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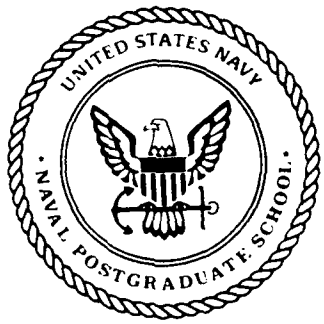

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THESIS

AN ANALYSIS OF A PROPOSED NAVY COLLEGE FUND

by

Roy W. Crowe

December 1989

Co-advisors: S. L. Mehay
M. J. Eitelberg

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In this thesis the author examines the impact of enhanced educational benefits in the form of a Navy College Fund (NCF) on Navy recruiting. This thesis examines the effects of the Army College Fund on the accession of high-quality recruits using statistical analysis of the Army's experience with the Army College Fund. The economic supply model is used to forecast the number of high-quality recruits the Navy could expect if a similar program were implemented for the Navy. An attempt is made to compare the cost-effectiveness of high-quality enlistees with that of lower-quality enlistees. In addition, the costs of the proposed NCF is compared with the costs of alternative recruiting policies. The results suggest that a new NCF could offer a cost-effective method to increase the quantity of high-quality enlistees. Several recommendations are offered regarding the implementation of such a program.

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An Analysis of a Proposed Navy College Fund

by

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Lieutenant, United States Navy
B.A., Lycoming College, 1980

Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

In this thesis the author examines the impact of enhanced educational benefits in the form of a Navy College Fund (NCF) on Navy recruiting. This thesis examines the effects of the Army College Fund on the accession of high-quality recruits using statistical analysis of the Army's experience with the Army College Fund. The economic supply model is used to forecast the number of high-quality recruits the Navy could expect if a similar program were implemented for the Navy. An attempt is made to compare the cost-effectiveness of high-quality enlistees with that of lower-quality enlistees. In addition, the costs of the proposed NCF is compared with the costs of alternative recruiting policies. The results suggest that a new NCF could offer a cost-effective method to increase the quantity of high-quality enlistees. Several recommendations are offered regarding the implementation of such a program.

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I. INTRODUCTION

In the presence of a declining youth population, low unemployment, a widening gap between civilian and military pay, and an increasing first-term attrition rate, the Navy is faced with unprecedented problems in manning its enlisted force. To compensate for the strong economy and the decline in relative military pay, Navy manpower planners have several policy options. From a recruiting standpoint, these options include: increase the number of recruiters; increase the amount of advertising; use enlistment bonuses; and implement a program of enhanced educational benefits similar to the current Army College Fund (ACF).

The first three options target the traditional Navy recruiting market of work-oriented youths and high school seniors. However, this population is heavily recruited by civilian businesses and colleges as well as by the other Services. The Navy still manages to acquire 40 percent of its new recruits from high school seniors. To maintain its quality and quantity of recruits, it would be beneficial for the Navy to develop a new marketing strategy, a strategy that would minimize conflict with the other Services and allow the Navy to obtain the needed numbers of high-quality recruits. The implementation of a Navy College Fund is the basis of a new marketing strategy to target the college-bound youth market.

The college-bound youth market is a market that contains the high-quality recruits desired for technical Navy skills and one that is still open to development. It appears that this market, despite the decline in the youth population, is growing. This is evident in the increasing number of SAT and ACT examinees, and the rising number of college enrollments. In addition, the current Youth Attitude Tracking survey (YATs) shows that a majority (77-80 percent) of high school seniors and young men have a strong interest in attending college. [Ref 1, Encl 1, p. 1]. Furthermore, several studies on the educational expectations of high school seniors and high school graduates indicate a strong desire to pursue advanced education as a reason to enlist in the military [Ref 2]. This is a break from the traditional rationale that education benefits are a service member's right. But the Navy College Fund would be designed to enhance the educational benefits of certain targeted recruits who would not otherwise enter the military.

The Army College Fund represents a very successful penetration of the college-bound youth market. This program demonstrates that there are individuals who are willing to exchange military srvice in specific Army Military Occupational Specialties (MOSs) for future educational benefits. The ACF evolved following the termination of the Vietnam-Era GI Bill as a recruiting incentive targeting the college-bound youth market.

Since the end of World War II through the early years of the All-Volunteer Force, post-service educational benefits were viewed as a service member's right. These benefits were also considered as compensation for compulsory service during the years of the draft and the three major conflicts occurring during this period. With the end of the "GI Bill" benefits on 31 December 1976, the Services suffered an initial loss of high-quality recruits in the late 1970s and early 1980s. To offset the loss of the GI Bill educational benefits and to restore post-service educational benefits, the Post Vietnam-Era Veterans' Educational Assistance Program (or VEAP) was instituted. VEAP provided a 2-to-1 matching program for funds, based upon the service member's contribution to the program (with a maximum contribution of $2,700 by the individual and $5,400 by the government).

VEAP was a failure in many ways. First of all, it failed to attract many high-quality recruits, and participation in in the program was limited. To increase participation in VEAP and to give the Army a unique recruiting incentive, the Army College Fund (ACF) was established in 1982. This program consisted of monetary "kickers" for qualified recruits (high school diploma graduates, with aptitude test scores above the 50th percentile) who entered targeted skills, specifically the combat arms. The amount of the kicker was dependent upon the individual's length of service.

In 1985, the Montgomery GI Bill was enacted as an experimental program. Like VEAP, the Montgomery GI Bill requires a contribution on behalf of the member ($1,200 in the first 12 months of service) with a total benefit of $10,800. With the new GI Bill in effect, the ACF was restructured to a a maximum benefit of $14,400. The combined effect of the new GI Bill and the ACF meant that a qualified new recruit can earn a maximum of $25,200 for a four-year enlistment in a selected MOS.

Like the ACF, the Navy College Fund is intended to serve two primary purposes: 1) to increase the number of high-aptitude recruits in those skill ratings suffering from personnel shortages, and 2) to expand recruiting to the college-bound market. It is anticipated that these high-quality recruits will replace the lower-quality, general detail recruits (or GENDETs) currently backfilling certain "A" school seats. GENDETs are selected during recruit training to fill vacant "A" school quotas and have very different quality and retention characteristcs than do those who enlist for guaranteed training. Most notably, GENDETs have a first-term attrition rate that is 11 percent greater than their counterparts in guaranteed "A" school assignments. Because of this higher attrition rate, more GENDET accessions are needed than high-quality accessions to meet enlisted planning requirements. In addition, waivers of

minimum eligibility scores are often needed to allow the GENDETs to attend most "A" schools. [Ref 1 Encl 1 p.5].

In fiscal 1990, 8,684 NCF accessions would be needed to eliminate most "A" school assignments backfilled with GENDETs across 37 ratings. The initial objective of the NCF would be to make up this shortage in "A" school graduates, The NCF would then be adjusted each year, based upon utilization and quality trends in targeted ratings, to meet the changing needs of the Navy. [Ref 1 Encl. 1 p. 6]

These arguments are the foundation for implementing the Navy College Fund. But an important question is: How will this program affect Navy recruiting? To assess the impact of enhanced educational benefits upon recruiting, this thesis sets out to analyze statistically the effects of the Army College Fund upon Army recruiting. The implications of these findings for Navy recruiting are then examined. This study also estimates the potential cost savings of using high-quality recruits in place of GENDETs in targeted ratings.

II. LITERATURE REVIEW

Prior studies of enhanced educational benefits since the termination of the Vietnam-Era GI Bill can be divided into two groups: the Rand experiments of the early 1980s and the economic analyses of enlistment supply over the last seven years. This chapter reviews the results of the Rand experiments. It also examines selected economic studies of active-duty manpower supply.

A. THE EXPERIMENTS

The first experiment relating to enhanced educational benefits was the "Multiple Option Recruiting Experiment" (MORE) OF 1979. As reported by Haggstrom et al, this program tested the attractiveness of two-year enlistment terms and enhanced post-service educational benefits (or "kickers") as recruiting incentives for the Army's combat arms and for engineering ratings in the Navy [Ref 3]. The enhanced educational benefits varied by branch of service and over time. The initial Army VEAP "kicker" was $1,000 for each year of obligated service up to four years. Later during the experiment, the Army tested a "super VEAP kicker" of $2,000 above the regular VEAP kicker. The Navy tested two separate VEAP kickers: an additional $2,000 in one test area, and $4,000 in another test area.

The Army experiment offered various combinations of enlistment incentives in six test areas. These options were, by test area:

Area 1: Two-year option, assignment to Europe, with VEAP kickers.

Area 2: Two-year term with VEAP kickers.

Area 3: Assignment to Europe, with VEAP kickers.

Area 4: VEAP kickers.

Area 5: Two-year option, assignment to Europe, with VEAP kickers for those enlisting for 3 or 4 years.

