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ABSTRACT

The most commonly-used procedure in selective college admissions involves selecting students on the basis of predicted college grades computed from the regression of college grades on test scores and high school grades. Minority students have usually fared poorly in the selective admissions process and, consequently, the possibility of bias in selective admission procedures is apparent. The authors examine the six different ideas of bias in selection, analyze data from racial-ethnic minority students and majority students from 35 colleges, and discuss the implications of their study. The results indicate that models of bias with theoretical differences yield practical differences when applied to selective college admissions. The different value judgments the models enforce is of great importance to those implementing selection procedure since the choice of procedure in most cases dramatically affects the judgments of fairness or bias. College admissions personnel should give consideration to the relation of selection procedures to the values and goals of their colleges. (Author/PG)

RACIAL-ETHNIC BIAS IN SELECTIVE COLLEGE ADMISSIONS

Nancy S. Cole
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The American College Testing Program

Often in the last hundred years higher education in America has played an important role in providing social and economic mobility for relatively disadvantaged members of our society. Today's disadvantaged of primary concern are members of racial-ethnic minorities, and again, as in the past, higher education has assumed a responsibility in attempting to overcome some of the inequities suffered by these groups. A major thrust in this area has been achieved through the institution of special programs for disadvantaged minority students at colleges across the nation. However, in spite of much sympathy in many admissions offices, minority students have usually fared poorly in the regular selective admissions process. Consequently, the possibility of bias in selective admission procedures deserves careful consideration.

The most commonly-used procedure in selective college admissions involves selecting students on the basis of predicted college grades computed from the regression of college grades on test scores and high school grades. Thus, possible bias in these predictions (namely, systematic deviation of predicted college grades from achieved college grades) has been thoroughly examined. Several authors reported that tests were as predictive of college grades in predominantly black colleges as in white colleges (Funches, 1967; Hills & Stanley, 1970; Munday, 1965; Stanley & Porter, 1967). In studies comparing blacks and whites in integrated colleges, the common result has been that, although the prediction equations may differ for the two groups, the use of prediction equations based on all (or white) students does not penalize blacks on the average and are often, in fact, biased in their favor (Bowers, 1970; Cleary, 1968; Harris & Reitzel, 1967; Kallingal, 1971; Pfeifer & Sedlacek, 1971; and Temp, 1971). Thus, the conclusion reached by many educators and explicated by Stanley (1971) has been that grade predictions are fair predictors of college success for minority students, and rather than contributing to racial bias, such predictions indicate important areas of educational disadvantage which must be recognized.

Although grade predictions per se do not appear to be biased against minority students, it does not follow that using grade predictions for selective college admissions is in every way fair. Several authors have noted (e.g. Cole, in press; Darlington, 1971; Thorndike, 1971) that there are many reasonable definitions of bias, or its converse fairness, of which selection on the basis of grade predictions under the regression approach is only one. Cole (in press) examined six different ideas of bias in selection, each of which was shown to have different implications for the selection of minority students in several hypothetical situations. The six models were the regression models described above, the quota model, Darlington's subjective regression model, the Einhorn-Bass equal risk model, Thorndike's constant ratio model, and a conditional probability model.

Definitions of Selection Bias

The regression model. When the regression model of predictions is applied to selection situations, bias is defined in terms of consistent average errors of prediction. Thus, if $(a_0, a_1, \ldots, a_p)$ denote the coefficients used to predict college grades Y from p predictor variables $(X_1, \ldots, X_p)$, then the difference between mean predicted grades and mean observed grades will be indicated by $\bar{\hat{Y}} - \bar{Y}$, where $\hat{Y} = a_0 + \sum_j^p a_j X_j$. An indicator of the relative bias in two groups, i and j, under the regression model is then given by B_R,

$$B_R = (\bar{\hat{Y}}_i - \bar{Y}_i) - (\bar{\hat{Y}}_j - \bar{Y}_j). \quad (1)$$

When B_R is positive, the prediction equation is biased in favor of group i; when negative, the bias is against group i.

The quota model. Under the quota model of bias, the concern is with proportional representation of different groups among those students selected and involves the assignment of the desired representation *a priori*. Sex quotas are common in college admission procedures, and racial-ethnic quotas (such as those which would match the proportional selection to the proportional representation in the larger population) are sometimes proposed as fair in selective college admissions. A quota model involves a subjective judgment of the value of representation of different groups regardless of predicted criterion scores or chances of success in college and a procedure which meets the quotas is judged fair.

