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ABSTRACT

The possibility of using the grade differential statistic in college admissions decisions is explored. The grade differential statistic is the mean difference between the freshman college grade point average (GPA) and the high school GPA (HSGPA) for freshman college entrants from a particular high school. Rather than being an index of high school academic quality, the index appears to be a measure of the grading practices of high schools. In some instances, it may be useful to consider this index in admissions decisions. Only high schools that admitted at least 16 students per year to the University of California at Berkeley in the fall of 1989 were included in this study. Data for 313 students for fall 1987, 346 students for fall 1988, and 335 students for fall 1989 were used. Results show that the grade differential statistic is consistent from year to year. Multiple regression equations show that the statistic, when used in conjunction with HSGPA, adds considerably to the coefficient of determination and the predictive power of the HSGPA. However, at the University of California at Berkeley, even if the grade differential statistic was reliable and valid for schools contributing 5 students, it could be used in only about 50 percent of the decisions. Nevertheless, there are situations in which it could be useful. Five tables present findings from the analysis. (SLD)

Use of the Grade Differential Statistic in Predicting College GPA

by
Thomas A. Cesa

At many colleges, criteria for freshman admission are based, at least in part, on variables that correlate with the college grade point average after one year of study. Morgan (1989) documents that the best predictor of the grade point average in college at the end of the freshman year is the high school grade point average and that the second best predictor is the SAT total score. A review of two decades of research concludes that "...no additional measures provides [sic] much useful information in forecasting FGPA, once high school record and test scores have been considered" (Willingham et al., p. 8, 1990).

Nonetheless, there continues to be considerable interest in identifying additional variables that can predict the college grade point average after one year better than existing variables because the use of independent variables with more predictive power could contribute to more accurate freshman admissions criteria. Some authors have examined reformulations of the GPA criterion (Goldman & Hewitt, 1975; Young, 1990). Others, e.g., Tom (1982) have explored the use of additional non-traditional predictors. This paper explores the possibility of using the grade differential statistic in admissions decisions.

The grade differential statistic is the mean difference between the freshman college grade point average and the high school grade point average for freshman entrants from a particular high school. But what does the grade differential statistic mean, or how should it be interpreted? A frequent but inaccurate interpretation is that it is an index of high school academic quality. High schools with smaller grade differentials are considered to be of better academic quality than high schools with large negative grade differentials. A problem with this line of reasoning is that students enter high schools with differing amounts of academic preparation. Junior high school students are not randomly assigned to high schools so there are real and substantial differences among high schools in terms of the academic preparation and aptitude of students that enter and subsequently graduate from them. High schools with large negative grade differentials are not necessarily of poor academic quality and visa versa.

Some high school seniors will decide which colleges to apply to based upon the perceived match between their levels of ability and the selectivity of the colleges to which they might apply (Manski & Wise, 1983). The College Board claims that the high school seniors can use their SAT scores to help select suitable colleges. It is reasonable to assume that graduating seniors with the higher grade point averages apply to the colleges that are more difficult to enter and those with lower grade point averages tend to select colleges that are easier to enter. If across graduating classes students with certain high school grade point averages are consistent in choosing which colleges they apply to, and ultimately enroll at, then it is possible that there will also be consistencies in the grade differential statistic of the students from these high schools.

Can the grade differential statistic be a measure of high school grading practices? If across high schools the high school GPA contains considerably more variability than the college freshman GPA, then whatever variance is in the grade differential statistic must reflect high school grading practices. At UC Berkeley there is some evidence that many freshmen are subject to the same grading standards. Even though there are over 600 undergraduate course titles, the 34 most popular grant 50% of all undergraduate student credit hours (Hudson, 1987). In addition, many of the lower-division courses tend to have large enrollments. "More than 60% of freshman and sophomore SCH [school credit hours] are taken in classes which enroll more than 100 students" (Hudson, pp. 6-7, 1985). Large class sizes plus the tendency of undergraduates to take many of the same classes subject the students, particularly freshmen, to relatively uniform grading standards. The grade differential statistic appears to measure the grading practices of the high schools.

