AFIT/GLM/LAR/93S-7

A COMPARISON OF NON-PERFORMANCE CHARACTERISTICS WITH UNITED STATES AIR FORCE OFFICER PROMOTIONS

THESIS

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The views expressed in this thesis are those of the authors and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

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Abstract

The question of which non-performance factors influence the promotion of officers to major, lieutenant colonel, and colonel within the Air Force for Promotion boards held in 1992 is the focus of this thesis. The thesis statistically examines the impact of the variables commissioning source, prior enlistment, age, aeronautical rating, graduate education level obtained and source of education, Professional Military Education courses taken and method of completion, distinguished graduate status from commissioning source and Professional Military Education courses for "in-the-zone" and "below-the-zone" promotions. Multivariate logistics regression techniques are used to analyze and identify those variables significant to promotion. Odds-ratios are used to determine the sensitivity of each variable. Each of the variables is found to be significant in some of the promotion models.

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I. *Introduction*

Promotion and/or rank attainment is a fundamental concern for the Air Force Officer. Selection to a higher rank yields both tangible and intangible rewards. In contrast, non-selection for promotion can complicate an officer's career plans. A prediction for the near future and, quite possibly, the not so near future is that the Air Force will continue to draw down in size which presents the dual possibilities of more involuntary reductions through reduction in force (RIF) boards and fewer promotions. If future RIF boards use criteria similar to the 1992 board, those officers passed over for promotion represent the most vulnerable section of eligible officers. For every officer interested in his career the question arises, "What does it take to be promotable?" The authority for promoting commissioned officers can be found in the United States Code, Title 10. The code allows the Secretary of the Air Force to direct a promotion board to recommend a specified number of officers for promotion. After the rank of captain, promotions are determined on a "best qualified" basis. This competitive process is necessary because, by law, the amount of promotions available is less than the number of officers eligible for that rank. When a promotion board is convened, the board members must evaluate each eligible officer's records and determine which officers are "best qualified". Since an officer's records contain only a limited amount of data, there has to be some form of implicit weighting of the criteria. An assumption made by the current authors is that the first cut made by board members is based on performance factors. The first cut separates those officers with high performance scores on their Officer Performance Report (or Officer Evaluation Report) from those officers with low scores. Because of the nature of inflated performance reports (Ginosky, 1988), after this initial cut

there are still more eligible officers than promotions available. The board members must then reduce the pool of eligible officers further to meet the imposed limit set on promotions. Undoubtedly, supplemental criteria are weighted differently in the decision making process.

Although job performance must be a primary decision variable, the other decision variables are not as readily apparent. After excluding performance, other factors that influence promotion decisions should be documented. Our research questions focus on what non-performance factors influence a promotion board's decision to promote one consistent good performer over another and whether these decision criteria can be determined and documented through a statistical evaluation. By studying those officers who have just been considered by their most recent promotion board, it may be possible to determine what factors influenced promotion during that particular board. If the records of a majority of promoted officers have qualities that the records of non-promoted officers do not, then a linkage between these factors and successful promotion may be suggested. The objective of this research is to evaluate the records of promoted and non-promoted officers to isolate the non-performance factors related to promotion. The particular factors studied were chosen based on our own personal experiences in the Air Force and on the arguments of other analysts (Ginosky, 1988; Beusse, 1976) who have identified positive or negative factors contributing to promotion decisions. The non-performance factors researched were commissioning source; Professional Military Education courses completed and how they were completed; highest degree attained; age; prior enlisted experience; whether an officer's graduate study was done at the Air Force Institute of Technology (AFIT), sponsored by AFIT, or through no association with AFIT; rated status; and distinguished graduate status from either an officer's commissioning source or Professional Military Education coursework.

II. *Literature Review*

Organizational Promotion

Promotion is critical to both the employer and employee. Businesses view promotion as important because it represents a return on the investment they made in training and educating their employees. Conversely, promotion is important to the individual because it represents acknowledgment of good performance and, in most cases, an increase in pay. Promotion may be defined as "the advancement in station, rank or honor" (The Merriam, 1974: p. 556). Generally promotion carries with it more responsibility and more privileges. From the earliest organizations, a hierarchy of jobs has existed with more positions at the lower level and fewer above. Organizations realized that those higher level positions greatly influenced the success of the organization, and they were concerned with how to get the right people into the right jobs (Howell & Dipboye, 1986: 238). The consensus was that it was essential to have leaders in higher level positions. One study of promotable executives showed that leadership was an outstanding quality in 41% of those executives considered promotable and weak in 56% of those considered unpromotable (Randle, 1956). How then does an organization determine which individuals will make good leaders? Leadership theories such as trait theory and personal-behavior theory proved too limited to substantially point out good leaders (Adams & Fyffe, 1969). Other theories of leadership including the path-goal model and Fielder's contingency model (Gibson, Ivancevich, & Donnelly, 1991) have been developed, but none of these models is universally accepted, leaving the supervisor to decide which criteria will be used in deciding whom to promote.