The subjective regression model. Darlington (1971) proposed a combination of the subjective value judgments of the quota model with the regression model by predicting not the criterion alone but a weighted combination of the criterion and some cultural variable. Thus, if one were willing to accept a minority student with a college grade of Y as equal in subjective value to a majority student with a grade of Y + k, then the fair procedure would be to predict not Y but a function of Y, k, and C (the cultural variable distinguishing minority and majority). Thus, under this subjective regression model one group can be explicitly favored in the selection process according to one's subjective values, and the determination of fairness or bias depends upon the subjective judgment made.

The equal risk model. Under the equal risk model (Einhorn & Bass, 1971), fairness requires that persons with equal chances of success on the criterion be treated the same in selection. This model allows the selector to set a maximum level of risk to assume, and all applicants with chances of success within the limit of risk are selected regardless of subgroup.

Bias according to the equal risk model occurs whenever the minimum chance of success of those selected from one group differs from the minimum chance of those selected from another group. In that case the selector's risk would differ for the two groups. Thus, the indicator of bias computed for this model is based on the maximum risk the selector takes in each group. That risk for group i is

$$Pr_i\{Z < (Y_p - \hat{Y}_i) / \sigma_{y.x(i)}\},$$

where Z is a unit normal deviate, $\hat{Y}_i$ is the predicted grade cutoff for selection in group i, and Y_p is the criterion pass point. The indicator of bias for groups i and j under the equal risk model (B_{ER}) is then given by

$$B_{ER} = \text{RISK (i)} - \text{RISK (j)}. \qquad (2)$$

The constant ratio model. Thorndike (1971) proposed that in a fair selection procedure the ratio of the proportion of a group selected ($Pr\{\hat{Y}>\hat{Y}_i\}$) to the proportion successful $Pr\{Y>Y_p\}$ should be the same for all groups when Y_i is the selection cutting point and Y_p the criterion pass point. Thus, an indicator of bias under this model can be defined as

$$B_{CR} = \frac{Pr_1\{\hat{Y}>\hat{Y}_1\}}{Pr_1\{Y>Y_p\}} - \frac{Pr_2\{\hat{Y}>\hat{Y}_2\}}{Pr_2\{Y>Y_p\}} \quad (3)$$

If B_{CR} is positive (the selection-success ratio is larger for group 1 than for group 2), then the bias favors group 1.

The conditional probability model. Cole (in press) suggested that the group most deserving fairness in many selection situations is the group of applicants who, if selected, would succeed. Under this model, selection cutting points should be set so that the conditional probability of selection given success in group i ($Pr_i\{\hat{Y}>\hat{Y}_i|Y>Y_p\}$) is the same for each racial-ethnic group. When applied to subsequent applicants, these cutting points would assure each group of applicants the same chance of selection among those who could succeed if selected. A measure of bias under this model is

$$B_{CP} = Pr_1\{\hat{Y}>\hat{Y}_1|Y>Y_p\} - Pr_2\{\hat{Y}>\hat{Y}_2|Y>Y_p\}. \quad (4)$$

If B_{CP} is positive the selection favors group 1 since the conditional probability is larger in group 1.

Comparison of models. The six models of bias are expressions of different value judgments applied to the selection situation. Two of the models, the regression and equal risk models place strong positive value on the selection of highly successful students for college. Two other models, the quota and subjective regression models, place great value on the social advantage of increased minority college enrollments regardless of other concerns. The two final models, the constant ratio and conditional probability models, place greatest value on a fair opportunity for selection (as related to student success) in all groups. The different implications of the six models have been examined in several hypothethical situations by Cole (in press). Some key differences are illustrated for ~~one type~~ of situation in Figure 1 for the four statistically-based models. From study of hypothetical situations it is clear that the models can have dramatically different prescriptions for how selection should be done. It is the purpose of this paper to examine actual data from a number of colleges to determine to what extent present selective admissions procedures are fair according to the definitions discussed.