At UC Berkeley, information about an applicant's high school is used in some admissions decisions but to a minimal extent (Academic Senate, 1989). That is, students from schools with unconventional grading practices have their records examined more closely. This paper will suggest, however, that it may be useful, in some instances, to place more weight on the grade differential statistic.

Methodology

The grade differential for an individual student is defined as the difference between the cumulative UC grade point average at the end of the freshman year (UCGPA) and the high school grade point average (HSGPA). Although HSGPA can exceed 4.00, due to the inclusion of extra grade points for honors classes taken, the admissions practice, and the practice followed here, is to cap it at 4.00. The grade differential for a particular high school consists of the average of the grade differentials for all students from that high school. The grade differential statistic consists of a group of grade differentials for several high schools. If i designates an individual, and K designates the number of students from high school k, then the grade differential for an individual i, designated as $GRADEDIF_i$, and the grade differential statistic for an individual school k containing m_k students, designated as $GRADEDIF_k$, are defined as follows:

$$GRADEDIF_i = UCGPA_i - HSGPA_i$$

$$GRADEDIF_k = \frac{1}{m_k} \sum_{i=1}^{m_k} GRADEDIF_{ik}$$

Grade differentials can be used as scores. Students from school k can be given the score of $GRADEDIF_k$. This procedure can be used for all students in the study so that each student has a grade differential score. Students from a given high school will have the same score but the students from different high schools can have different scores. This score can be used along with other scores as a criterion for predicting cumulative freshman grade point average.

Two issues occur with regard to the GRADEDIF score. One is whether the high schools will have grade differentials that are similar from one year to the next. The degree of consistency of the rankings of the grade differentials by high school will be tested by using the Friedman statistic. Kendall's coefficient of concordance, a measure comparing the maximum possible concordance of ranks with a measure of the obtained concordance of ranks, will also be calculated. Data for three fall freshman classes (1987, 1988, 1989) will be used.

The second issue is the strength of the relationship between the GRADEDIF score and the freshman year cumulative grade point average criterion. The method chosen to investigate this matter is a series of multiple regression equations with the dependent variable being UCGPA and the independent variables being various combinations of HSGPA, SATT, and GRADEDIF. A multiple regression equation with just HSGPA as the independent variable, another with just SATT as the independent variable, a third with GRADEDIF as the independent variable, a fourth with HSGPA and SATT as independent variables, a fifth with HSGPA and GRADEDIF as independent variables, a sixth with SATT and GRADEDIF as independent variables, and a seventh with HSGPA, SATT and GRADEDIF as independent variables will be calculated for fall 1988 and fall 1989 data separately. The predictive power of the multiple regression equations will be measured in terms of the adjusted coefficient of determination, i.e., r^2.

For the grade differential statistic to be somewhat stable it is necessary to have at least a moderate number of students from each high school. Therefore, only those high schools that contributed at least 16 students to UC Berkeley in the fall of 1989 were included in the study. It is possible that fewer than 16 students entered UC Berkeley from each of these schools in the falls of 1988 and 1987. It is also possible that some of these students may have dropped out of Berkeley before their freshman year was completed thereby lowering even further the number of cases for analysis.

Results

Table 1 shows the number of students with valid grade differential data from each of the 16 top feeder high schools for the falls of 1987, 1988, and 1989. There were 313 students in the study for fall 1987, 346 for fall 1988, and 335 for fall 1989. Table 1 also shows the grade differentials by school. For fall 1989 the smallest grade differential was -.2214 for School C and the largest was -.7614 for School N. The smallest differential for fall 1988 was -.2147 at School L and the largest was -.8153 at School H. For fall 1987 the smallest differential was -.1495 for School L and the largest was -1.0296 for School H. Notice that the school with the largest differential for two years was School H and the school with the smallest differential for two years was School L.

The right-hand part of Table 2 shows more clearly the consistencies of ranks. For two of the three years, the following schools had the same ranks: School A was ranked 10th twice, School B was ranked 12th twice, School G was ranked 5th twice, School H was ranked 16th twice, School J was ranked 6th twice, and School L was ranked 1st twice. There are in addition to the exact rank matches, some schools that have grade differential ranks that differ by just one or two positions in two or more years.