Area 6: Control group.

The Navy offered various combinations of options in different areas as well, but these options were limited to a few select test areas. *The Navy options were only open to* high-quality enlistees. By test area, the available options were:

Area A: Two-year option with VEAP kicker and immediate "A" school assignment.

Area B: Two-year option with VEAP kicker and "A" school upon reenlistment.

Area C: Two-year option with "A" school upon reenlistment.

Area D: Two-year option.

Area E: Control group.

Area F: VEAP kicker of $4,000 for four-year enlistment.

Each service used geographically dispersed Armed Forces Entrance and Examining Stations (or AFEES), chosen to represent a balance in terms of preexperimental recruiting performances. Additionally, as seen above, the Navy tested whether guaranteed "A" school assignments would be effective as enlistment and reenlistment bonuses. Also, the $4,000 VEAP kicker in Area F was discontinued when the quota of 500 enlistments was reached, so this cell only represents three and one-half months of the experiment.

The Defense Manpower Data Center (DMDC) provided data for the experiment on monthly enlistment contracts for each AFEES by Service, sex, Armed Forces Qualification Test (AFQT) category, and educational attainment for the period January 1978 through December 1979. Data for unemployment and wage levels of each AFEES were derived from monthly reports provided by the Bureau of Labor Statistics.

The response to the various enlistment incentives was measured by the relative increase in recruiting performance by each test area from 1978 to 1979. Regression analysis was performed on unemployment rates, wages, and recruiting levels by test area to control for migration between test areas (recruit migration from a control area to an experimental area) and recruiter effort during the experiment.

For the educational benefits in the Army test areas, the two-year option test areas experienced a 4.1 percent relative increase in enlistments; and the three- and four-year

test areas demonstrated an overall 7 percent relative increase in enlistments. Combined response to the VEAP kickers was a 7.8 percent relative increase in test areas with the optional European assignment, and a 3.8 percent relative increase when European assignment was mandatory. The total response to the super VEAP kickers was a 2.1 relative increase above the response for the standard VEAP kicker.

Two economic models were then estimated using regression analysis applied to the data. Model One contained variables for each test area, while Model Two contained variables for each option. Both models contained variables for unemployment, wages, recruiters, and for time (month of the year). The dependent variable for each model was the logarithm of the number of enlistments.

The estimated regression coefficiients of the explanatory variables in Model One did not differ greatly from the raw relative increases reported above. All of the test area coefficients had statistically insignificant effects on high-quality enlistments. For Model Two, the regression coefficients for the options were also statistically insignificant with respect to high-quality enlistments; although they did display a small positive effect on overall enlistments. However, the test areas did out-perform the control areas in attracting high-quality recruits, especially those who entered through the Delayed Entry Program (DEP). The MORE also did not greatly affect the occupational choices of enlistees.

During MORE, the Navy suffered an overall decline in high-quality enlistments. Of the test areas offering enhanced educational benefits, Area F only offered the VEAP kicker for a limited period, so the full effect of the option could not be determined. Overall, the test areas offering educational benefits displayed a 1.3 percent relative increase in high-quality recruits. The regression analysis (similar to the analysis of Army results) revealed that none of the educational benefits had a statistically significant effect upon high-quality enlistments. However, the authors of the study point out that the Navy data contained factors that could not be adequately separated due to the limited size of the experimental areas and the short duration of the $4,000 VEAP kicker option.

The MORE can be viewed as offering too many options in too few test areas with limited attractiveness. The Army restrictions for European assignment and the Navy restrictions for Marine Engineering and Firemen ratings may have served to offset the incentives instigated by the VEAP kickers. Since the attractiveness of the standard VEAP was very low, and had an insignificant effect on enlistments, this may have had a further disrupting effect upon the experiment. Therefore, the lessons of the MORE may tell us more about how <u>not</u> to run a social science experiment than about the effects of selected enlistment options.

The MORE study was followed in 1981 by the Educational Assistance Test Program (EATP). As reported by Richard Fernandez, the EATP consisted of three test programs: Ultra VEAP kicker (UVK), a Noncontributory VEAP (NCV), and a Tuition Stipend (T/S). [Ref 4 p. 13] The EATP was initiated because of the poor quality of Army recruits in 1980 and a Congressional desire to provide recruiters with new tools to attract enlistees. [Ref 4 p. 11] The experiment included the Army, the Navy, and the Air Force. Like the MORE program, each service selected geographically diverse AFEES to form test and control cells. The EATP was based on the concept that a recruit is a rational economic person who can evaluate alternatives by discounting them to present value and then compare them.

The four test programs consisted of:

Control:	Basic VEAP, with kickers up to $6,000 for the Army.
Ultra VEAP:	Army kickers to $12,000.
Noncontributory VEAP:	DOD pays Army enlistee's contribution with Army kickers up to $6,000.
Tuition/ Stipend:	For all Services, tuition assistance of $1200 a year plus $300-a-month subsistence allowance, transferable to dependents or a cash-out on reenlistment.

To be eligible for one of the test programs, the recruit had to be a high school diploma graduate (HSDG), scoring in AFQT categories I-IIIA, (upper 50th percentile), and entering a targeted skill area.

The methodology of the experiment consisted of comparing the test cells with the control cells in terms of growth or decline in enlistments from the base period. It was assumed that the control cells would take into account changes in recruitment due to world outlook (e.g., the Hostage crisis). Regression analysis was used to improve the estimates of program effects by developing a model for all changes that could be measured. Four variables were used in measuring civilian employment opportunities: average hourly earnings of production employees, average weekly hours of production employees, total employment and the unemployment rate for workers 16 and older. Recruiting effort was measured by the number of production recruiters fielded by each Service by month. The data were then converted to conform to AFEES areas. (This turned out to be a complex procedure, because both Army and Navy data were required. This necessitated converting the data from 54 Army Recruiting Battalions and 42 Navy Recruiting Districts to conform to AFEES areas.)

Data were then obtained from DMDC for recruit contracts, from the Bureau of Labor Statistics (the monthly publication "Employment and Earnings") for civilian labor market conditions, and from the Census Bureau for estimates of the youth population by county.

Table I shows the relative increase of high-quality, new recruits by Service and test cell. Each figure gives the ratio of the absolute increase to the increase in the

control area. For the Army and the Navy, the "Ultra VEAP kickers" resulted in the largest relative increase in enlistment contracts. In the Navy, this was closely followed by the Tuition/Stipend program. The Noncontributory VEAP showed the smallest relative increase in enlistments, with almost no effect on Army enlistments and modest increases for the Navy and the Air Force. As seen here, the Tuition/Stipend program was detrimental to the Army, yet beneficial to the Navy and the Air Force.

TABLE I
RESULTS OF THE EATP EXPERIMENT BY SERVICE

	Relative Increase in High-quality Enlistments by Service		
TEST CELL	ARMY	NAVY	AIR FORCE
UVK	8.72	8.39	1.42
NCV	-0.12	3.42	3.60
T/S	-6.10	8.22	5.55

Source: R. L. Fernandez, "Enlistment Effects and Policy Implications of the Educational Assistance Test Program"

Fernandez then investigated the influences of hourly earnings, hours worked weekly, employment, and unemployment rate upon each of the test cells. Additionally, he tracked the number of production recruiters by test cell. The NCV had higher wages and higher unemployment than the remaining cells (due in part to high unemployment in Detroit). For the Army recruiter, levels remained constant; for the Navy and the Air Force recruiter, levels decreased in test cells offering T/S and increased for cells offering NCV.

Because of the uneven changes in economic factors and recruiters, regression analysis was conducted to control for changes across test cells. Using a log-linear model, with the log of enlistments by AFEES as the dependent variable, Fernandez estimated a separate model for each Service. The regression analysis confirmed the test cell effects exhibited in Table I. The UVK resulted in a statistically significant increase of 9 percent high-quality enlistees for the Army and the Navy. The NCV resulted in a significant increase of 5 percent for Air Force enlistments, but the co-efficient was not significant for either the Army and the Navy. The T/S resulted in an enlistment increase of 10 percent for the Navy and an increase of 7.5 percent for the Air Force, but a 6 percent decrease for the Army.

Fernandez maintains that the UVK can raise enlistments in the army without hurting the other Services because of spillover effects from one Service to another. At the same time, the T/S results indicate heavy inter-Service competition, hurting Army enlistments and benefiting the other Services. Of the remaining variables--time, economic indicators, and recruiters--each Service had mixed results. Overall, an increase in hourly wages, weekly hours, and employment decreased the quantity of enlistments, while increases in unemployment rate and the number of recruiters increased the quantity of enlistments. The unemployment

elasticities varied by Service, ranging from .24 to .29 and estimated recruiter elasticities varied from .09 to .30.