Method

Data

Data from racial-ethnic minority students (black or Mexican-American) and majority students were analyzed for 35 colleges. The colleges, sources of the data, and size of minority and majority groups are described in Table 1. The first 17 colleges listed in Table 1 were available from previously published studies by Bowers (1970), Cleary (1968), Harris & Reitzel (1967), Pfeifer & Sedlacek (1971) and Temp[1] (1971). The remaining 18 colleges were drawn from the 1970, 1971, and 1972 Research Services of the American College Testing Program (ACT). Ten of the colleges were from the 1970 and 1971 Research Services through which those colleges identified black or Mexican-American groups for special analyses. Student self-reported racial-ethnic identification was available in the 1972 Research Services from regular administration of the ACT Assessment and eight integrated colleges with sufficient numbers of minority students were analyzed.

The predictor variables available among the 35 colleges included high school rank and high school grades, the Scholastic Aptitude Test (SAT) of the College Entrance Examination Board, the School and College Ability Test, (SCAT), and the ACT Assessment. In most cases the criterion was overall first semester or first year grade point average, but in the four cases noted in Table 1 the criterion was a first semester grade in a freshman English course.

Procedure

In selective college admissions, it is common for all racial-ethnic groups to be combined for the construction of regression equations. Consequently, this procedure was simulated in each of the colleges studied, and the fairness or bias in the procedure according to each definition of bias was examined. When essentially all minority and majority students at a college were included.

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[1]The authors acknowledge the kindness and helpfulness of George Temp, John Bowers, and Educational Testing Service for providing the additional information from Dr. Temp's study which was required for the analyses.

in the samples available, the regression equation based on the total sample was used. When the majority group was sampled so that the minority and majority samples were artificially of approximately equal size, the majority group regression equation was used to more nearly approximate the equation for the total student body.

For the computations of bias several additional assumptions were made. First, multivariate normality of the predictors and criterion was assumed. This assumption is commonly made and appears reasonable in this type of data. However, this is not crucial to the models but a convenience for computation. Second, a college grade pass point was set. Because the grade scales varied from college to college, Y_p was set in terms of the mean and standard deviation of the majority or combined group--specifically at one-half standard deviation below the majority or combined mean, depending on the particular samples analyzed. Since approximately 70% of the students pass (or succeed) in college with this value of Y_p, it seemed a realistic choice for comparison of the models[2]. Finally, to compute a specific predictor cutting point in each college, it was necessary to specify what proportion of applicants came from each group and what proportion of the total applicants could be accepted. Because this information was not available for the colleges being analyzed, the arbitrary assumption

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[2]Additional values of Y_p at the mean of the majority or combined group and one standard deviation below the mean, were examined for a sample of the colleges and the results paralleled those presented here.

was made that 20% of the applicants were from the minority group and 80% from the majority group for each college. It was further assumed that 50% of the applicants could be selected. These figures were chosen to represent common college admissions situations, but other values also examined yielded essentially similar results.[3]

Using the computed regression equations based on all available predictors and the assumptions noted, for each college the necessary selection cutting point was computed along with the indicators of bias defined in equations (1), (2), (3) and (4). Although the bias indicators as defined are not in the same units, they do seem to represent intuitively comparable scales. In each case, zero represents no bias. A bias as extreme as .40, for example, represent a similarly large discrepancy in grade predictions for the regression model, in risk for the equal risk model, in selection-success ratios for the constant ratio model, and in conditional probabilities for the conditional probability model. In addition, predictor-criterion correlations were computed for minority and majority groups within each college as were the proportion of each group selected and the expected success rates of the selected groups ($Pr_i\{Y>Y_p|\hat{Y}>\hat{Y}_i\}$).

Results

Level of Prediction

The median correlation of predicted grade, based on all available predictor variables, with achieved grade was .34 for the minority group

[3]The proportion of applicants from each group and proportion selected were varied in a sample of colleges. For (minority applicant proportion, majority applicant proportion, and proportion selected), the additional values examined were (.20, .80, .75), (.20, .80, .25), (.05, .95, .75), (.05, .95, .50), (.05, .95, .25), (.40, .60, .75), (.40, .60, .50), and (.40, .60, .25).