Whether or not there is consistency of ranking across the three years was tested by using the Friedman statistic. Table 2 was used to calculate the Friedman statistic which was 29.03. With $\alpha = .05$, H_0 is rejected since $\chi^2_{2:0.95} = 5.99$. The Friedman statistic supports the contention that these 16 schools are consistently ranked across these three years with regard to the grade differential statistic.

A question of additional interest concerns the strength of the consistency of the rankings. Kendall's coefficient of concordance, which ranges from 0 to 1.0, is an index of the degree of concordance of the rankings. It was .65, indicating a high level of concordance among the rankings.

Table 3 shows the extent to which the variables SATT, HSGPA, GRADEDIF, and UCGPA are intercorrelated. Of particular interest is the extent to which HSGPA, SATT, and GRADEDIF correlate with UCGPA. For fall 1988, HSGPA has the highest correlation (.48), SATT the second highest correlation, (.46), and GRADEDIF has the lowest correlation (.16). For fall 1989 the pattern is similar with HSGPA having the highest correlation (.48), SATT the second highest correlation (.41), and GRADEDIF the lowest correlation (.26). For fall 1988 all of the correlations are significant at α = .05 except for the correlation between GRADEDIFF and SATT. For fall 1989 all correlations are significant at α = .05 except for the correlation between GRADEDIF and HSGPA.

Of considerable interest is the correlation between GRADEDIF and the two other independent variables, SATT and HSGPA. For fall 1988 the correlation with SATT is not significant. However, there is a significant negative correlation between GRADEDIF and HSGPA of -.19. For fall 1989 the correlation between GRADEDIF and SATT is low and significant at .09. The correlation between GRADEDIF and HSGPA is not significant. These results, given that the correlations between GRADEDIF and UCGPA are significant, suggest that GRADEDIF is measuring something different than that which is being measured by either SATT or HSGPA. Since it is measuring something different, it is possible that it can contribute considerably to a multiple regression equation into which either the SATT, or HSGPA, or both, are entered.

Table 4 shows the results of the multiple regression equations. Each of the seven equations for both years produced significant F ratios at the .01 level of significance indicating that all of the combinations combinations of the independent variables were significant predictors of UCGPA. Of the equations with just one independent variable, the most powerful predictor of UCGPA was HSGPA, which produced adjusted r^2 values of .225 and .221, for the 1988 and 1989 data respectively. The second most powerful single variable was SATT, which had adjusted r^2 values of .214 and .155 for the 1988 and 1989 data, respectively. The adjusted r^2 values produced when GRADEDIF alone was the independent variable were .021 and .056, respectively.

When the variables are taken two at a time, the HSGPA and GRADEDIF pair was the pair that predicted UCGPA best for both years with adjusted r^2 values of .279 and .274 for 1988 and 1989. This is remarkable since much research shows that the second best predictor of the freshman year college GPA should be the SATT. The HSGPA and SATT pair of independent variables produced somewhat lower adjusted r^2 values of .267 and .228 for 1988 and 1989. The two variables that produced the lowest adjusted r^2 values were SATT and GRADEDIF. This pair of variables produced adjusted r^2 values of .238 and .194 for fall 1988 and fall 1989. When all three independent variables are used as predictors, the adjusted r^2 values are .311 and .276 for the 1988 and 1989 data.

GRADEDIF adds .054 to the predictive power of HSGPA in 1988 and .053 in 1989. This is a considerable improvement in the predictive power over using HSGPA alone. The addition of the SATT as a third variable raises the predictive power by .032 in 1988 and by only .002 in 1989.

Discussion and Conclusion

The results show that the grade differential statistic is consistent from year to year. The multiple regression equations show that the GRADEDIF statistic when used in conjunction with HSGPA adds considerably to the coefficient of determination. This leads to the conjecture that the grade differential statistic might in fact be useful in evaluating applicants for admissions purposes.