Performance-Based Promotion

Since the hierarchy of jobs narrows as you progress to higher-level positions in the organization, there are always more people available to promote than there are positions to be filled. As with leadership theories, theories on how to decide on whom to promote are plentiful. These theories can be separated into two broad categories. First, there are models dealing with the methods organizations should use to promote personnel, and secondly, there are models identifying the behaviors individuals should exhibit to aid in their promotion. The majority of organizations have clearly expressed a preference for promoting from within provided a "qualified candidate" is available (Levine, 1991) . Although the notion of a "qualified candidate" may be debatable, the consensus is that performance should be the most important aspect determining an individual's promotability. One survey showed that 86.6% of corporate executives emphasized performance when making promotion decisions (Powell, 1969).

Many different perspectives exist on what factors beyond performance should be evaluated. Traditionally, unions have sought to have seniority be a primary criterion (Schnell, 1987: 160). This rule costs the firm some flexibility in decision making and may result in the promotion of a senior, but less-than-optimal employee. Another widely used promotion method is the process of job posting with studies showing up to 87% of companies using this method (Levine, 1991). In addition, an individual's actions may also influence promotion. To get promoted an individual must want to get promoted and convince decision making authorities that he/she is ready for, and the best choice for, promotion. Research has demonstrated that those individuals unwilling to sacrifice or those individuals who place significant limitations on their willingness to sacrifice show a marked decrease in rate of promotion (Baker, Markham, Bonjean & Lorder, 1988).

In the past few years, the amount of cases litigated over unfair promotion practices has steadily risen (Reynolds, 1992). These concerns have led organizations to take steps

to ensure that they have fair and unbiased promotion policies. There is a significant difference in perceived fairness between those companies that offer clearly defined paths and criteria for promotion and those companies that have vague promotion decision policies (McEnrue, 1989). Federal laws prohibit discrimination in promotion to the same degree as in hiring and firing. It is illegal to apply standards in promoting that may be disparate or give an advantage to a particular group. All criteria used in deciding promotions must be free of bias. Additionally, the US Circuit Court of Appeals for the 5th District has ruled that using standards that are vague and subjective in selecting individuals for promotion is unacceptable (Cope, 1991). Since the current study focuses on promotion and non-performance factors, other studies linking promotion and some non-performance factors are reviewed.

Studies Relating Promotion to Other Factors

An individual's personality gives him/her the ability to influence the lives of peers and increase his/her acceptability to others. Being able to successfully integrate ambition, aggressiveness, and drive into one's personality is considered an important factor in achieving a promotion-influencing personality (Powell, 1969). Personality has been shown to be a good predictor of performance. It has also been argued that personality measures have a place in personnel selection and promotion (Tett, Jackson, & Rothstein, 1991). The results of a meta-analysis study showed a positive correlation of .24 between personality and performance (Tett et al, 1991).

Seniority has traditionally been a strong force in promotion. A survey of executives showed that 55.6% of the respondents reported that it had a direct influence on their promotion policies, and 37.2% stated that it had an indirect influence (Powell, 1969). Research on the impact of age on promotion has been inconsistent with studies finding that upward mobility decreases with age (Lawrence, 1984), is unaffected by age (Cleveland & Landy, 1983), or increases with age (Stewart & Gudykunst, 1982).

Recently, a multivariate study of age and promotability showed age to have a negative impact (β= -.21, $p<.05$) and to significantly interact with other variables (Cox & Nkomo, 1992).

Having a college degree is considered a fundamental qualification requirement in pursuing an executive position (Powell, 1969) with the degree multiplying the likelihood of promotion and halving the likelihood of failure (Randle, 1956). One recent study of the relationship between promotion and education obtained a correlation of .74 ($p< .01$), signifying a strong relationship between the two (Baker, 1988).

Studies researching the trait theory of leadership found a high correlation between leadership and high intelligence (Gibson et al, 1991). General mental ability correlated .64 ($p < .01$) with promotability of first-line supervisors in a validity generalization study (Schmidt, Hunter, Pearlman, & Shane, 1979). A study of pilot and navigator trainees reached the conclusion that general intellectual ability was the best predictor of performance. Corrected correlations ranged between .33 and .44 on all performance measures (Ree & Earles, 1992).