(range: .02 to .67) and .47 for the majority group (range: .15 to .72). By contrast the use of separate within group regression equations resulted in median multiple correlations of .39 for the minority group and .49 for the majority group.[4]

Selection Bias

The distributions[5] of the bias indicators are given in Table 2. The use of a combined prediction equation to select those students with the highest predicted grades resulted in a modest overprediction of grades in the minority group ($\bar{\hat{Y}} - \bar{Y} = 0.158$) and a very small underprediction in the majority group ($\bar{\hat{Y}} - \bar{Y} = -0.006$). Thus, the moderate average bias (average $B_R = 0.16$) favors the minority group according to the regression model. This result parallels the common finding that combined equations tend to overpredict for minority students. Note, however, that the use of separate within group regression equations are by definition fair since the mean predicted criterion ($\bar{\hat{Y}}$) and the criterion mean ($\bar{Y}$) always coincide for within group regression.

The risk in both groups was essentially the same resulting in an average $B_{ER} = .02$. Thus, the combined regression procedure was fair to both groups according to the equal risk model.

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[4]When test scores and high school grades were analyzed separately for the 18 colleges for which both were available, the median multiple correlation was .34 for tests and .34 for high school grades within the minority groups. For the majority groups the corresponding figures were .43 for tests and .45 for high school grades.

[5]The intermediate results for each college on which these distributions are based may be obtained on request from the authors.

However, according to both the constant ratio and conditional probability models, the use of a combined prediction equation and a single selection cutting point resulted in rather severe bias, on the average, against minority students. The average ratio of selection rates to success rates was .48 for the minority group and .80 for the majority group indicating that the majority was selected at a much higher rate in relation to their success rate than were minority numbers. Similarly, the conditional probability of selection for potentially successful minority group members was only .31 while for majority group members this probability was .65. Thus, the average bias against the minority group (average B_{CR} = -.32, average B_{CP} = -.34) in the use of a combined regression equation is extreme according to both the constant ratio and conditional probability models.

Although bias indicators are not given for the subjective regression and quota models, some results are available. First, the use of a combined prediction equation resulted in an average regression favoritism for the minority group which might also be accomplished by using the subjective regression model and a k value of comparable magnitude. Second, in 33 of the 35 cases analyzed the proportion of minority applicants selected was considerably less than the proportion of majority applicants selected. This results in proportional minority representation in the selected group of well less than the 20% in the applicant group.

Success Rates Among Selectees

Selection via the combined prediction equation resulted in an average expected success rate of .64 among the minority students selected and of .83 among selected majority students. Under application of the regression model (use of separate equations) and equal risk model, this discrepancy was slightly decreased. However, use of either the constant ratio or conditional probability models increased the discrepancy resulting in even lower minority expected success rates.

Discussion

There are several important implications of the results of this study. The results indicate that the models of bias with theoretical differences yield practical differences as well when applied to the process of selective college admission. As a consequence the discussion of the models and the different value judgments they implement is of great practical importance to those implementing selection procedures since the choice of procedure in most cases dramatically affects the judgment of fairness or bias of the procedure.

The correlations obtained show the efficacy of test scores and high school grades as predictors in minority as well as majority groups although the corelations were usually lower in the minority group. In addition, the depressing effect on the correlations under the use of a combined prediction equation rather than separate, within group equations is greatest in the minority group. Thus, when possible it is especially advantageous to use within minority group prediction equations.

Further, the results indicate that currently used combined equation selection procedures fail to fit the definition of fairness given under the regression, constant ratio, or conditional probability models. Under the former, the minority group is favored while according to the latter two bias against that group is indicated. Thus, whatever model's values are espoused, the need for change is current procedures is likely.

It should be noted that although the regression model of bias is most frequently favored in discussions of racial-ethnic bias, that model is rarely implemented in considerations of sex in selection. Hanson, Cole, and Lamb (in preparation) have shown that strict use of the regression model for selection of men and women would result in entering classes of two-thirds women and one-third men. This unsatisfactory situation is apparently avoided by most admissions officers by accepting different value judgments for the sex selection situation--namely quotas. One advantage of the conditional probability model is that it leads to socially meaningful results in cases both of sex and racial-ethnic background, allowing a consistency in values across both. It prescribes the selection of somewhat more minority students than are now usually selected and also the selection of a fairly even mix of men and women.