On the other hand, it is not possible to directly apply the grade differential statistic from the current results to the general admissions process because only about 16% of the freshmen come from source schools that contribute 16 or more students (Table 5). However, if the grade differential statistic were reliable and had sufficient validity with schools that contributed from 11 to 15 students, then it would be applicable to an additional 14% of the new freshmen. And if it were reliable and valid when applied to schools that contributed from 6 to 10 students, it would be applicable to an additional 20% of the freshmen. It seems unlikely that it would be reliable on schools contributing five or fewer students. Thus, if the grade differential statistic were reliable and valid on source schools contributing five or more students, it could be used in only about 50% of the freshman admission decisions.

Nonetheless there may be certain situations under which it is feasible to use the grade differential statistic for admissions purposes. Berkeley, along with the other UC campuses, admits about 7% of its freshmen under the special action admissions program. In special action admissions, persons do not qualify for regular admissions because either they haven't submitted the appropriate paperwork or their grades or test scores are too low. Since many special action applicants have considerable missing data in their records, the use of the grade differential statistic holds the promise of providing some much needed additional data upon which to base the admissions decision.

References

Academic Senate, University of California (May 1989). *Freshman admissions at Berkeley: A policy for the 1990's and beyond.*

Goldman, R.D., & Slaughter, R.E. (1976). Why college grade point average is difficult to predict. *Journal of Educational Psychology*, 68, 9-14.

Hudson, E. (1985). The lower-division classroom experience at Berkeley. Office of Institutional Research, Berkeley, California.

Hudson, E. (1987). The undergraduate core curriculum at Berkeley. Office of Institutional Research, Berkeley, California.

Manski, C. F., & Wise, D. A. (1983). *College Choice in America.* Harvard University Press, Cambridge, Massachusetts.

Morgan, R. (1989). Analysis of the predictive validity of the SAT and high school grades from 1976 to 1985. College Board Report No. 89-7.

Tom, A. (1982). Non-traditional predictors of academic success for special action admissions. Office for Student Affairs Research and Information, University of California, Davis.

Willingham, W.W., Lewis, C., Morgan, R., & Ramist, L. (1990). *Predicting College Grades: An analysis of institutional trends over two decades.* Educational Testing Service, Princeton, New Jersey.

Young, John W. (1990). Are validity coefficients understated due to correctable defects in the GPA? *Research in Higher Education*. 31(4), 319-325.

Table 1. Number of Students and Grade Differentials for the Fall 1987, 1988, and 1989 Terms for the Top Feeder High Schools*

	Number of Students**			Grade Differentials		
School	1987	1988	1989	1987	1988	1989
A	11	18	17	-0.7265	-0.6198	-0.4419
B	21	21	28	-0.8077	-0.7282	-0.6847
C	23	32	16	-0.4533	-0.2466	-0.2214
D	26	21	19	-0.4657	-0.4582	-0.5552
E	9	15	19	-0.8528	-0.6011	-0.4009
F	4	13	19	-0.4460	-0.7644	-0.7099
G	80	72	69	-0.4856	-0.5442	-0.4253
H	31	29	19	-1.0296	-0.8153	-0.6601
I	12	13	16	-0.9969	-0.5818	-0.7269
J	15	21	16	-0.6447	-0.5708	-0.5151
K	20	18	16	-0.6902	-0.5211	-0.7598
L	8	4	12	-0.1495	-0.2147	-0.3987
M	8	15	18	-0.7734	-0.7902	-0.6861
N	14	17	17	-0.8847	-0.6333	-0.7614
O	17	15	20	-0.6991	-0.7613	-0.4223
P	14	22	14	-0.6879	-0.6062	-0.4198
Totals	313	346	335			

*High schools with 16 or more students in the fall of 1989.

