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THE TRANSLATION OF SUPERVISORY RATINGS INTO MEASUREMENTS OF RELATIVE VALUE

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Abstract

The goal of this study was to develop a procedure for determining the magnitude of the performance differences between different categories of enlisted personnel. The professional judgment of Marine Corps officers is used as the basis for building a scale that translates the current performance-evaluation system into a measure of an individual's relative value to the service.

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EXECUTIVE SUMMARY

In order to make informed judgments about enlistment standards and the optimal mix of enlisted personnel, the magnitude of the performance difference between different groups of personnel must be known. Although there is abundant evidence that performance varies with education and ability, existing studies give no information on the magnitude of the performance differences between personnel categories. This study develops a procedure for determining the size of the performance difference between different groups of personnel. The usefulness of this procedure is illustrated by examining the performance difference between high school graduates and non-high school graduates and determining the magnitude of this gap.

PROCEDURES

Proficiency and fitness marks are currently used as the performance-evaluation system for enlisted personnel. This evaluation system gives an ordinal ranking of Marines. In this study, the proficiency and fitness mark system is used as the basis for building a cardinal scale that measures the magnitude of the difference between performance marks. A survey was distributed to a cross section of 258 Marine Corps captains and majors asking them to translate their proficiency and fitness mark scoring system into measures of an individual's relative value to the service. The officers were asked to estimate the percentage of difference, in terms of value to the service, between adjacent proficiency and fitness marks. Relative value was based on estimates of how much more work a Marine assigned one mark would accomplish compared to a Marine who received the adjacent mark. The responses of the individual officers were aggregated to determine an average translation scale between proficiency and fitness marks and percentage of difference in relative value. Table I gives the mean scale for translating proficiency and fitness marks into measures of relative value to the service.

The translation scale shown in table I was used to rescale the proficiency and fitness marks to reflect the relative value to the service of

TABLE I

MEAN SCALE FOR TRANSLATING PROFICIENCY AND FITNESS MARKS

Proficiency marks	Percent difference in relative value	Fitness marks	Percent difference in relative value
5.0		OS	
	> 18.7		> 27.5
4.9		EX-OS	
	> 16.6		> 27.8
4.8		EX	
	> 16.5		> 29.5
4.7		AA-EX	
	> 16.7		> 21.5
4.6		AA	
	> 15.2		> 17.6
4.5		AV-AA	
	> 16.9		> 17.1
4.4		AV	
	> 12.9		> 22.5
4.3		BA-AV	
	> 10.6		> 16.2
4.2		BA	
	> 9.7		> 13.1
4.1		UN	
	> 9.3		
4.0			
	> 32.9		
3.0-3.9			
	> 24.8		
2.0-2.9			
	> 17.3		
1.0-1.9			
	> 23.1		
0.0-0.9			

TABLE II

THE DISPERSION OF PERFORMANCE AMONG MARINE CORPS ENLISTED PERSONNEL COMPARED TO CIVILIANS

Measure	Difference in relative value (in percent)[a]			
	Difference between top 5th and bottom 5th percentiles		Estimated standard deviation of the mean performance	
	Marines	Civilian results[b]	Marines	Civilian results[b]
Proficiency marks[c]	161	120	29	$\geq$20
Fitness marks[d]	147	120	26	$\geq$20

[a]The civilian results reflect performance differences within given occupations whereas the results for Marines reflect performance differences across all Marine occupations. Thus, the estimates for Marines are expected to be greater.

[b]See [1].

[c]Calculated using the population of Marines who reported for their first tour of duty in FY1981.

[d]Calculated using a large sample of E-5s and E-6s who reenlisted between FY1980 and FY1982.

Marines receiving various marks. The rescaled relative-value proficiency and fitness marks reveal that the dispersion in performance across individual Marines is similar to the dispersion of productivity levels found for civilian workers [1]. Table II compares the estimated dispersion in productivity among civilian workers to the dispersion in the performance levels of Marines. The distribution of proficiency marks for first-term personnel and the distribution of fitness marks for careerists are both used to estimate the performance difference between a Marine in the top 5th percentile and a Marine in the bottom 5th percentile. As shown in table II, the estimates of the dispersion in the performance of Marines, based on both proficiency and fitness marks, mirror results found for the civilian sector.

APPLICATIONS

The rescaled proficiency and fitness marks were used to determine the magnitude of the performance difference between high school graduates and non-high school graduates. The proficiency mark system is used to evaluate enlisted personnel of the rank of corporal or lower and thus gives insight into the performance differences among junior enlisted personnel. Analysis of the rescaled proficiency marks for first-term accessions revealed that the magnitude of the performance difference between graduates and nongraduates increases with AFQT score. High school graduates in the 20th AFQT percentile perform 10.4 percent better than nongraduates of equal ability, whereas high school graduates in the top AFQT percentile perform 18.7 percent better than nongraduates of equal ability (see figure I). In addition, on average, graduates have a higher mental aptitude than nongraduates. Evaluation of the performance difference between graduates and nongraduates at the mean ability levels for each of these education groups revealed that high school graduates perform 13.8 percent better than nongraduates.

Fitness marks are used to evaluate enlisted personnel of the rank of sergeant or above, and thus are a performance measure for senior personnel. Comparison of the fitness marks for second-term sergeants revealed that the difference between graduates and nongraduates is not large. High school graduates in the 20th AFQT percentile perform 0.5 percent better than nongraduates of equal ability, and high school graduates in the top AFQT percentile perform 2.1 percent better than their nongraduate counterparts (see figure II). Allowing for the difference in ability levels, average high school graduates perform 1.4 percent better than nongraduates.

FINDINGS

This study resulted in the following specific findings:

- On average, first-term high school graduates are 13.8 percent more valuable than nongraduates after training.

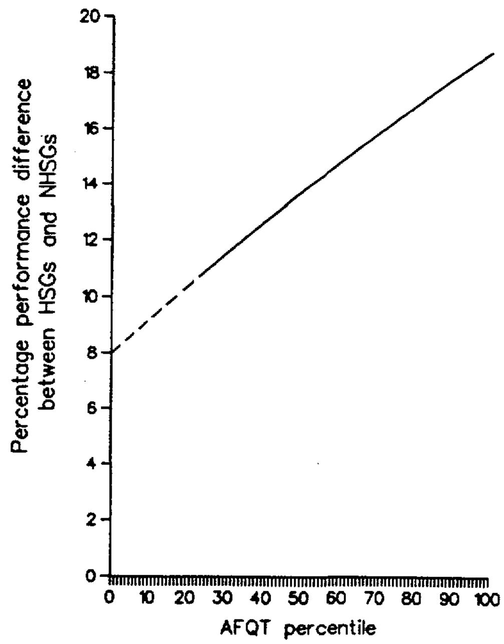

FIG I: PERCENTAGE PERFORMANCE DIFFERENCE BETWEEN HSGs AND NHSGs USING PROFICIENCY MARKS

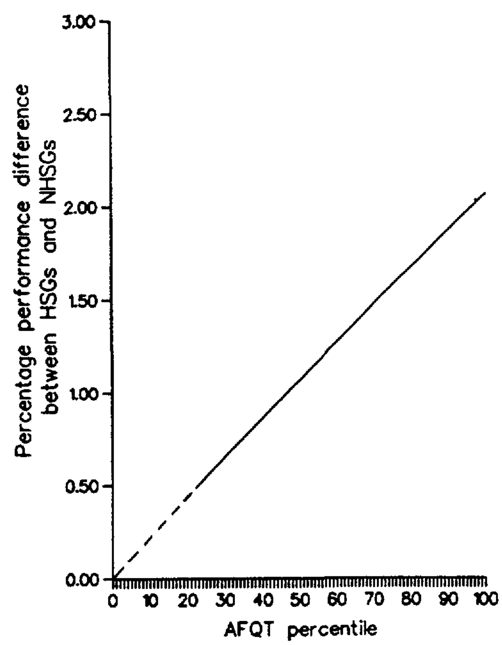

FIG II: PERCENTAGE PERFORMANCE DIFFERENCE BETWEEN HSGs AND NHSGs USING FITNESS MARKS

- On average, career (E-5 and E-6) high school graduates are 1.4 percent more valuable than nongraduates after training.

- For first-term high school graduates, the difference in value between a Marine in AFQT category I (AFQT percentile of 93) and a Marine in AFQT category IVa (AFQT percentile of 21) is 16.9 percent after training.

- For career (E-5 and E-6) high school graduates, the difference in value between a Marine in AFQT category I (AFQT percentile of 93) and a Marine in AFQT category IVa (AFQT percentile of 21) is 6.8 percent after training.

REFERENCE

[1] Schmidt, Frank, and Hunter, John. "Individual Differences in Productivity: An Empirical Test of Estimates Derived From Studies on Selection Procedure Utility." *Journal of Applied Psychology*, vol. 68, 1983

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INTRODUCTION

The magnitude of the performance differences between different types of individuals is a crucial factor in the determination of the optimal mix of Marine Corps enlisted personnel. Although there is abundant evidence that on-the-job performance rises with mental ability and education, the magnitude of the performance increments is unknown. The goal of this study was to develop a procedure for determining the magnitude of the performance difference between personnel categories. This general methodology was applied to quantifying the performance gap between high school graduates and nongraduates.

Proficiency and fitness marks are currently used to evaluate the performance of enlisted personnel. Proficiency marks are used to evaluate junior personnel. This group includes the ranks of private (E-1) through corporal (E-4) and generally makes up the first-term enlisted force. Proficiency marks range from 0 to 5.0 and are to be given in accordance with the scale shown in table 1. A mark below 2.0 is given for an unsatisfactory performance. A mark between 2.0 and 3.9 reflects a poor to fair performance, and a mark of 4.0 and above is given for good to outstanding performances. Fitness marks are used to evaluate senior enlisted personnel. Fitness marks range from unsatisfactory to outstanding and are to be given in accordance with the scale shown in table 2.

Grade inflation is significant for both proficiency and fitness marks. Figure 1 gives the distribution of proficiency marks for Marines who reported for their first tour of duty in FY 1981. Figure 2 gives the distribution of fitness marks for E-5s and E-6s who reenlisted between FY 1980 and FY 1982. As figures 1 and 2 show, the distributions of marks are highly concentrated at the upper ends of both marking scales. However, the existence of mark inflation does not undermine the relative meaning of the marking systems. Despite the mark inflation and the subjectivity that most researchers believe is reflected in these marks, the current performance-evaluation system does provide an ordinal ranking of Marines.

As currently used, neither proficiency nor fitness marks have cardinal significance. A proficiency mark of 4.0 cannot be interpreted as being twice as good as a mark of 2.0. The only interpretation that can be made is that

TABLE 1

PROFICIENCY RATING SCALE[a]

Mark	Corresponding adjective	Standards of performance
0 to 1.9	Unsatisfactory	Does unacceptable work in most of his/her duties, generally undependable; needs considerable assistance and close supervision on even the simplest assignment.
2 to 2.9	Poor	Does acceptable work in some of his/her duties but cannot be depended upon. Needs assistance and close supervision on all but the simplest assignments.
3 to 3.9	Fair	Handles routine matters acceptably but needs close supervision when performing duties not of a routine matter.
4 to 4.4	Good	Can be depended upon to discharge regular duties thoroughly and competently but usually needs assistance in dealing with problems not of a routine nature .
4.5 to 4.8	Excellent	Does excellent work in all regular duties, but needs assistance in dealing with extremely difficult or unusual assignments.
4.9 to 5.0	Outstanding	Does superior work in all of his/her duties. Even extremely difficult or unusual assignments can be given to him/her with full confidence that they will be handled in a thoroughly competent manner.

[a]Source: U.S. Marine Corps, "Individual Records Administration Manual," MCO P1070.12D.

TABLE 2

FITNESS RATING SCALE[a]

Mark	Corresponding adjective	Standards of performance
UN	Unsatisfactory	Unacceptable.
BA	Below average	Below generally accepted standards.
AV	Average	Meets generally accepted standards.
AA	Above average	Highly qualified.
EX	Excellent	Qualified to a degree seldom achieved by other of this grade.
OS	Outstanding	One of the clearly superior individuals of this grade.

[a]Source: U.S. Marine Corps, "Performance Evaluation System," MCO P1610.7

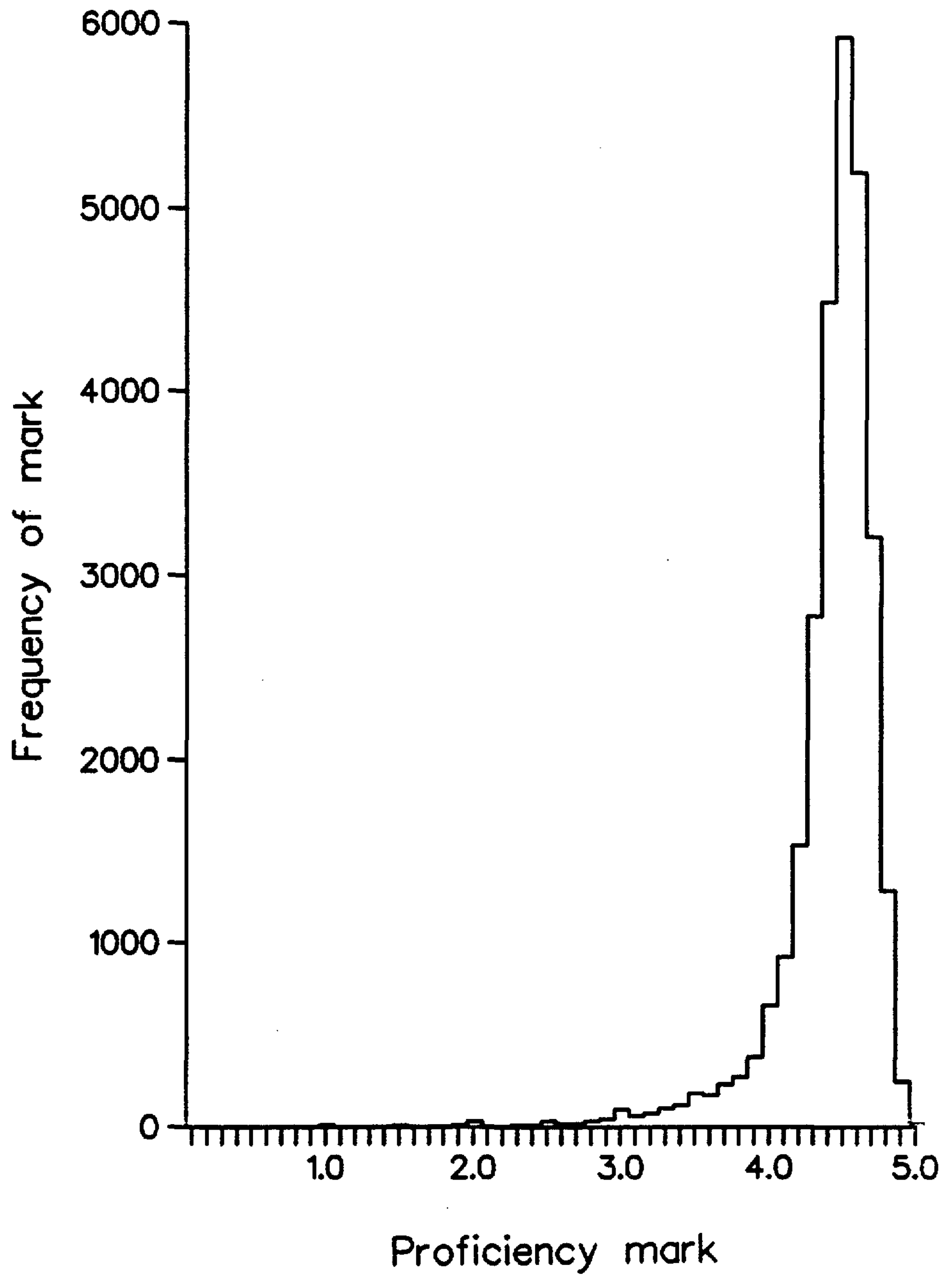

FIG 1: DISTRIBUTION OF PROFICIENCY MARKS

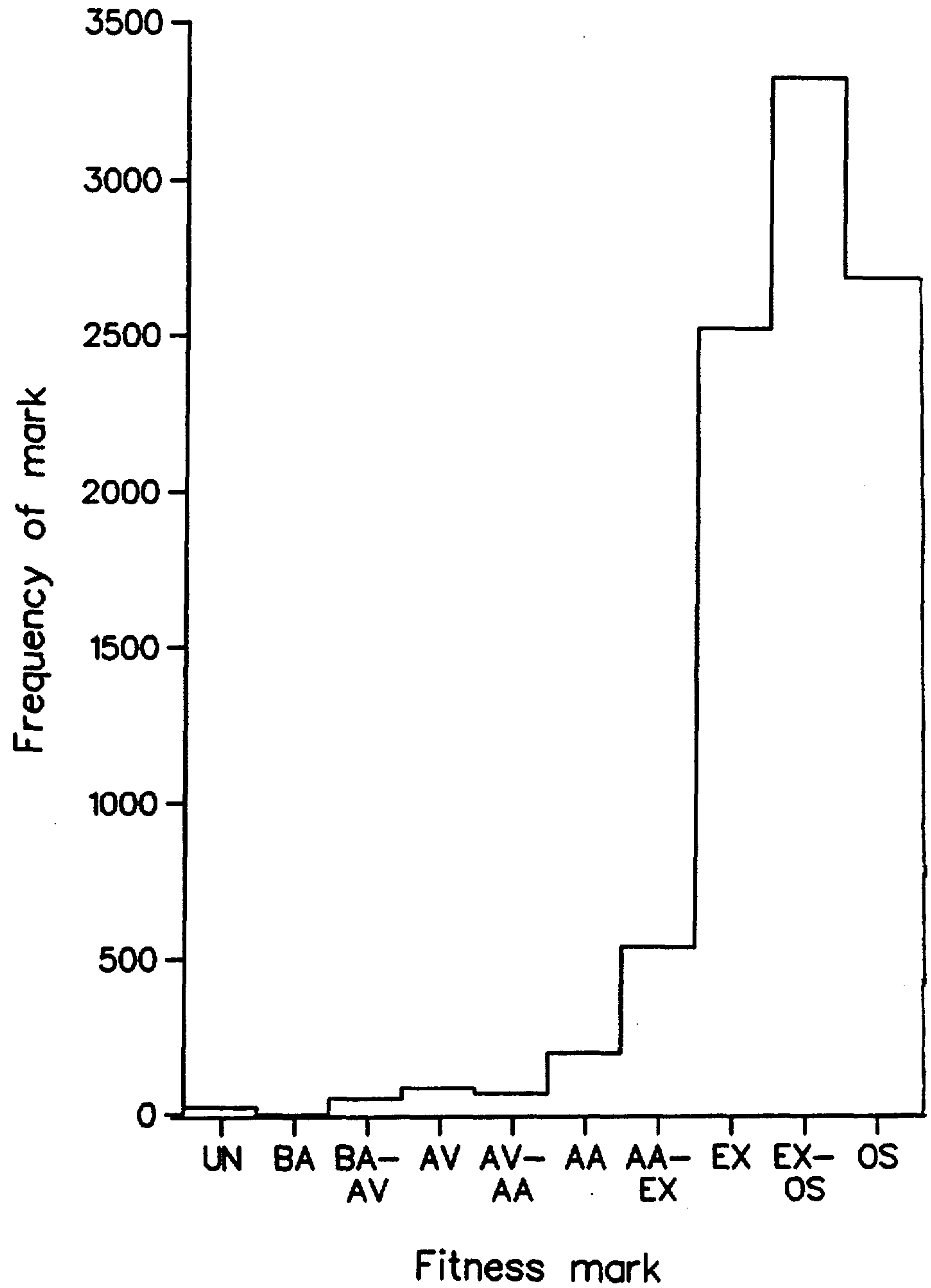

FIG 2: DISTRIBUTION OF FITNESS MARKS

a proficiency mark of 4.0 is associated with a performance level significantly better than that associated with a mark of 2.0. The current performance-evaluation system cannot be used directly to evaluate how much better or worse one performance level is compared to another.

This study uses the current performance-evaluation system as the basis for developing a cardinal scale that measures the magnitude of the differences between performance marks. A cardinal performance scale makes it possible to evaluate how much better one individual or group is than another.

Studies on productivity in the private sector reveal a significant variation in productivity across individuals. Frank Schmidt and John Hunter [1] analyzed data from 18 sources on the productivity of individuals in private industry. The authors gave a conservative estimate of the standard deviation of the mean output as 20 percent. After categorizing workers by occupation and analyzing the variation in output among individuals, the authors concluded that productivity in the private sector varies widely. Workers in the top 5th percentile were estimated to be 120 percent more productive than workers in the bottom 5th percentile. Such significant differences in productivity across individuals in private industry suggest that there may be major performance differences across Marines. Specifically, high school graduates (HSGs) are believed to perform significantly better on the job than non-high school graduates (NHSGs), and a wide variety of evidence supports this contention.

Recommendation for reenlistment is one indirect measure of job performance that supports the belief than HSGs out-perform NHSGs. It is expected that individuals who perform well are recommended for reenlistment and individuals who perform poorly are not. HSGs are recommended for reenlistment more frequently than NHSGs. Of the regular non-prior service males who enlisted in 1980 and completed a 4-year term, 80.5 percent of HSGs were recommended for reenlistment. In contrast, only 61.0 percent of the NHSGs were recommended for reenlistment.