The concept of physical attractiveness influencing promotion is a valid concern for Air Force officers, since a photograph is required to be in every officer's records. Although physical attractiveness is a purely subjective matter, several studies have identified it as an influence in promotion decisions. Even small effects may prove critical when decision makers are presented with a large number of equally qualified candidates (Morrow, McElroy, Stamper, & Wilson, 1990). In evaluating the effect of physical attractiveness in the military promotion process, a mock promotion board was performed (Madura, 1977). Photographs were rotated between record folders with the rest of the information in the folder remaining constant. The folders containing "positive charisma" photos consistently rated higher than those folders containing "negative charisma" photos

for the same performance data. Basically, the same pictures were being promoted regardless of the record set accompanying the photo.

Promotion in the Air Force

Although there has been a lot written about promotion and promotion theories and several studies relating promotion to other factors have been completed, the unique military promotion process limits the relevance of previous research. The definition of promotion in the Air Force is to be selected to a higher grade based on future potential as demonstrated by past and current performance (AFR 36-89, 1992). This selection is made by a board of colonels and generals, for promotions above the rank of captain, based on an individual's records alone. Since the board members ordinarily do not know the individual officers they are considering for promotion, they may not use any of the criteria previously discussed. Because the board members do not have an opportunity to actually observe a candidate, they may be inclined to focus on other, potentially irrelevant, factors in making their decisions (Ginosky, 1988). In response, the literature that specifically relates to promotion of officers in the military is reviewed.

Considerable research has been conducted on military promotions, but limited work has focused on promotions and non-performance factors. In one study completed in 1977, the career progression toward general officer was studied (Beishke & Lipsey, 1977). The research included Chi square tests of significance comparing promotion progress against many different variables. Nonperformance variables similar to those in the current research included commissioning source, AFIT degree, completion of Professional Military Education, and aeronautical rating. The study compared colonels, who were not selected for promotion, to colonels selected for promotion to general rank. The study showed an independence between these factors and general rank attainment, but no light was shed on their importance in attaining the rank of colonel, lieutenant colonel, or major. A contingency analysis conducted between naval officer promotions to

commander and commissioning source found that Naval Academy graduates had a significantly ($p<.01$) higher promotion rate (Parish, 1973). However, no other variables or interactive effects were analyzed. In one simulated study, a hypothetical promotion study was done. Officers in three groups, Air War College students, Air Command and Staff College students, and Squadron Officer School students were randomly chosen to select officers for promotion from captain to major from a fictitious set of records. The factors they could use in making their decisions were: 1) Officer Effectiveness Reports, 2) Professional Military Education, 3) Formal education, 4) Assignment history, and 5) Aeronautical rating. The results showed that the group multiple correlations were relatively low indicating that there was a lot of variation within the groups, but all the factors were nevertheless statistically significant predictors (Glenn, 1977). However, this simulated study has not been replicated in a field setting, nor have the findings been generalized to populations of lieutenant colonels or colonels.

The attainment of a PhD and its effect on promotability to colonel was evaluated in a 1983 dissertation. In this study, it was found that a PhD had a negative effect ($r = -.074$, $p = .04$) on promotability to colonel (Cubera, 1983). In contrast, a different study showed that graduate education to the masters level had a very significant effect on the promotion of naval officers (Cymrot, 1986). Based on these studies, graduate education is important, but neither study addresses whether the institutional source of the education influences promotion.

Finally, we reviewed a study that examined attitudes about promotion. The attitudes of active duty officers from all four services were collected through a survey. The Air Force results showed 50% of the respondents were dissatisfied with the promotion process and only 38% were satisfied. The survey respondents were also asked to rank the factors that actually influence promotions and the factors they believed should influence promotions. The results showed a clear emphasis on performance and ability

factors. The survey did not include items asking about non-performance factors except for time-in-service, time-in-grade, military training, and interpersonal relations (Beuss, 1976). The consistent failure of the research community to consider non-performance factors led to a gap in our knowledge of the promotion decision making process. In evaluating the literature available on promotion, we found much written about the subject, but little that specifically addresses the effects of non-performance factors on promotion decisions.

Hypotheses

Based on personal experiences and previous research, the following hypotheses were developed.

H_1: Commissioning source, aeronautical rating, graduate degree completion, and Professional Military Education attendance will be significant positive predictors of promotion to all ranks.

H_2: Distinguished graduate status (commissioning source or Professional Military Education courses), age, and source of graduate education will not be significant predictors of promotion.