**Number of students with valid grade differential data.

Table 2. Calculation of the Friedman Statistic and Kendall's Coefficient of Concordance

	Grade Differentials			Rank of Grade Differentials			
School	1987	1988	1989	1987	1988	1989	r^2(k)
A	-0.7265	-0.6198	-0.4419	10	10	7	729
B	-0.8077	-0.7282	-0.6847	[illegible]	12	11	1225
C	-0.4533	-0.2466	-0.2214	3	2	1	36
D	-0.4657	-0.4582	-0.5552	4	3	9	256
E	-0.8528	-0.6011	-0.4009	13	8	3	576
F	-0.4460	-0.7644	-0.7099	2	14	13	841
G	-0.4856	-0.5442	-0.4253	5	5	6	256
H	-1.0296	-0.8153	-0.6601	16	16	10	1764
I	-0.9969	-0.5818	-0.7269	15	7	14	1296
J	-0.6447	-0.5708	-0.5151	6	6	8	400
K	-0.6902	-0.5211	-0.7598	8	4	15	729
L	-0.1495	-0.2147	-0.3987	1	1	2	16
M	-0.7734	-0.7902	-0.6861	11	15	12	1444
N	-0.8847	-0.6333	-0.7614	14	11	16	1681
O	-0.6991	-0.7613	-0.4223	9	13	5	729
P	-0.6879	-0.6062	-0.4198	7	9	4	400
Sums				136	136	136	12378

Table 3. Correlations among Measures

Fall 1988

	SATT	HSGPA	GRADEDIF	UCGPA
SATT	1.00	0.64	-0.01*	0.46
HSGPA	0.64	1.00	-0.19	0.48
GRADEDIF	-0.01*	-0.19	1.00	0.16
UCGPA	0.46	0.48	0.16	1.00

Fall 1989

	SATT	HSGPA	GRADEDIF	UCGPA
SATT	1.00	0.68	0.09	0.41
HSGPA	0.68	1.00	0.01*	0.48
GRADEDIF	0.09	0.01*	1.00	0.26
UCGPA	0.41	0.48	0.26	1.00

*All correlations are significant at $\alpha = .05$ except those with asterisks.

Table 4. Regression of the Freshman Grade Point Average on High School GPA, SAT Total, and the Grade Differential Statistic

Fall 1988

	Regression Equation Coefficients				r^2	F -
Equation	HSGPA	SATT	GRADEDIF	Constant	Adj.	Ratio*
1. HSGPA	0.00666			0.64130	0.225	98.43
2. SATT		0.0015560		1.19924	0.214	92.06
3. GRADEDIF			0.54438	3.42279	0.021	8.14
4. HSGPA + SATT	0.00426	0.0000908		0.41878	0.267	62.07
5. HSGPA + GRADEDIF	0.00722		0.84592	0.93363	0.279	65.88
6. SATT + GRADEDIF		0.0015670	0.57772	1.52506	0.238	53.41
7. HSGPA + SATT + GRADEDIF	0.00504	0.0000804	0.77201	0.71105	0.311	51.14

Fall 1989

	Regression Equation Coefficients				r^2	F -
Equation	HSGPA	SATT	GRADEDIF	Constant	Adj.	Ratio*
1. HSGPA	0.00625			0.85050	0.221	93.74
2. SATT		0.0012130		1.66970	0.155	60.94
3. GRADEDIF			0.66571	3.49071	0.056	20.27
4. HSGPA + SATT	0.00504	0.0000401		0.80573	0.228	49.15
5. HSGPA + GRADEDIF	0.00619		0.64037	1.19981	0.274	62.43
6. SATT + GRADEDIF		0.0011500	0.56137	2.03312	0.194	40.30
7. HSGPA + SATT + GRADEDIF	0.00533	0.0000286	0.61797	1.15570	0.276	42.41

*All F ratios are significant at .01 or beyond.

Table 5. Fall 1990 New Undergraduates from High Schools

	High Schools			Students		
Number from Source	Number	Pct	Cum. Pct	Number	Pct	Cum. Pct
16 or more	21	2.4%	2.4%	454	16.2%	16.2%
11-15	32	3.7%	6.1%	400	14.3%	30.5%
6-10	77	8.8%	14.9%	559	20.0%	50.5%
5	44	5.0%	19.9%	220	7.9%	58.3%
4	70	8.0%	27.9%	228	8.1%	66.5%
3	73	8.4%	36.3%	219	7.8%	74.3%
2	163	18.7%	55.0%	326	11.6%	86.0%
1	393	45.0%	100.0%	393	14.0%	100.0%
Total	873	100.0%		2799	100.0%	