Promotion rates are another indirect measure of job performance. High school graduates are more likely to be promoted than nongraduates. Of the regular non-prior service males who enlisted in 1980 and completed a 4-year term, 77.6 percent were promoted to corporal in their first term. In contrast, only 58.5 percent of the NHSGs made corporal in their first term.

Pilot job performance tests also provide evidence that graduates outperform nongraduates. Preliminary results from the pilot tests reveal that in certain military occupational specialties (MOSs), high school graduates perform better than nongraduates [2]. The pilot tests, which are composed of a hands-on and written test, were given to enlisted personnel in three MOSs: infantry (0311), ground radio repair (2541), and auto mechanics (3521). Analysis of the hands-on test results for auto mechanics and ground radio repairmen revealed that education is not an important factor in determining job performance for these MOSs. However, in the hands-on test score for infantry, HSGs score better than NHSGs by approximately one-third of a standard deviation, even when controlling for ability. Education is not a significant factor determining scores on the written test for any of the MOSs in the sample. Thus, the job performance test results support the contention that at least in the infantry field, HSGs perform better than NHSGs on the job.

The most convincing evidence that HSGs perform better than NHSGs comes from the Marine Corps performance-evaluation system. All enlisted personnel of the rank of corporal or below are regularly evaluated using the proficiency mark system. Thus, proficiency marks provide a measure of job performance for junior personnel. High school graduates receive higher proficiency marks than nongraduates. It has been shown that when one standardizes proficiency marks across MOSs and controls for ability levels, HSGs score 0.13 points (or 0.4 of a standard deviation) higher than NHSGs [3].

Senior enlisted personnel of the rank of sergeant or above are evaluated using the fitness mark system. It is difficult to compare the performance of HSGs and NHSGs for senior personnel, because NHSGs cannot enlist for a third term in the Marine Corps. Senior individuals who are still NHSGs (that is, NHSGs in their second term) are planning either to leave the Marine Corps or to get their diploma. However, despite the fact that many senior NHSGs may be working toward their high school degree and thus are almost graduates, they do not do as well as graduates on performance evaluations. Although the gap between fitness marks is not very large, high school graduates consistently receive higher marks than nongraduates.

THE SURVEY

Although there is abundant evidence supporting the contention that HSGs perform better than NHSGs in the Marine Corps, none of the existing information gives insight into the magnitude of the performance difference between graduates and nongraduates. Many ordinal measures of performance are available, but there are no cardinal measures of performance for the Marine Corps. In fact, there have been only a few studies on quantifying job performance differences for any of the services. One way to obtain estimates of the relative performance of graduates and nongraduates is through the existing performance-evaluation system.

Although many factors determine the mark an individual receives in the current performance-evaluation system, it is reasonable to assume that individuals who receive high marks are worth more to the Marine Corps than those who receive low marks. It is assumed that Marines receiving high marks are able to repair more jeeps, fix more radios, perform better in combat, or motivate those around them better than Marines who receive low marks. In other words, it is assumed that high-scoring Marines are more productive and produce higher quality output than low-scoring Marines. In order to determine the magnitude of the differences between scores, a scale that translates the current ordinal ranking system into a scale of relative value must be constructed.

A survey was developed that asked Marine Corps officers to translate their own proficiency (PRO) and fitness (FIT) mark scoring systems into measures of relative value to the service. Since Marine Corps officers are the individuals who actually assign PRO and FIT marks, it is believed they are best qualified to determine the translation scale. The officers were asked to assign the percentage of difference in value to the Marine Corps that they associate with incremental marks in the performance evaluation system. The form the officers were asked to complete is reproduced as figure 3. The scale for PRO marks ranges from 0 to 5.0, and the scale for FIT marks ranges from unsatisfactory (UN) to outstanding (OS). For FIT marks, the officers were asked to compare marks for the "general value to the service" category.

Given the distribution of marks (figures 1 and 2), the relevant range

Fill in the two tables below with the percent (%) that best reflects your estimate of the difference between adjacent scores. Proficiency marks are shown in the standard 5-point scale. Fitness report marks are shown for the "general value to the service" category. In between each pair of marks (going up the scale), write your estimate of the percent increase in VALUE TO THE MARINE CORPS between Marines receiving these marks. Estimates should represent your opinion of the incremental increase (%) over the next lower mark, and should be made independent of grade and MOS (i.e., consider that grade and MOS are identical in making your assessment of Marines being marked on the scoring system).

If, for example, in your experience, Marines to whom you historically have given proficiency marks of 4.5 are "worth 'X'% more to the Marine Corps" than those to whom you have given a mark of 4.4, then you should enter 'X' in the blank between 4.4 and 4.5. Or, if a Marine accomplishes twice as much as another, then the former is worth 100% more to the Marine Corps. Please complete all 23 blanks, and indicate the percent for each incremental increase that best reflects YOUR PERSONAL SCORING SYSTEM (note that the sum of your responses in each column DOES NOT have to total 100%):

PROFICIENCY MARKS

Scale	Percent Increase in "Value to the USMC"
5.0	
	)------------------
4.9	
	)------------------
4.8	
	)------------------
4.7	
	)------------------
4.6	
	)------------------
4.5	
	)------------------
4.4	
	)------------------
4.3	
	)------------------
4.2	
	)------------------
4.1	
	)------------------
4.0	
	)------------------
3.0 - 3.9	
	)------------------
2.0 - 2.9	
	)------------------
1.0 - 1.9	
	)------------------
0.0 - 0.9	

FITNESS REPORT MARKS

Scale	Percent Increase in "Value to the USMC"
OS	
	)------------------
EX - OS	
	)------------------
EX	
	)------------------
AA - EX	
	)------------------
AA	
	)------------------
AV - AA	
	)------------------
AV	
	)------------------
BA - AV	
	)------------------
BA	
	)------------------
UN	

Your MOS____________

FIG 3: SAMPLE QUESTIONNAIRE

of the marking scale is 4.0 to 4.8 for the PRO marks and AA-EX to OS for FIT marks. Over 90 percent of PRO marks assigned are between 3.9 and 4.9, as shown in figure 1. Thus, on the questionnaire, marks above 4.0 are given in one-point increments, and marks below 4.0 are grouped into blocks of ten points. Questionnaire respondents are asked to compare, for example, the range 2.0-2.9 to the range 3.0-3.9.

Eighty-nine percent of FIT marks assigned range from EX to OS, as shown in figure 2. However, since the FIT scale contains only ten possible marks, questionnaire respondents are asked to compare all adjacent marks.

A pilot survey was conducted with a sample of 23 officers at U.S. Marine Corps Headquarters. The results from the pilot survey were discussed with the respondents to insure the validity of the responses. The questionnaire was modified in accordance with the suggestions and comments of those participating in the pilot study. The entire questionnaire is reproduced in appendix A.

The survey questionnaire was distributed to Marine officers attending three different schools (Command and Staff, Amphibious Warfare, and Advanced Communication Officer's Course) at the USMC base in Quantico. Since the officers attending these schools are drawn from a wide variety of commands throughout the Marine Corps, they comprise a representative sample. A total of 258 Marine Corps captains and majors were surveyed. Of the 250 completed questionnaires, 218 (85 percent) are clearly filled out in accordance with the survey's directions. The 32 ambiguous responses were dropped from the data set. Excluding these questionable responses from the data set does not have a significant effect on the results.

Figures 4 through 6 give the distribution of responses for three of the PRO-mark comparisons in the survey. Figure 4 gives the distribution of responses for the comparison of PRO mark 4.0 to the block of PRO marks 3.0 to 3.9. Figures 5 and 6 give the distribution of answers for the comparison of PRO mark 4.4 to a mark of 4.5 and a mark of 4.9 to a 5.0, respectively. Because the respondents are asked to compare PRO marks in blocks of ten below a mark of 4.0, the percentages of difference for these comparisons are expected to be greater than for the comparisons of one-point incremental marks.

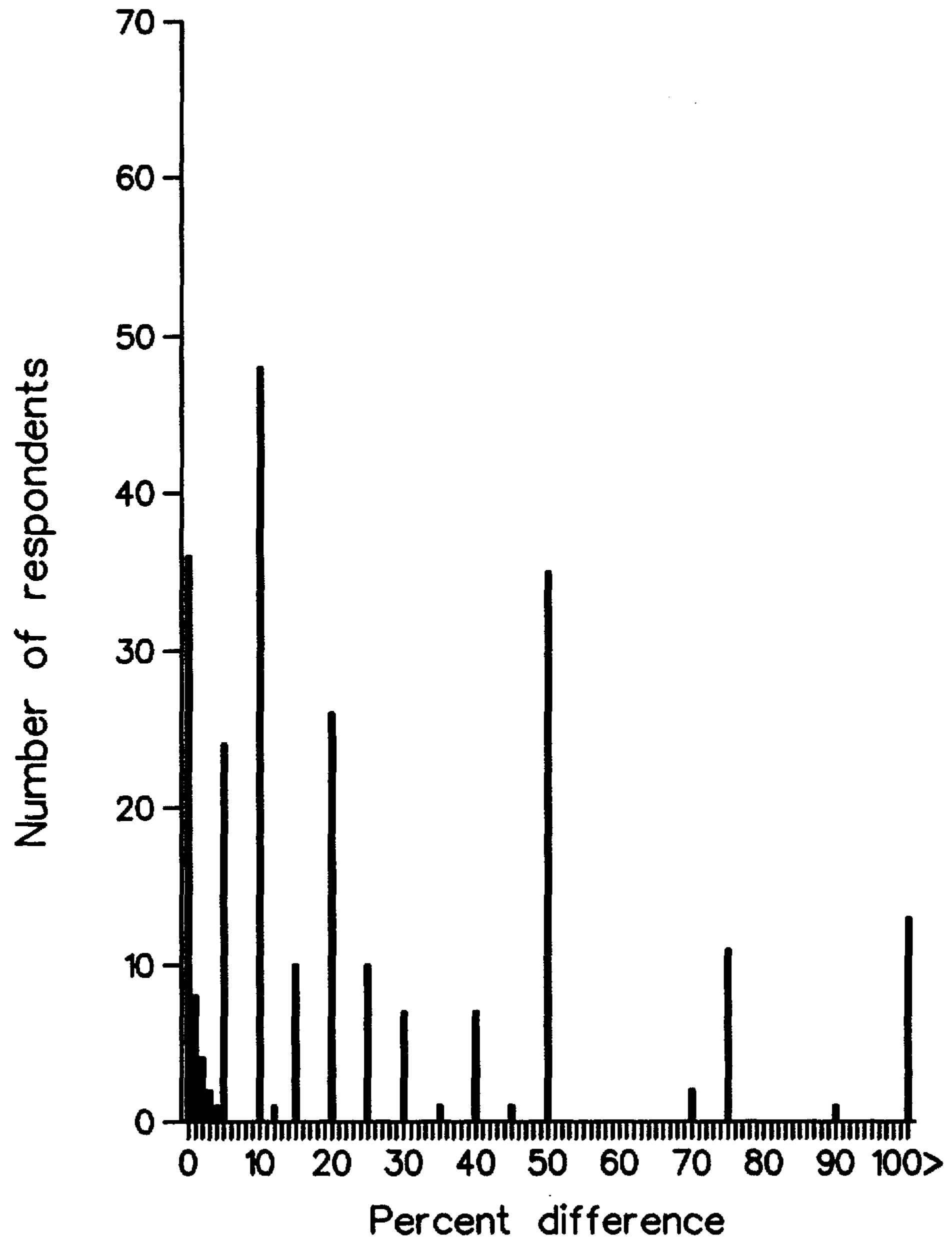

FIG 4: THE DISTRIBUTION OF RESPONSES FOR THE PERCENT DIFFERENCE BETWEEN PROFICIENCY MARKS OF 3.0–3.9 AND 4.0

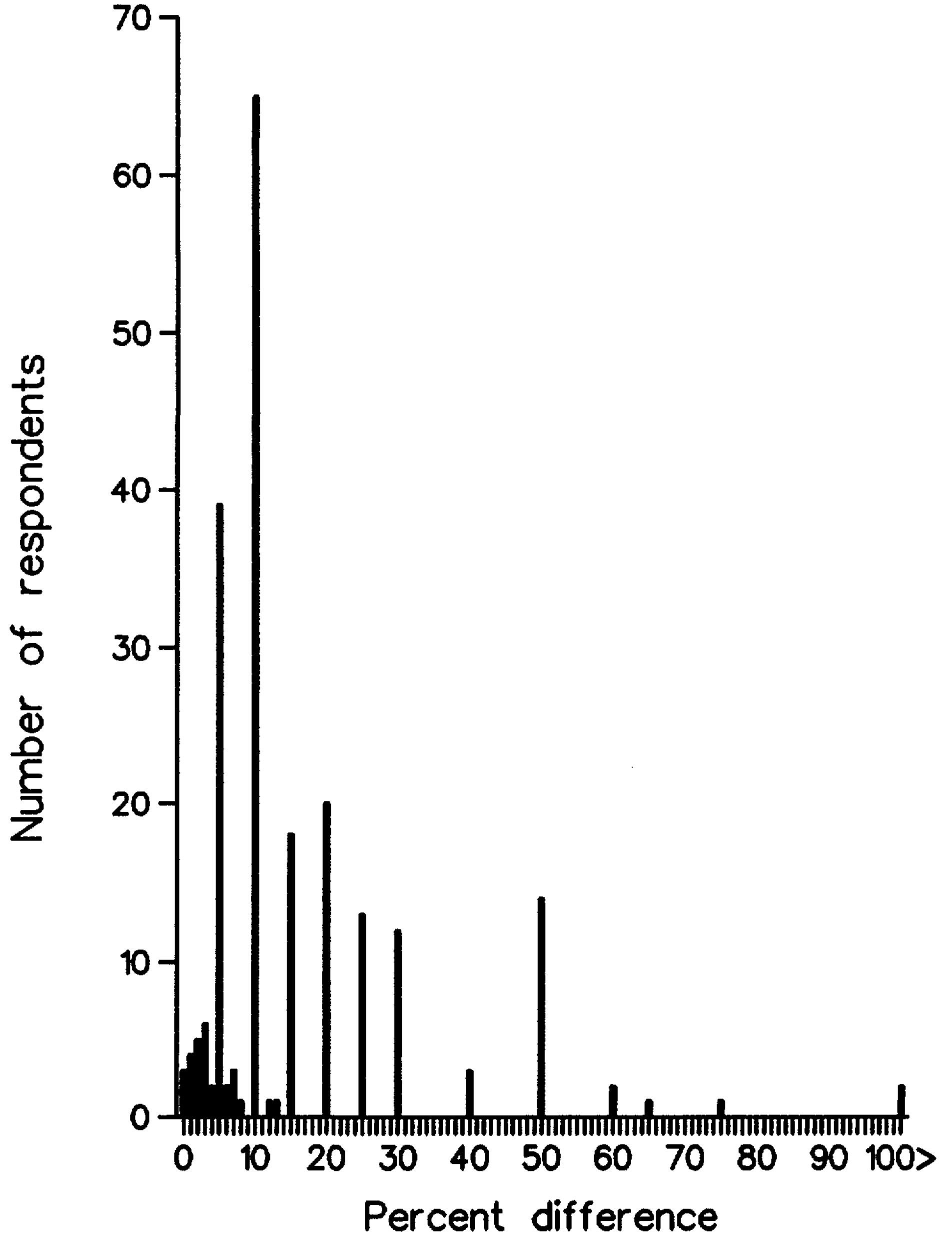

FIG 5: THE DISTRIBUTION OF RESPONSES FOR THE PERCENT DIFFERENCE BETWEEN PROFICIENCY MARKS OF 4.4 AND 4.5

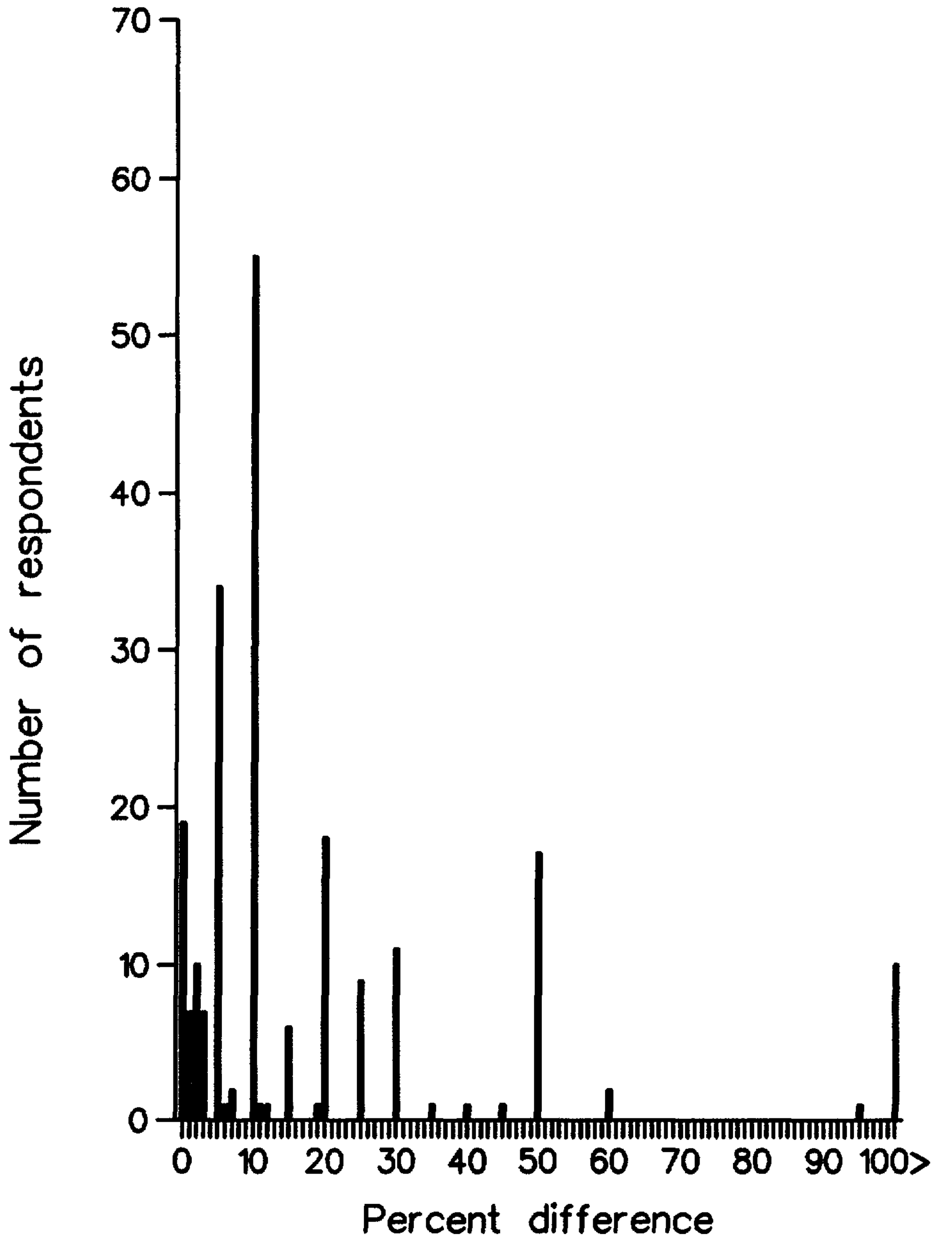

FIG 6: THE DISTRIBUTION OF RESPONSES FOR THE PERCENT DIFFERENCE BETWEEN PROFICIENCY MARKS OF 4.9 AND 5.0

Although there is significant dispersion in the responses, the number of outliers is relatively few. Most outliers occur for comparisons at the bottom and the very top of the marking scales. Since very few individuals receive these marks, the responses in these ranges have virtually no effect on the analysis. In addition, there is no evidence that the outliers result from abnormal conditions. Finally, wide dispersion of responses is expected because it is believed that marking practices vary widely among individuals. Therefore, there is no basis for excluding these observations from the analysis.

The data were analyzed to determine the extent and source of the variation between respondents' answers and thus to determine reliability. The dispersion in the data stems from two sources. First, some dispersion occurs because the difference between adjacent scores (items) varies over the range of the score scale. For example, on the PRO mark scale, the difference between a 5.0 mark and a 4.9 mark (item 1) most likely differs from the gap between a 4.9 and a 4.8 (item 2). Second, dispersion occurs because the survey respondents (the judges) mark differently.

Significant dispersion in the data is not necessarily a reflection of poor reliability. Since there is no reason to believe the score scales for PRO and FIT marks are linear, significant variation in responses across items is expected. The variation in responses among judges, however, may reflect unreliable data stemming from inconsistent marking. Although the responses of judges will vary because of individual differences in marking, the pattern of marking across judges should be basically the same. For example, if judge 1 assigns a relatively high percent to item 1 and a low percent to item 2, judge 2's response should have the same general pattern. Judge 2 may assign a much higher percent to both items 1 and 2, but his answers will be consistent with judge 1 if they follow the same pattern. If judge 2 assigns a relatively low percent to item 1 and a high percent to item 2, then his answers are inconsistent with answers of judge 1.

