

RESEARCH ADDENDUM

Additional Findings on UC and the SAT

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This research addendum addresses several follow-up issues that have been raised in discussions within BOARS and by other UC faculty subsequent to the initial publication of the paper, “UC and the SAT: Predictive Validity and Differential Impact of the SAT I and SAT II at the University of California.” In particular, this addendum presents additional research findings on three issues:

- 1) ***Additional findings on UC Riverside and the SAT*** Due to problems of missing data, the initial paper reported only partial results for UC Riverside, and those results appeared to indicate that, unlike other UC campuses, the SAT I might be a slightly better predictor of freshman grades than the SAT II at that particular campus. Because of this anomalous result, BOARS requested that staff re-analyze the complete UCR dataset. Results of that re-analysis are presented below. The new UCR findings show a pattern of results more similar to the other UC campuses, with SAT I and SAT II largely equivalent in terms of their predictive power.
- 2) ***“Edge of eligibility pool” analysis*** The anomalous result for UC Riverside also raised a broader analytical issue, one not necessarily confined to a particular UC campus: Given that UC Riverside is among the least selective UC campuses in terms of its admissions standards, might not the UCR results suggest that the SAT I is superior to the SAT II in predicting outcomes in general for students at the “edge” of the UC-eligibility pool, that is, among students with weaker academic profiles? This paper presents the results of several new analyses related to that issue. The results show that the SAT II is a consistently stronger predictor than the SAT I throughout the entire range of the UC eligibility pool.
- 3) ***Discrepant-score analysis*** Another variant of the “edge of the eligibility pool” question is whether the SAT I might be better than the SAT II in identifying “diamonds in the rough,” that is, students with strong academic aptitude, as indicated by their SAT I scores, but whose high-school records or achievement-test scores are relatively weak. This paper presents new findings on that issue, showing that students with discrepant SAT I scores are few in number and perform less well at UC.

Additional Findings on UC Riverside and the SAT

The original paper on “UC and the SAT” included only two years of data for UC Riverside –1996 and 1999 – but excluded UCR data for 1997 and 1998 from the prediction analysis. As noted in the original report, the UCR data uploads into the UC Corporate Student System for 1997 and 1998 had extensive missing data: The majority of

the UCR student records for those years were missing freshman GPAs, which were essential to the prediction analysis. However, because of the anomalous results for UC Riverside, which appeared to indicate that the SAT I might be a slightly better predictor than the SAT II for those years in which data were available, BOARS requested that UCOP and campus research staff retrieve and upload data for the missing years and re-analyze the entire UCR dataset. Following are the results of that re-analysis.

Table 1 below displays standardized regression coefficients and percentages of variance in UCR freshman grades (UCGPA) accounted for by HSGPA, SAT I and SAT II scores. The analysis is based on the academic records of 7,281 freshmen who entered UCR during the four-year period from Fall 1996 through Fall 1999 and who completed their freshman year. All findings are statistically significant at the .01 level:

Table 1				
Additional Findings for UC Riverside:				
Standardized Regression Coefficients and				
Percent of Variance in UC Freshman GPA Explained				
by HSGPA, SAT I and SAT II Scores				
1996 through 1999				
<i>Regression equation: UCGPA = HSGPA + SAT I + SAT II</i>				
	Standardized Regression Coefficients			% of Explained
	HSGPA	SAT I	SAT II *	Variance
HSGPA	0.35			12.6%
SAT I		0.26		6.6%
SAT II			0.28	7.7%
SAT I + SAT II		0.11	0.19	8.2%
HSGPA + SAT I	0.32	0.19		16.2%
HSGPA + SAT II	0.30		0.20	16.1%
HSGPA + SAT I + SAT II	0.30	0.12	0.11	16.7%
* Composite includes SAT II W + M + 3rd Test.				

The new UCR data show a pattern of a results much more consistent with that reported for other UC campuses, although it continues to be the case that, in some of these comparisons, the SAT I performs slightly better than the SAT II in predicting academic outcomes at UC Riverside. Looking at the predictor variables individually – shown in the first three rows of Table 1 – HSGPA is the best *single* predictor of freshman grades at UCR, accounting for 12.6% of the explained variance. SAT II scores were the second-best single predictor, accounting for 7.7% of the variance in freshman grades, while SAT I scores ranked third, accounting for 6.6% of the variance in a single-variable prediction equation.