H_3: Prior enlisted status will be a significant and negative predictor of promotion

III. *Method*

Criterion Measure

The criterion variable in this study was promotion. The variable was dichotomous with an individual either being promoted (coded as a 1) or not being promoted (coded as a 0). Because the study evaluated the results of specific promotion boards, certain assumptions about the dependent measure needed to be made. An officer's years of commissioned service primarily determines when an officer is available for promotion. The typical target years for "in the zone" promotions are 11 years of commissioned service for promotion to major, 15 years for promotion to lieutenant colonel, and 20 years for promotion to colonel with the specific year group for each promotion being determined by the Secretary of the Air Force (AFR 36-89, 1992). Prior to an officer's "in the zone" promotion opportunity, the officer is also considered by promotion boards both 1 year and 2 years "below-the-zone" (i.e., early). Each year, a promotion board is convened to consider officers with the required amount of years of commissioned service and officers who might have been previously promoted "below-the-zone" and have spent at least 2 years in their current rank for promotion. In this study, if an officer had been promoted "below-the-zone" that officer was considered to have been promoted on the cycle being studied. Additionally, although it is possible to be promoted following an officer's primary board, or "after-the-zone", we considered that officer as non-promoted since the probability is less than 5% that the officer will be subsequently promoted (Fleming, 1984). The promotion decisions considered in this research were the 1992 promotion boards for selection to major, lieutenant colonel, and colonel.

Predictor Measures

The predictor variables in this study were: age; prior enlistment; commissioning source; professional military education completion and method taken; aeronautical rating; distinguished graduate status from commissioning source, Air Command and Staff college, and Squadron Officers School; level of graduate degree obtained; and source of graduate degree.

Age. Age was expressed as a continuous variable. It was determined by subtracting the officer's year of birth from the current year (i.e. 1993).

Prior Enlistment. Prior enlistment applies to those officers who spent some years of service as an enlisted member prior to earning their officer's commission. It was coded as a dichotomous variable for this study with a 0 being no prior enlistment and a 1 for prior enlistment. To determine if an officer was enlisted prior to becoming commissioned, the officer's year of commissioning was subtracted from the officer's total federal military service date. If the result was greater than one, the officer was deemed to have been previously enlisted. A value of greater than one was used to counter the possibilities of an officer starting training or prep school in the latter part of one year and receiving his or her commission the following year.

Commissioning Source. The majority of officers receive their commission through one of three avenues. An officer may be commissioned through a military academy, an officer training school, or reserve officer training corps. These three categories served as the primary options for this study. Academy graduates were coded as a 1, reserve officer training course graduates as a 2, and officer training school graduates as a 3. Commissioning through any military academy was considered an academy commission and commissioning through any service's officer training program placed the officer into a single officer training school classification. Any officer commissioned through other sources was not included in this study.

Professional Military Education Completed and Method Taken. Professional military education schools throughout the services are divided into three groups: senior service schools, intermediate service schools, and primary service schools. These professional military education courses may be attended only at specific points of an officer's career. Because of collinearity problems, only the highest level school an officer was qualified to complete was included as a predictive measure for that model. Professional military education courses may be completed in several different ways. Primary service school may be completed by attending the school in residence or by completing the coursework through correspondence. Both the intermediate and senior service schools may be completed in residence, by correspondence, or by seminar. The appropriate professional military education courses were categorized as no completion or by specific method taken. If an officer had completed a course by correspondence or seminar and also in residence, the officer was only considered to have attended in residence because that method is the only method that has a limited amount of available slots each course period. Officers who had not completed the appropriate level course were coded as a 0, completion in residence was coded as a 1, completion by correspondence as a 2, and completion by seminar as a 3.

Aeronautical Rating. An officer's aeronautical rating was categorized into one of three different categories: pilot, navigator, or support. The categorization was based on the officer's Air Force Specialty Code. If an officer's primary or secondary Air Force Specialty Code corresponded to that reserved for a pilot, then the officer was categorized as a pilot. Navigator and support categorizations were accomplished in the same manner. If an officer had mixed specialty codes, such as a secondary specialty code that was for pilots and a primary specialty code for a support duty, the officer was categorized as a pilot. In mixed specialty code scenarios, pilot was the first choice and navigator the second choice. Pilots were coded as a 1, navigators as a 2, and support officers as a 3.

Distinguished Graduate Status. Several opportunities exist for an officer to earn a distinguished graduate designator throughout his/her career. Three specific opportunities were regarded as potential predictor variables. Dichotomous variables reflected whether an officer was a distinguished graduate (0 for no, 1 for yes) from his/her commissioning source , from Squadron Officer's School, and from Air Command and Staff College. This measure was less comprehensive because intermediate service schools other than Air Command and Staff College may be attended and a Distinguished Graduate status earned. However, the data for these individuals was not readily available.