A reliability index was calculated for both the PRO and FIT data. The reliability of the data (R) is measured as

$$R = \frac{MS_b - MS_w}{MS_b} \tag{1}$$

where

MS_w = the within-groups mean square (which measures the variation in responses caused by differences across judges and differences across judges and items)

MS_b = the between-groups mean square (which measures the variation in responses because of differences in items).

The data is reliable if the within-groups mean square (the error) is small. If the within-groups mean square equaled zero, the reliability measure would be 1, indicating that there were no differences in the responses across judges on any of the items. Under this circumstance, the only variation in the data would be across items. Therefore, if the data is highly reliable, R will be close to 1. The reliability index for the PRO and FIT mark data is .82 and .87, respectively. Thus, the data is highly reliable in terms of the consistency of the answers across the survey respondents.

ANALYSIS OF THE SURVEY

To determine a translation scale, the responses of the individual officers were aggregated. Three alternative measures of central tendency–the mean, the mode, and the median–can be used to construct an average translation scale. Tables 3 and 4 give the mean, the median, and the modal response for each of the survey items.

Relative to the mean, the median and the mode both give less weight to outlying answers. Thus, the median or the mode are the preferred measures of central tendency in cases where outlying observations reflect bogus data. In this survey, however, outlying responses reflect the fact that some officers grade atypically. Since these officers give performance evaluations, their outlying personal marking scales should be reflected in the distributions of PRO and FIT. That is, the outlying responses should be given full consideration.

TABLE 3

TRANSLATION OF PROFICIENCY MARKS INTO RELATIVE-VALUE DIFFERENCES USING ALTERNATIVE MEASURES OF CENTRAL TENDENCIES

Proficiency mark		Percentage difference in relative value: Mean	Median	Mode
5.0				
	>	18.7	10	10
4.9				
	>	16.6	10	10
4.8				
	>	16.5	10	5
4.7				
	>	16.7	10	10
4.6				
	>	15.2	10	10
4.5				
	>	16.9	10	10
4.4				
	>	12.9	10	10
4.3				
	>	10.6	10	10
4.2				
	>	9.7	10	10
4.1				
	>	9.3	10	10
4.0				
	>	32.9	20	10
3.0-3.9				
	>	24.8	10	10
2.0-2.9				
	>	17.3	2	0
1.0-1.9				
	>	23.1	0	0
0.0-0.9				

TABLE 4

TRANSLATION OF FITNESS MARKS INTO RELATIVE-VALUE DIFFERENCES USING ALTERNATIVE MEASURES OF CENTRAL TENDENCIES

Fitness mark		Percentage difference in relative value		
		Mean	Median	Mode
OS				
	>	27.5	20	10
EX-OS				
	>	27.8	20	10
EX				
	>	29.5	20	20
AA-EX				
	>	21.5	20	10
AA				
	>	17.6	10	10
AV-AA				
	>	17.1	10	10
AV				
	>	22.5	10	10
BA-AV				
	>	16.2	5	0
BA				
	>	13.1	0	0
UN				

Both the median and the mode are also effected by the discrete nature of the responses. In general, the survey respondents gave answers in multiples of five (10, 15 or 20). The discrete nature of the responses makes the median, in particular, sensitive to small changes in the distribution of responses.

For these reasons, the mean is the best measure of central tendencies of the survey responses and is used in this analysis. The data were also analyzed using median-based translation scales and the results are presented as an alternative to the main analysis.

Table 5 gives the mean scale for translating PRO and FIT marks into relative measures of value to the service. The standard errors are given in parentheses.

The high reliability of the data and the low standard errors both suggest that the sample means are good estimates of the population means. In addition, as documented in appendix B, the data were categorized by the MOS of the respondents to determine whether the occupational field of the marker affects the response. Although the translation scale varies by MOS, the differences in the mean responses of officers from varying occupational fields are not statistically significant. Therefore, one translation scale can be used for all MOSs.

Using the translation scales given in table 5, the PRO and FIT marks were rescaled to reflect the magnitude of difference between scores. The rescaled PRO and FIT marks are relative-value marks because they measure performance in terms of the percentage of increase in relative value to the service. For the relative-value proficiency and fitness marks (RVPRO and RVFIT), a value of 1 is assigned to the lowest marks. The next highest mark is assigned the value that reflects the percentage of difference between the two scores. For example, in rescaling the FIT marks, a value of 1 was assigned to the grade of unsatisfactory (UN), 1.131 was assigned to below average (BA), and 1.314 (1.131 + .162*1.131) was assigned to below average to average (BA-AV). On the new scale, a below average to average (BA-AV) mark is interpreted as being 31.4 percent better than an unsatisfactory mark (UN) and 16.2 percent ((1.314-1.131)/1.131) better than a below average (BA) mark. The scales for RVPRO and RVFIT are given in table 6 and depicted graphically in figures 7 and 8. The PRO and FIT scales were

TABLE 5

MEAN SCALE FOR TRANSLATING PROFICIENCY AND FITNESS MARKS

(Standard errors are in parentheses)

Proficiency marks		Relative value	Fitness marks		Relative value
5.0			OS		
	>	18.7 (1.6)		>	27.5 (1.8)
4.9			EX-OS		
	>	16.6 (1.3)		>	27.8 (1.6)
4.8			EX		
	>	16.5 (1.2)		>	29.5 (2.7)
4.7			AA-EX		
	>	16.7 (1.7)		>	21.5 (1.2)
4.6			AA		
	>	15.2 (1.1)		>	17.6 (1.1)
4.5			AV-AA		
	>	16.9 (1.3)		>	17.1 (1.3)
4.4			AV		
	>	12.9 (0.9)		>	22.5 (2.1)
4.3			BA-AV		
	>	10.6 (0.7)		>	16.2 (3.2)
4.2			BA		
	>	9.7 (0.6)		>	13.1 (2.7)
4.1			UN		
	>	9.3 (0.7)			
4.0					
	>	32.9 (4.8)			
3.0-3.9					
	>	24.8 (2.3)			
2.0-2.9					
	>	17.3 (3.2)			
1.0-1.9					
	>	23.1 (7.4)			
0.0-0.9					

TABLE 6

TRANSLATION OF PERFORMANCE MARKS INTO RELATIVE-VALUE MARKS

PRO mark	RVPRO mark	FIT mark	RVFIT mark
5.0	9.087	OS	5.685
4.9	7.655	EX-OS	4.459
4.8	6.565	EX	3.489
4.7	5.635	AA-EX	2.694
4.6	4.829	AA	2.217
4.5	4.192	AV-AA	1.885
4.4	3.586	AV	1.610
4.3	3.176	BA-AV	1.314
4.2	2.872	BA	1.131
4.1	2.618	UN	1
4.0	2.395		
.			
.			
.			
3.5	1.802		
2.5	1.444		
1.5	1.231		
0.5	1		

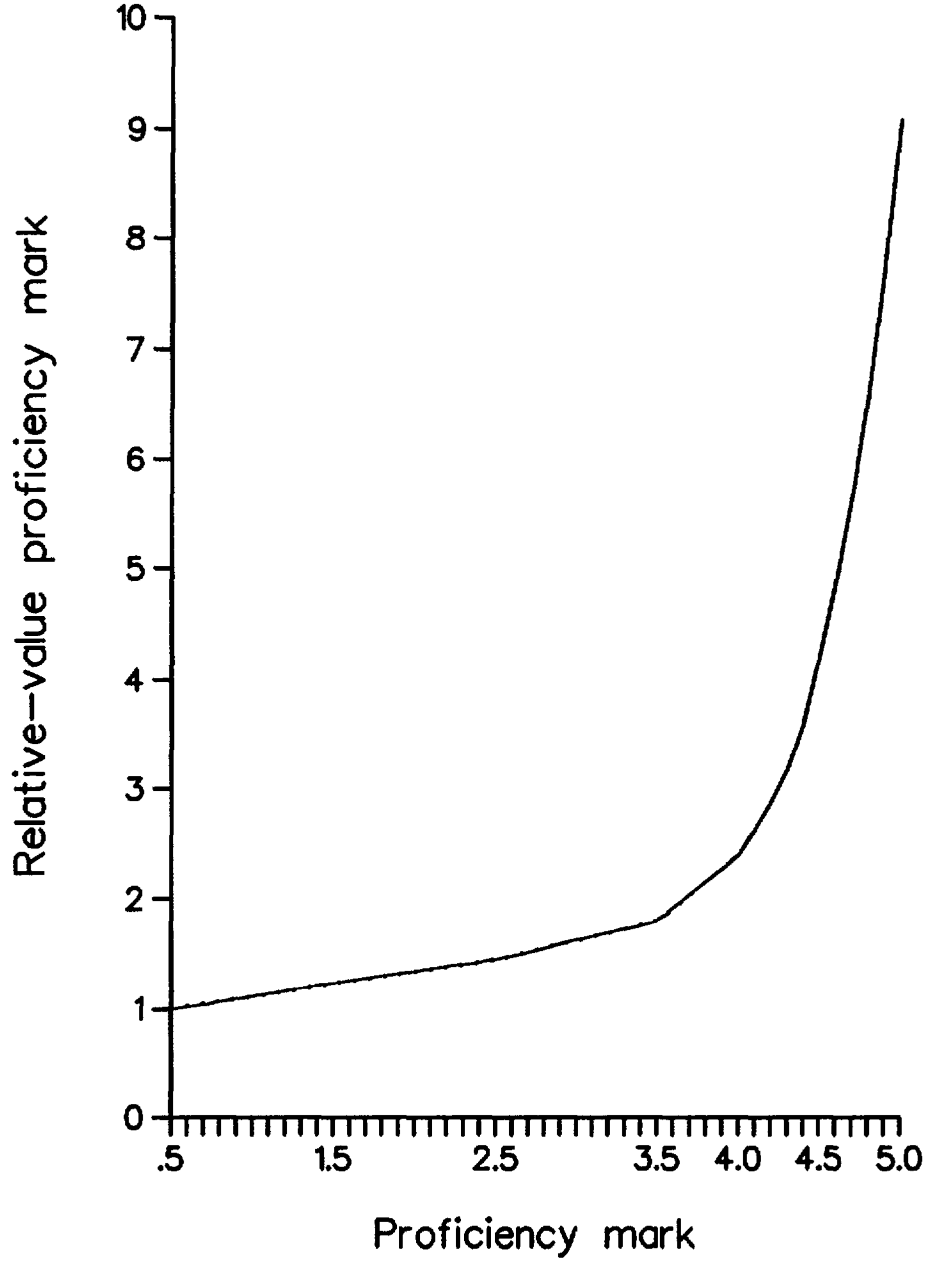

FIG 7: TRANSLATION BETWEEN PROFICIENCY AND RELATIVE-VALUE PROFICIENCY MARKS

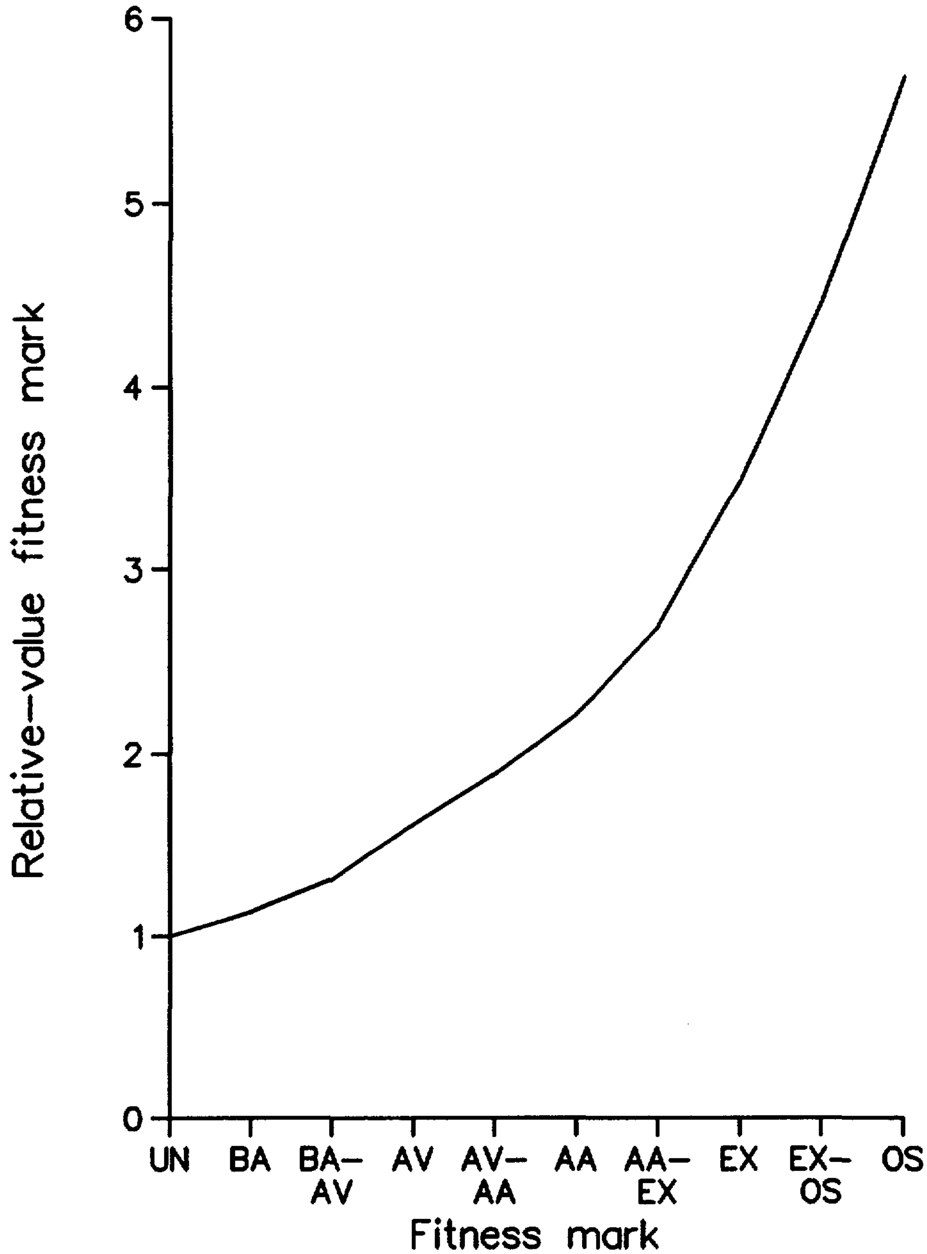

FIG 8: TRANSLATION BETWEEN FITNESS AND RELATIVE-VALUE FITNESS MARKS

also rescaled using the median response as the measure of central tendency; these are presented in appendix C.

The range of the relative-value scale for RVPRO marks shown in table 6 is very similar to the dispersion in productivity among civilian workers found by Schmidt and Hunter [1]. Approximately 5 percent of the Marines who reported for their first tour of duty in FY 1981 got PRO marks of 4.7 to 5.0, which equal RVPRO marks of 5.635 to 9.087. A little more than 5 percent received PRO marks of 3.8 or below, which equal RVPRO marks of 2.158 or below. The relative-value scale (table 6) reveals that Marines in the top 5th percentile are approximately 161 percent more valuable than Marines in the bottom 5th percentile. This result is similar to the 120-percent difference found for civilian workers in [1], as shown in table 7. In addition, the mean RVPRO mark for all new entrants in FY 1981 is 4.10, with a standard deviation of 1.20. A Marine receiving an RVPRO mark one standard deviation above (or below) the mean is approximately 29 percent better (or worse) than the average. Thus, the standard deviation of the mean RVPRO mark equals about 29 percent of the mean performance level. This variation in output is also very similar to the estimate by Schmidt and Hunter of a 20-percent standard deviation of mean output, an estimate they believe to be conservative.

The comparison also holds true for RVFIT marks. The distribution of FIT marks is skewed toward the top of the scale. Of E-5s and E-6s who reenlisted between FY 1980 and FY 1982, over 90 percent received FIT marks ranging from AA-EX to OS. Twenty-eight percent of the Marines received the top mark, OS, which equals an RVFIT mark of 5.685. Interpolating the marks, the top 5 percent received an RVFIT mark of 5.466 or above. The bottom 5 percent received a mark of AA or below, which equals an RVFIT mark of 2.217 or below. The relative-value scale shows that individuals in the top 5th percentile perform 147 percent better than individuals in the bottom 5th percentile. The average RVFIT mark is 4.31, with a standard deviation of 1.10. Thus, the standard deviation of the mean RVFIT mark is approximately 26 percent of the mean performance level.

TABLE 7

THE DISPERSION OF PERFORMANCE AMONG MARINE CORPS ENLISTED PERSONNEL COMPARED TO CIVILIANS

Measure	Difference in relative value (in percent)[a]			
	Difference between top 5th and bottom 5th percentiles		Estimated standard deviation of the mean performance	
	Marines	Civilian results[b]	Marines	Civilian results[b]
Proficiency marks	161	120	29	$\geq$20
Fitness marks	147	120	26	$\geq$20

[a]The civilian results reflect performance differences within given occupations whereas the results for Marines reflect performance differences across all Marine occupations. Thus, the estimates for Marines are expected to be greater.

[b]See [1].

APPLICATION OF THE TRANSLATION SCALE

The scales provided in table 6 translate proficiency and fitness marks into cardinal measures of job performance. With the use of cardinal measures of performance, the magnitude of the performance difference between HSGs and NHSGs can be determined.

The mean RVPRO and RVFIT marks were calculated for HSGs and for NHSGs. For the proficiency marks, the population of individuals who reported for their first tour of duty in the Marine Corps in FY 1981 was used. Each individual's PRO mark was translated into the equivalent relative-value proficiency mark, and the mean RVPRO scores were determined for graduates and nongraduates. Mean RVFIT marks were determined from a sample of E-5s and E-6s who reenlisted between FY 1980 and FY 1982. Each individual's FIT mark was translated into the equivalent relative-value fitness mark and the mean RVFIT marks were determined for HSGs and NHSGs.

As shown in table 8, the mean RVPRO mark for HSGs is 4.27; for NHSGs it is 3.54, significantly lower. The mean RVFIT marks for HSGs and NHSGs are 4.32 and 4.27, respectively. These results indicate that, for junior personnel in their first term, HSGs perform 20.6 percent better than NHSGs. The 95-percent confidence interval for the RVPRO performance difference ranges from 19.7 to 21.5 percent. For senior enlisted personnel, HSGs perform 1.2 percent better than NHSGs; the 95-percent confidence interval ranges from -0.2 to 2.5 percent. As expected, smaller performance differences are estimated if the median-based translation scale is used, as shown in appendix D. However, because these calculations do not control for the differences in marking that exist across MOSs, they result in a biased estimate of the difference between graduates and nongraduates.

Given two individuals with the same educational background and aptitudes, one may receive a high mark in one MOS, whereas the other may receive a much lower mark in another MOS. There are two possible reasons why marking varies among MOSs. One is that the tasks people are being asked to do vary significantly among fields. A high school degree or high aptitudes may dramatically increase performance in some MOSs but have little effect on performance in others. Under these circumstances,

TABLE 8

SAMPLE RVPRO AND RVFIT MEANS FOR HSGs AND NHSGs

		RVPRO	
Education	Mean	Standard deviation	Sample size
HSG	4.27	1.18	22,438
NHSG	3.54	1.11	6,609
		RVFIT	
Education	Mean	Standard deviation	Sample size
HSG	4.32	1.09	7,782
NHSG	4.27	1.12	1,812

the variation in the marks of cohorts across MOSs reflects true differences in performance rather than biased marking, and comparison of the mean scores of HSGs and NHSGs will give an estimate of the true performance gap. However, the second and more likely reason for the variation in marks across MOSs is that marking scales are different. In this case, the RVPRO and RVFIT scales are valid for comparisons within an MOS, but comparisons cannot be made across MOSs. Aggregating marks across MOSs is not valid because the grading scales are not the same. In determining the average score difference between HSGs and NHSGs, the possibility of inconsistency in the grade distributions among MOSs must be accounted for.

Regression analysis was used to determine the effect a high school diploma has on an individual's performance mark while controlling for the occupational field. Several models were tested to determine the relationship between MOS and performance marks. A general linear function was used to determine the relationship between performance marks and MOS category as follows:

$$
\begin{aligned}
PMARK &= \gamma_0 + \gamma_1 EDUC + \gamma_2 AFQT + \gamma_3 AFQT * EDUC \\
&\quad + \sum_{i=4}^{32} \gamma_i MOSC_i + \sum_{i=33}^{61} \gamma_i MOSC_i * EDUC \\
&\quad + \sum_{i=62}^{90} \gamma_i MOSC_i * AFQT \qquad (2)
\end{aligned}
$$

where

PMARK = the performance mark (RVPRO or RVFIT)

EDUC = a dummy variable for a high school diploma (1 if the individual has a high school diploma; 0 if the individual does not have a high school diploma)

AFQT = the percentile score on the Armed Forces Qualifications Test

$MOSC_i$ = a set of 29 dummy variables for MOS category, which is defined by the first two digits of the individual's MOSs (1 if the individual's MOS is in that occupational field; 0 otherwise).