Finally, it is our belief that college personnel implementing selective college admissions should give serious consideration to the relation of selection procedures to the values appropriate to goals of their colleges. We believe further that with such consideration many colleges should choose to implement the conditional probability model of fairness to guarantee equal opportunity of selection to potentially successful students regardless of their rachial-ethnic background.

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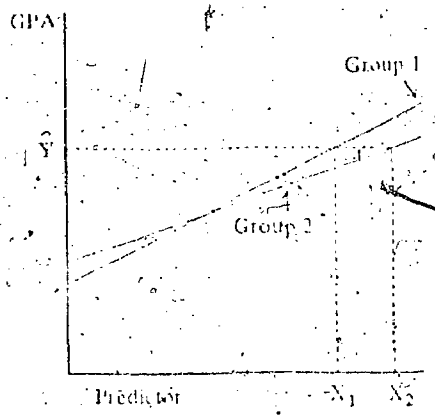
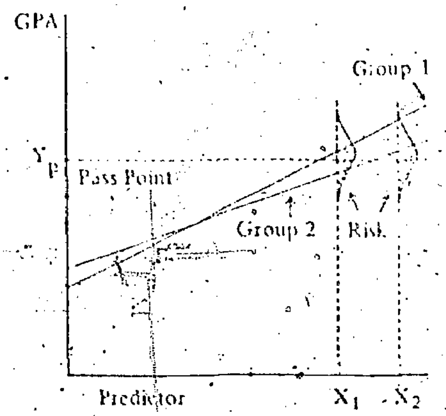
REGRESSION MODEL



REGRESSION MODEL: Students with the highest predicted GPAs, using separate equations within groups, are selected. In the graph above, a student in Group 1 with predictor score X_1 has the same predicted GPA as a student in Group 2 with predictor score X_2. Thus, while the model prescribes the selection of students predicted to do best in college, the example illustrates the case in which because prediction is poorer in one group (Group 2), members of that group with high predictor scores must score higher than members of another group to obtain the same predicted GPA.

EQUAL RISK MODEL

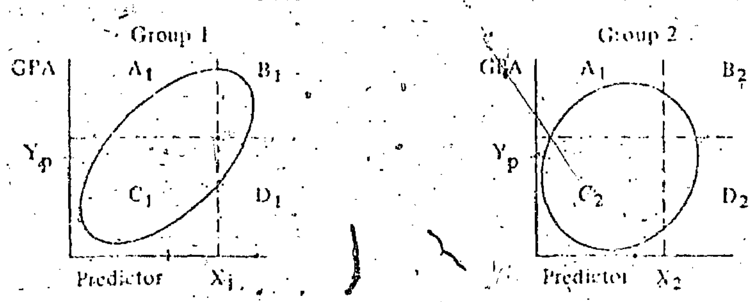


EQUAL RISK MODEL: Students with the highest chances of success or smalles risk are selected. Group 1 with predictor score X_1 has the same risk as a student in Group 2 with predictor score X_2. Thus, while the model prescribes the selection of lowest risk students, the example illustrates the case in which because prediction is poorer in one group (Group 2), members of that group with high predictor scores must score higher than members of another group to have the same risk.

Fig. 1. A description and contrast of four models of bias.

Fig. 1 (Continued)

CONSTANT RATIO MODEL

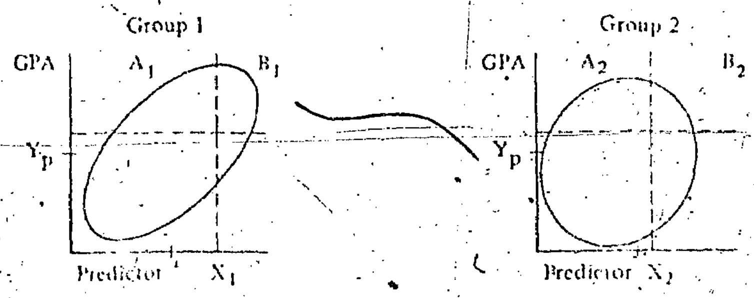


CONSTANT RATIO MODEL: Students are selected so that the ratio of the proportion selected to the proportion successful is the same in all groups. In the graph above an ellipse of the distribution of predictor and GPA scores is presented along with letters which represent the number of students falling in each of the four areas in the graph. Thus, the proportion selected is represented by (B+D)/(A+B+C+D) and the proportion successful by (A+B)/(A+B+C+D). X_1 and X_2 are set to satisfy the constant ratio model so that

$$(B_1+D_1)/(A_1+B_1) = (B_2+D_2)/(A_2+B_2)$$

Although prediction is poorer in Group 2 than Group 1, in contrast to the first two models, X_2 is less than X_1. However, because a smaller proportion of Group 2 members are successful, members of that group have a smaller chance of selection, and very few of the potentially successful members of Group 2 are among those selected.

