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A STATISTICAL ANALYSIS OF BLACK-WHITE PERFORMANCE DIFFERENTIALS OF U.S. MILITARY PERSONNEL

by

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A STATISTICAL ANALYSIS OF BLACK-WHITE PERFORMANCE DIFFERENTIALS OF U.S. MILITARY PERSONNEL

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ABSTRACT

Research has suggested current civilian black/white wage differentials can be explained primarily by a skill gap. The research also suggests that much of this gap is a result of differences in premarket acquired cognitive skills, rather than innate ability, labor market discrimination, or quantity of education. The first goal of this thesis is to determine whether gaps in military productivity exist and whether they are comparable in size to the civilian wage/productivity gaps. The second goal is to determine whether any gaps in observed military productivity can be explained by acquired cognitive abilities. Following the civilian literature, this thesis uses AFQT to measure the skills of enlistees, and college GPA to measure the skills of officers. Multivariate models are used to analyze black-white performance differences for Navy officers and Marine Corps and Air Force enlisted personnel. The findings indicate that there is a black-white gap in performance of military personnel, although the gap tends to be smaller than civilian wage differences. In addition, acquired skills explain some, but not the majority, of this gap. The relatively weaker relationship

between AFQT and productivity in the military is likely to result from selection by the military and self selection by individuals.

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I. INTRODUCTION

A. BACKGROUND

Labor Market discrimination is defined as occurring when minorities, *who are equally productive*, are paid less than whites for the same job, or are assigned to jobs for which they are overqualified(Ehrenberg and Smith, 1996). When such disparities occur in an organization, labor is not utilized to its maximum potential productivity and output is lower (or costs higher) than it would otherwise be. The issue of discrimination against minorities in the civilian workplace has generated considerable research attention by labor economists over the past 25 years. The analysis of discrimination, human capital development, and performance measurement is critical to both the equity and efficiency of workforce management and manpower allocation decisions.

These issues are no less important in the management of military manpower resources, particularly in light of changing demographics in the United States. As can be seen in Table 1.1 below, the diversity of the labor force has increased considerably in the last two decades. This change is predicted to continue with even greater representation by minorities and women in the future.

Shares of the Civilian Labor Force for Major Demographic Groups: 1976, 1992, 2005

	Year		
	1976	1992	2005 (projected)
White males (non-Hispanic)	53%	43%	38%
Women (all races)	41	46	48
Blacks (both genders)	10	11	11
Asians and Native Americans (both genders)[a]	2	3	5
Hispanics (all races, both genders)	4	8	11

[a]Includes Alaskan Natives and Pacific Islanders.

Table 1.1 Civilian Labor Force Demographics
SOURCE: Ronald G. Ehrenberg and Robert S. Smith, "*Modern Labor Economics: Theory and Public Policy,*" (1996)

With more and more of the recruiting age population represented by minority groups, the mix of minorities to recruit and their performance within the organization continue to be significant manpower issues. The military services need to focus on the issues of minority representation in the force and performance to meet recruitment goals and to maximize productivity (such as fleet readiness). Policies that embrace diversity are necessary not only to meet representation and equity goals, but also to maintain the viability of the all-volunteer force.

The armed forces generally have been perceived as a leader in the integration of minorities into the workforce. Historically these changes have largely been a result of political pressure for change rather than motivated by an internal push for enhanced efficiency or for enhanced organizational performance. Nonetheless, such changes have impacted both the recruiting and operational environment.

Recent research has indicated that the propensity of American youth, particularly blacks, to pursue military service has decreased in recent years. During the period 1989 - 1995 the propensity to enlist among high quality (AFQT CAT IIIA and above High school diploma graduates) white males fell 10 percent, while propensity among black males fell almost 30 percent(Orvis, Sastry, and Mcdonald, 1996). This decline in propensity, when combined with the strong civilian job market, has damaged the military's ability to achieve accession goals, both overall goals as well as specific minority goals.

The Navy in particular has had difficulty in attracting and retaining Blacks and other minorities in sufficient numbers to meet current requirements. The Department of the Navy "12/12/5" goal is one example of an attempt to improve minority representation in the armed forces. Established in 1993 by the Secretary of the Navy, the 12/12/5 goal dictated that accessions(officer and enlisted) consist of 12 percent Black, 12 percent Hispanic, and 5 percent Asian by 2005. The goal was based on Census Bureau projections of population mix in the year 2005. Previous goals had been based on Department of Education predictions for college graduation rates and were felt to be too restrictive in managing the demographics of the officer corps and enlisted force(Department of Defense, 1997).

The issue of skill levels and their measurement and the relationship between acquired skill and military performance potential are critical in determining the appropriate accession standards for new entrants. Accession standards, in turn, determine the youth population qualified for military service. When Congress questions the representation of Blacks and other minority groups in the senior enlisted and officer ranks, the Navy needs to be able to demonstrate that the existing representation disparities are not the result of institutional bias, intentional or otherwise. If observed performance patterns within the military resemble patterns in the civilian workforce, they may be explainable by appealing to observed productivity differentials, which may be addressed in the recruit selection process.

If observed military performance differentials can be linked to gaps in acquired skills, then policy makers must address this gap, especially when the performance differentials affect effort, promotion, pay and other rewards. Recently the civilian skill gap has been linked to socioeconomic status (SES) factors as opposed to the quantity or quality of education received. The general trend in research findings has moved away from a focus on discrimination as the explanation for the civilian wage gap, towards educational background (quantity and quality) and eventually to SES and other unobserved factors. As a result, the solutions for increasing the available pool of high quality recruits reflects a more difficult social problem that affects the general population, and one which is not readily solved by improvements in education alone.

In light of the difficulty in recruiting and retaining high quality minority personnel, particularly in the officer corps, identifying barriers to performance is a significant issue for the US Navy and the military services in general. It is particularly important to identify statistically that portion of any racial performance difference which may be due to differences in skills acquired prior to entering the military and that portion which may be due to other factors, such as institutional bias.

B. RESEARCH OBJECTIVES

Civilian research by Derek Neal and William Johnson (1996) has suggested that Black-White wage (performance) differentials in the workplace can be largely accounted for by a premarket skill gap, as reflected in AFQT scores, rather than by racial discrimination in the labor market. They argue that AFQT is a measure of acquired cognitive skills, not innate mental ability. Their research indicates that observed Black-White differentials in the labor market can be largely accounted for by this differential in acquired cognitive skills. This thesis will adopt the methodology that Neal and Johnson used to examine civilian wage differences in an analysis of black-white differences in military performance.

The conventional assumption in labor economics is that wages reflect worker productivity. Thus, one can assume that absent discrimination the black-white wage gap reflects differences in on-the-job productivity between these groups.[1] The first goal of this thesis is to determine whether the black-white civilian wage gap observed in the civilian sector(and the presumed difference in productivity) is also reflected in differences in the measured productivity of military personnel, including both officers and enlisted. The second goal is to determine whether observed productivity and any black-white gaps can be explained by acquired abilities. Following the civilian literature, the thesis uses AFQT to measure acquired skills of enlistees, and college GPA to measure skills of officers.

C. SCOPE, LIMITATIONS, AND ASSUMPTIONS

The scope of the research in this thesis is limited by the availability of performance measures for enlisted personnel and officers, and skill measures for officers. The data that were available for Marine Corps enlisted

[1] Recent literature, however, has focused on the many reasons why wages can diverge from individual spot marginal products even in a profit maximizing setting (Lazear, Personnel Economics).

personnel, while indicative of overall performance for junior personnel, are not highly correlated with the AFQT as a measure of acquired cognitive abilities. This is likely due in part to the less technical nature of Marine Corps mission requirements. The Air Force performance data is more suited for the analyses in this thesis because this branch has a high proportion of highly technical occupational specialties. As of this writing, data were still not available for Navy enlisted personnel. The officer data utilized for this analysis is limited to Navy Unrestricted Line(URL) Officers.

The final merged data sets used in this analysis were restricted to the results of matching individuals in three different data sets. The three files were the Department of Defense, Socioeconomic Survey, Enlisted Master Files for each service, and performance data files provided by each service. After these files were matched the total number of available observations fell. Nonetheless, information form all three files was necessary to allow an examination of the effect of acquired skills on performance and the effect of socioeconomic background factors on differences in the AFQT acquired skill measure.

The primary barrier to more useful data for analysis is the privacy protection of individual performance records. Supervisor evaluations are not available for the Marine Corps Enlisted records. In addition, the measure used for officer ability(the college GPA) is less useful than SAT scores, but again privacy and cost limitations prohibit the extensive use of SAT scores for this analysis.

Regardless of ability to "explain" performance differentials through measures of acquired skills, age, gender, and other factors, the remaining "unexplained" gaps are open to interpretation. It can be assumed that the remaining differences are due to characteristics which affect performance, but cannot be observed or measured. On the other hand, these differences may be attributed wholly or partially to disparate treatment of minorities. However, this research does not presume that all unexplained differences are solely attributable to racial discrimination.

D. THESIS ORGANIZATION

This thesis is composed of five chapters including this Chapter I introduction. Chapter II provides some background information and an overview of previous research on performance and wage differentials. Chapter III is a description of the data and methodology used in the statistical analysis in the thesis. Chapter IV presents the results of the regression analyses of military performance and makes comparisons with prior civilian research. Chapter V provides conclusions and recommendations for policies and future research.