Evaluation of this general model revealed that AFQT and MOS category affect the constant term for both the RVPRO and RVFIT regressions. The F tests to determine whether AFQT and the set of MOSC dummies add to the explanatory power of the regression are significant for both RVFIT and RVPRO marks, as shown in appendix E. The significance of MOS category implies that individuals with the same educational level and AFQT score will receive different performance marks in different occupational fields. The shift term, EDUC, is significant for RVPRO marks but not for RVFIT marks. Thus, education has a direct effect on RVPRO but not on RVFIT marks. In contrast, the interaction term for AFQT and EDUC is significant for both RVPRO and RVFIT marks, indicating that the effect of education on performance marks varies with ability level. The interaction terms for MOSC and EDUC add to the explanatory power of the regression for RVPRO marks but not for RVFIT marks. Since the set of interaction terms is significant for proficiency marks, the effect of educational level on RVPRO marks varies by occupational field. In contrast, the effect of educational level on RVFIT marks is the same across MOS categories because the set of interaction terms proves to be insignificant. The interaction terms for MOSC and AFQT also add to the explanatory power of the regression for RVPRO marks but not for RVFIT marks. The interpretation of this result is that AFQT affects RVPRO marks differently across occupational fields but has the same effect on RVFIT marks across fields.

Using the results of the F tests on the general model (equation 2) as a guide, regression models were developed to approximate the relationship between RVFIT and RVPRO and education. The regression model for RVFIT marks is as follows:

$$RVFIT = \alpha_0 + \alpha_1 AFQT + \alpha_2 AFQT * EDUC + \sum_{i=3}^{31} \alpha_i MOSC_i \ , \qquad (3)$$

where

RVFIT = the individual's rescaled relative-value fitness mark.

Because the effect of education and ability are the same across MOSs for RVFIT marks, a single-regression that contains one set of dummy variables to control for the MOS effect on marks can be used without causing severe multicolinearity problems. The problem of multicolinearity that does arise is offset by the advantages of estimating a single equation. The sample size for the single equation is very large, and both HSGs and NHSGs are well represented. The model is also estimated using the median translation scale, which yields generally similar results, as shown in appendix F. As an alternative to the single-equation approach, a regression model is estimated separately for each MOS category. The resulting estimates are basically the same; these are presented in appendix G.

Choosing a regression model for RVPRO marks is more complicated because the effects of education and ability on proficiency marks vary across MOSs. If a single equation is used a large number of dummy variables should be included in the model, since MOS category interacts with both ability and education. However, inclusion of three sets of dummy variables results in severe multicolinearity problems. Thus, the model is estimated without the interaction terms between MOSC and EDUC and AFQT, as follows:

$$
\begin{aligned}
RVPRO &= \beta_0 + \beta_1 EDUC + \beta_2 AFQT + \beta_3 AFQT * EDUC \\
&\quad + \sum_{i=4}^{32} \beta_i MOSC_i \ , \qquad (4)
\end{aligned}
$$

where

RVPRO = the individual's rescaled relative-value proficiency mark.

The model was also estimated using the median translation scale, which yields similar results (see appendix F). Leaving out the interaction terms forces the effect of education and AFQT on PRO marks to be the same across MOSs. The full model with all the interaction terms was also estimated and the results are very similar (see appendix G).

An alternative way of dealing with the problem of multicolinearity is to estimate a separate regression for each MOS category, instead of using dummy variables to control for the effect of occupation. The main disadvantage to this approach is that the sample for each MOS category is small and generally includes only a handful of NHSGs. However, in this case, the small sample problem may be less severe than the multicolinearity problem that arises in the single-equation approach. Thus, a regression model was estimated separately for each MOS category; the results were highly similar and are presented in appendix G.

The parameter estimates for the RVFIT marks are reported in table 9. The correlation matrix is given in appendix H. The base case is a NHSG

TABLE 9

THE REGRESSION PARAMETER ESTIMATES FOR RVFIT MARKS

Variable	Parameters	Variable	Parameters
Constant	4.21*	40XX	-0.28**
AFQT	0.003*	44XX	0.20
AFQT*EDUC	0.0009**	55XX	-0.15
MOSC:		58XX	-0.29**
01XX	0.03	59XX	-0.23
03XX	-0.11	60XX	-0.20
04XX	-0.03	61XX	-0.14
08XX	-0.05	63XX	-0.18
11XX	-0.17	64XX	-0.15
13XX	-0.16	65XX	-0.23
18XX	-0.07	70XX	-0.11
21XX	-0.12		
23XX	-0.13		
25XX	-0.20		
26XX	-0.21		
28XX	-0.18		
30XX	-0.08		
31XX	-0.03		
33XX	-0.44*		
34XX	-0.21		
35XX	-0.22		

$\overline{R}^2 = 0.01$

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

in the 7300 occupational field. The parameter estimates in table 9 represent deviations from the base case. Entries that are significant at the 95 and 90 percent levels are indicated. The inclusion of the interaction term AFQT*EDUC in the RVFIT mark regression causes some multicolinearity problems. In addition, some of the dummy MOS category variables are highly correlated with AFQT and EDUC. The variances of some of the MOS parameter estimates are very large. The estimated MOS coefficients generally do not prove to be significant because of their imprecision.

The estimates of the parameters for the RVPRO regressions are given in table 10. The correlation matrix is given in appendix H. Most of the coefficients prove to be significant. Entries that are significant at the 95 and 90 percent levels are noted.

In order to compare the percentage of difference in performance of HSGs and NHSGs, the percentage of improvement in the marks of HSGs relative to the marks of NHSGs must be calculated. Since performance marks vary across MOSs, it is impossible to estimate the average aggregate percentage of performance difference between HSGs and NHSGs. The different marking scales make it inappropriate to aggregate across MOSs. That is, because of the variation in the marks of HSGs and NHSGs across MOSs, it is impossible to determine the percentage of performance difference separate from MOS category. Since the average percentage of performance difference in the Marine Corps as a whole between HSGs and NHSGs (the desired measure) cannot be calculated, the average percentage of performance difference within MOSs is used as a proxy for the overall difference in performance.

The proxy measure for average percentage of performance difference is calculated by taking a weighted average of the regression coefficients for all MOS categories. The average marks of HSGs and NHSGs were calculated and compared to determine the average difference in performance within MOSs (the proxy measure).

The proxy measure of the HSG-NHSG performance gap differs from the average performance gap in general (the desired measure) in that the proxy measure gives the average intra-MOS difference and does not account for inter-MOS performance differences. Only under the special condition that the proportion of graduates and nongraduates is constant for all MOSs

TABLE 10

THE REGRESSION PARAMETER ESTIMATES FOR RVPRO MARKS

Variable	Parameters	Variable	Parameters
Constant	3.97*	40XX	0.02
AFQT	0.005*	44XX	0.54*
EDUC	0.296*	46XX	-0.22
AFQT*EDUC	0.005*	55XX	-0.61*
MOSC:		58XX	-0.14
01XX	0.16	59XX	-0.21**
02XX	0.57*	60XX	0.24*
03XX	-0.98*	61XX	-0.14
04XX	-0.23*	63XX	-0.07
08XX	-1.13*	64XX	0.21**
11XX	-0.27*	65XX	-0.08
13XX	-0.63*	68XX	-0.27
14XX	-0.72*	70XX	-0.11
15XX	-0.44*	72XX	-0.57*
18XX	-0.76*		
21XX	-0.42*		
23XX	-0.15		
25XX	-0.53*		
26XX	-0.19		
28XX	-0.24*		
30XX	-0.08		
31XX	-0.57*		
33XX	-0.56*		
34XX	-0.10		
35XX	-0.61*		

$\overline{R}^2 = 0.23$

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

would the average HSG-NHSG performance gap in general (the desired measure) be equal to the average gap within an MOS (the proxy measure). Since the proportion of graduates to nongraduates varies among MOSs, the average performance gap within MOSs (the proxy measure) is not the same as the average performance gap in general (the desired measure).

The calculation of the average percentage of performance difference between HSGs and NHSGs within MOSs (the proxy measure) is relatively straightfoward for RVFIT marks. The coefficients on $MOSC_i$ were each weighted by the number of individuals in the MOS (given in table G-3 in appendix G) which yielded an average coefficient of -.141. The weighted average of the coefficients on $MOSC_i$ measures the average effect of MOS category on relative-value proficiency marks. The average relationship between RVFIT marks and the explanatory variables is, therefore,

$$RVFIT = 4.21 + .003AFQT + .0009AFQT * EDUC - .141 \ . \quad (5)$$

Although graduates do better than nongraduates, the analysis of the fitness marks does not support the contention that there is a large performance gap between senior HSGs and NHSGs. Education appears to be a good predictor of a recruit's level of commitment. At the end of the first term, individuals who are not committed to performing satisfactorily as a Marine generally leave. Because individuals in their second term are generally committed to doing a good job, education is not a good predictor of performance.

As depicted in figure 9, the difference in relative-value marks between HSGs and NHSGs of equal ability ranges from .019 for an individual with an AFQT percentile of 21 to .090 for an individual in the top AFQT percentile. Thus, the percentage difference in performance between HSGs and NHSGs ranges from 0.5 percent (for the 21st AFQT percentile) to 2.1 percent (for the top AFQT percentile). Figure 10 shows how the percentage performance difference between HSGs and NHSGs varies across the AFQT percentiles.

In addition to comparing performance between education groups, equation 5 can be used to compare individuals with different ability levels within the same education group. Senior HSGs in ability category I (93rd AFQT

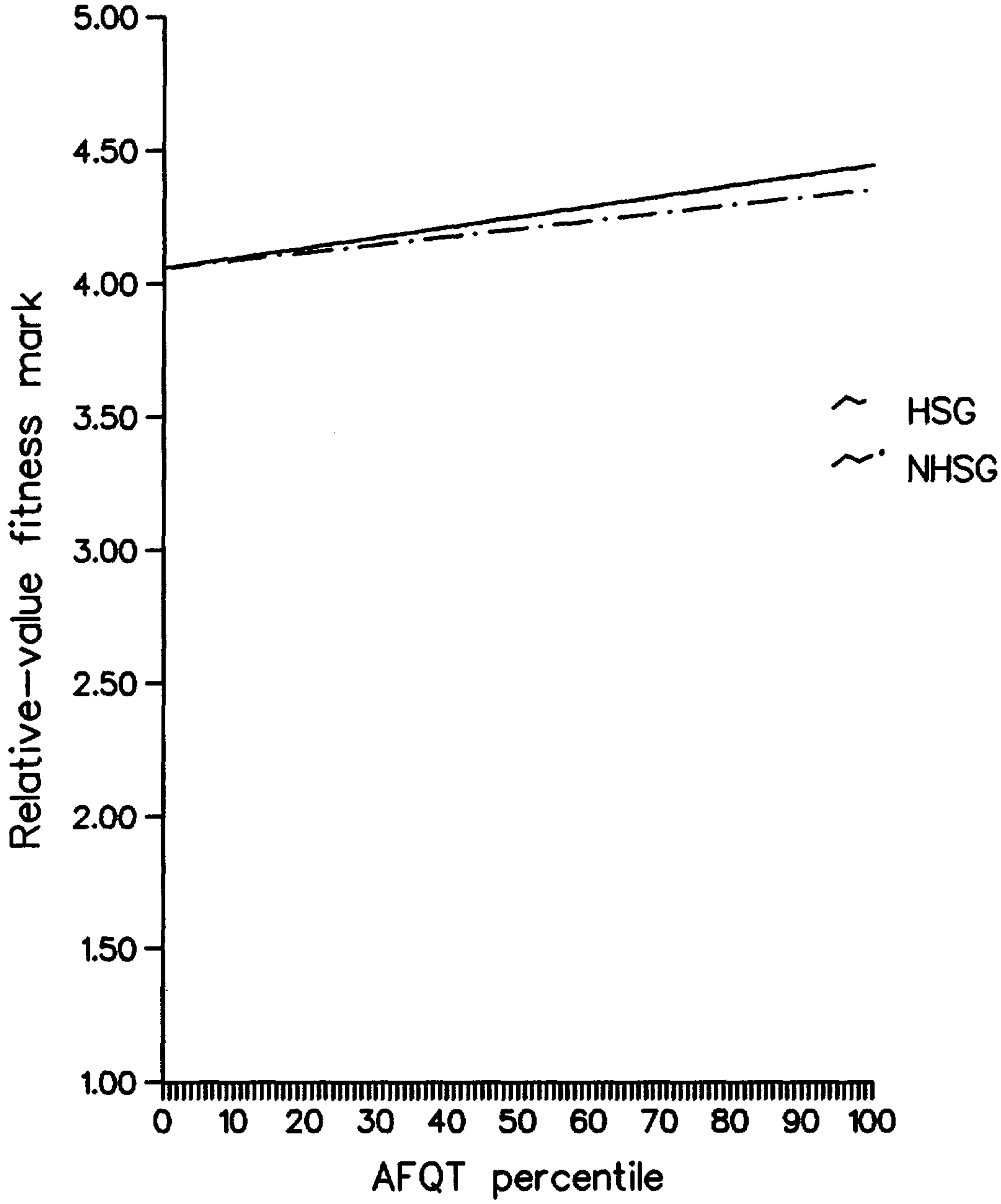

FIG 9: RELATIVE-VALUE FITNESS MARK BY EDUCATIONAL LEVEL AND AFQT PERCENTILE

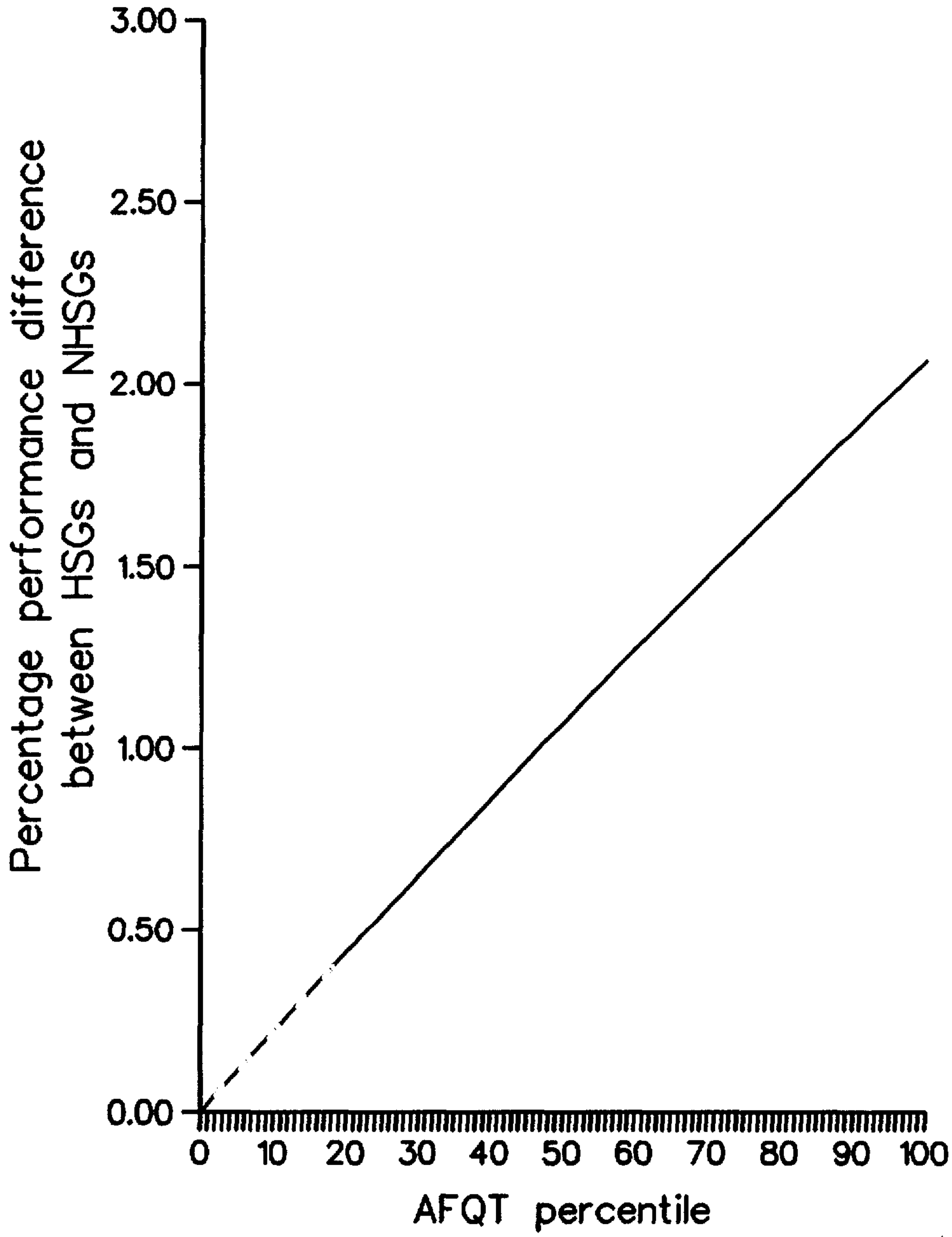

FIG 10: PERCENTAGE PERFORMANCE DIFFERENCE BETWEEN HSGs AND NHSGs USING RELATIVE-VALUE FITNESS MARKS

percentile) do 6.8 percent better than HSGs in category IVa (21st AFQT percentile). Similarly, senior NHSGs in ability category I do 5.0 percent better than NHSGs in category IVa.

The average RVPRO marks of HSGs and NHSGs were compared using the same approach that was used to compare RVFIT marks. The coefficients from each individual MOS category were weighted by the number of individuals in the MOS (given in table G-2). The weighted average of the regression coefficients measures the average relationship between EDUC and AFQT and RVPRO marks for all MOS categories. The average relationship between RVPRO marks and the explanatory variables is as follows:

$$\begin{aligned} RVPRO &= 3.97 + .296EDUC + .005AFQT \\ &\quad +.005AFQT * EDUC - .208 \ . \end{aligned} \tag{6}$$

The average performance gap within an MOS between first-term HSGs and NHSGs is large. As figure 11 shows, the difference in relative-value proficiency marks ranges from .401 for HSGs in the 21st AFQT percentile to .796 for HSGs in the top AFQT percentile. The range of marks for NHSGs is lower. From the information given in figure 11, it was calculated that HSGs perform from 10.4 to 18.7 percent better than NHSGs with equal ability, as shown in figure 12.

Using equation 6 to compare individuals with different ability levels within the same education group, it was found that junior HSGs in ability category I (93rd AFQT percentile) do 16.9 percent better than HSGs in category IVa (21st AFQT percentile). The difference for NHSGs is much smaller. Junior NHSGs in ability category I do 9.0 percent better than NHSGs in category IVa.

In addition to out-performing NHSGs with equal ability, HSGs also have a higher average mental aptitude level than NHSGs. The observed performance difference between HSGs and NHSGs is ultimately determined by differences in both educational level and ability. The performance difference between the typical HSG and the typical NHSG is calculated by using the sample means as an estimate for average AFQT for HSGs and NHSGs. Table 11 gives the sample means for AFQT.