CONDITIONAL PROBABILITY MODEL



CONDITIONAL PROBABILITY MODEL: Students are selected so that the conditional probability of selection given success is the same for all groups. In the graph above, A+B represents all successful students and therefore B/(A+B) represents the conditional probability of selection given success. X_1 and X_2 are set to satisfy the conditional probability model so that

$$B_1/(A_1+B_1) = B_2/(A_2+B_2).$$

As with the constant ratio model, although prediction is poorer in Group 2, X_2 is less than X_1. However, in contrast to the other three models, the chances of selection of potentially successful members in both groups is the same, indicating a kind of fairness to those who can succeed.

TABLE 1

Identification of Colleges

Code	Description of College	Source of Data	Minority Group	Minority N	Majority N	Predictors[a]
A	Eastern, state supported	Cleary (1968)	Black	59	60	SAT
B	Eastern, state-supported	Cleary (1968)	Black	83	365	SAT, HSR
C	Southwestern, state-supported	Cleary (1968)	Black	131	258	SAT, HSA
D	University of Illinois	Bowers (1970	SEOP	405	4,855	SCAT, HSPR
E	Predominantly white University	Harris & Reitzel (1967)	Black	45	3,895	HSR
F	Temp's College 1	Temp (1971)	Black	100	100	SAT
G	Temp's College 2	Temp (1971)	Black	98	99	SAT
H	Temp's College 3	Temp (1971)	Black	104	104	SAT
I	Temp's College 4	Temp (1971)	Black	92	93	SAT
J	Temp's College 5	Temp (1971)	Black	140	140	SAT
K	Temp's College 7	Temp (1971)	Black	99	100	SAT
L	Temp's College 8	Temp (1971)	Black	100	97	SAT
M	Temp's College 9	Temp (1971)	Black	100	100	SAT
N	Temp's College 10	Temp (1971)	Black	100	95	SAT
O	Temp's College 11	Temp (1971)	Black	68	69	SAT
P	Temp's College 12	Temp (1971)	Black	39	100	SAT
Q	University of Maryland	Pfeifer & Sedlacek (1971)	Black	126	178	SAT, HSA
R	Midwestern, state-supported university	1972 ACT Res. Serv.	Black	131	2,653	ACT, HSG
S	Large midwestern state-supported university	1971 ACT Res. Serv.	Black	130	4,970	ACT, HSG
T	Large southern state university	1972 ACT Res. Serv.	Black	76	2,793	ACT, HSG
U[b]	Southern, state-supported university	1971 ACT Res. Serv.	Black	146	1,335	ACT, HSG
V[b]	Southern, state-supported university	1970 ACT Res. Serv.	Disadvantaged	100	740	ACT, HSG
W	Southern, state-supported university	1972 ACT Res. Serv.	Black	129	765	ACT, HSG
X	Southern, state-supported university	1972 ACT Res. Serv.	Black	117	1,073	ACT, HSG
Y	Midwestern, state-supported university	1972 ACT Res. Serv.	Black	42	829	ACT, HSG
Z	Large midwestern state university	1972 ACT Res. Serv.	Black	84	1,697	ACT, HSG
AA	Eastern, private college	1972 ACT Res. Serv.	Black	189	1,658	ACT, HSG
BB	Midwestern state-supported university	1972 ACT Res. Serv.	Black	62	2,632	ACT, HSG
CC	Southern, state-supported university	1970 ACT Res. Serv.	Black	260	1,987	ACT, HSG
DD[b]	Southwestern, 2-year college	1970 ACT Res. Serv.	Chicano	108	170	ACT, HSG
EE	Southwestern, state-supported college	1970 ACT Res. Serv.	Spanish surname	139	613	ACT, HSG
FF	Southwestern, state-supported college	1970 ACT Res. Serv.	Spanish surname	186	1,155	ACT, HSG
GG[b]	Southwestern, state-supported university	1970 ACT Res. Serv.	Spanish surname	105	147	ACT, HSG
HH	Southwestern, state-supported university	1970 ACT Res. Serv.	Mexican American	380	2,946	ACT, HSG
II	Southwestern, state-supported university	1970 ACT Res. Serv.	Mexican American	369	748	ACT, HSG