Fernandez concludes that the EATP experiment gives the first evidence that a generaous educational benefit can help the Services attract high-quality enlistees, and that this program need not be open to all enlistees. The EATP also suggests that the primary reason for low participation rates in VEAP is not the requirement for individual contributions, but the small overall benefit. The author also reports that the EATP options did result in skill channeling in all the Services.

The only shortcoming in the evaluation of EATP results lies in the concepts of spillover and competition. Total high-quality enlistments for the Army increased 22 percent during the test period, while Navy high-quality enlistments decreased 2 percent and Air Force enlistments increased 8 percent. In the UVK test cells, enlistments in the Army and the Navy increased by 9 percent. The Army increase was attributed to the $12,000 VEAP kicker. The Navy's increase had no clear cause, because it only offered the standard VEAP, leading to the argument of spillover from Service to Service.

Under T/S, all three Services' test cells increased their enlistments by offering the same program. Without the advantage in benefits, the Army posted a smaller relative increase in enlistments to its base year (14 percent) than in

its other test cells and a relative decrease compared to its control group. The Navy demonstrated a relative 3 percent increase over the base year and an 8.2 percent relative increase to its control group, with the control group posting a 5 percent decrease in enlistments relative to the base year. Because of the better recruiter performance of the T/S test cells and the poor recruiter performance in the NCV and UVK cells, the Navy was forced to shift recruiters away from the T/S test cells to compensate for the low-quantity of enlistees enlistees being obtained elsehwere. Apparently, the movement of Navy and Air Force recruiters out of the T/S cells (Army recruiters only increased slightly in the T/S cells) demonstrates that the UVK and NCV test cells experienced more inter-Service competition than the equitable T/S, with the Army still coming out on top in the number of enlistments in all test cells.

The regression analysis would, of course, confirm the raw data of the experiment's findings, given the nature of the independent variables used. Therefore, the argument that the T/S cell resulted in increased inter-Service competition is easily disputed. In fact, given the same enlistment incentives, the Army would have to work as hard as the other Services, because it now lacked a recruiting advantage. Considering that one of the reasons for the EATP was to improve the Army's recruiting tools (more so than the other Services), the authors comments may be viewed as biased in behalf of the Army.

B. ECONOMIC ANALYSIS OF ENLISTMENTS

Goldberg and Greenston, in "Economic Analysis of Army Enlistments: Policy Implications", used Time-Series Cross-Sectional (TSCS) data to model active duty enlistment supply. Using annual Navy Recruiting District (NRD) level data from fiscal 1976 through fiscal 1983 (assuming that the number of HSDG, in AFQT test categories I through IIIA, contracts were a log-linear function of supply factors), the authors developed an enlistment supply model of economic, demographic, and policy variables. These variables included: relative military pay, cyclical and long-run civilian unemployment levels, a dummy variable to represent the loss of the GI Bill and to account for VEAP, population, racial mix, urban/rural mix, and the number of recruiters. A separate model was estimated for each Service.

Goldberg and Greenston predicted that certain recruiting districts wouled experience more enlistments--specifically, those districts that had high, relative military pay, an increase in either cyclical or long-run regional unemployment, large populations, large urban areas, and more recruiters. At the same time, the two detractors to high-quality enlistment were identified: loss of the GI Bill and districts with higher percentages of blacks.

The analyses by Goldberg and Greenston suggest that a one percent increase in relative military pay would result in a 2.29 percent increase in Army high-quality recruit

supply and a 0.97 percent increase in Navy high-quality recruit supply. A one percent increase in unemployment would result in a 6.5 percent increase in Army recruit supply and a 3.4 percent increase in Navy recruit supply. This model also suggests that, since 1977 the Army and the Navy experienced a 35 percent and 28 percent loss, respectively, in high-quality recruit supply due to the loss of the GI Bill. The authors also found the Army's Ultra VEAP (ACF) did not have a statistically significant effect on total enlistments, but that it was effective in channeling enlistees into targeted occupations. [Ref 5 p. 70]

Goldberg and Greenston also discuss the high cost of implementing a GI Bill similar to the Vietnam-Era GI Bill. Their cost estimate was based upon a DOD estimate that a return to the Vietnam-Era GI Bill had the potential to attract an additional 18,000 high-quality recruits, at a total cost of $2 billion, which would result in a cost of $111,100 per additional high-quality recruit ($2 billion divided by 18,000 recruits). And at this cost, there are far more economical ways to attract additional high-quality recruits, such as a ten percent pay raise for the high-quality Non-Prior Service (NPS) males only or a ten percent increase in the number of recruiters. (The cost would vary from $1,200 to $8,200 per recruit.) [Ref 5 pp. 70-71]

Goldberg and Greenston's extensive econometric modeling of enlistment supply shows the effects of unemployment, pay, loss of the GI Bill, and recruiters upon enlistments. The only shortfall may be in their calculations of the effects of the Army College Fund. At the time of their analysis, the ACF had only been in effect for one year, and participation was restricted to the combat arms. Their methodology was sound, but they may have lacked sufficient data to fully measure the impact of the ACF.

Daula and Smith, in "Recruiting Goals, Enlistment Supply, and Enlistments in the U.S. Army", also measured the impact of the ACF on Army enlistments from 1980 to 1983. The sample was limited to the period after fiscal 1980 because of changes in Army policy regarding the definition of enlistment goals and penalties. In addition, data regarding some variables were not available for earlier periods. [Ref 6 p. 108] Daula and Smith also used Time-Series Cross-Sectional data from Army Recruiting Battalions (districts) in a log-linear model to determine the influence of economic, sociodemographic variables, interservice competition, and recruiting resources on the enlistment of supply-constrained (NPS, high-quality males) and demand-constrained recruits.

The varialbes in the models were similar to those used by Goldberg and Greenston, with additional variables for: high-quality mission, other DOD high-quality enlistments,

advertising, ACF, Noncontributory VEAP, Mini GI Bill, and Enlistment Bonus Test cells. Of the variables representing either cash or education bonuses, only the ACF had a statistically significant effect on recruiting. Also, the ACF had an elasticity of .25 for high-quality enlistments and an overall elasticity of 0.16, far greater than the relative effect found by Fernandez in the EATP. [Ref 6 p. 115]

The greater influence of the ACF upon enlistments found by Daula and Smith, as opposed to the findings by Goldberg and Greenstons, may be due to the data. In the Daula and Smith study, the ACF had been in effect for two years. Nevertheless, Daula and Smith have shown that the ACF was significant in attracting high-quality recruits into the Army.

In "The Economic Determinants of Military Enlistment Rates", Dale and Gilroy also found that educational benefits were an important influence on the enlistment decisions of young men. In the first model estimated by Dale and Gilroy, the variables representing educational benefits were measured in real terms by deflating with the Consumer Price Index. The results suggest that the real value of educational benefits (holding constant the effects of inflation) were significant in explaining enlistment rates for young men. Furthermore, the VEAP kickers were significant in explaining the enlistments of white men. [Ref. 7 p. 11]

A second set of models based upon AFQT group were also examined using the current (rather than real) value of the educational benefits. Here, too, educational benefits were found to have a significant impact on the enlistment rates for high-quality males. Dale and Gilroy concluded that unemployment, relative military pay, and noneconomic factors all play an important role in determining the enlistment rate. They also noted that educational benefits are very important to high school graduates in the highest AFQT categories. [Ref 6 pp. 30-31]

The two Rand experiments and the three economic analyses of enlistments agree that educational benefits can have a significant effect upon high-quality enlistments, along with other factors such as the number of production recruiters, relative military pay, and advertising expenditures. This thesis explores the effect of educational benefits on high-quality enlistments, controlling for the effects of pay, recruiters, and other factors. The focus is on the impact of educational benefits on recruitment and determining whether the Navy College Fund would be a cost-effective method of expanding the Navy's recruiting market.

III. DATA AND METHODOLOGY

The purpose of this chapter is to estimate an econometric model of Army enlistment supply, focusing on the effect of the Army College Fund. The data for this analysis were generously provided by the U.S. Army Recruiting Command at Fort Sheridan, Illinois.*

A. DATA

The Army enlistment data consist of 78 monthly observations for each of the 54 Army Recruiting Battalions from the first quarter of fiscal 1981 through the second quarter of fiscal 1987. Also included are observations for the following variables:

-- the number of high-quality enlistments;

-- number of production recruiters;

-- Recruiting Battalion high quality mission;

-- the unemployment rate for each battalion;

-- the military-civilian pay ratio for each battalion;

-- the qualified population;

-- the minority population;

-- dummy variables representing the various experimental educational benefit and enlistment bonus programs;

-- and dummy variables representing the ACF and enlistment bonus programs.

