the distribution. One could also apply log transformation to address the positive skew (right skew) that affects minority and low-income students.

Another approach would adjust the test scores or add a tolerance to the test scores based on the difference in average test scores within each demographic group. This addresses a shift in the location of the distribution, as opposed to skew in the distribution. Possible adjustments might include the following:

- Add 30 points to the combined SAT test scores of women (0.9 point on the ACT)
- Add 143 points to the combined SAT test scores of Black or African-American students (4.3 points on the ACT) and 100 points to the combined SAT test scores of Hispanic or Latino students (3 points on the ACT)
- To adjust by income, add 35 points to combined SAT test scores for students with family income less than $50,000 and subtract 13 points for every $10,000 in family income above $70,000 (1 point and 0.4 points on the ACT, respectively)

Address the underlying problem. Change the funding of public-school systems to be on a statewide per capita basis, instead of basing the funding on local property taxes or local sales taxes. The current funding mechanism may be unconstitutional.