Level of Graduate Study. To become an officer, it is required that an individual have a bachelors or bachelors-equivalent degree. Additional education is permitted and is often characterized as a career plus. In this study, two dichotomous variable were used to represent graduate study. One variable represented having a master's degree, and the other variable represented having a doctoral degree. Both variables were coded as a 1 if the degree was attained and a 0 if no degree was attained.

Method of Graduate Study. In addition to deciding whether to pursue further education, an officer has several options with respect to how that education will be attained. Two different binary variables were used to differentiate among three methods of graduate study. One method of study was for the officer to attend the Air Force Institute of Technology (AFIT) in residence. Another method was for the officer to attend a civilian school full time, with the schooling being funded by AFIT (henceforth AFIT-sponsored). Finally, an officer could complete graduate studies on his or her own free time with no connection to AFIT.

Samples

Nine samples were used. The samples used were line officers commissioned in 1971, 1972, 1973, 1977, 1978, 1979, 1981, 1982, and 1983 through a military academy, OTS, or ROTC. These samples represent the most recent year groups that at the time of

the study had been considered by a promotion board to the ranks of colonel, lieutenant colonel, and major, respectively, for both "primary-zone" and "below-the-zone" promotions. Demographic details about each sample are shown in Table 1 and Table 2.

Procedure

To retrieve data for the study, we used the Air Force's worldwide ATLAS database. The database stores the records of all active duty officers. By selecting commissioning year as a weighted identifier, the database provided all records from the file for each year group. From this output, officers commissioned by sources other than those in our study were removed. This procedure established the sample for each year group. Distinguished Graduate status from Squadron Officer's School and Air Command and Staff College was not included in the original database and had to be determined by requesting lists of all the distinguished graduates from the schools. This list was then compared to our master sample to determine which individuals were distinguished graduates.

TABLE 1
Demographic Data

	Promotion to Colonel			Promotion to Lieutenant Colonel			Promotion to Major		
	In the zone	1 yr below the zone	2 yrs below the zone	In the zone	1 yr below the zone	2 yrs below the zone	In the zone	1 yr below the zone	2 yrs below the zone
Year Group	1971	1972	1973	1977	1978	1979	1981	1982	1983
Sample size	1282	1395	2169	2156	2420	3561	2874	2970	3501
Mean age	45.3	44.5	43.5	39.8	39.4	39.2	36.8	34.9	35.9

TABLE 2

Percentage of Each Sample's Composition

Year Group	1971	1972	1973	1977	1978	1979	1981	1982	1983
Promoted	44	19	9	67	14	3	76	12	2
Academy	12	14	18	19	19	11	15	15	15
Reserve Officer Training Corps	46	51	49	65	50	34	41	47	47
Officer Training School	42	35	33	16	31	55	44	38	38
pilots	34	33	37	26	20	15	25	26	24
navigators	17	17	19	12	12	10	19	17	12
support	49	50	44	62	68	75	56	57	64
masters	94	93	90	87	85	81	69	59	53
PhDs	4	4	3	2	2	1	1	1	< 1
enlisted	4	10	9	16	23	30	26	27	29
Distinguished Graduates commissioning source	21	21	18	18	16	14	12	15	15
Distinguished Graduates Squadron Officer's School	6	9	6	5	5	4	7	6	7
Distinguished Graduates Air Command & Staff	1	1	1	1	1	< 1	0	0	0
AFIT in residence	9	9	9	10	10	8	9	8	9
AFIT sponsored	10	9	7	8	8	7	8	7	8

IV. *Results & Discussion*

Data Analysis

The basic analytical model used is the standard multiple regression model as shown in Figure 1. However, because of some of the unique aspects of the research data, the basic model is not completely accurate. Because the response variable is dichotomous, the standard method of evaluating multiple regression variance through a ordinary least squares method presents peculiar problems. First, errors are not normally distributed when there is only a zero/one response because there are only two possible values for the error term. Second, the error terms do not have equal variances when the response variable is an indicator variable. Lastly, using a standard least squares estimator it is possible to

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon$$

where:	Y	= response variable
	x	= predictor variable
	k	= number of predictor variables
	β_0	= the y-intercept
	β_k	= coefficient value
	ε	= error term

Figure 1. Multiple Regression Analysis Standard Model (McClave and Benson, 1991: 522).

predict a response variable less than zero or greater than one which is not in actuality possible (Neter, Wasserman, & Kutner, 1989). When a response variable is categorical, it is likely that the shape of the response function will be curvilinear. In order to correctly fit a function, the response variable is transformed. The specific transformation required is the logistics (or logit) transformation. This transformation has the result of modeling the

response variable as an S-shaped curvilinear function with asymptotes approaching zero and one (Weisberg, 1985).

