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ABSTRACT

This paper describes a modified lottery selection procedure and compares it with several popular unbiased candidate selection models in a Venezuelan academic selection situation. The procedure uses modified version of F. S. Ellett's lottery method as a means of partially satisfying the principles of substantive fairness. Ellett's procedure establishes an upper cut-score and recommends acceptance of everyone whose test score is at or above the cut-score. A second lower cut-score is also established, so that everyone scoring at or below this score is rejected. After hiring or admitting candidates in the upper group, additional openings are filled by those between the upper and lower cut-scores. The modification of Ellett's procedure, referred to as the probability level assignment model (PLAM), involves division of the score scale between the upper and lower cut-scores into several equal-width intervals, within which applicants are selected via lottery in proportion to the probability for success upon admission or employment. Results from application of this method to 272 first-year students at the Universidad de Oriente in Cumana, Venezuela, indicate that the PLAM appropriately addresses the various criteria of selection fairness. Eight data tables are appended. (TJH)

SELECTION BIAS ACCORDING TO A NEW MODEL AND FOUR PREVIOUS MODELS USING ADMISSION DATA FROM A LATIN AMERICAN UNIVERSITY

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Running head: Selection Bias

Selection Bias According to a New Model and Four Previous Models Using Admission Data from a Latin American University

The purpose of this paper is to describe a modified lottery selection procedure and to compare it with several popular unbiased selection models in a Venezuelan academic selection situation.

Background

In an interesting analysis several years ago, Ellett (1977) examined the ethical concept of fairness in relation to selection bias. Ellett compared each of several "unbiased" selection models' necessary conditions for nonbias against the following criteria of substantive fairness: (1) everyone with the same qualifications should be treated in the same manner during selection; (2) if there are more equally qualified applicants than there are openings, a lottery from among that group should be used to fill the

openings; and (3) every suitably qualified applicant should have the same probability of being identified as qualified (and, similarly, every unqualified applicant should have the same probability of being so identified).

Ellett's review concluded that none of the selection test bias models (regression, equal risk, constanst ratio, and conditional probability models) reviewed satisfied these substantive fairness criteria because the criteria require that a predictor test have perfect validity. This pessimistic conclusion was reached for the unbiased selection models reviewed because each used a single-cut score, whether the cut-score be within a subgrouping of applicants or in the pooled applicant group. When a single cut-score is used that all applicants at or above the cut-score are selected, even though some persons so selected have little chance of success, and that all applicants below this cut-score are rejected, even though some persons so rejected have considerable chance of being successful.

As a practical solution, Ellett propose a modified lottery as a way to satisfy partially the principles of substantive fairness. Under this proposal an upper cut-score is established which is sufficiently high that the probability of being at least minimally successful is very high for all those above it. Error of measurement in the predictor test may taken into account in setting this cut-score by lowering it on the basis of the test's standard error of measurement. Once set, everyone whose test score is at or above this cut-score is selected. In a similar way, a second,

lower cut-score is established so that everyone scoring at or below this score is rejected.

Job or admission openings are filled by selecting those in the upper group first. If there are additional openings, these are filled by lottery from among those applicants whose test scores are between the upper and lower cut-scores.

The basis of Ellett's proposal is the concept that applicants within each of the three groups are essentially equivalent or "exchangeable". Ellett reaches this deduction because the predictor test lacks perfect validity and so, except for measurement error, persons within each of the three groups are identical.

This deduction runs counter to our experience with all but the poorest tests. Even a test with less than perfect validity is able to distinguish validly at least the higher from the lower ability applicants. To the extent that higher scoring applicants in the "middle group" have s higher probability than those applicants with lower scores of being at least minimally successful, to that extent will Ellett's procedure treat unfairly higher-and lower-scoring applicants from the "middle-group".

Probability Level Assignment Model

A modification of Ellett's proposal may lead to an increase in substantive fairness when a selection test has reasonable, but imperfect, predictive validity. This modification is called the probability level assignment model (PLAM) in this paper. The procedure is outlined in Table 1.