Allowing for the difference in ability between graduates and nongraduates, the average HSG scores .55 points higher (4.54 - 3.99 = .55) than the

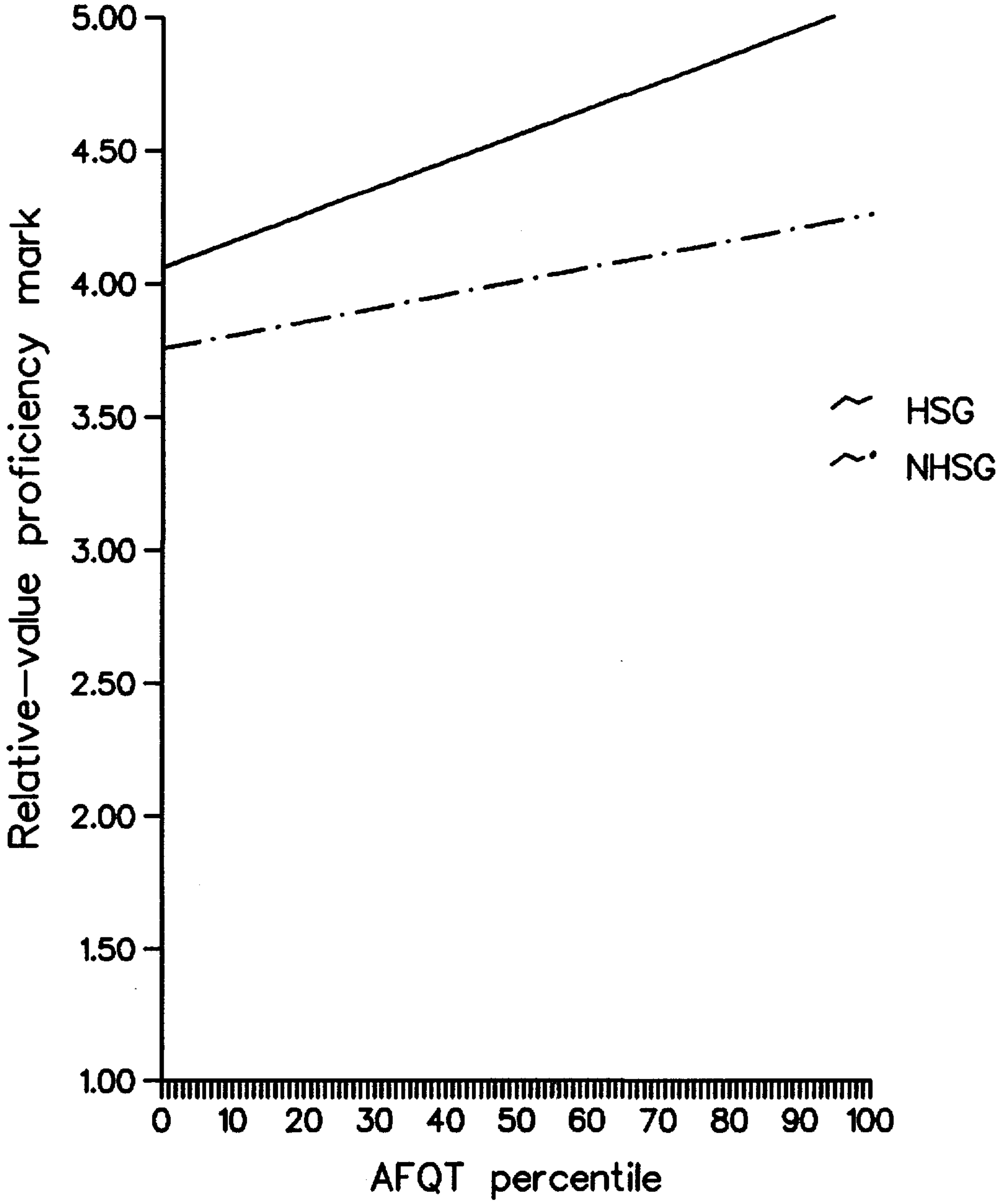

FIG 11: RELATIVE-VALUE PROFICIENCY MARK BY EDUCATIONAL LEVEL AND AFQT PERCENTILE

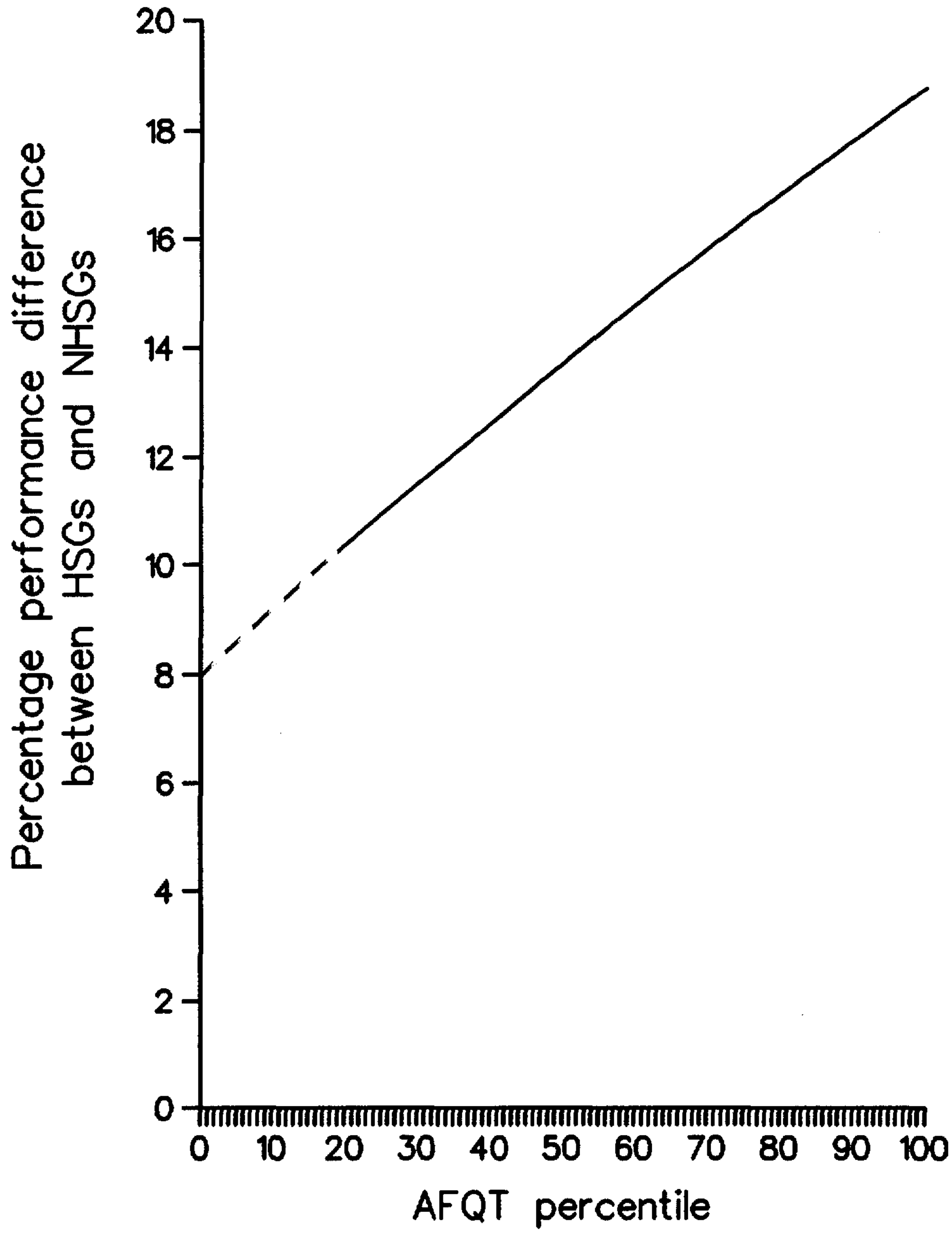

FIG 12: PERCENTAGE PERFORMANCE DIFFERENCE BETWEEN HSGs AND NHSGs USING RELATIVE-VALUE PROFICIENCY MARKS

TABLE 11

SAMPLE MEANS AND STANDARD ERRORS FOR AFQT

Sample	Education level	Mean	Standard error
RVPRO	HSG	48.0	0.15
	NHSG	45.2	0.25
RVFIT	HSG	56.7	0.44
	NHSG	54.1	0.25

average NHSG in RVPRO marks. Thus, first-term HSGs perform 13.8 percent better than NHSGs. The average HSG receives a RVFIT mark of 4.29, whereas the average NHSG receives a RVFIT mark of 4.23. Thus, HSGs perform 1.4 percent better than the average NHSG in terms of RVFIT marks.

CONCLUSION

Analysis of the performance-evaluation system confirms that there is significant variation in job performance across personnel categories. The magnitude of the performance difference between adjacent fitness and proficiency marks is significant. Thus, given the distribution of marks, the evidence supports the conclusion that there are significant differences in performance across personnel categories.

Both the fitness mark and proficiency mark scoring systems support the conclusion that HSGs perform better than NHSGs on the job. The performance gap is very large for first-term personnel. Depending on ability level, first-term HSGs perform from 10.4 to 18.7 percent better than NHSGs with equal ability. Accounting for the fact that HSGs have higher AFQT scores, it was calculated that HSGs perform 13.8 percent better than NHSGs in general. Although senior HSGs out-perform NHSGs, the performance gap is relatively small. Depending on ability level, senior HSGs perform from 0.5 to 2.1 percent better than NHSGs of equal ability. Accounting for the difference in average AFQT scores, it was calculated that senior HSGs perform 1.4 percent better than NHSGs in general.

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APPENDIX A
THE QUESTIONNAIRE

ASSESSMENT OF THE "VALUE" OF MANPOWER QUALITY

HQMC is conducting research to develop a methodology for establishing Marine Corps manpower quality requirements. Quality is represented by such categories as education credentials (HSG, NHSG, GED, etc.) and mental group (MG I thru V). At the present time, none of the Services use a DoD-recognized or accepted analytic procedure for determining these requirements. The current Marine Corps study effort is being performed by the Marine Corps Operations Analysis Group (MCOAG) of the Center for Naval Analyses (CNA). It involves use of the principles of economic analysis, including identification and measurement of the costs and benefits associated with accessing, training, and retaining differing quality Marines. In order to more appropriately assess the RELATIVE VALUE to the Marine Corps of different quality Marines, MCOAG requires assistance in the form of the professional judgment of Marine leaders.

Although proficiency and fitness report marks provide a RANK ORDER of performance, they do not provide an indication of HOW MUCH better the performance actually is. That is, a commanding officer knows that a "4.6 Marine" is more valuable to the Marine Corps than a "4.2 Marine," but "how much more?" is not known. Since no universally acceptable substitute for performance (i.e., rifle range or PFT score) exists against which to measure and quantify the "general value to the Marine Corps" of different quality Marines, it is hoped that the professional judgment of Marine Corps leaders can be used to quantify the MAGNITUDE of this difference by considering the current performance evaluation systems. These estimates will be combined with those of all Marine leaders completing the form to produce an overall AGGREGATE table for translating performance evaluation marks into ESTIMATES OF RELATIVE VALUE to the Marine Corps.

Given the current political climate and the obvious Congressional interest in the DoD and Marine Corps budgets (active duty manpower represents 58% of the total USMC budget), development of an analytically sound methodology for projecting Marine Corps manpower quality requirements is of top priority. While many factors will go into the final choice of a proficiency or a fitness report mark given to an individual Marine, the interest in this assessment is how much more value to the Marine Corps does this mark represent compared to the mark on the grading scale just below it. Although certainly difficult, the judgmental effort requested in support of this research deserves your best shot.

Fill in the two tables below with the percent (%) that best reflects your estimate of the difference between adjacent scores. Proficiency marks are shown in the standard 5-point scale. Fitness report marks are shown for the "general value to the service" category. In between each pair of marks (going up the scale), write your estimate of the percent increase in VALUE TO THE MARINE CORPS between Marines receiving these marks. Estimates should represent your opinion of the incremental increase (%) over the next lower mark, and should be made independent of grade and MOS (i.e., consider that grade and MOS are identical in making your assessment of Marines being marked on the scoring system).

If, for example, in your experience, Marines to whom you historically have given proficiency marks of 4.5 are "worth 'X'% more to the Marine Corps" than those to whom you have given a mark of 4.4, then you should enter 'X' in the blank between 4.4 and 4.5. Or, if a Marine accomplishes twice as much as another, then the former is worth 100% more to the Marine Corps. Please complete all 23 blanks, and indicate the percent for each incremental increase that best reflects YOUR PERSONAL SCORING SYSTEM (note that the sum of your responses in each column DOES NOT have to total 100%):

PROFICIENCY MARKS

Scale	Percent Increase in "Value to the USMC"
5.0	
	)------------------
4.9	
	)------------------
4.8	
	)------------------
4.7	
	)------------------
4.6	
	)------------------
4.5	
	)------------------
4.4	
	)------------------
4.3	
	)------------------
4.2	
	)------------------
4.1	
	)------------------
4.0	
	)------------------
3.0 - 3.9	
	)------------------
2.0 - 2.9	
	)------------------
1.0 - 1.9	
	)------------------
0.0 - 0.9	

FITNESS REPORT MARKS

Scale	Percent Increase in "Value to the USMC"
OS	
	)------------------
EX - OS	
	)------------------
EX	
	)------------------
AA - EX	
	)------------------
AA	
	)------------------
AV - AA	
	)------------------
AV	
	)------------------
BA - AV	
	)------------------
BA	
	)------------------
UN	

Your MOS___________

APPENDIX B
THE MEAN TRANSLATION SCALE FOR PRO AND FIT MARKS BY MOS CATEGORY

The data were divided according to the military occupational specialty (MOS) category of the respondent to determine if the translation scale systematically varies by MOS. The respondents were grouped into five broad MOS categories:

Combat	= occupational fields 3, 8, and 18
Combat Support	= occupational fields 2, 13, 25, 26, 35, and 57
Technical	= occupational fields 28, 40, 59, 63, 64, 66, 72, and 73
Service and Administration	= occupational fields 1, 4, 11, 14, 15, 21, 23, 30, 31, 33, 34, 41, 43, 44, 46, 55, and 58
Aviation	= occupational fields 60, 61, 65, 68, 70, and 75.

Tables B-1 and B-2 give the PRO and FIT mark translation scales for each MOS category. Comparison of the scales using analysis of variance (ANOVA) revealed that the differences in the mean responses of the officers surveyed are not statistically significant. For all but two of the entries on the grade scale, the null hypothesis that the five mean responses of officers are the same across MOSs was found valid at the 95 percent confidence level. Pair comparisons of the means also confirmed the null hypothesis that the responses do not differ by MOS. The entries for which the null hypothesis was rejected are the comparisons of 4.0 to 3.0-3.9 on the PRO mark scale and BA to BA-AV on the FIT mark scale. However, the evidence overall supports the contention that the translation scale does not differ across MOS categories.

TABLE B-1

MEAN SCALE FOR TRANSLATING PROFICIENCY MARKS BY MOS CATEGORY

Proficiency marks		MOS Category				
		Combat	Com. Sup.	Tech.	Ser./Admin.	Aviation
5.0						
	>	19.9	12.5	12.1	18.3	21.8
4.9						
	>	16.5	12.9	15.1	18.4	18.6
4.8						
	>	16.7	13.3	17.7	17.8	16.0
4.7						
	>	17.9	15.7	16.2	14.7	16.2
4.6						
	>	14.1	12.3	14.6	13.7	18.9
4.5						
	>	17.9	15.4	21.9	16.5	16.0
4.4						
	>	12.7	11.9	16.4	13.2	13.0
4.3						
	>	10.0	9.4	9.1	13.7	11.0
4.2						
	>	9.8	8.5	7.4	10.9	9.9
4.1						
	>	8.7	11.6	5.9	10.2	9.2
4.0						
	>	28.1	24.2	87.6	30.9	23.1
3.0-3.9						
	>	28.2	17.1	28.7	15.2	23.7
2.0-2.9						
	>	18.7	9.8	21.8	11.9	18.2
1.0-1.9						
	>	30.4	8.1	46.6	12.6	15.8
0.0-0.9						

TABLE B-2

MEAN SCALE FOR TRANSLATING FITNESS MARKS BY MOS CATEGORY

Fitness marks		MOS Category				
		Combat	Com. Sup.	Tech.	Ser./Admin.	Aviation
OS						
	>	26.6	25.5	29.7	27.3	31.5
EX-OS						
	>	27.3	23.5	31.9	26.7	30.7
EX						
	>	30.4	25.7	37.1	26.8	29.6
AA-EX						
	>	21.0	20.5	18.1	21.4	22.3
AA						
	>	15.5	13.7	18.3	19.8	22.0
AV-AA						
	>	15.2	15.9	14.6	21.0	18.3
AV						
	>	20.9	19.0	30.6	23.9	22.6
BA-AV						
	>	12.2	7.0	49.6	15.8	17.1
BA						
	>	12.5	5.7	12.3	14.3	17.0
UN						

APPENDIX C
TRANSLATING PRO AND FIT MARKS INTO RELATIVE-VALUE MARKS USING THE MEDIAN RESPONSE

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TRANSLATING PRO AND FIT MARKS INTO RELATIVE-VALUE MARKS USING THE MEDIAN RESPONSE

Using the median response of the percentage of difference in value between adjacent marks, the following translation scale was developed. The relative-value fitness and proficiency marks using the median scale (RESFIT and RESPRO) are given in table C-1.

TABLE C-1

TRANSLATION OF PERFORMANCE MARKS INTO RELATIVE-VALUE MARKS USING THE MEDIAN RESPONSE

PRO mark	RESPRO mark	FIT mark	RESFIT mark
5.0	3.84	OS	2.90
4.9	3.49	EX-OS	2.42
4.8	3.17	EX	2.02
4.7	2.89	AA-EX	1.68
4.6	2.62	AA	1.40
4.5	2.39	AV-AA	1.27
4.4	2.17	AV	1.16
4.3	1.97	BA-AV	1.05
4.2	1.79	BA	1
4.1	1.62	UN	1
4.0	1.48		
.			
.			
.			
3.5	1.35		
2.5	1.12		
1.5	1.02		
0.5	1		

APPENDIX D
COMPARISON OF THE PERFORMANCE MARKS OF HSGs AND NHSGs USING THE MEDIAN TRANSLATION SCALE

APPENDIX D
COMPARISON OF THE PERFORMANCE MARKS OF HSGs AND NHSGs USING THE MEDIAN TRANSLATION SCALE

Table D-1 gives the mean marks of HSGs and NHSGs when PRO and FIT marks are translated into measure of relative value using the median response. On average, junior HSGs score .30 points higher on the median-based rescaled PRO marks than NHSGs, which implies that they perform 14.4 percent better. Senior HSGs and NHSGs get the same median-based rescaled FIT mark on average, which implies that their performance is the same. Use of the median translation scale results in smaller differences in performance compared to the mean translation scale.

TABLE D-1

THE SAMPLE MEANS AND DESCRIPTIVE STATISTICS FOR THE RESCALED PRO AND FIT MARKS USING THE MEDIAN TRANSLATION SCALE

	Median rescaled PRO mark		
Education	Mean	Standard deviation	Sample size
HSG	2.38	.459	22,438
NHSG	2.08	.476	6,609
	Median rescaled FIT mark		
Education	Mean	Standard deviation	Sample size
HSG	2.34	.451	7,782
NHSG	2.34	.466	1,812

APPENDIX E
F-TEST RESULTS

F tests were used to determine which variables should be included in the model. Each variable in the general single equation model given in equation 2 of the main text, that is,

$$\begin{aligned} PMARK &= \gamma_0 + \gamma_1 EDUC + \gamma_2 AFQT + \gamma_3 AFQT * EDUC \\ &\quad + \sum_{i=4}^{32} \gamma_i MOSC_i + \sum_{i=33}^{61} \gamma_i MOSC_i * EDUC \\ &\quad + \sum_{i=62}^{90} \gamma_i MOSC_i * AFQT, \end{aligned} \tag{E-1}$$

was tested to determine whether it adds to the explanatory power of the model. The F-test results for RVPRO and RVFIT marks are given in table E-1. In test 1 (column one), the variables were tested in the order given to see whether their inclusion adds to the explanatory power of the regression. Alternative orders were tested and yielded similar results. In test 2, the variables were tested to determine if, after all the other variables are included in the model, they add to the explanatory power of the regression.

For RVPRO marks, the F-test results reveal that all the variables listed add to the explanatory power of the model. For RVFIT marks, EDUC and the two interaction terms with MOSC do not significantly add to the explanatory power of the model.

TABLE E-1

F-TEST RESULTS

RVPRO MARKS

Variable	PR>F (test 1)	PR>F (test 2)
AFQT	0.00	0.00
EDUC	0.00	0.00
MOSC	0.00	0.00
AFQT*EDUC	0.00	0.00
MOSC*AFQT	0.00	0.00
MOSC*EDUC	0.00	0.00

RVFIT MARKS

Variable	PR>F (test 1)	PR>F (test 2)
AFQT	0.00	0.01
EDUC	0.17	0.53
MOSC	0.00	0.03
AFQT*EDUC	0.07	0.06
MOSC*AFQT	0.29	0.31
MOSC*EDUC	0.15	0.15

APPENDIX F
ALTERNATIVE REGRESSION RESULTS USING THE MEDIAN TRANSLATION SCALE

The regression models are estimated using the median translation scale for PRO and FIT marks. As presented in the body of the paper, the regression model for FIT and PRO marks are as follows:

$$RESFIT = \alpha_0 + \alpha_1 AFQT + \alpha_2 AFQT * EDUC + \sum_{i=3}^{31} \alpha_i MOSC_i \quad \text{(F-1)}$$

$$RESPRO = \beta_0 + \beta_1 EDUC + \beta_2 AFQT + \beta_3 AFQT * EDUC + \sum_{i=4}^{32} \beta_i MOSC_i \quad \text{(F-2)}$$

where

RESFIT = the individual's rescaled relative-value fitness mark under the median translation scale

RESPRO = the individual's rescaled relative-value proficiency mark under the median translation scale.

EDUC, AFQT, and $MOSC_i$ have been previously defined.

The parameter estimates for the RESFIT and RESPRO marks are reported in tables F-1 and F-2. The base case is a NHSG in the 7300 occupation.

For the fitness mark regression the coefficients on each $MOSC_i$ were weighted by the number of individuals in the MOS (given in table G-2, appendix G), yielding an average coefficient of -.062. The average relationship between RESFIT marks and the explanatory variables is, therefore,

$$RESFIT = 2.31 + .002 AFQT + .0001 AFQT * EDUC - .062 \,. \quad \text{(F-3)}$$

TABLE F-1

THE REGRESSION PARAMETER ESTIMATES FOR RESFIT MARKS

Variable	Parameters	Variable	Parameters
Constant	2.31*	40XX	-0.12**
AFQT	0.002*	44XX	0.08
AFQT*EDUC	0.0001	55XX	-0.06
MOSC:		58XX	-0.12**
01XX	0.01	59XX	-0.10
03XX	-0.05	60XX	-0.09
04XX	0.01	61XX	-0.06
08XX	-0.03	63XX	-0.08
11XX	-0.07	64XX	-0.06
13XX	-0.07	65XX	-0.10
18XX	-0.03	70XX	-0.05
21XX	-0.05		
23XX	-0.06		
25XX	-0.09		
26XX	-0.08		
28XX	-0.07		
30XX	-0.04		
31XX	-0.01		
33XX	-0.19*		
34XX	-0.09		
35XX	-0.10		

$\overline{R}^2 = 0.01$

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

TABLE F-2

THE REGRESSION PARAMETER ESTIMATES FOR RESPRO MARKS

Variable	Parameters	Variable	Parameters
Constant	2.24*	40XX	0.01
AFQT	0.002*	44XX	0.17*
EDUC	0.14*	46XX	-0.08
AFQT*EDUC	0.002*	55XX	-0.21*
MOSC:		58XX	-0.04
01XX	0.05	59XX	-0.06
02XX	0.21*	60XX	0.10*
03XX	-0.38*	61XX	-0.04
04XX	-0.08**	63XX	-0.01
08XX	-0.44*	64XX	0.09*
11XX	-0.09*	65XX	0.04
13XX	-0.23*	68XX	-0.12
14XX	-0.29*	70XX	-0.04
15XX	0.19*	72XX	-0.20*
18XX	-0.28*		
21XX	-0.15*		
23XX	-0.05		
25XX	-0.18*		
26XX	0.07		
28XX	-0.07**		
30XX	-0.03		
31XX	-0.21*		
33XX	-0.20*		
34XX	0.03		
35XX	-0.22*		

$\overline{R}^2 = 0.23$

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

The estimated performance difference between HSGs and NHSGs is minuscule. Evaluating the above equation at the mean ability levels of HSGs and NHSGs respectively, it is calculated that HSGs perform .3 percent better than NHSGs. This result is very similar to the 1.4 percent difference estimated using the mean translation scale.