II. BACKGROUND

A. ANALYTICAL FRAMEWORK

The underlying framework for this thesis is provided by previous research on civilian wage differentials. In particular, the thesis relies on the methodology developed in a recent study by Neal and Johnson(1996). Neal and Johnson argue that black-white wage gaps can be accounted for by a skill gap as measured by the Armed Forces Qualification Test (AFQT). They use data from the National Longitudinal Survey of Youth(NLSY) for their statistical tests. The primary analytical method used by Neal and Johnson is to use standard wage regression estimated by OLS with the dependent variable as the log of wages. Their reduced form equation includes only Black, Hispanic, Age, and AFQT scores as explanatory variables. In their results, the observed wage differential between blacks and whites is explained entirely by AFQT for young women and largely explained for young men. Table 2.1 below shows the primary regression results of using AFQT as a measure of skill in a log wage equation. The central findings are in columns 3 and 6, which indicate a large reduction in the magnitude of the coefficient of the black variable when AFQT is included(a 70 percent reduction for males and a 100 percent reduction for females). For comparison, columns 2 and 5 show the usual approach, which uses a schooling variable to control for skill. A comparison of columns 2 to 1 and 5 to 4 shows that schooling accounts for a much smaller portion of the black-white wage gap than does AFQT.

LOG WAGE REGRESSIONS BY SEX

	MEN (N = 1,593)			WOMEN (N = 1,446)		
	(1)	(2)	(3)	(4)	(5)	(6)
Black	−.244	−.196	−.072	−.185	−.155	.035
	(.026)	(.025)	(.027)	(.029)	(.027)	(.031)
Hispanic	−.113	−.045	.005	−.028	.057	.145
	(.030)	(.029)	(.030)	(.033)	(.031)	(.032)
Age	.048	.046	.040	.010	.009	.023
	(.014)	(.013)	(.013)	(.015)	(.014)	(.015)
AFQT	...	...	.172	...	...	.228
			(.012)			(.015)
AFQT^2	...	...	−.013	...	...	.013
			(.011)			(.013)
High grade by 1991	...	.061	...	...	.088	...
		(.005)			(.005)	
R^2	.059	.155	.168	.029	.191	.165

NOTE.—The dependent variable is the log of hourly wages. The wage observations come from 1990 and 1991. All wages are measured in 1991 dollars. If a person works in both years, the wage is measured as the average of the two wage observations. Wage observations below $1.00 per hour or above $75 are eliminated from the data. The sample consists of the NLSY cross-section sample plus the supplemental samples of blacks and Hispanics. Respondents who did not take the ASVAB test are eliminated from the sample. Further, 163 respondents are eliminated because the records document a problem with their test. All respondents were born after 1961. Standard errors are in parentheses.

Table 2.1 Log Wage Regression
SOURCE: Derek A Neal and William R. Johnson, "The Role of Premarket Factors in Black-White Wage Differences," *Journal of Political Economy*, 104 no.5(OCT 1996).

This finding contradicts the belief that the unexplained wage gap(after controlling for skill) is due to labor market discrimination.

Their research depends on previous validation of the AFQT as a racially unbiased measure of skills. The 1989 version of AFQT scoring is used due to more extensive military studies addressing racial bias in that version of the test. Reliance on the 1989 test composite mitigates the effects of any racial/ethnic test bias in measuring acquired skills.

While not completely ignoring the existence of labor market discrimination, Neal and Johnson maintain that the closing of the black-white civilian wage gap in the last 20 years has largely eliminated differences in performance due to educational background(not reflected in AFQT) and racial bias. The remaining difference is largely accounted for when AFQT scores are included in the model as an exogenous measure of acquired skills.

B. LITERATURE REVIEW:THE LABOR QUALITY EXPLANATION

The research regarding the explanation of racial wage differentials over the last twenty years has pointed to several causal factors. The trend, however, has been toward a greater emphasis on educational and socioeconomic factors in explaining the black-white wage gap. The earlier emphasis on quantity of education has also given way to quality as a key factor. Most recently this quality aspect of education, as it relates to the acquisition of skills (i.e., human capital), has been attributed not only to elements of the education system, but also to socioeconomic factors which impact the acquisition of basic skills.

In most of the research the log of wages is used as the dependent variable in the regression models. Quality may also be differentiated in terms of both school quality and educational quality, which are not equivalent. School quality may account for specific academic environment characteristics, but does not generally include outside family background and environmental influences. In a number of research efforts the AFQT has been used as a measure of educational quality and acquired skills.

Reimers (1983) decomposes the wage differential into three components; selectivity bias, average group characteristics, and labor market discrimination and other omitted factors. Her equation, which controls for selectivity bias, indicates that there is a 23 percent wage differential between black and white males. Of this, up to 14 percent(one-half) is attributed to discrimination.

In examining compulsory school attendance, Angrist and Krueger (1991) find that length of schooling is significantly correlated with wages. Their research indicates that OLS estimates of the return to education may induce a downward bias in contrast to previous assertions that omitted factors tend to bias returns upward. These findings point to length of education as a key factor in explaining labor market returns.

Similar to Neal and Johnson is a paper by O'Neill (1990) who focuses on the role of human capital development in explaining black-white wage differentials among young males. O'Neill points out that while the black-white earnings gap has closed significantly in the last fifty years, during the 1980's the gap ceased to shrink and instead actually increased for younger ages. Her research suggests that while differences in schooling have declined over time, gaps in achievement have not changed. These skill gaps are measured by test scores and are attributed to differences in school quality and other socioeconomic factors. O'Neill also uses the AFQT as a measure of skill and correlates it to quality of schooling and parental background.

The following tables from O'Neil,(1990) trace changes in education quantity, earnings ratios, and AFQT scores that have occurred over time. Table 2.2 displays the diminishing difference over time in educational attainment for blacks and whites. The difference in mean years of schooling fell form nearly 4 in 1940 to less than one in 1988.

Changes in the Education Level of Black Men and White Men, 1940–1988

	Mean Years of School Completed (Men with Earnings)			*Percent with 4 years High School or More*[a]		*Percent with 4 years College or More*[a]	
	White	Black	Difference	White	Black	White	Black
U.S. Census	Ages 25–34			Ages 25–29			
1940	10.04	6.38	3.66	41.4	13.5	9.1	2.4
1950	10.89	7.77	3.12	57.7	25.6	14.2	3.8
1960	11.60	9.22	2.37	67.8	40.8	19.4	6.1
1970	12.54	10.86	1.68	77.7	60.5	24.5	8.9
1980	13.47	12.41	1.05	86.3	75.4	25.3	11.2
CPS	Ages 20–34			Ages 25–34			
1980	13.24	12.22	1.02	90.3	79.0	30.1	12.6
1988	13.25	12.59	0.66	91.1	83.2	27.9	15.4

[a]The Census data on high school and college completion refer to all civilian men, not just earners. The CPS data on school completion refer to men with earnings.
Source: U.S. Commission on Civil Rights, October 1986, and Microdata files Current Population Survey, March supplements for 1980 and 1988, microdata files.

Table 2.2 Changes in Education Levels
SOURCE: June O'Neil, "The role of Human Capital in Earnings Differences Between Black and White Men," Journal of Economic Perspectives 4, no.4(Fall 1990).

Table 2.3 displays trends in black-white earnings ratios by age and education levels. It shows that within individual age/educational groups, earnings ratios rose significantly from the 1940's to 1980's. O'Neil concludes that this rise within groups is due to an increase in skills resulting from increases in educational quality, parental inputs and a decline in labor market discrimination.

Black-White Weekly Earnings Ratios, for Male Wage and Salary Workers, by Region, Age, and Education: 1940, 1960, 1980

	Ages 25–34			*Ages 45–54*		
	1940	*1960*	*1980*	*1940*	*1960*	*1980*
All Regions:						
8–11 Years	62.3	71.6	81.6	56.4	69.1	79.1
High School	61.9	69.8	80.5	42.4	65.7	78.5
College	61.2	69.9	87.0	26.4[b]	52.8	78.5
All Levels[a]	48.9	63.7	79.4	40.3	56.2	68.2
South:						
8–11 Years	59.8	64.4	80.4	48.0	61.0	72.3
High School	53.1	63.2	79.5	--[c]	55.1	72.1
College	55.7	68.4	83.5	--[c]	58.6	66.8
All Levels[a]	42.4	57.6	77.1	36.5	50.2	63.4
Non-South:						
8–11 Years	70.1	80.8	87.3	62.2	76.8	87.4
High School	70.6	75.6	85.5	51.3[b]	69.4	84.2
College	--[c]	73.3	91.4	--[c]	50.4[b]	73.9
All Levels[a]	66.9	74.0	84.9	51.9	68.1	75.1

[a]Includes 0–7 and 13–15 years, not shown separately.
[b]Based on less than 100 observations, but more than 50 observations.
[c]Based on fewer than 50 observations.
Note: Earnings are for wage and salary workers only. Data on 0–7 and 13–15 years of school is included in the totals, but not shown separately.
Source: Census of Population, 1940–1980; Public Use Sample. Reported in U.S. Commission on Civil Rights, October, 1986.

Table 2.3 Earnings Ratios
SOURCE: June O'Neil, "The role of Human Capital in Earnings Differences Between Black and White Men,"Journal of Economic Perspectives(Fall1990)

Table 2.4 displays mean AFQT scores by race and education. O'Neil points to the relatively constant nature of AFQT scores during the 1950's as an indicator that something besides skills must have caused the closing of the wage gap during this period.

Mean AFQT Percentile Test Scores of Men Ages 19–21 by Race and Education

Years of school completed	*1953–58*		*1980*		*Difference*	
	Black	*White*	*Black*	*White*	*1953–58*	*1980*
Elementary						
5–6	7.7	15.4	4.5	7.3	7.7	2.8
7–8	12.4	28.1	9.4	14.9	15.7	5.5
High school						
1–2	19.1	40.4	14.0	30.4	21.3	16.4
3–4	32.2	57.2	19.4	46.5	25.0	27.1
College						
1–2	46.3	70.9	39.2	65.8	24.6	26.6
3–4	50.6	76.9	49.7	80.2	26.3	30.5

Note: Mean percentile scores on the Armed Forces Qualification Test (AFQT) for 1953–58 are based on data obtained from a 50 percent sample (0.75 million men) of the records of all individuals called up for the draft or attempting to enlist between 1953 and 1958. Scores are reported for all tested, including those rejected. Scores for 1980 are based on the results of the AFQT administered by the Defense Department to a national sample of youth.
Sources: 1953–58, D. O'Neill (1970). 1980 National Longitudinal Survey of Youth, microdata files (U.S. Commission on Civil Rights).