The PLAM establishes upper and lower cut-scores in a manner similar to Ellett's proposal. However, the score scale between these two cut-scores is divided into several equal width intervals. Within these intervals applicants are selected by lottery in proportion to the conditional probability of those in the interval being at least minimally successful on the criterion, hence the term probability level assignment. To assure fairness within subpopulations of applicants (e.g., racial groups), the total number of applicants selected from that subgroup may be proportional to the probability of being minimally successful in that subpopulation.

This probability level assignment model is similar to Bereiter's (1975) probability weighted model (PWM). In Bereiter's approach each applicant's name is entered in a lottery in proportion to the conditional probability of being at least minimally successful. Names are then drawn by simple random selection. The PWM appears to use a pooled or common regression line and does not adjust the lottery on the basis of subpopulation membership. By not using stratified random sampling, the PWM does not assure that, in any one application of the model, there will be a proportional number of applicants selected from particular test score levels.

The PLAM is related also to the equal probability model (EPM) proposed by Peterson and Novick (1976) since both are based on the conditional probability of being minimally successful. The EPM qualizes the conditional probability across groups whereas the PLAM capitalizes on the different conditional probabilities in each group to establish a limit on the number of applicants to be selected

from each group. Further, the EPM uses a single cut-score within each group. From Ellett's viewpoint, the EPM would be less substantively fair than is the PLAM for individual applicants. Thus, the PLAM attempts to be fair both to groups and to individuals within groups.

The PLAM, as other lottery and/or limiting admission models of selection, is criticized easily from the perspective of the employer (e.g., see Jensen, 1980) since it does not set out to maximize a criterion payoff for the employer: More false positive errors will be made using the PLAM than when using the regression model, for example. On the other hand, for any given degree of predictive validity, fewer false negative errors will be made using PLAM than using any of the other fair selection models. Further, fewer false positive errors will be made using PLAM than using other lottery models.

Depending on how valid the selection test is within a subpopulation of applicants, the consequences of false positive errors may be minimal. Further, payoff on the job or grade point average criterion may not be the only consideration for an employer or an institution in making selection decisions. Subgroup representation, for example, may be a desirable goal. One may be willing to sacrifice some criterion payoff to attain such representation provided the payoff loss is not severe. Similarly, reducing false positives may have less utility for some institutions than minimizing false negatives: clearly the PLAM would be preferred when the latter is the case.

The PLAM has been evaluated elsewhere (Ravelo-Hurtado, 1986) in terms of mathematical consistency, utility, ethical viewpoint, and (using simulated conditions) effect of unreliability. Table 2 summarizes this evaluation.

Empirical Comparison of Several Selection Models

The practical consequences of using the PLAM were explored empirically by comparing it with four other well-known fair selection models: the regression model (RM) (see Cleary, 1968), the equal risk model (ERM) (see Einhorn and Bass, 1971), the constant ratio model (CRM) (see Thorndike, 1971), and the conditional probability ratio model (CPM) (see Cole, 1973).

Context of the Comparisons

Sample The sample consisted of 272 (freshmen) students who had completed the first semester at the Universidad de Oriente (UDO) in Cumana, Venezuela. These students were admitted under the government's open-admission policy which prevailed until 1982. The students had taken the Academic Aptitude Test (AAT) on a voluntary basis along with approximately 20,000 candidates nationwide who were applying for admission to various universities throughout Venezuela for the 1980-81 academic year. The AAT was not used for admission decisions, but the data were used to establish that norms and validity coefficients. The students in the sample came from throughout Venezuela. Nevertheless it is a self-selected sample.