However, looking at the prediction variables in combination – rows four through seven of Table 1 – a more balanced picture emerges, with the SAT I having a small predictive advantage. When SAT scores are combined with HSGPA in the prediction equation, as is typically done in admissions, the SAT I has a slight edge: SAT I and HSGPA together

account for 16.2% of the variance in UCGPA at Riverside, compared to 16.1% when SAT II and HSGPA are combined in the prediction equation. In addition, in a three-variable prediction equation in which HSGPA, SAT I and SAT II are combined, the beta weight for the SAT I (.11) is slightly larger than that for the SAT II (.10).

Nevertheless, these differences are small, and the overriding picture that emerges from the new UCR data is one of similarity rather than difference: HSGPA has by far the greatest weight in predicting freshman grades at UC Riverside, and the SAT I and SAT II are largely overlapping and redundant in terms of the predictive power they add. This is very similar to the pattern observed at many other UC campuses.

Further support for this conclusion is provided by Table 2 below, which shows beta weights and percentages of explained variance for UCR by major disciplinary area:

Table 2				
Additional Findings for UC Riverside:				
Standardized Regression Coefficients				
and Percent of Variance in UC Freshman GPA				
Accounted for by HSGPA, SAT I and SAT II Scores				
by Major Disciplinary Area, 1996 to 1999				
<i>Regression equation: UCGPA = HSGPA + SAT I + SAT II</i>				
	Standardized Regression Coefficients:			% of Explained Variance
	HSGPA	SAT I	SAT II *	
General/Undeclared	.21	.07 **	.12	8.0%
Social Sci/Humanities	.22	.15	.12	12.2%
Biological Sciences	.24	.19	.17	23.1%
Math/PhySci/Engineering	.23	.08 **	.15	11.1%
* Composite includes SAT II W + M + 3rd Test.				
** Not statistically significant at <.01 level.				

As Table 2 demonstrates, HSGPA carries by far the greatest predictive weight in all major disciplinary areas at UC Riverside. With respect to the SAT I and SAT II, however, the pattern is more mixed across disciplines. The SAT II has less predictive weight than the SAT I among UCR students in the Social Sciences/Humanities (.15 for the SAT I compared with .12 for the SAT II) and the Biological Sciences (.19 for the SAT I vs. .17 for the SAT II). Among General/Undeclared majors, the SAT II is the better predictor (.12 for the SAT II vs. .07 for the SAT I). And among UCR students majoring in Mathematics, Physical Sciences and Engineering, the SAT II is clearly the superior predictor (.15 for the SAT II vs. .08 for the SAT I). These findings suggest that, for UC Riverside, the SAT II predicts freshman grades almost as well as the SAT I in all major disciplinary areas and rather better than the SAT I in the math-based disciplines.

Finally, Table 3 below shows regression results for UC Riverside by year. After HSGPA, SAT I scores had the greater predictive weight in the first two of the four years studied, 1996 and 1997, while the pattern reversed in the last two years, 1998 and 1999, when SAT II scores had the greater predictive weight.

The new data for UC Riverside shown in Table 3 also reveal a surprising finding that deserves mention here, though it is not directly germane to concerns about the relative predictive weight of the SAT I vs. SAT II: The *overall* percentage of variance in UCR freshmen grades predicted by high-school GPA and SAT scores has fallen precipitously over the past four years:

Table 3				
Additional Findings for UC Riverside: Standardized Regression Coefficients and Percent of Variance in UC Freshman GPA Accounted for by HSGPA, SAT I and SAT II Scores by Year, 1996 to 1999				
<i>Regression Equation: UCGPA = HSGPA + SAT I + SAT II</i>				
	Standardized Regression Coefficients			% of Explained
	HSGPA	SAT I	SAT II *	Variance
1996	0.34	0.14	0.12	24.7%
1997	0.28	0.17	0.09	18.0%
1998	0.33	0.08	0.11	16.4%
1999	0.27	0.09	0.11	12.6%