[a]SAT = Scholastic Aptitude Test verbal and math scores; HSR = high school rank in class; HSA = high school grade average; SCAT = School and College Ability Test; HSRR = high school percentile rank in class; ACT = 4 tests of the ACT Assessment; HSG = 4 student-reported high school grades.

[b]The college grade criterion was the grade in a freshman English course. In other cases the criterion was first semester or first year college grade point average.

TABLE 2

Distribution of Bias Indicators Using Majority or Combined Equation for both the Majority and Minority Groups

		Regression Model B_R	Equal Risk Model B_{ER}	Constant Ratio Model B_{ER}	Conditional Prob. Model B_{CP}
Use Favors Minority	.40 or above	6	0	2	0
	.20 to .39	9	0	0	2
	.06 to .19	9	4	1	1
Use Fair	-.05 to .05	8	31	1	0
Use Unfair to Minority	-.19 to -.06	2	0	7	5
	-.39 to -.20	0	0	8	11
	-.40 or below	1	0	16	16
	Ave.	.16	.02	-.32	-.34
	No. of Cases	35	35	35	35

Examination of Bias Using Combined or Majority Regression Equation in Both Minority and Majority Racial-Ethnic Groups

College	Predictors[a]	Equation Used	Mean Predicted Minus Observed GPA MIN	Mean Predicted Minus Observed GPA MAJ	Multiple Correlations and Standard Errors of Estimate MIN R	MIN SEE	MAJ R	MAJ SEE	Proportion Selected MIN	Proportion Selected MAJ	Einhorn-Bass Risk MIN	Einhorn-Bass Risk MAJ	Thorndike Ratio MIN	Thorndike Ratio MAJ	Cond. Prob. of Selection MIN	Cond. Prob. of Selection MAJ	Cond. Prob. of Success MIN	Cond. Prob. of Success MAJ
A	SAT	MAJ	.12	0	.40	.61	.49	.58	.20	.57	.32	.32	.43	.82	.43	.82	.68	.82
B	SAT,HSR	MAJ	.04	0	.25	.67	.49	.72	.39	.52	.28	.29	.60	.75	.45	.63	.74	.83
C	SAT,HSA	MAJ	.79	0	.60	.91	.72	.47	.75	.44	.33	.19	1.83	.64	.92	.59	.50	.92
D(men)	SCAT,HSPR	MAJ	.35	0	.23	.87	.41	.68	.02	.61	.37	.34	.05	.89	.03	.70	.68	.79
D(women)	SCAT,HSPR	MAJ	-.71	0	.23	1.07	.39	.61	.00	.62	.40	.33	.00	.89	.00	.70	.32	.78
E	HSR	MAJ	.41	0	.50	.70	.44	.58	.70	.45	.30	.27	1.26	.66	.83	.54	.66	.83
F	SAT	MAJ	.15	0	.21	.50	.27	.45	.14	[illegible]	.34	.32	.35	.85	.19	.64	.54	.76
G	SAT	MAJ	.44	0	.05	.73	.22	.53	.25	.56	.36	.32	.81	.81	.27	.60	.33	.75
H	SAT	MAJ	.28	0	.30	.62	.38	.41	.05	.61	.39	.33	.27	.88	.11	.68	.40	.78
I	SAT	MAJ	.21	0	.16	.60	.33	.49	.05	.61	.36	.33	.17	.88	.07	.67	.42	.77
J	SAT	MAJ	.37	0	.45	.68	.55	.44	.10	.59	.39	.33	.53	.86	.25	.71	.47	.83
K	SAT	MAJ	.44	0	.07	.80	.15	.69	.05	.61	.34	.32	.15	.88	.06	.64	.38	.73