The data for each sample was then input into a logistical regression model and was evaluated using a forward-stepping stepwise procedure. The criteria for inclusion of a variable into the model was a test measuring the improvement on the goodness-of-fit of the model with that variable added. The improvement on the model had to have a significance of greater than .10 and the variable could only be removed if its significance became less than .15. Table 3 shows the t-statistics used in the improvement test for those variables included in each model and their significance levels. The values for the t-statistics were derived by dividing the transformed coefficients by the standard error for each variable (Hosmer & Lemeshow, 1989). The shaded area of the table signifies that that variable was not evaluated in that particular model and empty cells mean that variable was not a significant predictor for the model.

The primary methods of evaluating predictor variable effects in a logistical regression are their introduction into the model and through odds-ratios. The odds-ratios can be found by taking the natural base e to the β power (e^{β}) with β being the coefficient of the variable in the regression equation. Through this method, betas that are positive yield odds-ratios greater than one and negative betas yield odds-ratios less than one. Therefore odds-ratios get closer to zero as the magnitude of the negative beta increases. The odds-ratios for all the significant variables are shown in Table 4. By comparing the odds-ratio in the table to the reference group within each variable, the impact of that particular variable, or of individual facets of polytomous variables, can be determined. The reference group for each variable was that aspect of the variable coded as a zero.

Individual Variables

All the predictor variables selected for this study were significant in at least three of the nine model equations (one model equation for each sample). The only variable that

was included in every model was being a distinguished graduate from Squadron Officer's School The distinguished graduate Squadron Officer's School variable was always a positive predictor and ranged from 2.76 to 18.8 implying that a Squadron Officer's School distinguished graduate was up to 18.8 times more likely to be promoted to major 2 years below-the-zone than an officer who did not complete Squadron Officer's School, all other variables being held equal. In contrast to our original hypothesis, distinguished graduate status was both a significant and positive indicator in all the models. In addition, the age variable was included in all the models except one; however, the odds-ratios hovered very closely to one showing the effect to be slightly negative or positive, depending on the particular model. The variable prior enlistment was significant in all but one model. In all instances, this variable showed up as a negative predictor with the greatest magnitude being found during below-the-zone promotions.

An officer's commissioning source was a significant predictor in most models. The reference group within the variable source was those officers commissioned through an academy. As the odds-ratios show, being commissioned in other manners gave an officer a reduced chance of being promoted with all other variables being equal. The only discrepancies in this category are the 1 year below-the-zone promotions to lieutenant colonel and major showing officers commissioned through Reserve Officer Training Corps having a better chance of promotion than academy graduates. As hypothesized, an officer's aeronautical rating was also a significant indicator of promotion in the majority of models. The reference group for this variable was officers that had a pilot status. In all instances, navigators or support officers have an odds-ratio less than one signifying that they have a smaller chance of promotion than pilots with navigators having, in most models, a smaller chance for promotion than support officers.

TABLE 3

t-statistics for the Variables Included in Each Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Year Group	1971	1972	1973	1977	1978	1979	1981	1982	1983
Reserve Officer Training Corps	-2.39**		-3.31*	-1.73**	1.69**	-3.77**	-3.78**	5.31**	-2.76*
Officer training school	-2.91**		-3.29*	-1.79**	-3.78**	-6.79**	-2.85**	-3.46**	-4.79*
Navigator	-4.23**	-3.86**		-3.14*	-5.57**	-2.66*	-2.58**	-2.75**	
Non-rated	-1.16**	-.807**		-4.14*	-5.74**	-2.19*	-5.01**	-3.44**	
Enlisted		-4.12	-1.64	-4.22**	-3.90**	-4.75**	-2.22	-5.16	-3.78**
Masters	1.65			9.75**	5.34**		8.68**	5.16**	4.04**
Doctoral	2.33			2.36*			1.59		
Distinguished graduate commission source	3.39**	4.17**	3.02	6.66**	6.97**	4.29**	4.20**	1.84	
Distinguished graduate Squadron Officer's School	3.22**	5.24**	4.63**	4.29**	5.80**	7.46**	4.14**	8.97**	10.30**
Distinguished graduate Air Command & Staff	2.46*		5.71**	2.00*	4.67**				
AFIT			-2.16		-2.13			-2.28	
AFIT Sponsored					-2.59*		2.07*		2.19
Age	-2.17	4.23**	2.37		4.36	7.14**	-2.14**	5.42**	6.60**
Service School Residence	12.1**	13.70**	14.60**	7.11**	4.31**	5.48**	4.65**		5.17**
Service School Seminar	4.78**	4.85**	3.17**	5.68**	2.76**	2.89**			
Service School Correspondence	4.65**	4.06**	2.67**	5.96**	3.55**	3.39**	3.50**		.79**