The Predictor The predictor used in this study was the Index of Academic Attainment (IAA). The Central Office of Guidance and Admission to Higher Education was set-up by the National Council of Universities (CNU) to implement higher education admission policies. To this end, both AAT scores and high school grade point analyze (HSGPA) are used as a composite predictor called the IAA:

$$IAA = .50(HSGPA) + .25(VR) + .25(NA)$$

Here, HSGPA = High school grade point average standardized on a 50 ± 10 scale,

VR = Verbal Reasoning subtest score the AAT expressed on a 50 ± 10 scale, and

NA = Numerical Ability subtest score of the AAT expressed on a 50 ± 10 scale

Verbal Reasoning is a 65 item, 75 minute, objective test measuring vocabulary knowledge, phrase content, and comprehension of ideas in context. Numerical Ability is a 65 item, 75 minute, objective test measuring knowledge of arithmetic, algebra, and geometry. Two forms of AAT are represented in the data for this study. The norm group reliabilities for these forms are (a) VR .87 (n = 11,252) and .86 (n = 10, 187), and (b) NA .85 (n = 11, 252) and .79 (n = 10, 187).

The Criterion to be Predicted

The criterion for this study was the student's college grade point average (GPA) after one semester at the University (UDO). Course grades at UDO are on a 10-point scale.

For purposes of this study we set the minimally acceptable grade point average as 4.5. Students with GPAs less than 4.5 are considered unsuccessful.

Selection Ratio

For purposes of this study, the selection ratio was set at 71% or 194 of the 272 students studied. Such a large selection ratio represents colleges and universities that are relatively nonselective. Recall, too, that before the introduction of the IAA admission to Venezuelan colleges and universities was open, so a 71% selection ratio is not unreasonable in this context. Further, setting the selection ratio at 71% permits a more complete study of the effects of each selection model in relation to the PLAM over a wide range of ability that applicants bring to the selection situation.

Groups of Students Studied

Four groups of students were studied as follows:

1. Socioeconomic status (SES) The Central Office for Guidance and Admission to Higher Education rates each student on five SES

variables then makes a composite index from these ratings. The variables are father's occupation, mother's educational level, amount of family income, source of family income, and type of home. Each variable is rated on a scale of 1 to 5, where 1 is the highest SES rating, then the five ratings are summarized to obtain an SES index ranging from 5 through 25.

For purposes of this study students were grouped into High SES (index scores less than or equal to 17) and Low SES (index scores above 17). Those in the Low SES group constituted the minority group.

2. Gender University records were used to identify a student's gender. Females constituted the minority group.

3. Age Typically, high school students graduate at age 18. Those students who were 18 years old or younger at the time of their admission to UDO constituted the younger group; those over age 18 constituted the older group. The older group constituted the minority group.

4. Type of High School Attended Students attended either a public or private high school. Those attending private high schools constituted the minority.

Table 3 shows the number of students in each of the groups. The table also shows the predictive validity of the IAA within each

subgroup. Only the difference between the correlations in the older and younger groups is statistically significant at the .05 level.

Criteria for Comparing the Models

There is no single criterion which would satisfy all stakeholders in a selection situation, thus, multiple criteria must be used. There are at least three types of stakeholders who have a stake in any selection procedure: the individual applicant, the leadership of a particular subgroup of applicants, and the employer (or institutional representative). The following criteria were used to compare the various fair selection models.

1. The number and proportion of applicants selected from each subgroup by each procedure. This criterion is of primary concern to subgroup leaders who seek to have more of their subgroup members selected and, thereby, give more of them access to social benefits. The number of subgroup members selected by any selection procedure which encorporates a regression equation in some form depends on the predictive validity of the test for the subgroup and on the distribution of the subgroup's scores on the predictor and the criterion.

2. The probability of a potentially successful applicant with a given test score being selected. This criterion is of primary concern to individual applicants who would be at least minimally

successful on the criterion if they would be selected. It is expected that the FLAH is most appealing on this criterion, especially to those scoring in the middle range on the predictor test, since they may have no chance of being selected when only a single, high cut-score is used.

3. The success ratio This criterion is of primary concern to institutional representatives (or employers) who seek to minimize the proportion of failures among those selected (i.e., those who will perform below the minimally acceptable level on the criterion). It is expected that the regression model will result in the highest overall success ratio, but the size of its advantage over other models would depend on the predictive validity, the placement of the cut-score, and the marginal distributions in any local application.

4. Means and standard deviations This criterion is of primary concern to institutional representatives (or employers) who are concerned with maximizing the total yield on a continuous criterion as a result of the selection process. It is expected that the regression model will maximize the total yield (i.e., result in the highest mean criterion score) among those selected, but the size of its advantage over other models would depend on the predictive validity and the marginal distributions in any local application.