Table 2.4 Mean AFQT Scores
SOURCE: June O'Neil, "The role of Human Capital in Earnings Differences Between Black and White Men," Journal of Economic Perspectives 4, no.4(Fall 1990).

Despite gains in education quantity and quality, black-white test score differences have not decreased since the 1980's. This continued differential is correlated with the decline of earnings for less skilled workers, particularly the youth population. Test scores are again related to the development of human capital in school and due to home environment influences. The model used by O'Neil is similar to previous research in relating the log of wages to AFQT scores. Results indicate differences in market wages are heavily influenced by acquired skills (i.e., human capital), which in turn are attributed to school quality and socioeconomic background (O'Neil, 1990).

Another work that points to quality of schooling as a factor explaining black-white wage differentials is Nan Maxwell's 1994 study "The Effect on Black-White Wage Differences of Differences in the Quantity and Quality of Education." This study uses the NLSY data from 1979 - 1988 and claims that the decline of school quality in general during the 1980's resulted in a reduction of the skill levels of blacks and the level of skills they brought to the labor market. Her work also points to the structural changes that have occurred in the economy toward more technical skills, which has contributed to the reversal of improvement in the wage gap. This effect is more pronounced for less educated (i.e. non-college graduates). Consistent with previous studies Maxwell uses the log of hourly wages as the dependent variable in her model. The primary independent variables in the model are AFQT score and level of education.

Maxwell finds that wage differentials are not the result of differences in returns to education, or quantity of schooling, but rather primarily a result of skill levels as measured by AFQT performance. As much as two-thirds of the 1980's gap is accounted for by differences in basic skills. In addition, background factors are found to be a significant determinant of basic skills. This research continues the trend towards attributing the large majority of the black-white wage differential to a gap in skills, which is a direct result of education quality and socioeconomic environment.

Grogger (1996) finds that school quality, as measured by schooling inputs, can not account for the recent trend in the black-white wage differential. Grogger points out, as others have, that the closing of the wage gap halted in the 1980's and actually increased slightly. The data used in his study is the NLSY and the High School and Beyond survey (HSB). The variable for school quality in the primary equation does not appear to be statistically significant for black wage determination. However, the fixed effects model indicates that schools (independent of quality measures impact on educational achievement) actually do have a significant impact on wages.

In addition to these civilian studies, the military services also have conducted research on attrition, retention and performance. As an example, differences in mid-career enlisted promotion outcomes have been examined in recent research by Golfin and Macllvaine (1995). They examine whether there are differences in promotion opportunities for enlisted personnel. The method of analysis is multivariate probit models to explain the probability of survival, promotion and demotion. Personal characteristics examined included AFQT, high school diploma status, marital status, age at accession, and race/ethnicity.

Findings indicate that of those who survive to 45 months, blacks and Hispanics are less likely to be promoted to the E5 paygrade during that time period. In addition, of those who remain past E6, blacks and Hispanics are less likely to be promoted early to E7. Of particular note for this thesis is their finding that AFQT is a significant predictor of promotion to E5 and accounts for almost all of the explained racial/ethnic differences in promotion to E7. Compounding the black-white differentials in promotion is the finding that blacks are 1.4 times as likely to be demoted as whites. The strong conclusion of this study points to AFQT as a primary indicator of survival and advancement, particularly to the upper enlisted paygrades.

In terms of Officer performance, a study by Bowman and Mehay (1997) examines Naval officer promotion probabilities to the grades of O-4 and O-5. A key issue in this study is the influence of human capital development in terms of graduate education and its impact on promotion. In their modeling a performance measure is developed using the percentage of recommendations for early promotion (RAP) on fitness reports prior to advancement board review. Findings indicate that RAP is a strong positive predictor of the probability of receiving graduate education, which in turn is a strong predictor of promotion to grade four (O-4).

C. LITERATURE REVIEW:OTHER EXPLANATIONS

In contrast to the labor quality approach to explaining civilian wage differentials presented by Neal and Johnson and others, some recent research has disputed the labor quality assumptions and general findings. The contrasting viewpoint finds racial biases in the measurement of skill and disputes the claim in general that such measures can account for the differences in black-white wage differentials.

Rogers and Spriggs(1995) dispute the findings that indicate black-white wage differentials can be attributed to racial differences in unobserved skills. In particular they find that the AFQT is not a racially unbiased measurement. Their research indicates that the AFQT composite score does not measure the same set of skills across race. As a result different components of the AFQT composite have varying effects depending on race. To support their findings they also present analyses which indicate school quality and family background variables fail to account for significant differences in AFQT scores.

In another more recent work Patrick L. Mason(1997) concludes that all of the increases in civilian wage differentials from 1973 to 1991 can be explained by labor market racial discrimination. He also discounts the labor quality approach to explaining the wage gap. Mason addresses views of the AFQT as a proxy variable for pre-market differences in unobserved ability, both as inherited ability or acquired skills. Mason points to work by Currie and Thomas(1995) which finds that the AFQT is a racially biased measure for pre-market skills. He also refers to Rodgers and Spriggs(1995) in discounting the use of the composite AFQT score to measure unobserved skills.

Both the progressive changes in the focus of research findings and the recent work of Neal and Johnson(1996) provide a basis for this thesis. The analysis in this thesis assumes that the military validation studies of the AFQT test regarding racial fairness provide sufficient support to use the AFQT as a measure of pre-market acquired skills. The emphasis on acquired skill measures and exogenous independent variables will be followed. The use of officer RAP as a dependent variable by Bowman and Mehay (1997) provides a useful performance measure which is less subject to grade inflation effects and other biases found in promotion statistics. As such it will be used in the analysis of officer performance differentials.

D. DETERMINANTS OF AFQT

The examination of the effects of acquired skills on performance leads to further questions as to what causes differences in the acquisition of human capital. In particular, researchers have analyzed what premarket socioeconomic factors might explain differences in acquired skills. Neal and Johnson(1996) reason that differences in the cost of human capital investments might explain why there are differences in the education of children in black or white families. They use the NLSY data to analyze the effect of family background on AFQT scores. Their results indicate that the family background factors available in the NLSY survey help to explain almost 50 percent of differences in black-white AFQT test scores. In particular, indicators of parental education and professional(occupational) status are highly significant in determining AFQT scores.

More recently, research by Harper and Heldreth(1998) and Booth and Schmiegel(1998) examine the relationship between socioeconomic status and performance in military. They use the merged SES survey data also to analyze the effect of family background on AFQT scores. In their models, they find that the most significant explanatory factors are a total socioeconomic index variable, parental college education, parental income, and single parent households. These characteristics have significant statistical effects on AFQT scores for both Air Force and Marine Corps enlisted personnel. The regression results from their studies can be found in Appendix tables C-1 and C-2.

In both the civilian and military studies the addition of socioeconomic factors at least doubles the explanatory power of the models. However, the R-squared for Neal and Johnson's model is 0.415, while the R-squared from the analysis of military personnel is only 0.116 for the Marine Corps and 0.070 for the Air Force. In addition, the socioeconomic factors account for a significantly larger portion of the differences in AFQT scores between blacks and whites in the civilian research. In the NLSY sample the addition of socioeconomic factors to the model reduces the effect of the black variable by almost 50 percent, while similar factors have little effect on the black coefficient in the military performance data. These differences may not be surprising since military selection leads to a far more compressed distribution of AFQT scores than in the civilian population. Whereas measured SES differences may account for many of the very low and very high AFQT scores in the population at large, they explain little of the variation among the more homogeneous military population.

III. DATA AND METHODOLOGY

A. DATA

This thesis utilizes data from several sources. The primary data for the analysis of enlisted performance comes from the Defense Manpower Data Center (DMDC) Military Entrance Processing Command (MEPCOM) accession cohort files. The MEPCOM files draw on information from the processing commands(MEPS) and also include information from the DMDC Master and Loss Edit files. The individuals in these files were matched by DMDC with the Socioeconomic Survey(SES) data files for fiscal years 1989 through 1995. The SES survey is administered to approximately 5,000 recruits from each of the four services annually by DMDC through the Recruit Training Command. The resulting merged file, when reserve, National Guard and prior service observations are deleted, contains 106,232 observations.

This data set was then combined with performance data provided separately by the Air Force and Marine Corps. The Air force performance data comes from the USAF Personnel Master File and is maintained by the Air Force Personnel

Center. This file provided a weighted enlisted performance review (EPR) measure. The Air Force non-prior service accession file from DMDC contains 18,546 observations. The Marine Corps data was provided by Headquarters Marine Corps Verification Extract File and the Headquarters Master File. The Marine Corps data include several performance measures of basic skills: Physical Fitness, Rifle Qualification Scores, Swim Qualifications, and Awards. Both the DMDC and assorted performance files were matched (at the Naval Postgraduate School) using social security numbers, which were subsequently cleared from the records. The Marine Corps non-prior service file contains 33,845 observations. The resulting data sets constructed at both DMDC and the Naval Postgraduate School provide pooled cross-sectional/time series data for the regression analyses.