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*The author would like to thank Dr. Bob Wegner and Mr. Jurl Toomepuu of the Research and Studies Division of the U.S. Army Recruiting Command for providing the data used in the analysis.

Data were also available for Navy, Marine Corps, and Air Force enlistment, covering the 30-month period from the first quarter of fiscal 1985 through the second quarter of fiscal 1987. However, data on the mission are not available. Also, due to a lack of information on the Navy, Marine Corps, and Air Force from the period prior to the implementation of the ACF, the analysis of this study is restricted to Army high-quality enlistments.

B. METHODOLOGY

The standard econometric model of enlistment supply utilizing pooled time-series cross-sectional data is:

$$\ln H = \Sigma\, b_i(\ln X_i) + u \qquad (1)$$

where $\ln H$ is the natural logarithm of high-quality (high-quality enlistees are high school diploma graduates, testing in AFQT categories I through IIIA) enlistments, $\ln X_i$ represents i determinants of high-quality supply, the b's represent the parameters to be estimated and u is the error term. The model assumes that enlistment supply is a log-linear function of various economic and sociodemographic factors.

This study controls for the effect of various economic and sociodemographic factors to isolate the effects of the ACF and the enlistment bonus program on high-quality Army enlistments. The next section discusses the construct of the explanatory variables used in the model.

C. EXPLANATORY VARIABLES

In this study, the variables used to explain high-quality enlistments are: unemployment, civilian to military pay ratio, the number of Army production recruiters, the qualified population, the minority population, and dummy variables representing the Army College Fund and the Enlistment Bonus Program. Each variable is discussed briefly in turn.

1. Unemployment

LUN = the natural logarithm of the civilian unemployment rate. Unemployment in this data set represents the local unemployment rate for all age categories within a battalion area. Unemployment is used as a proxy to represent fluctuations in the business cycle in a region (Recruiting Battalion). As unemployment increases, the number of high-quality enlistments is expected to increase; as the unemployment rate decreases, the number of high-quality enlistments is expected to decrease.

2. Pay Ratio

LPAY = the natural logarithm of civilian to military pay ratio. Pay ratio was measured by comparing local manufacturing wages within a Recruiting Battalion to entry level military wages (an average of paygrades E1 through E3). Pay ratio is a measure of the relative economic attractiveness of military over civilian employment. Earlier studies have shown that, while high-quality recruits are not as strongly affected by relative pay as are low-quality recruits, this

effect is statistically significant for both high- and low-quality recruits. Therefore, if the pay ratio narrows or favors the military, it should have a positive effect on the number of enlistments. That is, the expected sign of the estimated coefficient of LPAY is negative.

3. Recruiters

LARR = the natural logarithm of Army production recruiters assigned to the battalion. Recruiters are usually assigned to a Recruiting Battalion based upon that battalion's population and previous recruiting performance. Additional recruiters are reassigned to battalions that are not fulfilling their mission from battalions that are meeting or exceeding their quotas. Therefore, recruiters should have a positive effect upon the number of enlistments; but this effect should be subject to diminishing returns.

4. Qualified Population

LAPOP = the natural logarithm of the high-quality (high-school diploma graduates, testing in AFQT categories I through IIIA) youth population. The population estimates in this data set are from Wood and Poole estimates of youth population based upon the 1980 census. As the high-quality population of a battalion increases, so should the number of high-quality enlistments. This is due in part to the effect of recruiters: the larger the population, the more recruiters there are assigned to an area and the higher the mission assigned to large population areas.

The variable mission has been used in many econometric models of enlistment supply. Missions are usually assigned to a battalion based upon that battalion's population, unemployment rate, previous performance, and the needs of the Army. Kostiuk [Ref 8] has determined that recruit mission quotas are in part determined by the same factors as enlistment supply. Also, if quotas do not represent a binding constraint on observed enlistments (i.e., battalions failing to meet mission), Kostiuk points out that enlistment supply is probably being accurately measured by the econometric model. The data used in this econometric analysis indicate that Army Recruiting Battalions, more often than not, met or exceeded their mission quotas. This does not mean than mission quotas do not have an effect on enlistment supply. However, the ultimate goal of this analysis is prediction, that is to forecast the implications of enhanced educational benefits on Navy recruiting based upon the Army's experience with the ACF. Therefore, it was decided not to include the variable mission in this econometric model.

5. Minorities

LPM = the natural logarithm of the percentage of a battalion's total population comprised of minorities. This is expected to have a negative effect upon high-quality enlistments, since minority groups tend to score lower on the AFQT than do whites, and proportionately fewer minorities than whites possess a high school diploma.

6. Enlistment Incentives

Enlistment incentives are measured by two separate dummy variables. FUND = 1 when the ACF is in effect; BONUS = 1 to represent the effect of the enlistment bonus program. Each variable is set to 0 when the program is not in effect. These variables are expected to have a positive effect on enlistments. Human capital theory supports this hypothesized relationship in that a cash bonus or a guarantee of enhanced educational benefits may be necessary to overcome an individual's reservation wage (the minimum wage necessary to make military service a realistic option). Each of these programs targets a specific cohort of the youth market. Guaranteed future educational benefits target those individuals who are more forward-looking, e.g., individuals with a low internal personal discount rate. These are typically the college-bound youths who are willing to put off their entry into the job market to invest their time and money in training and education for a better job in the future. The cash bonus targets individuals who are more present-oriented, e.g., individuals with a high internal personal discount rate--that is, those individuals who are entering the job market, but need an extra incentive to make the military an attractive option.

Thus the full model to be estimated is specified as follows:

$$\ln H = a_0 + b_i LUN + b_2 LPAY + b_3 LARR + b_4 LAPOP + b_5 LPM + b_6 FUND + b_7 BONUS + u \quad (2)$$

The loglinear (constant elasticity) specification means the estimated coefficients (b_i's) can be interpreted as elasticities.

7. Nature of the Error Term

There are many problems inherent in pooled time-series, cross-sectional data that make estimation of the model by ordinary least squares (OLS) problematic. Within this model, problems can be expected with many of the variables. Recruiters ae strongly correlated with population and mission, because they are assigned based upon a recruit battalion's size and previous performance. Therefore, a larger battalion should always produce more enlistments than a smaller battalion. This occurs in part because the larger battalion, due to its population, has more recruiters and a higher recruiting goal. Warner resolved this problem by dividing the error term into two components: [Ref 9 p. 9]

$$U_h = z_i + v_{it} \quad (3)$$

The first component (z_i) characterizes the battalion-specific fixed effects and the second component (v_{it}) captures the random errors inherent in the model. Warner believes that the battalion-specific effects capture the effects of omitted variables that vary over the cross-section units but not over

time, and that these fixed effects are correlated with variables within the model, which may lead to biased estimates of the explanatory variables if the model is estimated by OLS.

A second problem is measurement error in the variables. The pay ratio is not a readily observable quantity (such as recruiters and enlistments) but is the result of surveys and calculations. Therefore, it is likely there will be problems with the measurement of the pay ratio variable leading to downward biased estimators. [Ref 9 p. 9] In addition, the pay ratio reflects the civilian pay of all age groups, not just that of civilian youth. This imparts another source of measurement error.

Another possible measurement error within this data set is associated with the population variable. In the data set, all of the various measures of population vary across battalions but are constant over time. Therefore, changes in youth cohort size and distribution over time are not represented, which may lead to biased estimators for population within the model.

When using pooled time-series, cross-section data in regression models, the error term is not always independent across time or over geographic areas (cross-sectional units), indicating the presence of autocorrelation. There are also the added problems of heteroscedasticity and autoregression. To obtain unbiased, efficient estimators for the model specified above, the Parks estimating method is utilized.

[Ref 10] (This methodology is imbedded in SAS procedure TSCSREG.) Parks considered the first-order autoregressive model in which random errors are either autocorrelated or contemporaneously correlated across cross-sectional units and have the following structure:

-- $E(U^2_{ij}) = \sigma_{11}$ heteroscedasticity

-- $E(U_{ij}U_{kj}) = \sigma_{ik}$ contemporaneously correlated

and -- $U_{ij} = \sigma_1 U_{1,j-1} + \sigma_{ij}$ autoregression.

In the Parks method, the beta coefficients are estimated by a two-step generalized least squares procedure.

The first-step in estimating the error term involves the use of ordinary least squares to estimate the beta coefficients and to obtain the fitted residuals:

$$U = Y - X\underline{B}_{OLS} \qquad (4)$$

Where U represents the random error, Y represents the dependent variable and $X\underline{B}_{OLS}$ represents the OLS estimates of the beta coefficients. A consistent estimator of the first-order autoregressive parameter is then estimated, and the autoregressive characteristics of the data are removed asymptotically through the transformation of taking weighted differences.*

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*One beneficial aspect of the Parks method is that the transformed model has not lost any of the original observations.