* $p < .01$ ** $p < .001$

TABLE 4

Odds-Ratio Values for Significant Variables

Year Group	1971	1972	1973	1977	1978	1979	1981	1982	1983
Reserve Officer Training Corps	.594		.471	.767	1.39	.349	.507	2.84	.441
Officer training school	.511		.386	.692	.322	.070	.582	.428	.155
Navigator	.407	.313		.569	.186	.286	.659	.567	
Non-rated	.840	.865		.581	.369	.575	.487	.570	
Enlisted		.182	.509	.559	.372	.145	.731	.281	.206
Masters	1.65			4.24	4.28		2.49	2.09	3.25
Doctoral	2.19			3.54			5.20		
Distinguished graduate commission source	1.75	2.15	1.91	2.90	2.98	2.78	2.09	1.32	
Distinguished graduate Squadron Officer's School	2.76	3.58	3.50	9.32	3.72	6.90	11.5	5.96	18.8
Distinguished graduate Air Command & Staff	5.32		11.6	7.83	6.98				
AFIT			.488		.595			.543	
AFIT Sponsored					.512		1.56		2.01
Age	.902	1.26	1.14		1.20	1.43	.956	1.18	1.37
Service School Residence	47.0	35.7	48.6	38.5	10.4	385	11.1		8.26
Service School Seminar	2.21	2.93	2.08	7.15	3.78	19.5			
Service School Correspondence	2.27	2.56	1.91	7.62	5.27	31.0	6.21		2.64

Graduate education variables also appeared frequently in the different models. A master's degree was a positive indicator for several different promotion cycles while a doctoral degree only was significant for in-the-zone promotions. A masters degree has commonly been considered "essential" for promotion and the results of this study support that belief. In contrast, a doctoral degree has frequently been considered detrimental for promotion and this belief is not supported by the 1992 promotion results. This may be an isolated artifact of the specific promotion cycle or it may represent that the Air Force is starting to realize the usefulness of continued education. The method of completing graduate education was sporadically included in the different models with AFIT attendance always being a negative indicator and an AFIT-sponsored degree having both negative and positive effects on its appropriate models.

This finding is surprising and disconcerting to the authors who happen to be AFIT students, because AFIT is frequently presented as beneficial for promotion.

Completion of the appropriate level of professional military education had, in most cases, the highest magnitude of positive predictability of all the variables. The reference group within this variable was officers who had not completed their appropriate level professional military education course. Completion of professional military education in any manner was a positive indicator of promotion with completion through in-residence showing some dramatically large odds-ratios. An example, is that all other variables being equal, an officer competing for a 2 year below-the-zone promotion to lieutenant colonel has 385 times more chance of receiving the promotion than an officer who has not completed an intermediate service school course.

Overall Models

As with standard regression, the primary purpose of a logistical regression is to find a model that fits the data as closely as possible. The difference arises however in the approach each analysis uses. In standard regression analysis, the goal is to minimize the

total variation of actual data points from the determined model. In contrast, a logistic regression tries to find the maximum likelihood estimators that will maximize the derived function (Hosmer et al, 1989). Because of this fundamental difference, using r^2 to asses the model fit is inappropriate (Cox & Wermuth, 1992); however, a similar analysis is performed. A central statistic used for this analysis is deviance whose equation is D = -2 ln[likelihood of current model / likelihood of saturated model] where D is the deviance (Hosmer et al, 1989). The individual deviance values are then evaluated through goodness of fit methods to derive a goodness-of-fit statistic $\hat{H}_g$ that is in practice equivalent to r^2. Goodness of fit statistics for each model are shown in Table 5. The goodness of fit statistics are interpreted similar to r^2 values with values closer to 1 meaning that the derived model fit the data more accurately.