For Navy Officer performance analyses the data is a combination of two sources. The basic information is derived from the Navy's Promotion History File, which contains background information on all officers reviewed for promotion to paygrade O-4(LCDR) between 1985 and 1995, (entry cohorts 1975-1985). This information is combined with information on all fitness reports received from entry until the O-4 board(i.e., at the O-1 through O-3 level).

Fitness report files are maintained by the Navy Personnel Research and Development Center, San Diego, Ca. The resulting merged officer file compiled by Drs. William R. Bowman, United States Naval Academy, and Stephen Mehay, Naval Postgraduate School, for Unrestricted Line Officers contains 24,672 observations.

B. METHODOLOGY

The methodology for this analysis generally follows the methodology developed by Neal and Johnson, as discussed in Chapter II. The independent variables in the multivariate models are limited in order to avoid including factors that may be endogenous to the performance differentials. Both conventional ordinary least squares(OLS) and maximum likelihood logit estimating techniques are used for the multivariate models. OLS techniques are used to estimate models with continuous dependent variables and maximum likelihood techniques are used for models with binary dependent variables.

1. Explanatory Variables

The independent variables used are the same for both Air Force and Marine Corps data. In both cases raw AFQT scores, age, gender, and ethnic group distinctions were used. For the analyses of Navy officers the same variables are used except for the substitution of GPA for AFQT. The independent variables were limited to avoid including endogenous factors in the estimation of performance differentials and allow comparison with prior civilian studies. Table 3.1 describes the explanatory variables.

VARIABLE NAME	DESCRIPTION
AGE	Age upon entry into military service or at commissioning for officers
GENDR	GENDR = 1 if female; = 0 otherwise
BLK	BLK = 1 if black; = 0 otherwise
HSP	HSP = 1 if Hispanic; = 0 otherwise
AFQT	Normalized raw AFQT score (for Air Force) AFQT percentile (for Marine Corps).
GPA	GPA = College grade point average(for officers)

Table 3.1 Explanatory Variables

GPA is taken from the Academic Profile Code(APC) in the officer data file. The APC is grouped in six categories with a range of 0-5. We convert the ranking so that 5 indicates the highest and 0 the lowest category. The following table shows GPA coding ranges.

GPA VARIABLE CODE	ACTUAL GPA VALUE
5	3.60 - 4.00
4	3.20 - 3.59
3	2.60 - 3.19
2	2.20 - 2.59
1	1.90 - 2.19
0	0 - 1.89

Table 3.2 GPA RANGE CODING

2. Enlisted Performance Variables

In the case of the Air Force, the measure available for enlisted personnel is the "enlisted performance review" (EPR). This factor accounts for a significant portion of an individual's overall performance evaluation, and hence would weigh heavily in promotion consideration. The EPR is measured on a continuous scale and as a result the regression model used in this case can be estimated using OLS. The Air Force performance record data set contains information for pay-grades E-1 to E-3. The dependent variable (EPR) represents the score attained on the enlisted performance review portion of an individual's evaluation record. The EPR score is time weighted based on the last five years of service with the most recent reports receiving the heaviest weighting. It is a continuous variable with a theoretical range of 0-135 and a relevant range for this sample of 54 - 135. These scores are heavily skewed to the high end with 50 percent scoring at or above 127(35 percent at 135) and a 123.2 mean EPR score.

In the case of the Marine Corps, the performance measures provided represent continuous as well as binary indicators. In order to model both types of data both OLS and binary logit models were estimated based on the nature of the performance measures used as the dependent variable. The binary variables SWIM and AWARD are used in the logit models, while the variables RIFLESC and PRTSC are continuous and are used in the OLS regressions. The Marine Corps performance record data sets contain information for pay-grades E-1 to E-2. A discussion of each of the Marine Corps dependent variables follows.

a) AWARD.

This is a dummy variable where 1 indicates receipt of a personal award and 0 indicates no awards.

b) SWIM_Y.

This is a dummy variable where 1 indicates higher-level swim qualification and 0 indicates lower levels and failures.

c) RIFLE_SCOR.

This is an idividual's rifle qualification test score. It is a continuous variable with a theoretical range of 0 to 250 and a relevant range of 100 to 250 for this sample. The raw score is subdivided in increments of ten.

d) PFT_SCORE.

This is an individual's physical readiness test score. It is a continuous variable with a theoretical range of 0 to 300 and a relevant range of 103 to 300 for this sample.

3. Officer Performance Variables

The dependent variable for the Naval officer analysis is the percentage of fitness reports during the period prior to the O-4 board in which the individual was recommended for early promotion (PCTRAP13). Promotion is considered a significant measure of officer performance and the RAP designation is a critical element in the overall content of officer fitness reports. In addition, the O-4 promotion board is the first critical point in the career progression for Naval officers. The RAP element of the fitness evaluation report is less subject to extreme grade inflation found in other elements of officer fitness reports.

A second performance variable is also created based on fitness reports. (PCTRAP13) is a continuous variable indicating the proportion of observed fitness reports prior to the O-4 board in which an individual was recommended for early promotion. The relevant range coincides with the theoretical range of zero to one.

4. Data Audit

The primary enlisted data set represents non-prior service, active-duty enlisted personnel who entered the specific service between FY 1989 and 1995. Total observations for the matched data set contains 106,232 observations for all four services. From the original sample the relevant USAF data consists of 18,546 observations and the USMC data consists of 33,845 observations. The Officer file represents individuals who were eligible ("in-zone") for promotion to O-4 in fiscal years 1985 through 1995. The resulting sample contains 24,672 Unrestricted Line officer(URL) observations. Actual number of observations used in the regression analyses varies considerably due to missing values for some variables. The following tables provide general statistics on the enlisted and officer variables.

INDEPENDENT VARIABLES	MEAN	STANDARD DEVIATION	RELEVANT RANGE
Age (years)	19.72	2.09	17-32
Female (proportion)	0.20	0.40	0-1
Black (proportion)	0.15	0.36	0-1
Hispanic (proportion)	0.05	0.21	0-1
AFQT (% score)	67.52	15.73	27-99
NORM RAW AFQT	0.004	0.998	-2.84 - 2.13

Table 3.3 Mean of variables for Enlisted USAF Sample

INDEPENDENT VARIABLES	MEAN	STANDARD DEVIATION	RELEVANT RANGE
Age (years)	18.98	1.65	17-32
Female (proportion)	0.34	0.18	-
Black (proportion)	0.14	0.36	-
Hispanic (proportion)	0.11	0.31	-
AFQT (% score)	60.61	17.75	10-99

Table 3.4 Mean of variables for Enlisted Marine Corps Sample

INDEPENDENT VARIABLES	MEAN	STANDARD DEVIATION	RELEVANT RANGE
Age (years)	23.13	2.33	19-35
Female (proportion)	0.01	0.11	0-1
Black (proportion)	0.32	0.18	0-1
Other Minority (proportion)	0.02	0.15	0-1
GPA	2.88	0.97	0-5

Table 3.5 Mean of variables for Navy Officer Sample

DEPENDENT VARIABLES	MEAN	STANDARD DEVIATION	RELEVANT RANGE
EPR	123.26	12.57	54-135
Rifle Score	20.84	1.44	10-25
PFT Score	251.04	35.16	103-300
Swim Qual	0.35	0.48	0-1
Award	0.08	0.27	0-1
PCTRAP13	0.56	0.31	0.0-1.0

Table 3.6 Mean of Dependent Variable for USAF and Marine Corps Enlisted and Navy Officers

5. Methods of Analyses

Multivariate ordinary least squares (OLS) and maximum likelihood estimation procedures are used to estimate the multivariate models. Ordinary least squares regression analysis is used when the dependent (performance) variables are continuous, and logistic analysis is used when the dependent (performance) measures are binary. This results in both linear and non-linear model estimations.

Parameter estimates for OLS provide the effect of a one-unit change in the independent variable X on the dependent variable Y. Parameter estimates from the Maximum Likelihood LOGIT model provide the increase or decrease in the log of the odds ratio of success (in terms of the given performance measure) per unit increase in explanatory variable (i.e., AFQT, ethnic, gender). For the dummy variables BLACK, HISPANIC, and GENDER changes in the odds ratio is indicated for those individuals with the characteristic in question (=1) in comparison to the base case (=0). All dependent variables used are intended as proxy measures for actual performance. AFQT and GPA variables are included to provide an exogenous measure of pre-military acquired skill. In addition, for the analysis of the Air Force data set, raw AFQT scores are computed and normalized to provide a comparison with previous work by Neal and Johnson, (1996).

For each data set two separate models are estimated. In the first model the measure of acquired cognitive skills is omitted. In the second model AFQT (or GPA for officers) is included to control for the skills differential effect on the selected performance measure. In each case, we examine the coefficient of the minority group dummy variable to see how the coefficient changes from the first to the second model specification.

IV. STATISTICAL ANALYSIS AND RESULTS

This chapter provides results of multivariate ordinary least squares and logistic regression analyses. The tables presented in the text summarize the key results, full model results are displayed in Appendix A. The primary findings focus on the existence of black-white performance differentials and the extent to which skill measures can account for these differentials. The findings from the USAF enlisted and Navy officer data files should provide the most relevant results due to the high level of skill requirements and variety of job tasks for these groups. The Marine Corps enlisted results are likely to display weak relationships to AFQT because the available performance measures tend to reflect physical standards rather than job performance standards.

The results presented here indicate that a racial performance differential does exist in the military for both officers and enlisted. However, only a portion of this differential is accounted for by acquired skills as measured by AFQT and GPA. Compared to the civilian research of Neal and Johnson(1996), controlling for acquired skills accounts for a smaller portion of the racial performance differentials for military personnel.