The second step consists of applying OLS to the transformed model to obtain a consistent estimator of σ_{ij}.

$$U^* = Y^* - X^*\underline{B}^*_{OLS} \qquad (5)$$

It can be shown that this estimator of the error term is consistent and asymptotially normally distributed. Finally, generalized least squares are used to obtain the final beta coefficients.

Through the Parks Method, this model should produce robust estimators of the economic, and sociodemographic variables and their effects upon the enlistments of high-quality youth. Furthermore, the variables FUND and BONUS should reflect the effect of these programs on high-quality Army enlistments. The next chapter reviews the results of the estimation of this model and the implications of the statistical results for Navy recruiting policies.

IV. EMPIRICAL ANALYSES

The analysis is divided into two parts. The first section discusses the results of the high-quality Army enlistment supply model. The second section discusses a cost-benefit analysis of the proposed Navy College Fund based, in part, on the results of the enlistment supply model.

A. ESTIMATES OF THE HIGH-QUALITY ARMY ENLISTMENT SUPPLY MODEL

Since the inception of the ACF, the growth in Army high-quality enlistments (defined as high school diploma graduates in AFQT categories I-IIIA), has surpassed that of the other Services and has outpaced the overall growth in high-quality enlistments for all Services combined. As depicted in Table II, the proportion of high-quality enlistments in the Army increased by 20 percent between fiscal 1982 and 1988, while the proportion of high-quality enlistments increased by just eight percent in the Navy. In all Services combined, high-quality enlistments increased by approximately 15 percent between fiscal 1982 and fiscal 1988.

The reasons for the rapid growth in high-quality enlistments throughout the military are varied. The recruitment picture in the 1980s was marked by several trends: an increase in relative military pay; a worsening, and then improving economy; an increased high-quality recruiting

mission; the inception of the Army enlistment bonus; and the introduction of the Army College Fund. The econometric analysis of high-quality Army enlistments presented here attempts to model the enlistments during this time frame, and estimate the policy effects of recruiters, enlistment bonuses, and especially of the ACF.

TABLE II
PERCENT OF ENLISTMENTS WHO
ARE "HIGH-QUALITY" BY ARMY, NAVY, AND ALL SERVICES
FISCAL 1982 THROUGH FISCAL 1988*

	Fiscal Year						
Service	1982	1983	1984	1985	1986	1987	1988
Army	39	45	47	50	53	58	59
Navy	44	53	50	50	47	52	52
All Services	45	52	52	53	55	60	60

Source: Defense Manpower Data Center.
* "High-quality enlistments include high school diploma graduates, testing in AFQT categories I-IIIA.

The sample data set consists of observations of 53 Army Recruiting Battalions over a 78-month period, from October 1980 through March 1988, yielding a total of 4,134 observations. Two Army Recruiting Battalions were not included in the sample data set due to missing observations. Additionally, due to missing data on Navy, Air Force, and Marine Corps recruiting experience, for certain years, the analysis is restricted to the Army only. The dependent variable is the total number of Army high-quality accessions.

The results of the estimation of the high-quality Army enlistment supply model are shown in Table III. Column 1 of Table III provides the results of estimating the model by the Ordinary Least Square (OLS) procedure without correcting for autocorrelation. Column 2 provides the results after correcting for autocorrelation. This correction was accomplished through the Parks method, which utilizes General Least Square (GLS) estimators, assuming a first-order autoregressive (AR1) error structure. The model in column 1 of Table III also includes dummy variables for the second, third, and fourth quarters of the fiscal year. These variables have been added to capture seasonal factors in recruiting. These variables have not been included in the model in column 2 because the Parks method controls for differences in time within its estimation procedure.

In using the log-linear form for each of these models, with all of the continuous variables measured in logarithms, the coefficient estimates may be interpreted as elasticities. Another feature of the log-linear model is the assumpton that the elasticity coefficient remains constant throughout. [Ref 11]

The results in Table III are remarkably robust: all of the estimated coefficients are statistically significant at the .01 level or better. Also, the explanatory power of the model is quite high for cross-sectional data. The R^2 in column 1 indicates the model explains about two-thirds of the

TABLE III
RESULTS OF THE ARMY HIGH-QUALITY ENLISTMENT SUPPLY MODEL

Independent Variable	Model 1[a]	Model 2[b]
Unemployment	0.465 (.015)*	0.501 (.010)*
Pay ratio	0.700 (.037)	0.642 (.029)
Recruiters	0.803 (.023)	0.694 (.013)
Percent Minority	-0.137 (.007)	-0.123 (.004)
Qualified Population	0.019 (.021)	0.217 (.013)
Army College Fund	0.376 (.014)	0.256 (.016)
Enlistment Bonus	0.223 (.010)	0.289 (.018)
Second Qtr	0.154 (.037)	N/A
Third Qtr	0.268 (.037)	N/A
Fourth Qtr	0.122 (.037)	N/A
R^2	.669	N/A
Root M.S.E.	.270	.995

* Figures in parenthesis are standard errors.
** Note all variables are statistically sngnificant for $p > 0.0001$.
a-- Model uncorrected for autocorrelation, utilizing OLS.
b-- Model corrected for autocorrelation, using Parks Method.
N/A Not applicable.

variation in enlistments. The results suggest that high-quality Army enlistments increase with unemployment, the military-civilian pay ratio, and the number of Army production recruiters. The results also suggest that battalions with larger qualified populations will produce more high-quality recruits than battalions with smaller markets, and that high-quality enlistments decrease as the relative size of the minority population increases. There is also a significant seasonal pattern to enlistments, with the largest effects occurring in the third quarter of the fiscal year (just after high school graduation).

In both of the estimated models, the variables with the strongest influence on high-quality Army enlistment supply are the relative pay ratio and recruiters. In the uncorrected (OLS) models, the elasticities are .70 for pay ratio and .803 for recruiters. In the corrected model, these elasticities fall slightly to .64 and .69, respectively. Therefore, a ten percent increase in pay ratio increases high-quality Army enlistments by 6.4 percent, while a ten percent increase in recruiters increases high-quality enlistments by 6.9 percent. However, several earlier studies have indicated that recruiters are subject to diminishing returns (in part due to the competition among recruiters within the limited youth market), leading to the conclusion that fielding additional recruiters may not be the most cost-effective way of increasing high-quality enlistments.

Unemployment also displays a statistically significant effect on high-quality enlistments. As shown in Table III, the elasticity for unemployment in the uncorrected model is .465, and it is .501 in the corrected model.

Of interest to this study are the coefficients of the dummy variables representing the ACF and enlistment bonus. Both of these variables are statistically significant in their effects on high-quality enlistments. As shown in Table III, the elasticity of the enlistment bonus is .223 in the uncorrected model and .289 in the corrected model. The elasticity of the ACF is .376 in the uncorrected model and .256 in the corrected model. This indicates that both the ACF and the enlistment bonus have had a strong positive effect on high-quality Army enlistments during this period. The effects of the enlistment bonus are much stronger than other studies have indicated. One reason for this is that prior to December 1985, a high-quality Army enlistee could receive the bonus and also enroll in the ACF. This practice was stopped to reduce the cost of Army enlistment incentives. [Ref 12 p.2] The effects of the ACF also demonstrate a much stronger impact on high-quality enlistments than indicated by either the MORE or EATP experiments and by any of the earlier econometric analyses of high-quality enlistment behavior. This is partially the result of the increased value and reduced personal cost, of the New GI Bill, compared with the earlier VEAP. As reported by Warner [Ref 9 p. 16], the

average value of VEAP was $2,411 in 1981, while the average value of the New GI Bill was $4,144 in 1986 (benefits are stated in 1981 dollars). And the individual contribution declined from $2,700 for VEAP to $1,200 for the New GI Bill.

The next step is to use the estimated elasticities of the ACF--and other determinants of high-quality enlistments --to model the potential effects of a proposed NCF on Navy high-quality enlistments. This analysis is presented in the next section.

B. COST-BENEFIT ANALYSIS

1. Impact of the Navy College Fund on Navy Recruiting

The purpose of this section is to project the potential effects of the Navy College Fund using the experience of the ACF. Using the forecasting techniques described by Robert F. Cotterman in "Forecasting Enlisted Supply: A Time Series of Cross Sections Model", this study attempts to project the number of ACF-motivated enlistees for the Army in fiscal 1990. This will serve as a basis for predicting the number of persons who will be motivated to enlist in the Navy by the Navy College Fund during fiscal 1990.