L	SAT	MAJ	.02	0	.27	.70	.51	.76	.10	.59	.32	.33	.23	.86	.15	.70	.63	.82
M	SAT	MAJ	.21	0	.02	.67	.45	.49	.06	.60	.38	.33	.23	.87	.07	.70	.29	.80
N	SAT	MAJ	.47	0	.34	.77	.25	.44	.04	.61	.40	.33	.22	.88	.10	.66	.44	.75
O	SAT	MAJ	.04	0	.08	.55	.42	.53	.19	.57	.33	.32	.38	.82	.21	.66	.55	.80
P	SAT	MAJ	.00	0	.34	.48	.49	.56	.13	.59	.30	.33	.25	.85	.19	.69	.74	.81
Q(men)	SAT,HSA	MAJ	.06	.00	.48	.55	.63	.59	.29	.55	.25	.29	.52	.79	.41	.68	.79	.87
Q(women)	SAT,HSA	MAJ	.30	.00	.62	.64	.65	.63	.30	.54	.29	.29	.80	.79	.54	.69	.68	.87
R	ACT,HSG	COMB	.00	.00	.38	.61	.58	.57	.04	.61	.31	.30	.11	.86	.08	.73	.73	.85
S	ACT,HSG	COMB	.12	.00	.30	.79	.42	.66	.07	.60	.34	.31	.17	.86	.11	.69	.66	.80
T	ACT,HSG	COMB	.22	-.01	.48	.68	.63	.64	.31	.54	.29	.28	.62	.78	.45	.68	.72	.87
U[b]	ACT,HSG	COMB	-.04	.00	.26	1.00	.33	.93	.40	.52	.31	.30	.59	.75	.46	[illegible]	.77	.78
V[b]	ACT,HSG	COMB	.44	-.06	.67	.86	.70	.79	.27	.55	.27	.25	.65	.76	.50	.69	.77	.91
W	ACT,HSG	COMB	.30	-.05	.43	.72	.63	.66	.19	.57	.28	.27	.47	.77	.32	.69	.67	.89
X	ACT,HSG	COMB	.11	-.01	.35	.84	.62	.73	.27	.55	.30	.27	.49	.78	.35	.68	.72	.87
Y	ACT,HSG	COMB	.12	-.01	.17	.59	.44	.62	.18	.58	.29	.30	.34	.82	.21	.67	.62	.81
Z	ACT,HSG	COMB	.02	.00	.32	.62	.40	.67	.20	.57	.29	.30	.35	.82	.26	.65	.74	.80
AA	ACT,HSG	COMB	-.03	.00	.28	.89	.43	.85	.19	.57	.31	.30	.32	.81	.24	.66	.75	.81
BB	ACT,HSG	COMB	.20	-.00	.37	.57	.55	.53	.09	.60	.32	.30	.30	.85	.17	.71	.57	.83
CC	ACT,HSG	COMB	.23	-.03	.45	.74	.58	.77	.34	.53	.27	.28	.62	.75	.47	.65	.74	.87
DD[b]	ACT,HSG	COMB	.10	-.05	.09	.76	.22	.75	.30	.56	.30	.30	.47	.76	.32	.60	.67	.78
EE	ACT,HSG	COMB	-.07	.02	.22	.49	.39	.53	.33	.54	.28	.30	.45	.79	.36	.62	.80	.79
FF	ACT,HSG	COMB	.05	-.01	.46	.69	.53	.67	.31	.54	.29	.28	.52	.77	.42	.65	.80	.85
GG[b]	ACT,HSG	COMB	.04	-.03	.49	.89	.59	.82	.41	.53	.28	.26	.63	.74	.52	.64	.83	.88
HH	ACT,HSG	COMB	.21	-.03	.51	.75	.50	.77	.34	.53	.28	.28	.63	.75	.48	.63	.76	.84
II	ACT,HSG	COMB	-.13	.06	.57	.84	.54	.74	.63	.46	.30	.27	.83	.71	.73	.59	.88	.83

[a] SAT = Scholastic Aptitude Test verbal and math scores; HSR = high school rank in class; HSA = high school grade average; SCAT = School and College Ability Test; HSRR = high school percentile rank in class; ACT = 4 tests of the ACT Assessment; HSG = 4 student-reported high school grades.

[b] The college grade criterion was the grade in a freshman English course. In other cases the criterion was first semester or first year college grade point average.