Table 4.1 presents the summary OLS regression results for the Air Force EPR performance data(See Appendix A for fuller results). Parameter estimates indicate a significant black-white differential. In the first estimates in columns 1-3, the coefficient for black indicates that on average blacks receive 1.9 points less on the EPR score. This difference is small relative to the mean EPR score of 123. However, given the narrow range of EPR scores(54-135) this difference is highly significant statistically. Including the AFQT variable in the second set of estimates in columns 4-6 reduces the size of the coefficient of the black variable. When the normalized AFQT variable is added the differential in the EPR score is reduced by 19 percent. In this model age, black and AFQT are statistically significant at the one percent level or better.

	WITHOUT AFQT			WITH AFQT		
VARIABLE	PARAMETER	S.E.	P-VALUE	PARAMETER	S.E.	P-VALUE
INTERCEPT	114.85	0.871	.0001	115.43	0.875	.0001
AGE	.457	0.044	.0001	.409	0.044	.0001
GENDER	-.242	0.231	.295	-.148	0.231	.522
BLACK	-1.91	0.258	.0001	-1.55	0.260	.0001
HISPANIC	.351	0.443	.429	.681	0.444	.125
AFQT				.829	0.094	.0001
	N=18,546 Rsqr=.009 F=42.407 Mean EPR score =123.26			N=18,546 Rsqr=.013 F=49.663 Mean EPR score =123.26		

Table 4.1 OLS EPR Performance models for USAF enlisted

Table 4.2 summarizes results for US Navy officer OLS regression on PCTRAP13(See Appendix A for full model results). Parameter estimates in columns 1-3 indicate that on average the number of RAPs blacks receive on their fitness reports prior to the O-4 board is 10 percentage points below that of whites. Given the mean of PCTRAP13 of .55 this is about 20 percent fewer RAPs for blacks, a sizable difference. Given the heavy weight the RAP grade has in determining overall performance this difference is very important to promotion and career advancement. When the GPA variable is added in columns 4-6 this gap decreases by about one-third to a difference of only 7 percentage points. Inclusion of GPA has the largest effect on the coefficient for the black binary variable. As in the USAF enlisted sample, only the age, black and skill variables are statistically significant.

	WITHOUT AFQT			WITH AFQT		
VARIABLE	PARAMETER	S.E.	P-VALUE	PARAMETER	S.E.	P-VALUE
INTERCEPT	.747	0.022	.0001	.577	0.025	.0001
AGE	-.008	0.001	.0001	-.006	0.001	.0001
GENDER	.030	0.019	.107	.015	0.020	.468
BLACK	-.102	0.013	.0001	-.070	0.014	.0001
OTHR MIN	-.036	0.015	.018	-.020	0.017	.223
GPA	-		-	.042	0.003	.0001
	N=17,572 Rsqr=.008 F=36.754 Mean PCTRAP13 = 0.56			N=14,788 Rsqr=.024 F=72.247 Mean PCTRAP13 = 0.56		

Table 4.2 OLS performance models for US Navy officers

Table 4.3 and 4.4 provide parameter estimates for the Marine Corps PFT and Rifle scores. While the results are statistically significant, not suprisingly addition of the AFQT skill variable has little marginal effect on PFT and rifle scores. Blacks on average score significantly higher on the PFT measure (7 points) and significantly lower (6 points) on rifle scores. In both cases gender has the strongest effect, with significantly lower scores on average for females.

	WITHOUT AFQT			WITH AFQT		
VARIABLE	PARAMETER	S.E.	P-VALUE	PARAMETER	S.E.	P-VALUE
INTERCEPT	256.56	2.517	.0001	258.64	2.60	.0001
AGE	-0.344	0.132	.0092	-.323	0.132	.0145
GENDER	-14.990	1.176	.0001	-14.887	1.176	.0001
BLACK	7.123	0.616	.0001	6.656	0.633	.0001
HISPANIC	4.550	0.701	.0001	4.205	0.713	.0001
AFQT	-		-	-.039	0.013	.0019
	N=26,117 Rsqr=.012 F=77.740 Mean PFT score =251.04			N=26,117 Rsqr=.012 F=64.137 Mean PFT score =251.04		

Table 4.3 OLS Performance model for Marine Corps PFT

	WITHOUT AFQT			WITH AFQT		
VARIABLE	PARAMETER	S.E.	P-VALUE	PARAMETER	S.E.	P-VALUE
INTERCEPT	20.584	0.120	.0001	20.175	0.125	.0001
AGE	.021	0.006	.0008	.017	0.006	.0058
GENDER	-1.122	0.061	.0001	-1.41	0.061	.0001
BLACK	-.631	0.029	.0001	-.542	0.030	.0001
HISPANIC	-.148	0.034	.0001	-.081	0.034	.0181
AFQT	-		-	.008	0.001	.0001
	N=18,636 Rsqr=.044 F=215.529 Mean Rifle Score=20.84			N=18,636 Rsqr=.053 F=206.673 Mean Rifle Score=20.84		

Table 4.4 OLS Performance models for Marine Corps Rifle Score

Tables 4.5 and 4.7 provide the summary logistic regression results for the Marine Corps Award and Swim qualification performance measures(See Appendix A for full results). Tables 4.6 and 4.8 display partial effects for parameter estimates associated with Tables 4.5 and 4.7, respectively. The only significant variable in the Awards model is age. Inclusion of the AFQT variable has minimal effect on the size of the estimated coefficients. The results for swim qualification show a strong negative relationship for black. The probability of blacks achieving higher-level swim qualification is on average almost 30 percent less than whites, no doubt reflecting less swimming experience prior to military service. The effect of AFQT is not statistically significant.

	WITHOUT AFQT			WITH AFQT		
VARIABLE	PARAMETER	S.E.	PR > CHISQR	PARAMETER	S.E.	PR > CHISQR
INTERCEPT	-3.367	0.239	.0001	-3.344	0.248	.0001
AGE	.048	0.013	.0001	.047	0.013	.0002
GENDER	.054	0.118	.6484	.050	0.118	.6739
BLACK	.087	0.061	.1501	.105	0.063	.0927
HISPANIC	.075	0.067	.2808	.089	0.071	.2097
AFQT	-		-	.002	0.001	.2372

Table 4.5 Logit Performance models for Marine Corps Award

	WITHOUT AFQT		WITH AFQT	
VARIABLE	PROBABILITY OF SUCCESS	MARGINAL EFFECT	PROBABILITY OF SUCCESS	MARGINAL EFFECT
BASE CASE	.079	-	.078	-
AGE	.082	.003	.082	.004
GENDER	.083	.004	.082	.004
BLACK	.085	.006	.086	.008
HISPANIC	.084	.005	.085	.007
AFQT	-	-	.078	.000

Table 4.6 Predicted probabilities for variables in Marine Corps Award Model (Table 4.5)

	WITHOUT AFQT			WITH AFQT		
VARIABLE	PARAMETER	S.E.	PR > CHISQR	PARAMETER	S.E.	PR > CHISQR
INTERCEPT	-.196	0.158	.2152	-.2215	0.162	.1735
AGE	-.009	0.008	.2729	-.009	0.008	.2576
GENDER	-1.349	0.111	.0001	-1.351	0.111	.0001
BLACK	-1.695	0.056	.0001	-1.689	0.056	.0001
HISPANIC	-.295	0.043	.0001	-.291	0.043	.0001
AFQT	-		-	.001	0.001	.5155

Table 4.7 Logit Performance models for Marine Corps Swim Qualification

	WITHOUT AFQT		WITH AFQT	
VARIABLE	PROBABILITY OF SUCCESS	MARGINAL EFFECT	PROBABILITY OF SUCCESS	MARGINAL EFFECT
BASE CASE	.409	-	.409	-
AGE	.407	-.002	.406	-.003
GENDER	.152	-.257	.152	-.257
BLACK	.113	-.296	.113	-.296
HISPANIC	.340	-.069	.341	-.068
AFQT	-	-	.409	.000

Table 4.8 Predicted probabilities for variables in Marine Corps Swim Qualification Model(Table 4.7)

In order to account for the possibility of non-linearity in the relationship we follow Neal and Johnson and estimate models with AFQT-squared. Regression equations are then estimated for the USAF EPR and Marine Corps PFT and Rifle Score samples. Regression results are provided in the tables in Appendix B. Results indicate that adding the squared term does not enhance the explanatory power of the model. Although the sign of the

AFQT-squared variable is generally negative in most of the models, the coefficient is ever statistically significant. It appears that the relationship between AFQT and performance is essentially linear.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This paper has examined black-white performance differentials among military personnel and their relation to preservice acquired skills. Based on analysis of the performance model's parameter estimates, the results indicate that performance differentials exist. The results also indicate that blacks on average receive significantly lower performance grades. However, for some performance measures the differentials are positive for minorities (e.g., Marine Corps PFT and Awards).

AFQT, GPA, and BLK are all significant predictors of performance measures and differentials when using data for Air Force enlisted and USN officers. When analyzing data on Marine Corps performance measures (swim qualification and rifle scores), AFQT is only weakly correlated with performance. However, the results in this thesis shows that AFQT and GPA are significant in explaining at least part of the black-white performance gap in the military service.

The answer to the question of whether performance differentials can be explained by skill measures is a qualified yes. The military performance productivity differentials appear to be smaller than comparable civilian wage gaps and, in turn, AFQT and GPA explain less of the racial gap. This result is probably in part due to the fact that the military selects entrants on the basis of AFQT. In evaluating performance differentials in the military we are observing a select group rather than the full range of workers as in the civilian research. Military screening and self selection of the military by individuals will tend to lead to dissimilar results for the military sample compared to civilian research.