Cotterman's methodology for forecasting enlistment supply involves estimating a model to explain the enlistment rate (the number of enlistment contracts divided by qualified population) rather than total enlistments, as the dependent variable. This technique consists of estimating the monthly

enlistment rate for each Recruiting Battalion, multiplying the enlistment rate by the qualified population of the Recruiting Battalion, and summing the observations to obtain the total number of projected recruits. One aspect of Cotterman's estimator is utilizing the disturbance term, the estimated rho values, of each cross section in the final period observed as part of the forecast. In the Parks Method the rho values are the estimates of first-order autocorrelation in each cross-sectional area (battalion). Because there is autocorrelation in the disturbances, past values of the disturbances are informative about future values, increasing the efficiency of the forecast. [Ref 13]

To utilize this methodology necessitates changing the dependent variable and certain independent variables in the econometric model and reestimating the model. The changes in the independent variables are: dropping the variable representing minority population, and combining production recruiters with qualified population (production recruiters divided by qualified population) to form a variable representing the ratio of production recruiters to qualified population. The econometric analysis of enlistment rate utilizes the same data set described earlier--53 Army Recruiting Battalions over a 70-month period from October 1980 through September 1987. The sample contains 3,710 observations. The enlistment rate model is estimated utilizing Parks Method of GLS estimation with an AR(1)

error structure. The final six months were deleted from the data set to allow the calculation of forecasting errors based upon the recruiting experience of fiscal 1988.

2. The Results of the Econometric Analysis of Enlistment

The results of the econometric analysis of enlistment rates are shown in Table IV. Column 2 of Table IV displays the results of estimating the model of total enlistment

TABLE IV
RESULTS OF THE MODEL OF ARMY HIGH-QUALITY ENLISTMENT RATES

Independent Variable	Model 2[a]	Model 3[b]
Unemployment	0.529 (.009)*	0.560 (.009)*
Pay ratio	0.658 (.026)	0.740 (.021)
Ratio of Recruiters to Qualified Population	N/A	0.624 (.011)
Recruiters	0.700 (.012)	N/A
Qualified Population	0.216 (.013)	N/A
Army College Fund	0.267 (.014)	0.254 (.014)
Enlistment Bonus	0.279 (.015)	0.285 (.017)
Root M.S.E.	.997	.996

a is the model with total number of enlistments as the dependent variable.
b is the model with enlistment rate as the dependent variable.
* Figures in parentheses are standard errors.
**Note all variables are statistically significant for $p > .0001$.

supply, as above, but deleting the final six months of the data. Column 3 displays the results of estimating the enlistment rate equation. As depicted in Table IV, there are only minor differences between the coefficients of the variables in the enlistment supply and enlistment rate models. The differences are due in part to the enlistment rate model having 424 fewer observations than the total enlistment supply model, and the differences in variable construction.

To estimate the number of high-quality Army accessions in fiscal 1990, data were obtained from the Navy Recruiting Command on forecasted unemployment rates and military-to-civilian pay ratios for fiscal 1990. These data were collected by Navy Recruiting Districts and they were matched to Army Recruiting Battalions using a conversion program designed by the Defense Manpower Data Center for the Naval Postgraduate School. The estimation technique used the number of Army production recruiters for each Recruiting Battalion in March 1988 (the last available observation).

Using this forecasting technique for fiscal 1988 as a test case, it was predicted that 56,076 high-quality recruits would enlist in the Army; the actual number was 60,388, a difference of seven percent. Thus the forecasting error of the model is acceptable. This model also estimated that the Army could expect 9,000 ACF-motivated and 10,000 bonus-motivated recruits fiscal 1988.

Using the Navy Recruiting Command forecast values for unemployment and pay for fiscal 1990, it is projected that 52,000 high-quality recruits will enter the Army in fiscal 1990. Of these recruits, it is estimated that 8,376 high-quality recruits will enlist primarily for the ACF, and that 9,840 will enlist for the bonus program. To obtain the number of high-quality recruits the Navy can expect, we make the following assumption: the same number of recruits (8,376) will join the Navy for the NCF. Furthermore, historically, 42 percent of all ACF participants are obligated to serve at least four years, and 62 percent of those enlisting for four years tested in AFQT categories I-II. Applying these same percentages to the Navy, it is estimated that an additional 2,181 high-quality recruits (those in AFQT categories I-II) will enlist for four years in the Navy to qualify for the NCF.

3. Cost of the Navy College Fund

The actual cost of the proposed Navy College Fund is dependent upon the following factors: (1) the number of participants; (2) the number of participants completing the minimum length of service requirement; (3) the number of participants making full contribution to the GI Bill; (4 the number of participants utilizing benefits; (5) the percent of earned benefit used; and (6) the timing of benefit utilization. To develop a cost model for the Navy College Fund, estimates of all of these variables must be developed.

Under the revised DOD accrual system, the present value of the Navy College Fund is estimated to be $1,460 per participant. This fee is placed in a trust fund to finance future educational benefits. The actual cost of the program will not be known until after the initial NCF cohort has completed its minimunm length of service and the ten-year benefit period has elapsed.

The cost of the program to the Navy will be offset by the program's outcomes, because higher-quality recruits are more cost-effective than lower-quality recruits. Compared with lower-quality recruits, for example, higher-quality recruits are more likely to complete their first enlistment and to finish training. They are also less likely than lower-quality recruits to have disciplinary problems and are more likely to be promoted to higher ranks in a shorter period of time. Overall, high-quality sailors improve force readiness by a greater extent. Of these factors, the cost of attrition is a measurable value. The other factors impose a virtually unknown cost on fleet units. The following discussion explores the cost of all these factors.

4. Cost-Effectiveness of High-Quality Recruits

One objective of the NCF is to fill shortages in critical skill ratings with high-quality enlistees. Shortages in "A" school attendees are currently filled by GENDET recruits (general detail recruits who enlist for one of three general apprenticeship programs--Airman, Seaman,

and Fireman) out of boot camp. This process of taking GENDET recruits and placing them in vacant "A" school seats is referred to as backfilling. By replacing the GENDETs with high-quality recruits, attrition rates and cost should decrease. As depicted in Table V, high-school diploma graduates in AFQT categories I and II have much lower attrition rates than do all other Navy recruits.

TABLE V
FIRST-TERM ATTRITION RATES OF NAVY RECRUITS WHO ENTERED ACTIVE DUTY IN FISCAL 1984 WITH SCHOOL GUARANTEES AND WITHOUT SCHOOL GUARANTEES, BY AFQT CATEGORY AND EDUCATION LEVEL

AFQT	Recruits with School Guarantees			
Category	HSDG	GED	NHSDG	Total
I	24	46	65	26
II	27	45	57	30
IIIA	28	58	63	31
IIIB	31	53	67	32
IVA	36	43	*	36
IVBC	45	*	*	45
Total	39	51	61	31

AFQT	Recruits without School Guarantees (Gendets)			
Category	HSDG	GED	NHSDG	Total
I	30	33	43	31
II	33	51	51	36
IIIA	33	58	68	41
IIIB	35	56	64	37
IVA	37	50	*	37
IVB	46	*	*	46
Total	45	55	61	38

* Not applicable due to small size of cohort.
Note: Attrition rates are expressed as the percentage of all recruits in the FY 1984 enlistment cohort that have failed to complete a first-term of enlistment.
The following abbreviations are used here: HSDG is high school diploma graduate; NHSDG is non-high school diploma graduate; and GED is General Educational Development high-school equivalency certificate.
Source: OPNAV-136C

Based upon these data, NCF participants would be expected to have an attrition rate that is 11 percent lower, on average, than that of the GENDETs currently backfilling "A" schools. If these GENDETs could be replaced by NCF enlistees, the Navy could recruit fewer GENDET recruits. This substitution would lead to a substantial savings for the Navy by reducing both recruiting and training costs.

The actual cost of an attrition loss is a function of the following: a one-time recruiting cost; training cost; and post-service benefits (benefits include unemployment and veterans' benefits for those who qualify), amortized over the period of productive enlistment following the completion of training [Ref 14 p 3]. Recruitment cost has been estimated to average $3,400 per Navy recruit [Ref 15]. The cost of boot camp is estimated to be $4,592, and the weighted average cost of 27 of the 29 "A" schools targeted by the NCF is $13,706 [Ref 1 Encl 6]. These figures are combined for a total cost of $21,690 for an enlistee leaving at the six-month point (including training and recruitment costs alone).

A 1979 GAO report on the cost of attrition estimates that an individual, in fiscal 1977, who leaves at or beyond the six-month point is eligible for an average of $12,765 in veterans' benefits, which are available up to 50 years after leaving the Service [Ref 14 p. 3]. In addition, GAO estimates that the average Navy recruit experiencing attrition

in 1977 was eligible for $838 in unemployment benefits. In current dollars, these amounts sum to $24,215. Although the present value of veterans' benefits is very small, much smaller than the present value of the NCF, these attrition costs to the government in the long run may very well eclipse the cost of the NCF many times over.