TABLE 5
Statistics Assessing How Well the Model Fits the Data

Year Group	1971	1972	1973	1977	1978	1979	1981	1982	1983
Goodness of fit	.13	.94	1.0	.70	.89	.90	.58	.87	.88

The $\hat{H}_g$ values calculated for this study show that as a general rule the regression models fit the data very well. The only models that did not show very strong model fits were the in-the-zone promotion to colonel model (.13) and the in-the-zone promotion to major model (.58). One possibility why the in-the-zone promotion models had the lower model fitting values is because a mandated percentage of officers must be promoted during these boards compared to no set percentage for below-the-zone boards. This increased promotion percentage may have led the board members to relax their criteria for promotion to assure that a sufficient number of officers were promoted. In essence, the number of officers who met the criteria desired by the board members was less than the

number needed by the Air Force; therefore, additional criteria were probably included to select the remaining officers, thereby increasing the deviance of the data points. This possible explanation may be further reinforced by the fact that there are fewer predictor variables significant in the below-the-zone promotions than the in-the-zone promotion models. The high values for $\hat{H}_t$ suggest to us that the models as derived are accurate representations of the promotion boards studied.

The results of this study support, for the most part, the popular beliefs about what factors drive promotion. For example, completing appropriate professional military education courses is widely considered to be an important stepping stone for promotion to higher grade levels. It is also widely believed that Academy graduates and pilots are more likely to be promoted than non-Academy graduates or non-pilots which is substantiated by our findings. In contrast, the distinguished graduate programs are frequently down-played and made to appear unimportant; however, during this promotion cycle being a distinguished graduate in any of the possible areas gave an officer a better chance of being promoted.

The preceding analysis illustrates one possible approach to evaluating the impact on promotion of various factors external to job performance. Although limited in scope, this study does establish clear relationships between promotion and the indicated non-performance variables. The authors would be hesitant to generalize the predictiveness of the models to future promotion boards because of their limited scope. There exists the possibility that there was a great amount of uniqueness in the 1992 promotion boards that would cause different variables to be significant than was the case for earlier or future boards. Using the same analysis on future promotion boards would yield enough data to be able to make predictive analyses about the effect of the studied non-job performance variables and promotion. The overall high scores of the $\hat{H}_t$ statistics are fairly conclusive that the models are accurate representations of 1992 promotions. The authors can not be

sure that the variables found significant were intentionally considered significant by the board members or were a result of other factors; however, we feel it is important for promotion officials to consider our findings.

Promotion officials should evaluate the findings of this study and determine if the significant variables found through regression techniques are what they really desire the relevant promotion criteria to be? Does the Air Force want to send the message to officers that being prior enlisted or attending AFIT could hinder an officer's promotability? Does the Air Force want to say that professional military education in residence is the strongest predictor of promotion all other things held equal? Does the Air Force want to continue to have three different avenues of commissioning available during times of a decreasing budget when there is a lot of evidence showing that academy graduates are more likely to be promoted? These are just some of the important and critical questions that arise from this study that should be addressed and answered by top Air Force officials so that their employees can be aware of the steps they should or could take to be promoted.

Conclusion

The findings of this research, in addition to the literature found on the subject leads us to conclude that not only is there a need to document the non-performance factors associated with the Air Force promotion process, but also, these non-performance promotion factors can be easily documented using the logistical regression model. As evidenced by the strong significance of some non-performance factors in the 1992 promotion cycle, we believe that some non-performance factors do influence a promotion board's decision to promote one consistent performer over another. We realize that this research is a limited snapshot of Air Force promotions directly relevant only to the 1992 cycle, therefore we recommend that the logistical regression model be used on future promotion cycles in order to produce trend analysis and conclusions generalizable to

future Air Force promotions. Many unstudied variables exist that may influence promotion board decisions (e.g. duty titles, official photographs, etc.). They may warrant further study. As long as the promotion process is fuzzy, continued research needs to be done to ensure that officers are aware of current promotion trends.

An additional recommendation is that survey research be conducted to determine if the perceived promotion requirements of the Air Force population match up to the relevant non-performance factors indicated in our research. Furthermore, research involving previous promotion board members could provide meaningful insight. Previous board members may provide firsthand information on criteria which those board members considered important when choosing which officers to promote. We believe that the promotion trends depicted by the logistical regression models combined with perceived promotion requirements would provide a valuable tool the Air Force leadership could use to shape the future officer corps.

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13. ABSTRACT *(Maximum 200 words)*

The question of which non-performance factors influence the promotion of officers to major, lieutenant colonel, and colonel within the Air Force for Promotion Boards held in 1992 is the focus of this thesis. The thesis statistically examines the impact of the variables commissioning source, prior enlistment, age, aeronautical rating, graduate education level obtained and source of education, Professional Military Education courses taken and method of completion, distinguished graduate status from commissioning source and Professional Military Education courses for "in-the-zone" promotions. Multivariate logistics regression techniques are used to analyze and identify those variables significant to promotion. Odds-ratios are used to determine the sensitivity of each variable. Each of the variables is found to be significant in some of the promotion models.

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