The coefficients on MOS categories in the proficiency mark regression were weighted by the number of individuals in the MOS, yielding the following average relationship:

$$\begin{aligned} RESPRO &= 2.24 + .140EDUC + .002AFQT + .002AFQT * EDUC \\ &\quad -.181\ . \end{aligned} \tag{F-4}$$

The average performance gap within an MOS between first-term HSGs and NHSGs is significant. Evaluating the above equation at the mean ability level of HSGs and NHSGs reveals that HSGs perform 11 percent better than NHSGs. This result, derived using the median-based translation scale, is very similar to the 13.8 percent difference calculated from the mean scale.

APPENDIX G
ALTERNATIVE REGRESSION MODELS

Alternative approaches were used to estimate the relationship between performance marks and education. A single equation model, equation 2 in the main text,

$$
\begin{aligned}
PMARK &= \gamma_0 + \gamma_1 EDUC + \gamma_2 AFQT + \gamma_3 AFQT * EDUC \\
&\quad + \sum_{i=4}^{32} \gamma_i MOSC_i + \sum_{i=33}^{61} \gamma_i MOSC_i * EDUC \\
&\quad + \sum_{i=62}^{90} \gamma_i MOSC_i * AFQT \ , \qquad \text{(G-1)}
\end{aligned}
$$

is estimated for RVPRO marks. Dummy interaction variables are included for MOSC and EDUC, MOSC and AFQT, and AFQT and EDUC. The base case is a NHSG in 7300 occupation field.

The parameter estimates are given in table G-1. Surprisingly, many of the parameter estimates are significant at the 95 percent level (as noted) despite the existence of significant multicolinearity. However, the coefficients on EDUC and the interaction terms, MOSC*EDUC and MOSC*AFQT, are not generally significant. The high degree of multicolinearity lowers the precision of the estimates, making it more difficult to conclude that a variable is significant. The performance gap between HSGs and NHSGs varies with ability level because of the presence of the interaction term AFQT*EDUC. Taking a weighted average of the coefficients on the MOS category dummy variables yields the following average relationship:

$$
\begin{aligned}
RVPRO &= 3.68 + .461 EDUC + .006 AFQT + .005 AFQT * EDUC \\
&\quad -.189 - .007 AFQT - .212 * EDUC \ . \qquad \text{(G-2)}
\end{aligned}
$$

The last three terms represent the average direct effect of MOSC, the interaction effect of MOSC and AFQT, and the interaction effect of MOSC and EDUC, respectively. The performance gap within a MOS between average ability HSGs and NHSGs equals 13.6 percent, which is basically the same as the 13.8-percent estimate derived from the regression approach used in the main text. Thus, leaving out the interaction terms between MOSC and EDUC and AFQT, as is done in the main text, has little effect on the predicted relative marks of HSGs and NHSGs.

Alternatively, to avoid the problem of severe multicolinearity that arises in the above specification, the following model is estimated separately for each MOS category:

$$RVPRO = \delta_0 + \delta_1 EDUC + \delta_2 AFQT + \delta_3 AFQT * EDUC \ . \quad \text{(G-3)}$$

Table G-2 gives the parameter estimates. Many of the estimates are not significant, probably because of the small sample size and the multicolinearity that still exists between AFQT, EDUC, and the interaction term.

Interpretation of the regression results for the individual MOS categories is subject to several qualifications. Individuals are assigned to an MOS based on a battery of test scores and their individual preferences. Because there is a selection criteria used in assigning individuals to MOSs, the individuals in any given MOS are not representative of the Marine Corps as a whole. Thus, the estimated regression parameters for a given MOS can only be used to make inferences about individuals in that occupational field. For example, the coefficient on the education variable (EDUC) for the combat occupation field (03XX) gives the effect of a high school diploma on RVPRO marks for people in combat. The regression parameter for combat cannot be used to make inferences about individuals who are not in that MOS category.

The coefficients from each individual MOS regression are weighted by the number of individuals in the MOS category, yielding the following average relationship:

$$\begin{aligned} RVPRO &= 3.54 + .252 EDUC + .004 AFQT \\ &\quad + .005 AFQT * EDUC \ . \end{aligned} \quad \text{(G-4)}$$

The performance gap within an MOS category between average first-term HSGs and NHSGs equals 13.5 percent, which is also highly similar to the 13.8 percent gap derived from the approach taken in the main text.

RVFIT marks are also analyzed by estimating separate regressions for each MOS category using the following general regression model:

$$RVFIT \;=\; \rho_0 + \rho_1 AFQT + \rho_2 AFQT * EDUC \;. \qquad \text{(G-5)}$$

The F-test results in appendix E suggest that EDUC enters the model only as an interaction term with AFQT. This implies that EDUC has little effect on performance for low mental categories but that its impact on performance rises with ability level. The parameter estimates are given in table G-3. Generally, the regression results are poor and the explanatory variables are not significant. The poor results are probably because of the small sample size per MOS category. When the sample is disaggregated by occupation, the variation in AFQT is limited and the representation of NHSGs is greatly diminished, which may be the cause of the weak results. Taking the weighted average of the coefficients yields

$$RVFIT = 4.09 + .003 AFQT + .001 AFQT * EDUC \;. \qquad \text{(G-6)}$$

Thus, these results imply that average senior HSGs perform 1.6 percent than NHSGs, a result basically equivalent to the estimate of 1.4 percent derived from the single equation approach used in the main text.

TABLE G-1

THE REGRESSION PARAMETER ESTIMATES FOR RVPRO MARKS, SINGLE EQUATION APPROACH

Variable	Parameters	Variable	Parameters
Constant	3.68*	35XX	-0.15
AFQT	0.006	40XX	0.48
EDUC	0.461	44XX	-0.94
MOSC:		46XX	-0.47
01XX	0.27	55XX	-0.40
02XX	1.19	57XX	1.42**
03XX	-0.65	58XX	0.17
04XX	0.01	59XX	0.98
08XX	-0.89	60XX	0.59
11XX	-0.20	61XX	0.53
13XX	-0.34	63XX	1.10
14XX	-2.10*	64XX	1.07
15XX	1.41**	65XX	0.94
18XX	-0.50	68XX	2.14
21XX	-0.19	70XX	-0.44
23XX	-0.50	72XX	-0.30
25XX	-0.24	AFQT*EDUC	0.005*
26XX	1.83	MOSC*AFQT:	
28XX	0.42	01XX	0.00
30XX	-0.27	02XX	-0.001
31XX	-0.27	03XX	-0.002
33XX	0.04	04XX	0.001
34XX	-0.47	08XX	0.001

TABLE G-1 CONTINUED

Variable	Parameters	Variable	Parameters
MOSC*AFQT:		MOSC*EDUC	
11XX	-0.004	01XX	-0.10
13XX	-0.004	02XX	-0.62
14XX	-0.010	03XX	-0.20
15XX	-0.015	04XX	-0.25
18XX	-0.002	08XX	-0.25
21XX	-0.005	11XX	-0.28
23XX	-0.008	13XX	-0.04
25XX	-0.000	14XX	1.07*
26XX	-0.008	15XX	-0.52
28XX	-0.003	18XX	-0.09
30XX	-0.004	21XX	0.06
31XX	-0.003	23XX	-0.20
33XX	-0.007	25XX	-0.24
34XX	-0.006	26XX	-1.07*
35XX	-0.005	28XX	-0.48
40XX	-0.007	30XX	0.06
44XX	0.005	31XX	-0.13
46XX	0.007	33XX	-0.27
55XX	-0.001	34XX	0.17
57XX	-0.012	35XX	-0.24
58XX	-0.001	40XX	0.11
59XX	0.004	44XX	1.22**
60XX	-0.002	46XX	-0.02
61XX	-0.010	55XX	-0.12
63XX	-0.008	57XX	-0.48
64XX	-0.006	58XX	-0.10
65XX	-0.007	59XX	-1.56*
68XX	-0.008	60XX	-0.23
70XX	0.008	61XX	-0.16
72XX	-0.001	63XX	-0.69**

TABLE G-1 CONTINUED

Variable	Parameters
MOSC*EDUC:	
64XX	-0.47
65XX	-0.43
68XX	-2.12*
70XX	-0.13
72XX	-0.20

$\overline{R}^2 = 0.24$

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

TABLE G-2

THE REGRESSION PARAMETER ESTIMATES FOR RVPRO MARKS, SEPARATE EQUATION APPROACH

		Regression parameters				
MOS	Sample size	Constant	EDUC	AFQT	AFQT*EDUC	$\overline{R}^2$
01XX	1566	4.10*	0.19	0.004	0.008**	0.05
02XX	54	3.30*	1.78	0.030	-0.026	-0.01
03XX	6688	3.01*	0.28*	0.004*	0.005*	0.07
04XX	277	3.07*	0.98*	0.020*	-0.012	0.05
08XX	1097	2.81*	0.19	0.006*	0.006	0.12
11XX	506	4.27*	-0.28	-0.007	0.016*	0.04
13XX	2039	3.40*	0.34*	0.001	0.007*	0.08
14XX	54	2.06**	0.98	0.008	0.014	0.28
15XX	26	4.67*	1.08	0.004	-0.025	-0.01
18XX	493	3.09*	0.49*	0.006	0.002	0.11
21XX	371	3.50*	0.51	0.001	0.005	0.06
23XX	153	1.37	3.26*	0.052*	-0.053*	0.03
25XX	2799	3.32*	0.37*	0.008*	0.002	0.07
26XX	241	6.01**	-1.13	-0.008	0.012	-0.01
28XX	655	4.47*	-0.41	-0.002	0.010	0.02
30XX	1834	3.69*	0.19	0.004	0.012	0.13
31XX	451	3.57*	0.11	-0.001	0.011	0.06
33XX	928	3.51*	0.49*	0.003	-0.000	0.04
34XX	228	2.51	1.36	0.023	-0.006	0.07
35XX	2402	3.56*	0.18**	-0.000	0.006*	0.04
40XX	171	2.82	1.98	0.020	-0.017	0.00
44XX	71	2.59	1.83	0.013	0.003	0.07
46XX	110	3.00*	0.71	0.017	0.000	0.11
55XX	126	5.02	-1.41	-0.017	0.027	0.03
57XX	50	7.09*	-2.45**	-0.042	0.50**	0.03
58XX	590	3.51*	0.62	0.011	-0.002	0.05
59XX	269	2.31	1.30	0.040**	-0.026	0.07

TABLE G-2 CONTINUED

MOS	Sample size	Constant	Regression parameters EDUC	AFQT	AFQT*EDUC	$\overline{R}^2$
60XX	1223	4.06*	0.47**	0.008**	0.000	0.04
61XX	638	4.41*	0.062	-0.008	0.010	0.04
63XX	599	4.60*	-0.04	0.0001	0.002	0.00
64XX	367	5.00*	-0.28	-0.003	0.009	0.01
65XX	290	4.43*	0.27	0.001	0.001	0.00
70XX	293	3.68*	0.05	0.003	0.018**	-0.05
72XX	196	2.56*	1.19*	0.024*	-0.017	0.11
73XX	126	10.48*	-6.73*	-0.076*	0.093*	0.06

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

TABLE G-3

THE REGRESSION PARAMETER ESTIMATES FOR RVFIT MARKS, SEPARATE EQUATION APPROACH

		Regression parameters			
MOS	Sample size	Constant	AFQT	AFQT*EDUC	$\overline{R}^2$
01XX	812	4.19*	0.005*	-0.000	0.01
03XX	1547	4.06*	0.003*	0.001	0.01
04XX	184	4.45*	-0.006	0.008*	0.01
08XX	281	4.16*	0.000	0.005	0.01
11XX	336	3.97*	0.001	0.006**	0.02
13XX	439	4.11*	0.004	-0.001	0.00
18XX	232	3.79*	0.005	0.008*	0.07
21XX	231	4.18*	0.003	-0.001	-0.01
23XX	92	4.26*	-0.005	0.007	-0.00
25XX	547	4.00*	0.003	0.002	0.00
26XX	141	3.75*	0.013	-0.006	0.01
28XX	256	4.62*	-0.003	-0.000	-0.00
30XX	861	4.14*	0.004**	-0.001	0.00
31XX	63	4.10*	0.012	-0.006	0.00
33XX	236	3.51*	0.009*	0.001	0.02
34XX	136	4.57*	0.008	0.003	-0.01
35XX	616	4.09*	0.003	-0.002	-0.00
40XX	180	3.96*	0.000	0.004	0.01
44XX	51	4.97*	-0.011	0.008	0.02
55XX	31	3.54*	-0.001	0.016	0.05
58XX	267	3.99*	0.001	0.003	-0.00
59XX	136	3.46*	0.003	0.008**	0.03
60XX	869	3.79*	0.008*	-0.001	0.01
61XX	369	4.42*	-0.001	0.000	-0.01
63XX	239	4.36*	0.003	-0.003	-0.00
64XX	196	4.69*	-0.005	0.002	-0.01
65XX	118	3.84*	0.009	-0.003	-0.00
70XX	171	3.96*	0.005	0.002	0.00
73XX	57	4.38*	0.004	-0.003	-0.03

TABLE G-3 CONTINUED

		Regression parameters			
MOS	Sample size	Constant	AFQT	AFQT*EDUC	$\overline{R}^2$
63XX	239	4.36*	0.003	-0.003	-0.00
64XX	196	4.69*	-0.005	0.002	-0.01
65XX	118	3.84*	0.009	-0.003	-0.00
70XX	171	3.96*	0.005	0.002	0.00
73XX	57	4.38*	0.004	-0.003	-0.03

* Significant at the 95 percent confidence level.

** Significant at the 90 percent confidence level.

APPENDIX H
CORRELATION MATRICES

The correlation matrices for the fitness mark and proficiency mark data sets are presented below in tables H-1 and H-2. Since there are a large number of MOS dummy variables, the full set of MOS dummies is not presented. Instead a sample dummy variable for the 7300 occupation field is included to give some insight into the correlation between occupational field and the other explanatory variables.

TABLE H-1

CORRELATION MATRIX FOR THE EXPLANATORY VARIABLES FOR RVFIT MARKS

	EDUC	AFQT	AFQT*EDUC	73XX
EDUC	1.00	0.05	0.75	0.01
AFQT	0.05	1.00	0.65	0.08
AFQT*EDUC	0.75	0.65	1.00	0.06
73XX	0.01	0.07	0.06	1.00

TABLE H-2

CORRELATION MATRIX FOR THE EXPLANATORY VARIABLES FOR RVPRO MARKS

	EDUC	AFQT	AFQT*EDUC	73XX
EDUC	1.00	0.05	0.71	0.02
AFQT	0.05	1.00	0.67	0.08
AFQT*EDUC	0.71	0.67	1.00	0.07
73XX	0.02	0.08	0.07	1.00

The means and standard deviations of the explanatory variables are given in tables H-3 and H-4.

TABLE H-3

MEANS AND STANDARD DEVIATION OF THE EXPLANATORY VARIABLES FOR RVFIT MARKS

Variable	Mean	Standard deviation
EDUC	0.81	0.39
AFQT	56.25	21.20
AFQT*EDUC	46.03	29.58
73XX	0.006	0.08

TABLE H-4

MEANS AND STANDARD DEVIATION OF THE EXPLANATORY VARIABLES FOR RVPRO MARKS

Variable	Mean	Standard deviation
EDUC	0.77	0.42
AFQT	47.42	22.23
AFQT*EDUC	37.12	28.42
73XX	0.004	0.07

TABLE I-1

SURVEY RESPONSES FOR TRANSLATING PROFICIENCY MARKS INTO RELATIVE-VALUE MARKS

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
0.00	0.00	25.00	0.00	0.00	15.00	0.00	15.00	0.00	0.00	0.00	5.00	0.00	0.00	0302
0.05	50.00	100.00	55.00	80.00	200.00	0.00	45.00	25.00	5.00	0.00	100.00	100.00	500.00	7320
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	50.00	50.00	1.00	1.00	2502
1.00	5.00	25.00	50.00	10.00	10.00	50.00	10.00	10.00	25.00	0.00	50.00	50.00	50.00	7210
2.00	2.00	2.00	2.00	5.00	5.00	5.00	5.00	2.00	2.00	2.00	1.00	0.50	0.50	2502
2.00	2.00	4.00	2.00	5.00	20.00	5.00	5.00	5.00	5.00	15.00	5.00	5.00	5.00	7208
3.00	3.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	15.00	50.00	50.00	50.00	2502
5.00	2.00	3.00	5.00	10.00	10.00	10.00	5.00	2.00	2.00	10.00	5.00	2.00	0.00	2502
5.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	25.00	25.00	25.00	2502
5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	0.00	100.00	100.00	100.00	4002
5.00	5.00	5.00	10.00	10.00	15.00	15.00	15.00	15.00	15.00	25.00	25.00	25.00	25.00	2502
5.00	5.00	5.00	10.00	25.00	10.00	5.00	2.00	2.00	0.00	25.00	10.00	0.00	0.00	2601
5.00	10.00	5.00	15.00	15.00	15.00	20.00	10.00	15.00	10.00	75.00	90.00	100.00	100.00	**
5.00	90.00	50.00	50.00	5.00	5.00	25.00	5.00	5.00	10.00	1.00	1.00	1.00	1.00	0800
10.00	4.00	6.00	8.00	5.00	15.00	4.00	3.00	2.00	90.00	25.00	0.00	0.00	0.00	2502
10.00	5.00	1.00	5.00	2.00	1.00	10.00	5.00	10.00	5.00	50.00	50.00	50.00	50.00	7320
10.00	9.00	8.00	8.00	9.00	8.00	7.00	8.00	7.00	8.00	15.00	20.00	25.00	15.00	2502
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	70.00	30.00	30.00	0.00	2502
10.00	10.00	10.00	10.00	10.00	30.00	10.00	10.00	10.00	10.00	20.00	50.00	50.00	50.00	2502
10.00	10.00	25.00	25.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	33.00	5.00	5.00	2502
10.00	40.00	40.00	25.00	25.00	25.00	10.00	10.00	5.00	5.00	5.00	0.50	0.00	0.00	7208
20.00	15.00	10.00	10.00	10.00	10.00	10.00	10.00	5.00	5.00	25.00	15.00	5.00	**	2502
20.00	20.00	20.00	20.00	20.00	10.00	20.00	15.00	10.00	10.00	50.00	10.00	0.00	0.00	7204
30.00	20.00	20.00	10.00	10.00	50.00	10.00	25.00	10.00	10.00	0.00	100.00	5.00	1.00	1803
50.00	25.00	10.00	25.00	20.00	10.00	10.00	5.00	5.00	5.00	0.00	0.00	0.00	0.00	7204
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10	1.00	50.00	100.00	100.00	0302
0.00	0.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	20.00	50.00	100.00	100.00	100.00	7501
0.00	0.00	10.00	5.00	0.00	60.00	30.00	25.00	0.00	0.00	20.00	0.00	0.00	0.00	7501
0.00	5.00	20.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	40.00	0.00	0.00	0302