Another positive aspect of high-quality sailors is that they are less likely to experience disciplinary problems than are other sailors. As depicted in Table VI, NHSDG and GED recruits in the fiscal 1985 and 1986 accession cohorts (those for which the most complete data are available) were twice as likely to leave the Navy for a disciplinary reason

TABLE VI
DISCIPLINARY DISCHARGE RATES OF NAVY RECRUITS WHO ENTERED ACTIVE DUTY IN FISCAL 1985 AND 1986, BY AFQT CATEGROY AND EDUCATION LEVEL

HIGH SCHOOL DIPLOMA GRADUATES
AFQT Category

Fiscal Year	I-II	IIIA	IIIB	IV	Total
1985	13	16	18	21	16
1986	11	14	17	20	14

NON HIGH SCHOOL DIPLOMA GRADUATES *
AFQT Category

Fiscal Year	I-II	IIIA	IIIB	IV	Total
1985	35	38	36	29	36
1986	30	32	36	14	32

Source: Defense Manpower Data Center
* Includes GEDs.
Note: Disciplinary discharge rates are expressed as the percentage of recruits in the enlistment cohort who were discharged for disciplinary reasons, when each cohort had reached 30 months of service.

than were HSDG recruits, and almost three times as likely as were high-quality (AFQT categories I-II) enlistees.

The precise cost of disciplinary cases cannot be easily estimated. Indiscipline imposes an unseen cost on the individual and his command. This cost includes: loss of productivity; administrative expenses; and damage to unit readiness and morale. GAO estimated that Unauthorized Absentees alone, for example, cost the military $1.1 billion in lost productivity and administrative expenses over the period from 1974 through 1977 [Ref 15 p. 11]. As the quantity of high-quality personnel increases in the Navy, the cost of indiscipline, based upon these attrition rates, should decrease. This represents another aspect of the cost-effectiveness of the recruits attracted by the NCF.

High-quality sailors will also enhance unit readiness. The article "Are Smart Takers Better? AFQT and Military Productivity", by Scribner et al, the authors found that high-quality enlistees perform significantly better than their lower-quality counterparts. The authors showed that tankers scoring in the upper AFQT test categories contributed significantly to the effectivenss of their tanks in training compared to the tankers who scored in the lower AFQT test categories when their tanks were fully operational. On this point, the authors concluded that using a tank in a degraded mode would cause the real effects of AFQT to emerge. It was thus concluded that the independent effect of AFQT scores on

tank performance should be considered in policy making [Ref 16 pp. 201-202].

Fagan, in "Comparative Costs of Alternative Forces in the U.S. Army", found that higher-quality soldiers are more cost-effective than lower-quality soldiers. Fagan based this upon the understanding that high-quality soldiers have lower rates of indiscipline, lower rates of unauthorized absence, lower first-term attrition rates, higher probability of success in schools, and faster promotion rates [Ref 17].

These two studies reinforce the perception that high-quality sailors will have a positive impact upon the Navy, supporting the cost-effectiveness of high-quality personnel.

Based upon the revised DOD accrual cost of a College Fund participant, the cost of the NCF is estimated at $3,184,260 (obtained by multiplying the individual cost of $2,460 by the 2,181 NCF participants).

The recruitment of additional high-quality recruits would lead to a requirement to recruit 240 fewer lower-quality GENDET recruits (240 x 11 percent). Based upon the cost estimates of an attrition loss, the Navy could reduce its recruiting and training expenditures by $5,205,600 ($21,690 x 240), plus the savings in veterans' and unemployment benefits. This savings in attrition costs, if realized, would greatly reduce the actual cost of the program.

There are three policy alternatives to the Navy College Fund expressed in the Army Enlistment Supply Model.

These policies involve increasing recruiters, military pay, or enlistment bonus programs. The impact of expanding recruiter and bonus programs are discussed below.

5. Policy Alternatives

a. Expanding the Recruiter Force

The Army Enlistment Supply Model demonstrates an elasticity of .69 for Army production recruiters. This suggests that a one percent increase in production recruiters would increase enlistments by .69 percent. Based upon the number of production recruiters in March 1988, a one percent increase in recruiters would result in adding 49 recruiters to the Recruiting Battalions. These additional recruiters, based upon the Army Enlistment Supply Model, should result in an increase of 426 high-quality recruits for fiscal 1990.

The Navy Recruiting Command estimates the cost to field an additional recruiter at $43,000 per year [Ref 18]. Based upon the model's estimate of an additional 8.5 recruits attracted per recruiter, the cost of each additional high-quality recruit is estimated at $5,058. Therefore, increasing the number of production recruiters may not be as cost-effective as the Navy College Fund in increasing the number of high-quality recruits. Addtionally, faced with a declining youth population, addtional recruiters will face increased competition with existing recruiters over the traditional recruiting markets. In contrast, the NCF involves creating an entry into the college-bound youth market. This is the

familiar argument of diminishing returns to production recruiters. The employment of recruiters may, therefore, be left as it is now, assigned to recruiting districts based upon population estimates and recruit mission.

b. Enlistment Bonus Program

The enlistment bonus offers another potentially successful method for increasing the quantity of high-quality recruits. The enlistment supply model suggests that an enlistment bonus program is slightly more effective than the college fund in increasing high-quality enlistments. Theoretically, bonus program targets potential recruits who are "present-minded" (as opposed to "forward-looking" members of the college-bound youth market) and members of the tradi tional recruiting market (who are not likely to be in the college-bound youth market). These individuals are planning to enter the job market; therefore, an enlistment bonus may be effective in making military employment more attractive than civilian employment or by steering recruits into less-desired ratings. For the most part, cash bonuses are not advertised, and are primarily employed as a mechanism to steer potential recruits into less desirable skill categories. (The Navy currently offers enlistment bonuses of up to $2,500 to qualified enlistees entering targeted ratings, who are willing to extend their initial enlistments by one year, and a bonus of $3,000 to nuclear power program enlistees, to delay their entry to ensure constant school

loading, thus using the incentive as a method of skill channeling [Ref 19].

The present value of the cost of an enlistment bonus program may outweigh the present value of the cost of the College Fund. In the two-year period from January 1986 to December 1987, 25,677 Army recruits participated in the Enlistment Bonus progam with an average bonus of $3,638 per enlistment contract. [Ref 12, Table 1-1] If bonus-induced recruits have the same early separation characteristics as do other high-quality recruits, the average bonus per successful recruit amounts of $4,836, compared to the cost of $1,460 for the college fund. This is because the bonus, once paid, is a sunk cost and cannot be retrieved if the recipient fails to complete his or her contracted length-of-service. At the same time, the College Fund is only available to those who meet minimum length-of-service requirements and make the required contributions to the GI Bill. Because of this, the present value cost of a college fund participant who fails to complete a first-term of enlistment is less than that of a bonus program participant who does likewise.

c. Other Policies

The effects of advertising on high-quality enlistments are not discussed because data on advertising costs were not available. The effects of pay ratio on recruiting is not discussed, because the implementation of large military pay raises does not appear to be a practical

option in the face of current budgetary deficits. In addition, military pay raises are determined by Congress, not by the Services.

Based upon the results of the Army Enlistment Supply Model, and the arguments on behalf of high-quality recruits, the proposed Navy College Fund presents a workable option for increasing the quantity of high-quality recruits in a cost-effective manner. A college fund may also be more favorably viewed than other recruitment incentives by the public and Congress, since a college fund broadens life opportunities available to an honorably-discharged Navy veteran.

V. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSION

The results of this study suggest that the Navy College Fund (or NCF) offers the Navy a cost-effective method to increase the quantity of high-quality enlistees (that is individuals who are high school diploma graduates, with test scores in AFQT categories I-II). As described previously, the NCF is comparable in cost to current enlistment incentives. However, it goes beyond these traditional methods by targeting a virtually untapped source of recruits--namely, the college-bound youth market. Furthermore, the impact upon the Navy of the additional high-quality recruits, attracted to enlist by the NCF, should diminish any perceptions of the NCF as an expensive and wasteful enlistment incentive.

Since this program targets individuals who are not members of the job-oriented youth market, the argument that educational benefits are reenlistment disincentives can be discounted for two reasons. First, without the enhanced educational benefits, it is likely that NCF participants would not have entered the Navy in the first place. Second, the short Army experience with the ACF has resulted in reenlistment rates as high as 36 percent, implying that a fair proportion of participants will remain beyond a first enlistment.

Unlike a policy of expanding enlistment bonuses and a policy of fielding of additional recruiters, the cost of the NCF will not be accurately determined until the first round of participants has had an opportunity to utilize the available benefits. This could be up to 14 years after the program has been initiated, further reducing the present value of the program per participant. Nevertheless, if all participants used the entire benefit within the first four years of discharge, the tuition assistance received by these individuals would add to the human capital of the nation, without adding to the Department of Education's ever-growing student debt.