* Composite includes SAT II W + M + 3rd Test

In 1996, HSGPA, SAT I and SAT II scores together accounted for 24.7% of the total variance in freshman GPA at UC Riverside. That percentage fell to 18.0% in 1997, 16.4% in 1998, and finally to 12.6% in 1999. The reasons for this trend are not entirely clear, although it is the case that UC Riverside experienced considerable growth in the size and diversity of its freshman class during this period. Grade inflation may have also played a role, and further analysis needs to be undertaken of those and other factors. At the same time, however, the above findings provide a useful note of caution about our general capacity to predict college outcomes based on students' high-school grades and test scores: While it is true that, in combination with HSGPA, students' SAT I and SAT II scores perform about equally well in predicting freshmen grades at UC Riverside, the *overall* predictive capacity provided by these measures accounts for a relatively small, and apparently declining, fraction of the total variance in freshman grades.

“Edge of the Eligibility Pool” Analysis

Prior to the above re-analysis of the UC Riverside data, the original UCR results also raised a broader analytical question, one not necessarily confined to any particular UC campus: Given that UCR is among the least selective UC campuses in terms of its admissions, did those results suggest that the SAT I might be a generally stronger predictor at the “edge of the eligibility pool,” i.e., among students with weaker academic records, even though the SAT II may be the better predictor at more selective campuses? BOARS directed staff to undertake analyses of several aspects of this question.

The “edge of the eligibility pool” hypothesis resonates with a widely held belief about the difference between generalized aptitude or reasoning tests, such as the SAT I, and achievement tests, such as the SAT II, that assess students’ mastery of specific academic subjects. On that view, aptitude tests may be better suited to identifying “diamonds in the rough,” i.e., high-potential students from disadvantaged backgrounds who might not be identified by achievement tests. A variant of this hypothesis is that, because aptitude tests are less tied to the high school curriculum than achievement tests, aptitude tests are less sensitive to the academic quality of a school and so may be better at identifying “diamonds in the rough” for this reason as well.

Yet there is little extant research to support this hypothesis. The few systematic studies available suggest that there is little difference between aptitude and achievement tests with respect to their prediction of outcomes for students from disadvantaged backgrounds. For example, Jencks and Brown (1975) and Alexander (1978) found that aptitude tests are not necessarily less sensitive to curriculum and instructional variations than conventional achievement tests.

Similarly, the UC data show no predictive advantage for the SAT I over the SAT II with respect to students with weaker academic records or from educationally disadvantaged backgrounds. Table 4 shows standardized regression coefficients for SAT I and SAT II scores across HSGPA quintiles (all following tables are based on UC systemwide data):

Table 4			
Standardized Regression Coefficients			
for SAT I and SAT II Scores			
by HSGPA Quintile, 1996 to 1999			
<i>Regression equation: UCGPA = SAT I + SAT II</i>			
HSGPA	Standardized Regression Coefficients		
Quintile	SAT I	SAT II *	
5	(high)	.04	.31
4		.02 *	.28
3		.08	.23
2		.10	.20
1	(low)	.08	.16

* Composite includes SAT II W + M + 3rd Test.

As Table 4 above demonstrates, SAT II achievement test scores are consistently stronger predictors of UC freshman grades than SAT I scores for students in all HSGPA quintiles. Although it is true that the beta weights for the SAT I are somewhat larger at the low end of the HSGPA spectrum, the SAT II achievement tests are still clearly the superior predictor at all levels.

Table 5 below presents standardized regression coefficients for HSGPA, SAT I and SAT II scores controlling for the academic quality of a student’s high school, using the California Department of Education’s Academic Performance Index (API) as a measure of school quality. If it is true that aptitude tests, such as the SAT I, are more “curriculum independent” than achievement tests, such as the SAT II, then one might expect the SAT I to have greater predictive weight than the SAT II among students from the lowest-performing schools. But this is not the case:

Table 5				
Standardized Regression Coefficients				
for HSGPA, SAT I and SAT II Scores				
by School API Quintile				
1996 to 1999				
<i>Regression equation: UCGPA = HSGPA + SAT I + SAT II</i>				
School API Quintile		Standardized Regression Coefficients		
		HSGPA	SAT I	SAT II *
5	(high)	.33	-.01 **	.20
4		.32	.01 **	.20
3		.29	.03 **	.25
2		.28	.07	.22
1	(low)	.25	.12	.18
* Composite includes SAT II W + M + 3rd Test.				
** Not statistically significant at <.01 level.				