**Missing data.

TABLE I-1 CONTINUED

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
0.10	2.00	5.00	10.00	20.00	50.00	70.00	75.00	80.00	85.00	90.00	100.00	100.00	100.00	4402
0.50	0.50	2.00	5.00	7.00	10.00	10.00	15.00	30.00	35.00	50.00	100.00	100.00	100.00	7588
1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	75.00	0.00	0.00	0.00	0802
1.00	1.00	3.00	3.00	10.00	5.00	5.00	3.00	3.00	3.00	15.00	25.00	25.00	5.00	0302
2.00	2.00	2.00	2.00	2.00	5.00	2.00	2.00	2.00	2.00	10.00	5.00	1.00	0.00	7268
2.00	2.00	2.00	2.00	2.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	5.00	0302
2.00	3.00	3.00	3.00	5.00	4.00	2.00	3.00	2.00	2.00	10.00	10.00	10.00	10.00	4002
2.00	3.00	4.00	5.00	5.00	5.00	5.00	10.00	15.00	20.00	50.00	50.00	50.00	50.00	**
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	2.00	0.00	7501
3.00	3.00	3.00	3.00	5.00	5.00	5.00	5.00	8.00	8.00	10.00	**	**	**	0302
5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	40.00	15.00	15.00	7522
5.00	5.00	10.00	15.00	18.00	20.00	18.00	15.00	14.00	12.00	10.00	6.00	4.00	0.00	7562
5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	30.00	10.00	0.00	0.00	7564
5.00	10.00	20.00	10.00	5.00	5.00	5.00	0.00	5.00	0.00	20.00	10.00	0.00	0.00	0302
5.00	10.00	30.00	40.00	50.00	50.00	40.00	40.00	30.00	30.00	30.00	**	**	**	0302
5.00	20.00	10.00	5.00	5.00	30.00	2.00	2.00	25.00	99.00	**	**	**	**	7562
5.00	30.00	20.00	5.00	5.00	1.00	1.00	1.00	1.00	1.00	50.00	10.00	10.00	10.00	3002
7.00	5.00	5.00	3.00	3.00	3.00	2.00	2.00	2.00	2.00	20.00	20.00	0.00	0.00	0802
7.00	25.00	23.00	20.00	20.00	20.00	15.00	11.00	8.00	7.00	4.00	3.00	2.00	0.00	3002
10.00	5.00	4.00	3.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3002
10.00	5.00	4.00	4.00	3.00	3.00	3.00	3.00	2.00	2.00	1.00	0.00	0.00	0.00	0302
10.00	10.00	5.00	2.50	5.00	2.50	2.50	7.00	9.00	2.50	5.00	5.00	5.00	5.00	0802
10.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	25.00	5.00	5.00	0302
10.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	25.00	5.00	5.00	5.00	0302
10.00	10.00	5.00	5.00	10.00	10.00	5.00	5.00	0.00	0.00	10.00	50.00	0.00	0.00	0302
10.00	10.00	5.00	5.00	10.00	10.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	3.00	7508
10.00	10.00	10.00	5.00	5.00	5.00	2.00	5.00	2.00	2.00	50.00	10.00	0.00	0.00	3402
10.00	10.00	10.00	5.00	5.00	5.00	4.00	3.00	2.00	5.00	75.00	0.00	0.00	0.00	1302
10.00	10.00	10.00	10.00	5.00	10.00	5.00	20.00	5.00	5.00	0.00	**	**	**	1802
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	20.00	30.00	0.00	0.00	0802
10.00	10.00	10.00	10.00	10.00	100.00	10.00	10.00	10.00	10.00	10.00	100.00	0.00	0.00	0302

TABLE I-1 CONTINUED

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
10.00	10.00	10.00	10.00	50.00	10.00	10.00	10.00	10.00	10.00	10.00	100.00	100.00	100.00	7583
10.00	10.00	10.00	25.00	50.00	10.00	10.00	10.00	10.00	10.00	50.00	50.00	50.00	50.00	7583
10.00	10.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	50.00	20.00	20.00	20.00	3002
10.00	15.00	10.00	5.00	5.00	3.00	10.00	5.00	10.00	10.00	20.00	15.00	10.00	10.00	4302
10.00	20.00	20.00	20.00	20.00	15.00	10.00	10.00	10.00	2.00	10.00	2.00	1.00	0.00	7208
10.00	40.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	50.00	100.00	100.00	100.00	7511
11.00	5.00	8.00	6.00	4.00	4.00	4.00	2.00	2.00	2.00	2.00	50.00	0.00	0.00	4002
12.00	12.00	12.00	8.00	8.00	7.00	6.00	6.00	5.00	5.00	70.00	10.00	5.00	0.00	0302
15.00	5.00	15.00	30.00	20.00	20.00	15.00	10.00	5.00	5.00	30.00	20.00	5.00	3.00	0302
15.00	10.00	30.00	25.00	20.00	15.00	15.00	12.00	10.00	10.00	10.00	30.00	1.00	0.00	0802
15.00	14.00	14.00	13.00	13.00	12.00	12.00	12.00	12.00	11.00	10.00	0.00	0.00	0.00	0302
15.00	15.00	5.00	5.00	10.00	10.00	10.00	5.00	5.00	5.00	20.00	20.00	10.00	0.00	0802
20.00	10.00	10.00	20.00	10.00	20.00	10.00	10.00	20.00	25.00	50.00	25.00	10.00	10.00	0802
20.00	10.00	20.00	15.00	10.00	10.00	5.00	25.00	10.00	10.00	0.00	50.00	20.00	0.00	7511
20.00	18.00	15.00	12.00	10.00	15.00	12.00	11.00	10.00	10.00	25.00	10.00	12.00	10.00	7511
20.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	15.00	10.00	**	**	5803
20.00	20.00	30.00	30.00	50.00	50.00	20.00	20.00	20.00	20.00	50.00	50.00	10.00	10.00	0802
25.00	20.00	20.00	15.00	10.00	25.00	10.00	10.00	5.00	5.00	25.00	0.00	0.00	0.00	7565
25.00	25.00	25.00	25.00	20.00	15.00	15.00	10.00	10.00	10.00	20.00	5.00	0.00	0.00	0180
30.00	20.00	10.00	6.00	6.00	7.00	4.00	3.00	2.00	2.00	5.00	2.00	1.00	1.00	7208
30.00	20.00	20.00	40.00	30.00	20.00	20.00	20.00	10.00	5.00	20.00	2.00	1.00	0.00	7562
30.00	20.00	30.00	20.00	20.00	20.00	40.00	20.00	20.00	10.00	20.00	60.00	30.00	10.00	7511
30.00	30.00	20.00	20.00	20.00	20.00	10.00	10.00	10.00	10.00	50.00	40.00	5.00	0.00	0802
30.00	30.00	30.00	20.00	20.00	20.00	20.00	10.00	10.00	10.00	10.00	0.00	0.00	0.00	0302
35.00	35.00	35.00	35.00	50.00	50.00	50.00	50.00	35.00	35.00	35.00	20.00	20.00	5.00	0302
40.00	35.00	30.00	25.00	20.00	15.00	10.00	10.00	5.00	1.00	1.00	0.00	0.00	0.00	2502
45.00	40.00	35.00	35.00	30.00	30.00	25.00	25.00	20.00	10.00	10.00	0.00	0.00	0.00	1302
50.00	10.00	50.00	20.00	10.00	10.00	20.00	10.00	2.00	2.00	10.00	0.00	0.00	0.00	0302
50.00	20.00	20.00	20.00	20.00	20.00	10.00	10.00	10.00	10.00	50.00	100.00	100.00	100.00	7522
50.00	25.00	10.00	10.00	10.00	15.00	20.00	20.00	25.00	25.00	75.00	50.00	75.00	50.00	7562
50.00	30.00	30.00	30.00	25.00	25.00	20.00	20.00	15.00	10.00	10.00	10.00	5.00	5.00	**
50.00	40.00	30.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	0402

TABLE I-1 CONTINUED

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
50.00	50.00	50.00	25.00	25.00	25.00	20.00	10.00	10.00	10.00	10.00	2.00	2.00	1.00	7557
50.00	50.00	50.00	40.00	30.00	30.00	20.00	20.00	20.00	20.00	20.00	10.00	10.00	10.00	1302
60.00	0.00	0.00	25.00	0.00	0.00	20.00	0.00	0.00	0.00	50.00	25.00	0.00	0.00	0302
60.00	40.00	10.00	10.00	50.00	25.00	15.00	10.00	20.00	5.00	50.00	0.00	0.00	0.00	0302
100.00	10.00	30.00	25.00	25.00	50.00	25.00	10.00	10.00	10.00	10.00	10.00	10.00	0.00	0802
100.00	50.00	50.00	300.00	10.00	30.00	10.00	0.00	20.00	10.00	10.00	0.00	0.00	0.00	0302
100.00	85.00	80.00	75.00	70.00	65.00	60.00	55.00	50.00	45.00	40.00	35.00	2.00	0.00	7562
100.00	100.00	50.00	50.00	100.00	7.00	5.00	10.00	10.00	10.00	10.00	0.00	0.00	0.00	7565
100.00	100.00	100.00	90.00	80.00	50.00	40.00	30.00	20.00	15.00	10.00	0.00	0.00	0.00	0302
0.00	0.00	0.00	2.00	2.00	5.00	5.00	5.00	10.00	15.00	20.00	50.00	0.00	0.00	0302
0.00	0.00	10.00	20.00	20.00	10.00	50.00	25.00	15.00	11.00	10.00	0.00	0.00	0.00	3502
0.00	0.00	80.00	80.00	80.00	0.00	0.00	0.00	0.00	20.00	20.00	20.00	0.00	0.00	**
0.00	1.00	1.00	1.00	5.00	5.00	1.00	1.00	1.00	0.00	10.00	10.00	15.00	0.00	0302
0.00	2.00	2.00	2.00	2.00	10.00	10.00	10.00	10.00	10.00	15.00	10.00	0.00	0.00	0302
0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	3502
0.00	5.00	5.00	5.00	5.00	10.00	10.00	5.00	10.00	10.00	50.00	25.00	0.00	0.00	0302
0.00	5.00	5.00	5.00	10.00	50.00	5.00	20.00	5.00	0.00	75.00	0.00	0.00	0.00	0402
0.00	10.00	10.00	0.00	0.00	10.00	0.00	10.00	0.00	0.00	20.00	20.00	10.00	0.00	3002
0.00	10.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	**	**	**	7580
0.00	10.00	25.00	50.00	50.00	40.00	15.00	15.00	5.00	5.00	5.00	0.00	0.00	0.00	7587
0.00	20.00	5.00	40.00	60.00	60.00	40.00	10.00	30.00	20.00	10.00	0.00	0.00	0.00	0302
0.50	10.00	10.00	90.00	5.00	75.00	20.00	2.00	2.00	2.00	10.00	0.00	0.00	0.00	3502
1.00	1.00	3.00	5.00	2.00	2.00	2.00	1.00	1.00	1.00	2.00	10.00	2.00	0.00	6002
2.00	1.00	5.00	5.00	2.00	2.00	2.00	2.00	2.00	2.00	5.00	5.00	5.00	0.00	3060
2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	3.00	2.00	2.00	0802
2.00	2.00	2.00	5.00	5.00	5.00	3.00	3.00	10.00	10.00	20.00	50.00	100.00	20.00	**
2.00	2.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	15.00	20.00	15.00	10.00	3060
2.50	2.50	2.50	2.50	10.00	10.00	20.00	5.00	2.50	2.50	2.50	50.00	0.00	0.00	0802
3.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	7.00	6.00	5.00	0.20	0.10	0.00	0302
3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	2.00	2.00	5.00	5.00	2.00	1.00	7583

TABLE I-1 CONTINUED

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
3.00	3.00	3.00	4.00	5.00	5.00	5.00	5.00	5.00	10.00	25.00	50.00	50.00	50.00	3002
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	1.00	1.00	0302
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	20.00	10.00	10.00	10.00	7208
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	40.00	40.00	5.00	1.00	0302
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	75.00	40.00	0.00	0.00	7576
5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	5.00	25.00	15.00	15.00	0302
5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	100.00	100.00	200.00	0302
5.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	20.00	10.00	0.00	0.00	1803
5.00	5.00	5.00	5.00	5.00	30.00	20.00	15.00	5.00	5.00	5.00	0.00	0.00	0.00	3002
5.00	5.00	5.00	5.00	10.00	5.00	5.00	10.00	5.00	10.00	25.00	20.00	15.00	15.00	**
5.00	5.00	5.00	5.00	10.00	10.00	15.00	15.00	10.00	10.00	0.00	50.00	0.00	0.00	0180
5.00	5.00	5.00	10.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	25.00	50.00	100.00	3060
5.00	5.00	5.00	10.00	10.00	10.00	10.00	5.00	5.00	5.00	15.00	1.00	0.00	0.00	7566
5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	5.00	0.00	0.00	0302
5.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	40.00	20.00	4.00	2.00	0302
5.00	5.00	9.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	5.00	5.00	5.00	5.00	0180
5.00	5.00	10.00	10.00	10.00	20.00	20.00	20.00	5.00	10.00	10.00	5.00	1.00	0.00	0302
5.00	10.00	5.00	15.00	3.00	5.00	4.00	2.00	1.00	1.00	5.00	5.00	0.00	0.00	3002
5.00	10.00	10.00	10.00	5.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	7565
5.00	10.00	15.00	20.00	25.00	30.00	40.00	30.00	25.00	20.00	75.00	10.00	5.00	0.00	7566
5.00	15.00	15.00	15.00	10.00	15.00	15.00	5.00	3.00	2.00	10.00	10.00	10.00	**	0402
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	10.00	10.00	10.00	10.00	0302
10.00	0.00	25.00	10.00	10.00	20.00	10.00	10.00	0.00	2.00	75.00	10.00	0.00	0.00	0302
10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	50.00	50.00	50.00	50.00	0402
10.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	30.00	30.00	1.00	1.00	7587
10.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	5.00	1302
10.00	10.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00	0.00	0.00	0402
10.00	10.00	5.00	10.00	5.00	10.00	5.00	5.00	5.00	5.00	10.00	50.00	20.00	2.00	1802
10.00	10.00	10.00	5.00	5.00	5.00	5.00	10.00	10.00	10.00	10.00	20.00	10.00	10.00	**
10.00	10.00	10.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	50.00	10.00	10.00	0.00	0302
10.00	10.00	10.00	10.00	10.00	10.00	10.00	5.00	5.00	5.00	20.00	60.00	20.00	20.00	7265
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	5.00	5.00	0802

TABLE I-1 CONTINUED

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	50.00	5.00	0.00	0.00	**
10.00	10.00	10.00	10.00	10.00	10.00	15.00	15.00	25.00	35.00	50.00	250.00	500.00	0.00	0302
10.00	10.00	10.00	10.00	10.00	20.00	20.00	20.00	20.00	20.00	10.00	10.00	5.00	5.00	0302
10.00	10.00	10.00	10.00	15.00	15.00	15.00	10.00	10.00	10.00	10.00	0.00	0.00	0.00	0302
10.00	10.00	10.00	15.00	15.00	15.00	20.00	20.00	25.00	25.00	75.00	150.00	300.00	0.00	0302
10.00	10.00	10.00	20.00	10.00	5.00	5.00	2.00	2.00	2.00	10.00	1.00	1.00	0.50	0302
10.00	10.00	10.00	20.00	15.00	10.00	10.00	10.00	10.00	10.00	75.00	30.00	30.00	20.00	7562
10.00	10.00	10.00	25.00	10.00	25.00	10.00	10.00	20.00	10.00	0.00	100.00	100.00	100.00	1802
10.00	10.00	10.00	40.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	1.00	0.01	0.01	7565
10.00	10.00	20.00	15.00	12.00	10.00	10.00	7.00	5.00	5.00	15.00	10.00	5.00	2.00	0302
10.00	10.00	20.00	20.00	20.00	20.00	20.00	10.00	10.00	10.00	0.00	0.00	0.00	0.00	0802
10.00	10.00	20.00	30.00	10.00	10.00	20.00	20.00	10.00	10.00	20.00	0.00	0.00	0.00	0302
10.00	10.00	30.00	10.00	30.00	25.00	30.00	15.00	50.00	10.00	30.00	10.00	5.00	0.00	0302
10.00	10.00	30.00	30.00	5.00	5.00	15.00	6.00	2.00	0.00	0.00	0.50	0.00	0.00	3402
10.00	20.00	5.00	10.00	10.00	5.00	5.00	10.00	10.00	10.00	0.00	50.00	0.00	0.00	7587
10.00	20.00	20.00	20.00	20.00	15.00	15.00	10.00	10.00	10.00	50.00	0.00	0.00	0.00	1302
10.00	20.00	30.00	10.00	20.00	40.00	10.00	10.00	10.00	10.00	50.00	50.00	10.00	10.00	0302
10.00	20.00	50.00	10.00	30.00	50.00	20.00	30.00	20.00	10.00	30.00	0.00	0.00	0.00	3002
10.00	40.00	10.00	30.00	20.00	20.00	10.00	20.00	10.00	10.00	50.00	40.00	0.00	0.00	0802
10.00	50.00	30.00	30.00	25.00	20.00	20.00	10.00	10.00	20.00	45.00	25.00	0.00	0.00	2502
15.00	5.00	5.00	10.00	10.00	10.00	10.00	10.00	15.00	10.00	50.00	75.00	50.00	50.00	0302
15.00	10.00	5.00	5.00	10.00	15.00	5.00	5.00	5.00	5.00	0.00	25.00	0.00	0.00	3002
19.00	17.00	15.00	15.00	14.00	13.00	12.00	11.00	10.00	10.00	12.00	10.00	10.00	10.00	7562
20.00	5.00	30.00	10.00	10.00	20.00	5.00	5.00	10.00	10.00	40.00	50.00	0.00	0.00	3502
20.00	10.00	5.00	5.00	10.00	10.00	5.00	0.00	0.00	0.00	15.00	10.00	0.00	0.00	2602
20.00	15.00	15.00	15.00	15.00	10.00	5.00	5.00	2.00	2.00	20.00	5.00	2.00	0.00	7583
20.00	20.00	10.00	5.00	5.00	10.00	10.00	5.00	5.00	5.00	20.00	100.00	20.00	5.00	0302
20.00	20.00	10.00	10.00	5.00	5.00	5.00	0.00	0.00	2.00	10.00	5.00	5.00	0.00	6002
20.00	20.00	15.00	15.00	10.00	15.00	10.00	10.00	10.00	10.00	10.00	1.00	0.00	0.00	0302
20.00	20.00	20.00	10.00	10.00	20.00	10.00	10.00	10.00	10.00	50.00	0.00	0.00	0.00	0180
20.00	20.00	20.00	30.00	20.00	30.00	20.00	20.00	10.00	5.00	40.00	30.00	90.00	0.00	0302
20.00	20.00	20.00	30.00	30.00	30.00	20.00	10.00	10.00	1.00	1.00	0.00	0.00	0.00	7523

TABLE I-1 CONTINUED

5.0-4.9	4.9-4.8	4.8-4.7	4.7-4.6	4.6-4.5	4.5-4.4	4.4-4.3	4.3-4.2	4.2-4.1	4.1-4.0	4.0-3.0	3.0-2.0	2.0-1.0	1.0-0.0	PMOS
20.00	25.00	24.00	20.00	20.00	20.00	5.00	2.00	2.00	2.00	25.00	0.00	0.00	0.00	1803
20.00	40.00	40.00	40.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	0.00	0.00	0.00	0302
25.00	5.00	5.00	10.00	5.00	25.00	5.00	10.00	5.00	5.00	10.00	**	**	**	7566
25.00	5.00	10.00	15.00	20.00	25.00	15.00	5.00	5.00	5.00	0.00	35.00	15.00	5.00	0302
25.00	10.00	25.00	20.00	10.00	25.00	20.00	10.00	10.00	10.00	50.00	50.00	10.00	0.00	0302
25.00	20.00	20.00	20.00	20.00	25.00	15.00	15.00	15.00	10.00	30.00	50.00	20.00	0.00	0302
25.00	25.00	20.00	20.00	15.00	15.00	10.00	10.00	10.00	5.00	5.00	5.00	0.00	0.00	7320
25.00	25.00	25.00	10.00	10.00	50.00	30.00	15.00	10.00	10.00	50.00	0.00	0.00	0.00	0802
25.00	25.00	25.00	15.00	15.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	3002
30.00	5.00	15.00	5.00	15.00	10.00	10.00	5.00	5.00	2.00	2.00	10.00	0.00	0.00	7564
30.00	20.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	50.00	10.00	5.00	2.00	0302
30.00	25.00	25.00	20.00	20.00	10.00	10.00	5.00	5.00	5.00	5.00	5.00	0.00	0.00	7583
30.00	30.00	30.00	20.00	20.00	30.00	10.00	10.00	10.00	10.00	40.00	40.00	0.00	0.00	7522
30.00	50.00	20.00	10.00	30.00	10.00	10.00	5.00	5.00	10.00	5.00	5.00	5.00	**	7511
50.00	10.00	10.00	10.00	50.00	10.00	50.00	10.00	10.00	10.00	0.00	0.00	0.00	0.00	7565
50.00	25.00	5.00	5.00	5.00	15.00	5.00	5.00	5.00	5.00	50.00	0.00	0.00	0.00	0302
50.00	25.00	20.00	10.00	20.00	25.00	20.00	10.00	20.00	25.00	50.00	50.00	0.00	0.00	0302
50.00	25.00	25.00	10.00	10.00	10.00	5.00	5.00	5.00	5.00	5.00	50.00	0.00	0.00	7563
50.00	30.00	20.00	20.00	20.00	10.00	10.00	10.00	10.00	10.00	20.00	10.00	0.00	0.00	7563
50.00	40.00	30.00	20.00	25.00	30.00	25.00	15.00	10.00	10.00	50.00	25.00	10.00	10.00	7562
50.00	50.00	30.00	10.00	10.00	30.00	10.00	10.00	10.00	10.00	20.00	75.00	25.00	0.00	1802
50.00	50.00	50.00	50.00	50.00	40.00	40.00	30.00	20.00	10.00	10.00	0.00	0.00	0.00	3002
50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	**	**	**	4302
95.00	75.00	50.00	15.00	2.00	10.00	5.00	2.00	1.00	1.00	20.00	1.00	0.00	0.00	0302
100.00	50.00	30.00	20.00	40.00	10.00	10.00	10.00	10.00	10.00	40.00	30.00	10.00	10.00	**
100.00	50.00	50.00	25.00	25.00	50.00	50.00	25.00	25.00	10.00	50.00	35.00	0.00	0.00	0802
100.00	50.00	50.00	50.00	50.00	50.00	20.00	30.00	10.00	10.00	0.00	10.00	10.00	0.00	0180
100.00	90.00	50.00	50.00	30.00	10.00	10.00	20.00	15.00	10.00	0.00	0.00	0.00	0.00	4402
100.00	100.00	100.00	70.00	60.00	50.00	25.00	20.00	10.00	10.00	1.00	**	0.00	0.00	0302
*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	10.00	10.00	10.00	10.00	0302
*	10.00	10.00	10.00	10.00	10.00	10.00	15.00	15.00	15.00	20.00	20.00	10.00	5.00	1302
*	25.00	10.00	**	50.00	25.00	10.00	5.00	5.00	5.00	75.00	50.00	0.00	0.00	1803