Results

Number and Proportion of Minority Group Students Selected with Each Model

Table 4 shows the number and proportion of applicants selected from each group when each of the selection models is applied in the manner suggested by its author(s). As may be seen, the conditional probability model (CPM) selects the largest number of applicants from every minority group except the private high school group. If each selection model is ranked within each grouping (gender, age, etc.) according to number of minority group members selected, and then these ranks are averaged, CPM has the highest average rank, PLAM is next, followed by CRM, ERM, and RM in that order.

Probability of a Potentially Successful Applicant with a Given Test Being Selected

Table 5 shows the probability of selecting a potentially successful applicant for each predictor test score level. The probabilities are displayed for each model and for each way of grouping the applicants. The values displayed in the table for the PLAM were obtained from empirical results by multiplying the proportion of applicants selected from a score interval by the proportion of applicants in that interval who were successful (i.e., who had UDO GPA 4.5). The other models set one-cut score within a

subgroup. Thus, the probability of selecting a potentially successful applicant equals one if that applicant's test score is greater than or equal to the cut-score and equals zero otherwise.

Success Ratio

The success ratio is the proportion of all those selected who are at least minimally successful. These proportions were obtained by applying each of the selection models as recommended by its author(s), then determining the proportion of selected students within each subgroup who were at least minimally successful. These results are displayed in Table 6. In addition, the table shows the proportion of all the students selected (n = 194) who were successful. Since each model selects somewhat different persons in each group, the success ratio is not equal over groups within a given model.

As may be seen from the table, the PLAM tends to select the lowest proportion of successful applicants overall, while the regression model tends to select the highest proportion of successful applicants. The overall success ratio difference between the RM and the PLAM is about .035 in favor of the RM.

With regard to the success ratio of minority candidates, however, the PLAM is somewhat better. It tended to select a slightly higher proportion of successful females and older students than the other models. It selected the smallest proportion of successful high SES students and was tied for third in the success

ratio for students from private schools. Differences between the model with the highest success ratio among minority groups and the model with the lowest success ratio tend to be about .071.

Means and Standard Deviations

Table 7 shows the means and standard deviations on the criterion variable (GPA) of those persons selected by each of the models. As may be seen the regression model selects those with the highest average criterion score, while the PLAM selects those with the lowest average criterion score. The differences among the models are small, however, with the maximum difference being around .10 or 7% of the standard deviation of the criterion scores of those selected by the regression model.

Conclusions

1. From a minority viewpoint the CPM is the most appealing model in this study because, in three of the four cases, a larger number of minority applicants were selected than when one of the other models was used. The PLAM was the next more appealing model for minority groups because when it was used, a larger number of minority applicants were selected than when one of the other models was used. Nevertheless, the more appealing model to a minority group (using the number of applicants selected as a criterion) is

the less appealing model to the corresponding majority group. Thus, the RM and ERM were the models that were more appealing to the majority groups.

2. The PLAM was the most attractive model for potentially successful applicants, regardless of group membership, because it gave a chance of selection to a larger range of potentially successful applicants than the other models. The other models were very similar to each other and quite different from the PLAM on this point.

3. From the viewpoint of utility to the institution, the RM, ERM, and CRM were the preferred models because they led to a larger success ratio than either the CPM or the PLAM. In addition, for those selected by using the RM, ERM, or CRM, the mean criterion score was consistently higher and the standard deviation lower than for the CPM and the PLAM. However, the PLAM made the errors of selection more likea between groups and this could encourage an institution to sacrifice a small benefit in order to have a more substantively fairer selection for all the groups.

Summary

As is to be expected in selection situations, as well as in other social control situations, different stakeholders seek to optimize different criteria. Leaders of groups seek admission to social benefits for more members of their groups. Individuals who perceive themselves as being qualified would like at least an equal

chance of being selected as other persons they perceive to be equally qualified. A selecting institution may seek to maximize the success ratio and/or total criterion gain. Different models address these different criteria and so are optimally appealing to the self-interest of various stakeholders. Perhaps a compromise between the stakeholders can be arranged. If so, the PLAM would seem to be the model that best implements this compromise. The differences between the results obtained in applying it and the optimal results, at least in this application, appear to be small and within tolerable limits of what various parties can expect to give up in order to reach a negotiated settlement.