After high-school grades, the SAT II is the better predictor of freshman grades than the SAT I for students from all school API quintiles. Again, while the beta weights for the SAT I are somewhat larger in the lower school quintiles, the SAT II remains the superior predictor even in the lowermost school API quintile.

Discrepant-Score Analysis

Yet another variant of the “diamond in the rough” hypothesis involves the question of *discrepant scores*, that is, cases in which a student may score poorly on one measure, such as SAT II scores or high-school grades, but score very well on a test of generalized reasoning or aptitude, such as the SAT I. In cases of discrepant scores, might not the SAT I provide significant additional information with which to identify high-potential

students that would not be available from any other source? Following are the results of several additional analyses requested by BOARS on this issue.

To identify cases of discrepant test scores, *z-scores* were calculated from composite scores for both the SAT I (verbal plus mathematical reasoning) and SAT II (Writing plus Mathematics). A *z-score* is the number of standard deviations that an observed value of a variable differs from that variable's mean.¹ *Z-scores* are used here because they facilitate comparisons across variables with different means and standard deviations.²

A student has discrepant scores on the SAT I and SAT II if their *z-scores* differ by some defined threshold level. Two threshold levels were used in this analysis: *Z-score* differences of 1.0 and 1.5.³ These discrepant-score groups were then further divided into two subgroups: Those with higher SAT I scores and those with higher SAT II scores. Findings were as follows.

As shown below in Table 6, the number of students with discrepant scores is very small under either threshold. The small size of the discrepant-score groups is a reflection of the high correlation between SAT I and SAT II scores in the UC sample ($R = 0.874$); the great majority of students with high SAT I scores also score well on the SAT II. As a result, only 4.6% of students were found to have discrepant scores using a *z-score* threshold of 1.0, and just 0.4% using the more stringent threshold of 1.5. Moreover, within these discrepant-score groups, the subgroups of those with higher SAT I scores accounted for only 2.4% and 0.3%, respectively, of the total UC sample:

Z-Score Threshold	High SAT I Group	High SAT II * Group	Total Number	% of Total UC Sample
1.0	1,859	1,748	3,607	4.63%
1.5	196	147	343	0.44%
* Composite includes SAT II W + M.				

Table 7 (next page) shows the demographic composition and other characteristics of the discrepant score groups at both threshold levels. The composition of the much larger group with similar test scores is also displayed.

¹ For example, if the SAT composite had a mean of 1000 and a standard deviation of 220, then a reported score of 780 would translate into a *z-score* of -1.0 .

² In the sample under consideration, the mean and standard deviation of SAT I scores are 1213 and 158 respectively; for the SAT II they are 1177 and 166.

³ A typical threshold for such studies is one standard deviation. See College Board (1997).

**Table 7
Summary Characteristics of Discrepant- Score Groups**

Z-score threshold	1			1.5		
Exam with higher score:	High SAT I	Similar Scores	High SAT II *	High SAT I	Similar Scores	High SAT II *
Size of group	1,859	74,286	1,748	196	77,550	147
Means within Groups						
Income (1998 dollars) **	\$79,171	\$78,410	\$70,226	\$80,510	\$78,272	\$60,735
High School GPA	3.76	3.84	3.86	3.68	3.84	3.84
UC Freshman GPA	2.81	2.92	2.94	2.69	2.92	2.9
SAT I	1,309	1,213	1,102	1,350	1,213	1,017
SAT II WM	1,075	1,177	1,259	1,034	1,177	1,251
Percent of Group by Race/Ethnicity						
White	37.7%	35.9%	32.4%	32.7%	35.9%	34.0%
Asian American	38.8%	40.5%	42.3%	45.9%	40.5%	36.1%
Chicano/Latino	8.9%	11.2%	13.0%	5.1%	11.2%	17.0%
African American	2.9%	2.8%	3.2%	3.1%	2.9%	3.4%
Native American	0.8%	0.6%	0.6%	1.0%	0.6%	0.7%
Other	2.1%	1.8%	2.1%	1.5%	1.8%	1.4%
Unknown	8.9%	7.2%	6.4%	10.7%	7.2%	7.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Composite includes SAT II W + M.