TABLE I-2

SURVEY RESPONSES FOR TRANSLATING FITNESS MARKS INTO RELATIVE-VALUE MARKS

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
0.00	50.00	0.00	50.00	0.00	50.00	0.00	0.00	0.00	0302
100.00	100.00	200.00	20.00	50.00	1.00	200.00	500.00	5.00	7320
5.00	5.00	50.00	10.00	10.00	5.00	1.00	1.00	1.00	2502
25.00	50.00	50.00	50.00	50.00	50.00	100.00	200.00	100.00	7210
1.00	1.00	5.00	5.00	5.00	5.00	2.00	1.00	0.00	2502
10.00	15.00	15.00	25.00	15.00	50.00	8.00	5.00	2.00	7208
10.00	15.00	15.00	10.00	10.00	10.00	10.00	10.00	10.00	2502
23.00	20.00	15.00	12.00	10.00	7.00	5.00	3.00	0.00	2502
5.00	5.00	10.00	20.00	20.00	20.00	25.00	25.00	50.00	2502
5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	**	4002
5.00	10.00	20.00	30.00	40.00	45.00	50.00	50.00	0.00	2502
10.00	25.00	10.00	10.00	25.00	10.00	25.00	5.00	0.00	2601
25.00	50.00	75.00	60.00	50.00	50.00	75.00	50.00	10.00	**
25.00	50.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0800
10.00	5.00	50.00	5.00	5.00	25.00	0.00	0.00	0.00	2502
10.00	10.00	50.00	5.00	5.00	10.00	50.00	10.00	50.00	7320
25.00	15.00	15.00	15.00	10.00	15.00	15.00	15.00	25.00	2502
5.00	20.00	40.00	70.00	5.00	0.00	0.00	0.00	0.00	2502
20.00	10.00	40.00	10.00	10.00	10.00	50.00	10.00	0.00	2502
33.00	10.00	33.00	33.00	5.00	5.00	33.00	5.00	5.00	2502
10.00	40.00	30.00	30.00	10.00	10.00	10.00	0.00	0.00	7208
20.00	10.00	10.00	15.00	5.00	25.00	10.00	5.00	0.00	2502
30.00	30.00	50.00	20.00	30.00	20.00	10.00	0.00	0.00	7204
25.00	25.00	500.00	100.00	5.00	0.00	0.00	0.00	0.00	1803
50.00	50.00	25.00	10.00	5.00	5.00	5.00	0.00	0.00	7204
0.00	0.00	0.00	1.00	1.00	1.00	10.00	100.00	100.00	0302
10.00	15.00	20.00	25.00	50.00	50.00	100.00	100.00	100.00	7501

**Missing data.

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
60.00	20.00	15.00	15.00	0.00	0.00	0.00	0.00	0.00	7501
20.00	20.00	20.00	10.00	10.00	10.00	10.00	0.00	0.00	0302
5.00	10.00	30.00	50.00	60.00	100.00	100.00	100.00	100.00	4402
2.00	5.00	10.00	25.00	50.00	50.00	100.00	100.00	100.00	7588
1.00	2.00	10.00	20.00	10.00	10.00	75.00	10.00	**	0802
1.00	3.00	5.00	10.00	15.00	15.00	25.00	25.00	0.00	0302
5.00	5.00	10.00	5.00	5.00	5.00	10.00	10.00	0.00	7268
10.00	10.00	10.00	15.00	15.00	15.00	5.00	5.00	5.00	0302
5.00	5.00	5.00	10.00	10.00	5.00	10.00	10.00	10.00	4002
5.00	5.00	8.00	15.00	20.00	25.00	30.00	40.00	100.00	**
20.00	10.00	6.00	5.00	5.00	4.00	4.00	2.00	1.00	7501
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	**	0302
10.00	10.00	10.00	10.00	20.00	20.00	20.00	10.00	10.00	7522
20.00	15.00	20.00	20.00	15.00	10.00	10.00	5.00	0.00	7562
25.00	20.00	15.00	15.00	20.00	15.00	15.00	10.00	10.00	7564
10.00	20.00	20.00	10.00	5.00	10.00	5.00	0.00	0.00	0302
5.00	30.00	50.00	50.00	40.00	30.00	20.00	**	**	0302
5.00	10.00	20.00	10.00	5.00	25.00	2.00	2.00	**	7562
10.00	40.00	20.00	30.00	20.00	5.00	5.00	10.00	5.00	3002
5.00	5.00	10.00	10.00	10.00	0.00	0.00	0.00	0.00	0802
10.00	20.00	15.00	15.00	12.00	12.00	10.00	7.00	0.00	3002
7.00	3.00	1.00	5.00	1.00	1.00	5.00	1.00	1.00	3002
20.00	10.00	5.00	3.00	0.00	0.00	0.00	0.00	0.00	0302
10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0802
10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0302
10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0302
5.00	15.00	20.00	5.00	5.00	5.00	10.00	2.00	0.00	0302
25.00	25.00	25.00	10.00	15.00	10.00	10.00	5.00	10.00	7508
60.00	40.00	20.00	20.00	20.00	10.00	10.00	0.00	0.00	3402

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
50.00	30.00	40.00	50.00	15.00	10.00	10.00	0.00	0.00	1302
30.00	30.00	25.00	20.00	5.00	5.00	100.00	**	**	1802
30.00	30.00	30.00	25.00	20.00	15.00	15.00	10.00	10.00	0802
10.00	10.00	100.00	10.00	10.00	10.00	100.00	0.00	0.00	0302
20.00	50.00	100.00	50.00	50.00	50.00	100.00	50.00	100.00	7583
10.00	10.00	25.00	50.00	50.00	50.00	50.00	50.00	50.00	7583
20.00	20.00	20.00	30.00	20.00	20.00	20.00	50.00	50.00	3002
25.00	15.00	25.00	15.00	10.00	15.00	10.00	5.00	10.00	4302
50.00	40.00	20.00	10.00	10.00	5.00	10.00	1.00	0.00	7208
10.00	20.00	30.00	20.00	100.00	100.00	100.00	100.00	100.00	7511
10.00	20.00	20.00	20.00	10.00	10.00	10.00	0.00	0.00	4002
25.00	35.00	25.00	25.00	20.00	20.00	60.00	5.00	0.00	0302
40.00	25.00	15.00	5.00	5.00	15.00	3.00	1.00	0.00	0302
20.00	15.00	20.00	15.00	15.00	15.00	20.00	10.00	0.00	0802
22.00	20.00	18.00	16.00	14.00	12.00	10.00	0.00	0.00	0302
20.00	10.00	20.00	10.00	20.00	10.00	10.00	0.00	0.00	0802
50.00	75.00	50.00	25.00	20.00	20.00	20.00	20.00	10.00	0802
50.00	50.00	100.00	25.00	20.00	50.00	25.00	0.00	0.00	7511
33.00	28.00	20.00	20.00	18.00	15.00	10.00	10.00	15.00	7511
20.00	15.00	15.00	20.00	10.00	10.00	**	**	**	5803
70.00	50.00	50.00	30.00	20.00	20.00	50.00	20.00	**	0802
50.00	40.00	30.00	25.00	25.00	0.00	0.00	0.00	0.00	7565
25.00	25.00	25.00	20.00	15.00	15.00	15.00	10.00	10.00	0180
25.00	20.00	9.00	5.00	3.00	3.00	2.00	2.00	2.00	7208
100.00	50.00	20.00	10.00	10.00	20.00	5.00	5.00	0.00	7562
30.00	20.00	30.00	20.00	30.00	20.00	50.00	20.00	50.00	7511
30.00	30.00	30.00	35.00	30.00	30.00	30.00	20.00	10.00	0802
20.00	20.00	10.00	10.00	0.00	0.00	0.00	0.00	0.00	0302
50.00	50.00	35.00	35.00	20.00	20.00	10.00	10.00	10.00	0302
40.00	30.00	20.00	13.00	10.00	7.00	5.00	0.00	0.00	2502

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
25.00	5.00	10.00	15.00	20.00	25.00	30.00	0.00	0.00	1302
20.00	50.00	20.00	20.00	10.00	10.00	50.00	0.00	0.00	0302
10.00	25.00	50.00	50.00	50.00	75.00	100.00	100.00	100.00	7522
20.00	50.00	30.00	50.00	20.00	10.00	5.00	1.00	1.00	7562
50.00	40.00	30.00	20.00	10.00	10.00	5.00	5.00	1.00	**
100.00	75.00	50.00	50.00	50.00	50.00	50.00	40.00	40.00	0402
50.00	25.00	25.00	20.00	15.00	10.00	5.00	5.00	1.00	7557
50.00	50.00	20.00	20.00	15.00	15.00	10.00	10.00	10.00	1302
50.00	25.00	0.00	25.00	0.00	0.00	50.00	0.00	0.00	0302
80.00	60.00	60.00	50.00	10.00	20.00	10.00	0.00	0.00	0302
100.00	60.00	40.00	40.00	30.00	40.00	30.00	30.00	10.00	0802
100.00	50.00	30.00	30.00	20.00	10.00	0.00	0.00	0.00	0302
100.00	70.00	65.00	50.00	15.00	5.00	35.00	20.00	0.00	7562
100.00	100.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00	7565
100.00	90.00	50.00	30.00	25.00	20.00	15.00	10.00	5.00	0302
10.00	40.00	40.00	40.00	20.00	20.00	0.00	0.00	0.00	0302
80.00	70.00	60.00	15.00	10.00	70.00	50.00	5.00	0.00	3502
0.00	0.00	60.00	50.00	**	20.00	20.00	0.00	0.00	**
20.00	20.00	20.00	10.00	10.00	10.00	10.00	0.00	0.00	0302
5.00	20.00	20.00	5.00	5.00	5.00	10.00	0.00	0.00	0302
5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	3502
25.00	25.00	50.00	25.00	25.00	25.00	25.00	0.00	0.00	0302
10.00	25.00	50.00	25.00	25.00	25.00	75.00	25.00	0.00	0402
10.00	10.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	3002
10.00	20.00	10.00	5.00	**	**	**	**	**	7580
25.00	75.00	50.00	30.00	25.00	30.00	50.00	10.00	0.00	7587
0.00	30.00	40.00	50.00	30.00	20.00	0.00	10.00	0.00	0302
25.00	90.00	30.00	50.00	10.00	10.00	5.00	5.00	0.00	3502
5.00	4.00	4.00	4.00	3.00	3.00	2.00	2.00	1.00	6002
5.00	5.00	10.00	5.00	5.00	5.00	5.00	5.00	25.00	3060

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	0.00	0802
5.00	8.00	20.00	25.00	25.00	10.00	25.00	2.00	0.00	**
15.00	15.00	20.00	20.00	15.00	15.00	15.00	15.00	0.00	3060
2.00	15.00	20.00	2.00	15.00	20.00	10.00	10.00	0.00	0802
10.00	2.00	1.00	1.00	2.00	3.00	2.00	0.50	0.00	0302
2.00	3.00	10.00	3.00	1.00	1.00	1.00	1.00	1.00	7583
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	20.00	3002
10.00	10.00	10.00	10.00	10.00	5.00	5.00	1.00	1.00	0302
100.00	75.00	50.00	25.00	25.00	10.00	10.00	5.00	5.00	7208
30.00	30.00	30.00	15.00	15.00	15.00	15.00	10.00	1.00	0302
5.00	5.00	5.00	5.00	5.00	10.00	15.00	0.00	0.00	7576
10.00	10.00	10.00	20.00	15.00	15.00	25.00	15.00	**	0302
5.00	10.00	20.00	25.00	25.00	25.00	25.00	20.00	25.00	0302
50.00	30.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	1803
15.00	10.00	5.00	20.00	10.00	5.00	5.00	0.00	0.00	3002
20.00	10.00	15.00	10.00	10.00	10.00	25.00	20.00	10.00	**
50.00	50.00	100.00	50.00	50.00	50.00	0.00	0.00	0.00	0180
5.00	15.00	25.00	50.00	100.00	100.00	100.00	100.00	100.00	3060
75.00	50.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	7566
15.00	20.00	20.00	15.00	10.00	10.00	10.00	0.00	0.00	0302
5.00	5.00	10.00	20.00	20.00	50.00	40.00	4.00	2.00	0302
10.00	10.00	20.00	30.00	40.00	50.00	100.00	25.00	5.00	0180
5.00	10.00	10.00	20.00	15.00	15.00	20.00	10.00	5.00	0302
10.00	15.00	15.00	10.00	5.00	5.00	5.00	0.00	0.00	3002
15.00	15.00	10.00	10.00	10.00	10.00	20.00	10.00	5.00	7565
100.00	100.00	100.00	100.00	50.00	50.00	50.00	50.00	0.00	7566
10.00	10.00	10.00	20.00	15.00	15.00	10.00	5.00	0.00	0402
15.00	15.00	10.00	8.00	8.00	6.00	6.00	2.00	2.00	0302
10.00	15.00	10.00	10.00	10.00	0.00	0.00	0.00	0.00	0302
10.00	20.00	20.00	10.00	10.00	10.00	10.00	50.00	50.00	0402

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
20.00	20.00	10.00	30.00	10.00	40.00	30.00	30.00	0.00	7587
15.00	10.00	10.00	10.00	5.00	5.00	4.00	3.00	2.00	1302
20.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00	**	0402
10.00	10.00	20.00	10.00	20.00	10.00	20.00	10.00	5.00	1802
20.00	20.00	20.00	20.00	15.00	10.00	10.00	5.00	5.00	**
10.00	20.00	20.00	10.00	10.00	10.00	10.00	10.00	0.00	0302
20.00	20.00	30.00	20.00	30.00	10.00	20.00	10.00	10.00	7265
20.00	20.00	15.00	5.00	5.00	5.00	5.00	5.00	5.00	0802
20.00	15.00	10.00	20.00	10.00	10.00	10.00	10.00	20.00	**
15.00	15.00	25.00	50.00	50.00	100.00	200.00	300.00	400.00	0302
50.00	25.00	25.00	20.00	10.00	10.00	10.00	0.00	0.00	0302
25.00	20.00	20.00	20.00	10.00	1.00	1.00	0.00	0.00	0302
25.00	25.00	25.00	25.00	50.00	50.00	50.00	100.00	200.00	0302
10.00	10.00	10.00	5.00	5.00	2.00	2.00	2.00	1.00	0302
15.00	15.00	20.00	15.00	10.00	10.00	10.00	20.00	20.00	7562
10.00	10.00	20.00	50.00	25.00	10.00	40.00	20.00	100.00	1802
20.00	20.00	10.00	5.00	20.00	1.00	1.00	0.00	0.00	7565
10.00	20.00	10.00	20.00	5.00	15.00	5.00	15.00	5.00	0302
10.00	10.00	20.00	20.00	20.00	20.00	10.00	0.00	0.00	0802
30.00	30.00	30.00	10.00	10.00	10.00	20.00	0.00	0.00	0302
20.00	40.00	50.00	30.00	20.00	10.00	10.00	5.00	0.00	0302
10.00	20.00	10.00	10.00	5.00	5.00	5.00	0.00	0.00	3402
25.00	25.00	50.00	50.00	25.00	0.00	0.00	0.00	0.00	7587
50.00	25.00	20.00	10.00	5.00	5.00	0.00	0.00	0.00	1302
30.00	20.00	30.00	20.00	30.00	20.00	20.00	80.00	50.00	0302
40.00	20.00	30.00	10.00	20.00	30.00	50.00	**	0.00	3002
30.00	25.00	20.00	30.00	10.00	10.00	50.00	20.00	0.00	0802
100.00	100.00	100.00	50.00	50.00	50.00	100.00	0.00	0.00	2502
30.00	25.00	25.00	25.00	25.00	25.00	20.00	10.00	5.00	0302
15.00	10.00	10.00	10.00	15.00	50.00	25.00	0.00	0.00	3002

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
10.00	10.00	20.00	15.00	10.00	10.00	20.00	30.00	40.00	7562
15.00	10.00	10.00	10.00	15.00	5.00	10.00	10.00	5.00	3502
20.00	15.00	10.00	20.00	20.00	10.00	10.00	0.00	**	2602
25.00	20.00	15.00	10.00	5.00	5.00	2.00	0.00	0.00	7583
15.00	10.00	10.00	20.00	15.00	10.00	10.00	30.00	10.00	0302
20.00	20.00	20.00	10.00	5.00	5.00	5.00	0.00	0.00	6002
30.00	25.00	20.00	15.00	10.00	5.00	5.00	0.00	0.00	0302
20.00	20.00	20.00	10.00	10.00	10.00	50.00	0.00	0.00	0180
30.00	30.00	50.00	30.00	30.00	10.00	30.00	0.00	0.00	0302
10.00	40.00	30.00	20.00	20.00	15.00	0.00	0.00	0.00	7523
20.00	50.00	25.00	20.00	25.00	25.00	5.00	0.00	0.00	1803
20.00	40.00	40.00	10.00	10.00	10.00	0.00	0.00	0.00	0302
15.00	10.00	10.00	10.00	5.00	5.00	**	**	**	7566
25.00	25.00	10.00	10.00	15.00	30.00	50.00	20.00	20.00	0302
50.00	25.00	50.00	25.00	20.00	20.00	10.00	10.00	10.00	0302
25.00	50.00	50.00	20.00	20.00	10.00	50.00	10.00	0.00	0302
20.00	20.00	15.00	15.00	10.00	10.00	0.00	0.00	0.00	7320
10.00	75.00	50.00	35.00	25.00	20.00	10.00	0.00	0.00	0802
25.00	25.00	10.00	5.00	5.00	0.00	0.00	0.00	0.00	3002
20.00	10.00	25.00	3.00	5.00	3.00	0.00	0.00	0.00	7564
30.00	30.00	20.00	20.00	10.00	10.00	2.00	2.00	0.00	0302
40.00	30.00	20.00	10.00	0.00	0.00	0.00	0.00	0.00	7583
20.00	20.00	40.00	20.00	20.00	20.00	30.00	5.00	5.00	7522
20.00	100.00	20.00	10.00	5.00	5.00	5.00	5.00	**	7511
100.00	50.00	100.00	50.00	100.00	0.00	0.00	0.00	0.00	7565
25.00	70.00	50.00	25.00	5.00	5.00	5.00	0.00	0.00	0302
100.00	25.00	50.00	50.00	75.00	75.00	100.00	0.00	0.00	0302
50.00	25.00	20.00	15.00	15.00	10.00	10.00	0.00	0.00	7563
50.00	40.00	40.00	20.00	20.00	10.00	10.00	2.00	2.00	7563
25.00	50.00	25.00	25.00	10.00	10.00	10.00	10.00	10.00	7562

TABLE I-2 CONTINUED

OS-EX/OS	EX/OS-EX	EX-AA/EX	AA/EX-AA	AA-AV/AA	AV/AA-AV	AV-BA/AV	BA/AV-BA	BA-UN	PMOS
30.00	10.00	50.00	50.00	30.00	20.00	10.00	10.00	0.00	1802
50.00	50.00	50.00	30.00	10.00	0.00	0.00	0.00	0.00	3002
50.00	50.00	50.00	50.00	50.00	50.00	50.00	**	**	4302
95.00	75.00	25.00	10.00	25.00	2.00	1.00	0.00	0.00	0302
10.00	90.00	10.00	70.00	10.00	60.00	50.00	40.00	20.00	**
100.00	75.00	50.00	40.00	25.00	50.00	50.00	0.00	0.00	0802
100.00	100.00	100.00	50.00	0.00	0.00	0.00	0.00	0.00	0180
100.00	50.00	10.00	5.00	5.00	0.00	0.00	0.00	0.00	4402
100.00	90.00	75.00	50.00	25.00	1.00	**	0.00	0.00	0302
15.00	10.00	10.00	10.00	8.00	8.00	4.00	4.00	4.00	0302
15.00	15.00	15.00	15.00	10.00	10.00	25.00	10.00	25.00	1302
25.00	50.00	25.00	10.00	10.00	10.00	25.00	0.00	0.00	1803

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The goal of this study was to develop a procedure for determining the magnitude of the performance differences between different categories of enlisted personnel. The professional judgment of Marine Corps officers is used as the basis for building a scale that translates the current performance-evaluation system into a measure of an individual's relative value to the service.

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