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Table 1. Summary of Steps Used to Implement the Probability Level Assignment Model (PLAM)

(1) Establish the minimum success level (score) on the criterion, Y_M.

(2) For each subgroup determine the lower cut-score, X_L, using the within subgroup Y-on-X regression. All candidates with $X \leq X_L$ are rejected.

(a) the lower cut-score corresponds to the maximum risk of a false negative, α_L, where α_L is specified with regard to the conditional distribution of $Y|X_L$ within a subgroup. That is, for each subgroup,

$$\alpha_L = P[Y > Y_M | \mu_{Y|X_L} , \sigma_{Y|X_L}]$$

(b) Frequently, it is appropriate to set $\alpha_L = .05$.

(c) The procedure for finding the X_L-value is similar to that outlined by Einhorn and Bass (1971).

(3) Determine for each subgroup, j, the conditional probability of being at least minimally successful given a predictor test score above X_L. That is,

$$p_j = P[Y > Y_M | X > X_L]$$

Bivariate normal curve tables may be used for this purpose.

(4) For each subgroup determine the number of vacancies to be filled from that subgroup.

(a) This number is proportional to the probability of being at least minimally successful given that one has been accepted:

$$\left\{\begin{array}{l}\text{proportion selected in} \\ \text{subgroup j}\end{array}\right\} = \frac{P[Y > Y_M | X > X_L]_j}{\sum_{j=1}^{J} P[Y|Y_M | X > X_L]_j}$$

(b) Bivariate normal curve tables may be used for this purpose.

(c) Usually, J = 2 (e.g., males and females).

Table 1 (continued)

(5) For each subgroup determine the upper cut-score, X_U, using the within subgroup Y-on-X regression in a manner similar to Step 2 above.

(a) The upper cut-score corresponds to the maximum risk of a false positive, α_U, specified in the conditional distribution of $Y|X_U$ within a subgroup.

$$\alpha_U = P[Y > Y_M | \mu_{Y|X_U} , \sigma_{Y|X_U}]$$

(b) α_U may be set to .05

(6) Using a proportional selection as determined in Step 3, fill as many of the vacancies as possible (perhaps, all vacancies) with candidates who have $X \geq X_U$.

(7) If more vacancies remain to be filled after selecting those with $X \geq X_U$, use the modified lottery described below to select candidates in proportion to the within group conditional probability of success, beginning with the upper score levels of each subgroup.

(a) Divide the test score scale between X_L and X_U into intervals (e.g., each interval may be $.5\sigma_X$ in width).

(b) For each interval, calculate the conditional probability of success given one's score is in the interval. That is,

$$P[Y > Y_M | X_i < X < X_{i+1}]$$

where X_i and X_{i+1} are the lower and upper boundaries of the interval

(c) Allocate the number of candidates to be selected from each interval in proportion to this within group conditional probability.

(d) Randomly select this number of candidates from each interval and for each of the J subgroups.

Table 2. Summary Evaluation of the Probability Level Assignment Model

Aspect	Evaluation
Mathematical Consistency	Logically consistent within subgroups for all the groups, since the converse model and the PLAM lead to the same conclusion.
Utility	1. Has a utility for the group that is proportional to the conditional probability of being successful. 2. Has lower utility for the employer when the number of vacancies is large and the highly qualified are few. 3. Has equal utility for applicants within a subgroup who have equal probability of success.
Effect of Unreliability of the Predictor	Sometimes affects, but only slightly, the test cutoff scores; however, the number of applicants to be selected from each subgroup remains the same.
Effect of Unreliability of the Criterion	1. Favors the minority, the majority, or neither one according to the case studied. 2. The difference between groups in percentage and number of applicants selected run from 0 6.
Ethical Viewpoint	1. It is a quota model because vacancies are assigned in proportion to a predetermined criterion and because it takes into account any probability of success found in the group. 2. The necessary condition for achieving an unbiased selection is linked to substantive fairness principles. 3. Qualified and unqualified applicants are treated differently according to their criterion scores if their predictor scores are extremely high or extremely low. 4. Qualified and unqualified applicants are treated equally according to their criterion performance scores if the predictor scores are between the low and high cutoffs.