Current military entrance standards screen out applicants below category IIIA(upper 50 percent score on the AFQT) and non-high school diploma graduates. This effectively eliminates the bottom portion of the ability distribution. In particular, for this thesis 86 percent of the Air Force enlisted sample scored at or above CAT IIIA with a mean AFQT score in the 67^{th} percentile. In the Marine Corps enlisted sample 69 percent are CAT IIIA and above with a mean AFQT score in the 60^{th} percentile. By comparison, the mean AFQT score among civilian youth is in the 50th percentile. In addition to selection by the military, individuals self select into the military which will tend to decrease the number from the upper portion of the ability distribution. Because the ability distribution in the military is truncated both above and below, there is less dispersion in productivity to explain in the military population as compared to the civilian population.

In comparing civilian black-white wage differentials to military black-white performance differentials we find significant differences in the two sectors. Earnings ratios for black/white men are approximately .75 in the research of Neal and Johnson(1996). By comparison the USN officer sample used in this thesis indicates a .80 black/white performance ratio. For the USAF enlisted sample the performance ratio is .985, or a less than two percent difference. These results would indicate that the black-white differential for military performance is significantly smaller, particularly in the enlisted ranks, than the current civilian wage/productivity gap. Again this is not surprising given the compressed ability distribution in the military resulting from the selection process.

The extent to which acquired skill measures(AFQT and GPA) account for differences in performance are significantly less than in the civilian wage research. Neal and Johnson find that almost 75 percent of the male and 100 percent of the female civilian wage differential can be accounted for by controlling for AFQT. In contrast, this thesis has found that only 31 percent of the USN officer and 19 percent of the USAF enlisted performance differential can be accounted for by acquired skill measures. While AFQT is a strong predictor of military performance among the entire civilian population it not as strongly correlated with performance among those selecting into, and selected by, the military.

B. RECOMMENDATIONS FOR FURTHER RESEARCH

This thesis has focused on black-white performance differentials and their relation to acquired skill measures. The data files used in this study contain only a portion of the performance measures routinely used to evaluate the performance of military personnel. Additional performance information would be useful in more accurately gauging the effects of acquired skills. In particular, for the Navy and Marine Corps examination of supervisor evaluations of enlisted personnel, rankings, and other performance measures could provide valuable information on performance and acquired skills. This information may be especially useful as the services begin to examine how much "quality" is necessary for individual ratings and military specialties in the effort to optimize the use of manpower resources.

APPENDIX A. OLS AND LOGIT RESULTS

Table A-1 USAF ENLISTED SAS RESULTS

MODEL: USAF ENLISTED A
Dependent Variable: EPR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	26564.15766	6641.03941	42.407	0.0001
Error	18541	2903574.5066	156.60290743		
C Total	18545	2930138.6643			

Root MSE	12.51411	R-square	0.0091
Dep Mean	123.25594	Adj R-sq	0.0089
C.V.	10.15295		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >|T|
INTERCEP	1	114.581210	0.87100028	131.551	0.0001
AGE	1	0.456464	0.04390410	10.397	0.0001
GENDR	1	-0.241799	0.23090003	-1.047	0.2950
BLK	1	-1.913564	0.25751280	-7.431	0.0001
HSP	1	0.350709	0.44295047	0.792	0.4285

MODEL: USAF ENLISTED B
Dependent Variable: EPR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	38726.27280	7745.25456	49.663	0.0001
Error	18540	2891412.3915	155.95536092		
C Total	18545	2930138.6643			

Root MSE	12.48821	R-square	0.0132
Dep Mean	123.25594	Adj R-sq	0.0130
C.V.	10.13193		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	115.434598	0.87455314	131.993	0.0001
AGE	1	0.408637	0.04414670	9.256	0.0001
GENDR	1	-0.147616	0.23066884	-0.640	0.5222
BLK	1	-1.551171	0.26023580	-5.961	0.0001
HSP	1	0.681183	0.44361500	1.536	0.1247
NORMAFQT	1	0.829494	0.09393092	8.831	0.0001

Table A-2 USN OFFICER SAS RESULTS

MODEL: USN OFFICERS A
Dependent Variable: PCTRAP13

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	13.70325	3.42581	36.754	0.0001
Error	17567	1637.40631	0.09321		
C Total	17571	1651.10957			

Root MSE	0.30530	R-square	0.0083
Dep Mean	0.55961	Adj R-sq	0.0081
C.V.	54.55650		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.746748	0.02200268	33.939	0.0001
AGE	1	-0.007891	0.00094190	-8.378	0.0001
GENDER	1	0.030099	0.01866228	1.613	0.1068
BLK	1	-0.101967	0.01293135	-7.885	0.0001
OTHRMIN	1	-0.035714	0.01508760	-2.367	0.0179

MODEL: USN OFFICERS B
Dependent Variable: PCTRAP13

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	32.75930	6.55186	72.247	0.0001
Error	14782	1340.53118	0.09069		
C Total	14787	1373.29048			

Root MSE	0.30114	R-square	0.0239
Dep Mean	0.56253	Adj R-sq	0.0235
C.V.	53.53352		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >|T|
INTERCEP	1	0.577392	0.02493358	23.157	0.0001
AGE	1	-0.005718	0.00100266	-5.703	0.0001
GENDER	1	0.014744	0.02029648	0.726	0.4676
BLK	1	-0.069951	0.01382255	-5.061	0.0001
OTHRMIN	1	-0.020377	0.01670866	-1.220	0.2227
GPA	1	0.041669	0.00258191	16.139	0.0001

Table A-3 USMC ENLISTED PFT SAS RESULTS

MODEL: USMC PFT A
Dependent Variable: PFT_SCOR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	379861.60533	94965.40133	77.740	0.0001
Error	26112	31897798.486	1221.5762288		
C Total	26116	32277660.091			

Root MSE	34.95105	R-square	0.0118
Dep Mean	251.04147	Adj R-sq	0.0116
C.V.	13.92242		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >|T|
INTERCEP	1	256.556291	2.51731871	101.916	0.0001
AGE	1	-0.344262	0.13210530	-2.606	0.0092
BLK	1	7.123011	0.61572292	11.569	0.0001
HSP	1	4.550826	0.70485912	6.456	0.0001
GENDR	1	-14.990489	1.17529072	-12.755	0.0001

MODEL: USMC PFT B
Dependent Variable: PFT_SCOR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	391614.16451	78322.83290	64.137	0.0001
Error	26111	31886045.926	1221.1729128		
C Total	26116	32277660.091			

Root MSE	34.94528	R-square	0.0121
Dep Mean	251.04147	Adj R-sq	0.0119
C.V.	13.92012		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	258.635001	2.60457035	99.300	0.0001
AGE	1	-0.323332	0.13225568	-2.445	0.0145
BLK	1	6.656742	0.63370310	10.505	0.0001
HSP	1	4.205724	0.71346840	5.895	0.0001
GENDR	1	-14.887379	1.17556664	-12.664	0.0001
AFQT	1	-0.039164	0.01262436	-3.102	0.0019

Table A-4 USMC ENLISTED RIFLE SCORE SAS RESULTS

MODEL: USMC RIFLE SCORE A
Dependent Variable: R_SCORE

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	1717.48105	429.37026	215.529	0.0001
Error	18631	37116.18685	1.99217		
C Total	18635	38833.66790			

Root MSE	1.41144	R-square	0.0442
Dep Mean	20.84369	Adj R-sq	0.0440
C.V.	6.77156		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	20.583828	0.12099392	170.123	0.0001
AGE	1	0.021279	0.00633917	3.357	0.0008
BLK	1	-0.630718	0.02918192	-21.613	0.0001
HSP	1	-0.147864	0.03408860	-4.338	0.0001
GENDR	1	-1.122454	0.06081420	-18.457	0.0001

MODEL: USMC RIFLE SCORE B
Dependent Variable: R_SCORE

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	2040.81370	408.16274	206.673	0.0001
Error	18630	36792.85420	1.97493		
C Total	18635	38833.66790			

Root MSE	1.40532	R-square	0.0526
Dep Mean	20.84369	Adj R-sq	0.0523
C.V.	6.74219		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	20.174597	0.12464225	161.860	0.0001
AGE	1	0.017443	0.00631878	2.760	0.0058
BLK	1	-0.541519	0.02987992	-18.123	0.0001
HSP	1	-0.081199	0.03433828	-2.365	0.0181
GENDR	1	-1.140519	0.06056682	-18.831	0.0001
AFQT	1	0.007746	0.00060541	12.795	0.0001

Table A-5 - USMC ENLISTED AWARD SAS RESULTS

The LOGISTIC Procedure USMC AWARD A

Data Set: WORK.A
Response Variable: AWARD
Response Levels: 2
Number of Observations: 28517
Link Function: Logit

Response Profile

Ordered Value	AWARD	Count
1	1	2292
2	0	26225

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	15953.252	15943.975	.
SC	15961.510	15985.266	.
-2 LOG L	15951.252	15933.975	17.277 with 4 DF (p=0.0017)
Score	.	.	18.069 with 4 DF (p=0.0012)

Analysis of Maximum Likelihood Estimates

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standardized Estimate	Odds Ratio
INTERCPT	1	-3.3665	0.2393	197.9738	0.0001	.	.
AGE	1	0.0476	0.0125	14.5412	0.0001	0.042533	1.049
BLK	1	0.0874	0.0607	2.0714	0.1501	0.017119	1.091
HSP	1	0.0753	0.0698	1.1633	0.2808	0.012846	1.078
GENDR	1	0.0538	0.1179	0.2080	0.6484	0.005337	1.055

Association of Predicted Probabilities and Observed Responses

Concordant	= 42.6%	Somers' D	= 0.037
Discordant	= 38.9%	Gamma	= 0.045
Tied	= 18.6%	Tau-a	= 0.005
(60107700 pairs)		c	= 0.518

The LOGISTIC Procedure USMC AWARD B

Data Set: WORK.A
Response Variable: AWARD
Response Levels: 2
Number of Observations: 28517
Link Function: Logit