** Due to missing data, the means for income are based on 1,613, 63,947, 1,504, 162, 66,780, and 122 observations, respectively.

Note particularly the results for the discrepant-score group with higher SAT I scores. Under both z-score thresholds, this group has a higher average family income and a smaller percentage of African American and Chicano/Latino students than either the similar-score group or the group with higher SAT II scores. These results run contrary to widely held beliefs about the superiority of the SAT I in identifying high-potential students from disadvantaged backgrounds; if anything, the SAT II appears to perform better in this respect. Note also the average UC freshman GPA for the discrepant-score group with higher SAT I scores: Under both z-score thresholds, this group exhibits a lower average UCGPA than either the similar-score group or the group with higher SAT II scores. Again, these findings are not consistent with the view that aptitude tests such as the SAT I are more useful in identifying “diamonds in the rough”: Students who stand out in their performance on the SAT I but not on the SAT II do not stand out in their performance at UC.

Finally, Table 8 (next page) presents findings on yet another variant of the “diamond in the rough” hypothesis, namely, that the SAT I may be superior in identifying “late bloomers” – students with high but as yet unrealized potential (as indicated by high aptitude-test scores but low high-school grades). On this view, the SAT I could help to tap such students who may subsequently “blossom” in the more enriched academic atmosphere of college.

Table 8 displays average UC freshman GPAs for students in the lowest HSGPA quintile. The rows of the table represent SAT I deciles, and the columns of the table represent SAT II deciles. The main focus of interest is in the lower-left (black) portion of the table – students with high SAT I scores relative to both their SAT II scores and HSGPAs. Less relevant is the center diagonal portion of the table (displayed in white), since students in these cells tend to score about the same, having either high scores or low scores on both tests. The upper-right portion of the table (gray area) represents students with high SAT II and low SAT I scores. Thus, it is only in the lower-left portion of the table – students with relatively high SAT I scores but with lower SAT II scores and HSGPAs – where the SAT I might provide additional information, beyond that which is available from the SAT II, with which to identify high-potential students who might otherwise be missed:

Table 8
Average UCGPAs in Lowest HS GPA Quintile
by SAT I and SAT II Deciles, 1996 to 1999

		SAT II Decile										
		1	2	3	4	5	6	7	8	9	10	
SAT I Decile	1	2.33	2.44	2.46	2.42	2.59	3.48		1.17			
	2	2.47	2.49	2.52	2.58	2.65	2.71	2.65	3.07			
	3	2.54	2.56	2.59	2.60	2.66	2.71	2.87	2.76	2.86		
	4	2.46	2.55	2.60	2.64	2.66	2.66	2.61	2.86	2.57		
	5	2.55	2.53	2.59	2.73	2.64	2.67	2.81	2.74	2.61	2.69	
	6	2.44	2.54	2.64	2.64	2.65	2.70	2.74	2.68	2.74	2.81	
	7	2.55	2.67	2.43	2.62	2.63	2.65	2.64	2.75	2.76	2.84	
	8	1.75	2.62	2.74	2.53	2.78	2.60	2.70	2.75	2.77	2.94	
	9	1.35	2.39	2.25	2.17	2.45	2.64	2.66	2.76	2.77	2.91	
	10			2.38	2.62	2.57	2.90	2.53	2.73	2.67	2.84	

As Table 8 illustrates, however, students with higher SAT I scores relative to their SAT II scores and HSGPA do *not* tend to perform especially well at UC. The overall weighted average UCGPA for the high-SAT I-discrepant score group (black area) was 2.57 (N=2,415). This is about the same as for the much larger, similar-score group (white area), for whom the weighted average UCGPA was 2.56 (N=11,206), and it is considerably below the average for the overall UC freshman sample, which was 2.91 (N=77,893). Interestingly, among students in the lowest HSGPA quintile, the discrepant-score group with higher *SAT II* scores (gray area) had the highest average UCGPA, 2.67 (N=1,617), suggesting that, to the limited extent that it is possible to identify “late bloomers,” the SAT II may serve better than the SAT I for that purpose.

References

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