Source: Ravelo-Hurtado (1986)

Table 3. Correlation and Regression Data for the UDO Sample

Group	n	IAA Mean (SD)	Predictive Validity	Slope	Intercept
Total sample	272	50.03 (7.55)	.51	.09612	-.03493
Male	149	50.15 (7.41)	.58	.10674	-.48333
Female	123	49.88 (7.75)	.43	.08386	.46703
Younger (≤ 18 yrs)	185	52.18 (7.04)	.52*	.10181	-.27810
Older (≥ 19 yrs)	87	45.44 (6.52)	.28*	.06021	1.45811
Low SES (≥ 18 yrs)	86	48.19 (7.00)	.58	.11208	-.94576
High SES (≤ 17 yrs)	186	50.88 (7.40)	.45	.08523	.57976
Public High School	218	49.19 (7.24)	.47	.09105	.13932
Private High School	54	53.39 (7.92)	.54	.09374	-.37852

*This difference is significant at the .05 level (z = 2.19). All other differences are nonsignificant.

Table 4. Number and Percent of Applicants Selected From Each Group According to the RM, ERM, CRM, CPM, and PLAM

Group	RM	ERM	CRM	CPM	PLAM
Male	109 (93)	111 (75)	114 (77)	105 (70)	112 (75)
Female	85 (69)	83 (67)	80 (65)	89 (72)	82 (67)
Younger	163 (88)	159 (86)	149 (81)	128 (69)	144 (78)
Older	31 (36)	35 (40)	45 (52)	66 (76)	50 (57)
Low SES	41 (48)	41 (48)	48 (56)	59 (69)	52 (60)
High SES	153 (82)	153 (82)	146 (78)	135 (73)	142 (76)
Public	144 (66)	143 (66)	143 (66)	155 (71)	144 (66)
Private	50 (93)	51 (94)	51 (94)	39 (72)	50 (93)

Note: (1) The numbers in parentheses are percentages.
(2) RM = regression model, ERM = equal risk model, CRM = constant ratio model, CPM = conditional probability model, PLAM = probability level assignment model.

Table 5. Chances of Selecting a Potentially Successful Applicant, at Each Test Score Level Under the RM, ERM, CRM, CPM, and PLAM, According to Gender, Age, Socioeconomic Status, and High School Type

	MODEL									
	RM		ERM		CRM		CPM		PLAM	
	GENDER									
IAA LEVEL	M	F	M	F	M	F	M	F	M	F
65.5-72.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
58.5-65.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
51.5-58.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.74	.54
44.5-51.5	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	.40	.31
37.5-44.5	.00	.00	.00	.00	.00	.00	.00	.00	.13	.14
30.5-37.5	.00	.00	.00	.00	.00	.00	.00	.00	.03	.05
23.5-30.5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	AGE									
	Y	0	Y	0	Y	0	Y	0	Y	0
65.5-72.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
58.5-65.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
51.5-58.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.68	.42
44.5-51.5	1.00	1/0	1/0	1/0	1/0	1/0	1/0	1.00	.37	.29
37.5-44.5	.00	.00	.00	.00	.00	.00	.00	1/0	.13	.17
30.5-37.5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.07
23.5-30.5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	SOCIOECONOMIC STATUS									
	L	H	L	H	L	H	L	H	L	H
65.5-72.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
58.5-65.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
51.5-58.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.63	.65
44.5-51.5	1/0	1.00	1/0	1.00	1/0	1/0	1/0	1/0	.28	.39
37.5-44.5	.00	1/0	.00	1/0	.00	.00	.00	.00	.09	.19
30.5-37.5	.00	.00	.00	.00	.00	.00	.00	.00	.02	.08
23.5-30.5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	HIGH SCHOOL TYPE									
	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr
65.5-72.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
58.5-65.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
51.5-58.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.62	1.00
44.5-51.5	1/0	1.00	1/0	1.00	1/0	1.00	1/0	1/0	.29	.57
37.5-44.5	.00	1/0	.00	1/0	.00	1/0	.00	.00	.13	.29
30.5 37.5	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
23.5-30.5	00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Note: (1) 1/0 indicates that there are probabilities of both 1 and 0 within an interval. This happens when the cutting point falls within the interval.
(2) M,F = male, female; Y,0 = younger, older; L, H = lower, higher; Pu, Pr = public, private.