Response Profile

Ordered Value	AWARD	Count
1	1	2292
2	0	26225

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	15953.252	15944.578	.
SC	15961.510	15994.128	.
-2 LOG L	15951.252	15932.578	18.674 with 5 DF (p=0.0022)
Score	.	.	19.505 with 5 DF (p=0.0015)

Analysis of Maximum Likelihood Estimates

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standardized Estimate	Odds Ratio
INTERCPT	1	-3.4436	0.2477	193.2567	0.0001	.	.
AGE	1	0.0467	0.0125	13.9391	0.0002	0.041677	1.048
BLK	1	0.1052	0.0626	2.8270	0.0927	0.020612	1.111
HSP	1	0.0887	0.0707	1.5733	0.2097	0.015139	1.093
GENDR	1	0.0496	0.1180	0.1771	0.6739	0.004927	1.051
AFQT	1	0.00150	0.00127	1.3974	0.2372	0.014695	1.002

Association of Predicted Probabilities and Observed Responses

Concordant	= 46.6%	Somers' D	= 0.041
Discordant	= 42.5%	Gamma	= 0.045
Tied	= 10.9%	Tau-a	= 0.006
(60107700 pairs)		c	= 0.520

Table A-6 USMC ENLISTED SWIM QUAL SAS RESULTS

The LOGISTIC Procedure USMC SWIM A

Data Set: WORK.A
Response Variable: WATER_Y
Response Levels: 2
Number of Observations: 25827
Link Function: Logit

Response Profile

Ordered Value	WATER_Y	Count
1	1	9134
2	0	16693

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	33560.750	32029.895	.
SC	33568.909	32070.691	.
-2 LOG L	33558.750	32019.895	1538.855 with 4 DF (p=0.0001)
Score	.	.	1302.633 with 4 DF (p=0.0001)

Analysis of Maximum Likelihood Estimates

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standardized Estimate	Odds Ratio
INTERCPT	1	-0.1957	0.1579	1.5363	0.2152	.	.
AGE	1	-0.00909	0.00829	1.2021	0.2729	-0.008187	0.991
BLK	1	-1.6945	0.0557	925.6198	0.0001	-0.323460	0.184
HSP	1	-0.2950	0.0427	47.7830	0.0001	-0.050707	0.745
GENDR	1	-1.3494	0.1110	147.8931	0.0001	-0.128899	0.259

Association of Predicted Probabilities and Observed Responses

Concordant	= 51.7%	Somers' D	= 0.213
Discordant	= 30.5%	Gamma	= 0.259
Tied	= 17.8%	Tau-a	= 0.097
(152473862 pairs)		c	= 0.606

The LOGISTIC Procedure USMC SWIM B

Data Set: WORK.A
Response Variable: WATER_Y
Response Levels: 2
Number of Observations: 25827
Link Function: Logit

Response Profile

Ordered Value	WATER_Y	Count
1	1	9134
2	0	16693

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	33560.750	32031.472	.
SC	33568.909	32080.427	.
-2 LOG L	33558.750	32019.472	1539.278 with 5 DF (p=0.0001)
Score	.	.	1303.094 with 5 DF (p=0.0001)

Analysis of Maximum Likelihood Estimates

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standardized Estimate	Odds Ratio
INTERCPT	1	-0.2215	0.1628	1.8521	0.1735	.	.
AGE	1	-0.00940	0.00831	1.2818	0.2576	-0.008468	0.991
BLK	1	-1.6886	0.0564	895.3359	0.0001	-0.322329	0.185
HSP	1	-0.2906	0.0432	45.2015	0.0001	-0.049945	0.748
GENDR	1	-1.3508	0.1110	148.1385	0.0001	-0.129028	0.259
AFQT	1	0.000502	0.000772	0.4229	0.5155	0.004911	1.001

Association of Predicted Probabilities and Observed Responses

Concordant	= 55.8%	Somers' D	= 0.209
Discordant	= 34.9%	Gamma	= 0.230
Tied	= 9.2%	Tau-a	= 0.095
(152473862 pairs)		c	= 0.604

APPENDIX B. ANALYSIS OF NON-LINEARITY OF AFQT

Table B-1 USAF NON-LINEARITY RESULTS COMPARISON

Model: MODEL1
Dependent Variable: EPR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	26564.15766	6641.03941	42.407	0.0001
Error	18541	2903574.5066	156.60290743		
C Total	18545	2930138.6643			

Root MSE	12.51411	R-square	0.0091
Dep Mean	123.25594	Adj R-sq	0.0089
C.V.	10.15295		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	114.581210	0.87100028	131.551	0.0001
AGE	1	0.456464	0.04390410	10.397	0.0001
GENDR	1	-0.241799	0.23090003	-1.047	0.2950
BLK	1	-1.913564	0.25751280	-7.431	0.0001
HSP	1	0.350709	0.44295047	0.792	0.4285

Model: MODEL1 / with AFQT
Dependent Variable: EPR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	40387.37183	8077.47437	51.823	0.0001
Error	18540	2889751.2924	155.8657655		
C Total	18545	2930138.6643			

Root MSE	12.48462	R-square	0.0138
Dep Mean	123.25594	Adj R-sq	0.0135
C.V.	10.12902		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	111.777576	0.91853209	121.692	0.0001
AGE	1	0.401978	0.04418112	9.098	0.0001
GENDR	1	-0.166914	0.23049316	-0.724	0.4690
BLK	1	-1.542414	0.25991142	-5.934	0.0001
HSP	1	0.683209	0.44331498	1.541	0.1233
AFQT	1	0.056145	0.00596189	9.417	0.0001

Model: MODEL1 / with AFQT and AFQT SQR
Dependent Variable: EPR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	40620.20918	6770.03486	43.436	0.0001
Error	18539	2889518.4551	155.86161363		
C Total	18545	2930138.6643			

Root MSE	12.48445	R-square	0.0139
Dep Mean	123.25594	Adj R-sq	0.0135
C.V.	10.12889		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	109.801841	1.85922189	59.058	0.0001
AGE	1	0.406197	0.04431521	9.166	0.0001
GENDR	1	-0.184920	0.23096037	-0.801	0.4233
BLK	1	-1.558662	0.26024771	-5.989	0.0001
HSP	1	0.677468	0.44333396	1.528	0.1265
AFQT	1	0.115207	0.04868902	2.366	0.0180
AFQTSQR	1	-0.000435	0.00035558	-1.222	0.2216

Table B-2 USMC NON-LINEARITY RESULTS COMPARISON

Model: MODEL1
Dependent Variable: R_SCORE

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	1717.48105	429.37026	215.529	0.0001
Error	18631	37116.18685	1.99217		
C Total	18635	38833.66790			

Root MSE	1.41144	R-square	0.0442
Dep Mean	20.84369	Adj R-sq	0.0440
C.V.	6.77156		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	20.583828	0.12099392	170.123	0.0001
AGE	1	0.021279	0.00633917	3.357	0.0008
BLK	1	-0.630718	0.02918192	-21.613	0.0001
HSP	1	-0.147864	0.03408860	-4.338	0.0001
GENDR	1	-1.122454	0.06081420	-18.457	0.0001

MODEL: USMC RIFLE SCORE / with AFQT
Dependent Variable: R_SCORE

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	2040.81370	408.16274	206.673	0.0001
Error	18630	36792.85420	1.97493		
C Total	18635	38833.66790			

Root MSE	1.40532	R-square	0.0526
Dep Mean	20.84369	Adj R-sq	0.0523
C.V.	6.74219		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >|T|
INTERCEP	1	20.174597	0.12464225	161.860	0.0001
AGE	1	0.017443	0.00631878	2.760	0.0058
BLK	1	-0.541519	0.02987992	-18.123	0.0001

HSP	1	-0.081199	0.03433828	-2.365	0.0181
GENDR	1	-1.140519	0.06056682	-18.831	0.0001
AFQT	1	0.007746	0.00060541	12.795	0.0001

Model: MODEL1 / with AFQT and AFQT SQR
Dependent Variable: R_SCORE

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	2043.87245	340.64541	172.490	0.0001
Error	18629	36789.79545	1.97487		
C Total	18635	38833.66790			

Root MSE	1.40530	R-square	0.0526
Dep Mean	20.84369	Adj R-sq	0.0523
C.V.	6.74209		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	20.329386	0.17608165	115.454	0.0001
AGE	1	0.016535	0.00636065	2.600	0.0093
BLK	1	-0.542657	0.02989348	-18.153	0.0001
HSP	1	-0.080769	0.03433951	-2.352	0.0187
GENDR	1	-1.138041	0.06059865	-18.780	0.0001
AFQT	1	0.002873	0.00396237	0.725	0.4684
AFQTSQR	1	0.000039606	0.00003182	1.245	0.2133

Model: MODEL1
Dependent Variable: PFT_SCOR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	379861.60533	94965.40133	77.740	0.0001
Error	26112	31897798.486	1221.5762288		
C Total	26116	32277660.091			

Root MSE	34.95105	R-square	0.0118
Dep Mean	251.04147	Adj R-sq	0.0116
C.V.	13.92242		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	256.556291	2.51731871	101.916	0.0001
AGE	1	-0.344262	0.13210530	-2.606	0.0092
BLK	1	7.123011	0.61572292	11.569	0.0001
HSP	1	4.550826	0.70485912	6.456	0.0001
GENDR	1	-14.990489	1.17529072	-12.755	0.0001

MODEL: USMC PFT / with AFQT
Dependent Variable: PFT_SCOR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	5	391614.16451	78322.83290	64.137	0.0001
Error	26111	31886045.926	1221.1729128		
C Total	26116	32277660.091			