Table 6. Success Ratio for Each Group and Overall According to the RM, ERM, CRM, CPM, and PLAM

Group	RM	ERM	CRM	CPM	PLAM
Male	.6881	.6757	.6667	.6952	.6250
Female	.6000	.6024	.6000	.5730	.6098
Difference	.0881	.0733	.0667	.1222	.0152
Gender Overall	.6495	.6443	.6392	.6340	.6186
Younger	.6564	.6541	.6846	.6953	.6458
Older	.5806	.5429	.5333	.4697	.6098
Difference	.0758	.1112	.1513	.2256	.0360
Age Overall	.6443	.6340	.6495	.6186	.5876
Low SES	.6341	.6341	.5833	.5085	.5962
High SES	.6601	.6601	.6712	.6667	.6338
Difference	-.0260	-.0260	-.0879	-.1582	-.0376
SES Overall	.6546	.6546	.6495	.6186	.6237
Public H.S.	.6042	.6014	.6014	.5806	.5764
Private H.S.	.7600	.7451	.7451	.8205	.7600
Difference	-.1558	-.1437	-.1437	-.2399	-.1836
School Overall	.6432	.6392	.6392	.6289	.6237

Note: The overall success ratios are not equal for the same model because the applicants selected (n=194) are not the same for different groups (classification variables). The overall ratios for SES and high school type are equal for the PLAM only by chance.

Table 7. College GPA Mean and Standard Deviation for Each Group for Applicants Selected Under the RM, ERM, CRM, CPM, and PLAM

	RM		ERM		CRM		CPM		PLAM	
Group	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	5.21	1.29	5.16	1.33	5.14	1.32	5.22	1.30	5.06	1.39
Female	4.93	1.43	4.93	1.44	4.96	1.45	4.84	1.46	4.92	1.51
Diff.	.28	-.14	.23	-.11	.18	-.13	.38	-.16	.14	-.12
Overall	5 09	1.36	5.06	1.38	5.07	1.37	5.05	1.38	5.00	1.44
Younger	5.15	1.37	5.16	1.38	5.24	1.37	5.32	1.39	5.15	1.41
Older	4.67	1.29	4.62	1.24	4.54	1.35	4.32	1.40	4.26	1.22
Diff.	.48	.08	.54	.14	.70	.02	1.00	-.01	.89	.19
Overall	5.08	1.37	5.06	1.37	5.08	1.39	4.98	1.47	4.91	1.43
Low SES	5.07	1.40	5.07	1.40	4.95	1.39	4.71	1.49	4.89	1.53
High SES	5.09	1.33	5.09	1.33	5.14	1.34	5.15	1.37	5.01	1.39
Diff.	-.02	.07	-.02	.07	-.19	.05	-.44	.12	-.12	.14
Overall	5.09	1.35	5.09	1.35	5.09	1.35	5.01	1.42	4.98	1.43
Public	4.92	1.35	4.92	1.36	4.92	1.36	4.84	1.38	4.85	1.40
Private	5.44	1.39	5.41	1.39	5.41	1.39	5.77	1.25	5.45	1.37
Diff.	-.52	-.04	-.49	-.03	-.49	-.03	-.93	.13	.60	.03
Overall	5.05	1.38	5.05	1.38	5.05	1.38	5.02	1.40	5.01	1.41

Note: The overall means and standard deviations are not equal for the same model because the applicants selected (n=194) are not the same for different groups (classification variables).