Root MSE	34.94528	R-square	0.0121
Dep Mean	251.04147	Adj R-sq	0.0119
C.V.	13.92012		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >|T|
INTERCEP	1	258.635001	2.60457035	99.300	0.0001
AGE	1	-0.323332	0.13225568	-2.445	0.0145
BLK	1	6.656742	0.63370310	10.505	0.0001
HSP	1	4.205724	0.71346840	5.895	0.0001
GENDR	1	-14.887379	1.17556664	-12.664	0.0001
AFQT	1	-0.039164	0.01262436	-3.102	0.0019

Model: MODEL1 / with AFQT and AFQT SQR
Dependent Variable: PFT_SCOR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	392990.97421	65498.49570	53.636	0.0001
Error	26110	31884669.117	1221.166952		
C Total	26116	32277660.091			

Root MSE	34.94520	R-square	0.0122
Dep Mean	251.04147	Adj R-sq	0.0119
C.V.	13.92009		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	261.424834	3.69960398	70.663	0.0001
AGE	1	-0.339311	0.13310871	-2.549	0.0108
BLK	1	6.637648	0.63395665	10.470	0.0001
HSP	1	4.213363	0.71350293	5.905	0.0001
GENDR	1	-14.847824	1.17615386	-12.624	0.0001
AFQT	1	-0.126575	0.08328478	-1.520	0.1286
AFQTSQR	1	0.000705	0.00066382	1.062	0.2883

APPENDIX C. SES DETERMINANTS OF AFQT

Table C-1 USAF ENLISTED

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	15	275215.55426	18347.70362	75.393	0.0001
Error	15018	3654771.0056	243.35936913		
C Total	15033	3929986.5599			

Root MSE	15.59998	R-square	0.0700
Dep Mean	67.30258	Adj R-sq	0.0691
C.V.	23.17887		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	42.244458	1.36536461	30.940	0.0001
PSEI	1	0.080012	0.00853135	9.379	0.0001
PSEI_NV	1	-0.921580	0.57850649	-1.593	0.1112
P_NHSD	1	-0.617051	0.50769177	-1.215	0.2242
P_SCOLL	1	2.597415	0.31759348	8.178	0.0001
P_COLL	1	2.922450	0.37557341	7.781	0.0001
OWN	1	0.374796	0.33720505	1.111	0.2664
NOPAY	1	-2.467280	0.66945913	-3.685	0.0002
S_DIST	1	-0.946851	0.36789658	-2.574	0.0101
NC_DIST	1	0.613213	0.39943040	1.535	0.1248
W_DIST	1	0.090541	0.43569056	0.208	0.8354
BLACK	1	-6.510568	0.41884743	-15.544	0.0001
HISPAN	1	-4.165962	0.67461230	-6.175	0.0001
OTHMIN	1	-2.008560	0.71895068	-2.794	0.0052
AGE	1	1.093496	0.06567801	16.649	0.0001
SPHH	1	1.073673	0.32006147	3.355	0.0008

Source: Harper, Rebecca L., and Heldreth, Carl R., "Socioeconomic Status and Performance in the US Navy and US Air Force," Masters Thesis, Naval Postgraduate School(1998).

PSEI = Parents highest SES index.
PSEI_NV = Dummy variable with 1 indicating parents never worked, uncertain, or invalid SES occupation code match.
P_NHSD = Dummy variable with 1 indicating parents with no high school diploma.
P_SCOLL = Dummy variable with 1 indicating parents obtained some college education, but not a degree.
P_COLL = Dummy variable with 1 indicating parents obtained a college degree.
OWN = Dummy variable with 1 indicating parents own a home.
NOPAY = Dummy variable with 1 indicating parents do not pay rent or a mortgage on their home.
S_DIST = Dummy variable with 1 indicating enlistee from Southern census region.
NC_DIST = Dummy variable with 1 indicating enlistee from North Central census region.

W_DIST = Dummy variable with 1 indicating enlistee from Western census region.

BLACK = Dummy variable with 1 indicating black enlistee.

HISPAN = Dummy variable with 1 indicating Hispanic enlistee.

OTHMIN = Dummy variable with 1 indicating American Indian, Alaskan Native, Asian/Pacific Islander.

AGE = Enlistee's age upon entering military.

SPHH = Dummy variable with 1 indicating enlistee raised in a single-parent household.

Table C-2 MARINE CORPS ENLISTED

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	15	571158.67232	38077.24482	135.585	0.0001
Error	15413	4328551.9745	280.83773273		
C Total	15428	4899710.6468			

Root MSE	16.75821	R-square	0.1166
Dep Mean	59.51727	Adj R-sq	0.1157
C.V.	28.15689		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	45.976326	1.63922882	28.048	0.0001
PSEI	1	0.128812	0.00909749	14.159	0.0001
PSEI_NV	1	-0.907723	0.53281124	-1.704	0.0885
P_NHSD	1	-0.451334	0.44882020	-1.006	0.3146
P_SCOLL	1	3.739354	0.34831668	10.736	0.0001
P_COLL	1	4.205539	0.39763169	10.576	0.0001
OWN	1	0.237763	0.33329502	0.713	0.4756
NOPAY	1	-2.938968	0.72121912	-4.075	0.0001
S_DIST	1	0.567545	0.41438370	1.370	0.1708
NC_DIST	1	0.333319	0.43581610	0.765	0.4444
W_DIST	1	1.037143	0.45246453	2.292	0.0219
BLACK	1	-10.744727	0.41700265	-25.767	0.0001
HISPAN	1	-6.622983	0.49583203	-13.357	0.0001
OTHMIN	1	-4.302295	0.75676641	-5.685	0.0001
AGE	1	0.448265	0.08176948	5.482	0.0001
SPHH	1	2.021771	0.31630382	6.392	0.0001

Source: Booth, Stefan J., and Schmiegel, Kevin M., "Socioeconomic Status and Performance in the US Army and US Marine Corps," Masters Thesis, Naval Postgraduate School(1998).

LIST OF REFERENCES

Angrist, Joshua D., and Krueger, Alan B. (1991) "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quartely Journal of Economics* 106 (November): 979-1014.

Booth, Stefan J., and Schmiegel, Kevin M. (1998) "Socioeconomic Status and Performance in the US Army and US Marine Corps" Monterey, CA: Naval Postgraduate School.

Bowman, William R. (1990) "Do Engineers Make Better Naval Officers?" *Armed Forces & Society* 16 no. 2 (Winter): 271-286.

Currie, Janet and Duncan, Thomas (1995) "Race, Children's Cognitive Achievement and the Bell Curve" NBER Working Paper #5240.

Department of Defense, (1997) "Women and Minorities in the Officer Pipeline" (Wash, D.C.: Office of the Assistant Secretary of Defense for Force management and personnel), unpublished manuscript.

Ehrenberg, Ronald G. and Smith, Robert S. (1996) *Modern Labor Economics: Theory and Public Policy* 6th ed., Addison-Wesley, New York.

Gay, Robert M., and Albrecht, Mark J. (1979). "Measuring On-the-Job Performance in Military Occupations" Santa Monica, CA: The Rand Corporation.

Golfin, Peggy A., and Macllvaine, Martha E. (1995) "Mid-Career Enlisted Promotion: Effects of Service and Personal Characteristics" (CRM 95-120). Alexandria, VA: Center for Naval Analyses.

Grogger, Jeff. (1996) "Does School Quality Explain the Recent Black/White Wage Trend" *Journal of Labor Economics* 14 (April): 231-53.

Harper, Rebecca L., and Heldreth, Carl R. (1998) "Socioeconomic Status and Performance in the US Navy and US Air Force" Monterey, CA: Naval Postgraduate School.

Horne, David K. (1987) "The Impact of Soldier Quality on Army Performance" *Armed Forces & Society* 13 no. 3 (Spring): 443-455.

Lazear, Edward P. (1998) *Personnel Economics for Managers.* New York: John Wiley.

Marcus, Alan J., and Quester, Aline O. (1984) "Determinants of Labor Productivity in the Military" Alexandria, VA: Center for Naval Analyses.

Mason, Patrick L. (1997) "Racial Discrimination and the Rate of Return to Cognitive Ability" 1968-1991 IN: University of Notre Dame.

Maxwell, Nan L. (1994) "The Effect on Black-White Wage Differences of Differences in the Quantity and Quality of Education" *Industrial and Labor Relations Rev.* 47 (January): 249-64.

Mehay, Stephen L., and Bowman, William R. (1997) "Human Capital and Job Performance in a Hierarchical Organization: Evidence from Military Personnel" unpublished report, Monterey CA: Naval Postgraduate School, February.

Neal, Derek A., and Johnson, William R. (1996) "The Role of Premarket Factors in Black-White Wage Differences" *Journal of Political Economy* 104 (October): 869-895.

O'Neil, June. (1990) "The Role of Human Capital in Earnings Differences between Black and White Men" *Journal of Economic Perspectives* 4 (Fall): 25-45.

Orvis, Bruce R., Sastry, Narayan, McDonald, Laurie L., (1996) "Military Recruiting Outlook: Recent Trends in Enlistment Propensity and Conversion of Potential Enlisted Supply" Santa Monica, CA: The Rand Corporation.

Reimers, Cordelia W. (1983) "Labor market Discrimination against Hispanics and Black Men" *Rev. Econ. and Statis.* 65 (November): 570-79.

Rodgers, William M., and Spriggs, William E. (1995) "What Does the AFQT Really Measure: Race, Wages, Schooling and the AFQT Score" *Social and Economic Studies* 44 no.3/4 (June/September).

Scribner, Barry L., Smith, D. Alton, Baldwin, Robert h., Phillips, Robert L. (1986) "Are Smart Tankers Better? AFQT and Military Productivity" *Armed Forces & Society* 12 no. 2 (Winter): 193-206.

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