Another attribute of the NCF is the prospect of future inter-Service competition over diminishing recruit resources. Whereas, increases in recruiters and wider knowledge of bonuses will most likely increase competition among the Services, the NCF should not have this effect. It has long been maintained that the ACF has not increased competition among the Services because the program targets recruits from the collge-bound youth market. The majority of ACF participants are two-year enlistees entering combat arms occupations. The NCF would only apply to four-year enlistees who attend certain "A" schools. During the tenure of the ACF, the number of Army four-year enlistees participating in the ACF has decreased steadily from 56 percent of all ACF participants in fiscal 1985 to 21 percent in fiscal 1988.

The reduced interest in the Army's four-year program should minimize the impact upon the ACF of the Navy's entry into the college-bound youth market.

There is another potential benefit to the NCF; it may lead potential recruits, who would not have otherwise found the Navy attractive, to investigate the Navy as a job opportunity.

B. RECOMMENDATIONS

Three recommendations are offered concerning the implementation of the NCF. First, the number of recruits attracted by the college fund may be increased if the program is extended to high-quality enlistees in AFQT categories I through IIIA. Persons in this aptitude range have accounted for 38 percent of the four-year enlistees participating in the ACF since fiscal 1985. Additionally, the attrition rates of these enlistees are similar to the attrition rate of enlistees in AFQT categories I and II. Furthermore, the impact on readiness and reductions in training cost associated with enlistees in AFQT categories I through IIIA would also be similar to that of high-quality recruits in AFQT categories I and II. Based upon the analysis in the previous chapter, the addition of AFQT category IIIA recruits to the program would attract an additional 1,337 high-quality recruits to the Navy annually. This could result in requirements to recruit 147 fewer lower-quality recruits and

contribute additional savings in recruiting and training costs.

Second, caution must be exercised in setting quotas on NCF enlistees. Strict adherence to quotas during the "Multiple Option Recruiting Experiment" led to a reduction in high-quality recruit accessions in one Navy test area. Therefore, if the demand for the NCF by potentially qualified recruits exceeds the quotas of NCF billets, expansion of the program may be required. Otherwise, these potential high-quality recruits may be lost to the Navy.

The third recommendation is that consideration be given to expanding the enlistment bonus program. The results of the econometric analysis of this study suggest that the enlisted bonus has a stronger impact (on the margin) than a college fund on enlistment supply. Though the bonus targets the traditional recruiting market of job-oriented youth, it has been an effective means for the Army in steering recruits to certain occupational specialties. And, unlike the college fund, the cost of the bonus is a "given". If the bonus program were to receive little, or no, advertising, it could act as a passive means, minimizing inter-Service competition, to make the Navy appear more attractive than the other Services. This goes beyond the current employment of the Navy's enlistment bonus program of ensuring the equal loading of nuclear power schools and to increase the first-term enlistments of individuals in selected ratings. The

combination of a bonus program and enhanced educational benefits should prove effective in increasing Navy high-quality enlistments.

There are several related areas of study that may be undertaken as a result of this thesis. As indicated during the course of this study, further research into the cost of an individual who fails to complete his or her first term of service is needed. In addition, continued research into the actual cost of the college fund would be beneficial for future estimates of the impact of high-quality sailors on the Navy. Along the same lines, research on the total cost of indiscipline--in monetary and non-monetary terms--should be undertaken.

In conclusion, the Navy College Fund offers a cost-effective method for filling a sizeable portion of the 8,684 "A" school assignments otherwise given to GENDET recruits. It also provides the Navy with a proven means for reaching the college-bound youth market of potential recruits.

APPENDIX A

THE DATA SET

The data were obtained from the U.S. Army Recruiting Command, and consist of 78 monthly observations of each Army Recruiting Battalion from October 1980 through March 1988. Included in this data set were continuous variables and dummy variables for Army, Navy, Marine Corps, and Air Force recruiting. Data for the latter three services were incomplete, in that the number of recruiters were missing for the first 12 months, and the number of high-quality recruit accessions were missing for the first 48 months of the data set. For the Army, data for the 19th Recruiting Battalion were also missing for certain variables. And the 56th battalion had observations for only a few months.

A detailed listing of each variable's composition and SAS name follows:

BATT1: An alpha-numeric representing each Army Recruiting Battalion, 1A-6G.

BATT2: A numeric, 1-56, representing each Army Recruiting Battalion.

Month: A numeric, 1-78, for each month recorded in the data set, where 1 = October 1980, etc.

Unemp: Unemployment, the unemployment rate for each battalion.

Pay: Pay ratio, the military to civilian pay ratio for each battalion. This was computed by comparing the local manufacturing wages to the military's entry wage levels (E1-E3).

Miss: Mission, the high-quality recruit mission assigned to each recruiting battalion.

Netdays: Number of production days within a given month.

Arrecr: Is the number of Army production recruiters assigned to a battalion.

Nrrecr: Is the number of Navy production recruiters in the Army battalion area.

Frrecr: Is the number of Air Force production recruiters in the Army battalion area.

Mrrecr: Is the number of Marine Corps production recruiters in the Army battalion area.

Apop: Is the qualified high-quality youth population in the battalion. All population figures are based upon Woods and Pooles forecasts using the 1980 census.

Bpop: Is the black youth population in the battalion.

Hpop: Is the Hispanic youth population in the battalion.

Mpop: Is the qualified male youth population, 17-21 years of age, in the battalion.

Opop: Is the "other" minority youth population in the battalion.

Wpop: Is the white youth population in the battalion.

GSA2: Is the quantity of high-quality Army recruits per battalion.

OS1: Is the quantity of high-quality Navy recruits per battalion.

OS2: Is the quantity of high-quality Marine Corps recruits per battalion.

OS3: Is the quantity of high-quality Air Force recruits per battalion.

B111: Is a dummy variable representing the Veap Kicker test program, set to 1 when the program was in effect and 0 otherwise.

NCVP: Is a dummy variable representing the Non-Contributory VEAP test program, set to 1 when the program was in effect and 0 otherwise.

EBTC: Is a dummy variable representing the Enlisted Bonus Test Cell, set to 1 when the program was in effect and 0 otherwise.

EBT8K: Is a dummy variable representing the $8,000 Enlisted Bonus Test Cell, set to 1 when the program was in effect and 0 otherwise.

EBT84K: Is a dummy variable representing the $8,000 and $4,000 Enlisted Bonus Test Cell, set to 1 when the program was in effect and 0 otherwise.

Fund: Is a dummy variable representing the Army College Fund, set to 1 when the program is in effect and 0 otherwise.

Bonus: Is a dummy variable representing the Enlisted Bonus Program, set to 1 when the program is in effect and 0 otherwise.

APPENDIX B

ALTERNATIVE ECONOMETRIC MODELS

As discussed previously, the variable mission was omitted from the econometric models because the goal of the analyses in this study was forecasting, and for the most, part Army Recruiting Battalions met or exceeded their high-quality mission quotas. But, as described in several econometric analyses of enlistment supply, high-quality mission has been statistically significant in modeling enlistment supply [Ref 6 and Ref 9].

To reflect the influence of high-quality mission on enlistment supply, will require adding the log of high-quality recruit mission to the econometric model of enlistment supply. The econometric analysis, with mission, utilizes the same data set described earlier--53 Army Recruiting Battalions over a 78-month period from October 1980 through March 1988. The sample contains 4,134 observations. The dependent variable is the log of high-quality enlistments. As displayed in Table VII, the inclusion of the variable mission, in the enlistment supply model, alters the model significantly. Column 1 of Table VII provides the results of estimating the model by the OLS procedure without correcting for autocorrelation. Column 2 provides the results after correcting for autocorrelation. This correction was accomplished through the Parks method, utilizing GSL

estimators, assuming a first-order autoregressive (AR1) error structure. Column 1 of Table III includes dummy variables for the second, third, and fourth quarter of the fiscal year.

The log-linear form is used for each of these models. Therefore, the coefficient estimates may be interpreted as elasticities.

The results in Table VII are remarkably robust: all of the estimated coefficients are statistically significant at the .01 level or better. The explanatory power of the model is slightly better than that of the model (see Table III) without the variable mission. As depicted in Table VII, the inclusion of the variable mission greatly reduces the influence of the other variables in the model. Of interest to this study were the coefficients of the variables representing the ACF and enlisted bonus programs.

By including mission as a variable, the elasticity of the ACF dropped from a .376 to a .142 in the uncorrected model, and from a .256 to a .138 in the corrected model. The elasticity of enlistment bonus also decreased from a .223 to a .091 in the uncorrected model, and from a .289 to a .173 in the corrected model.

Mission does have a significant effect on high-quality enlistments and on the econometric analysis of high-quality enlistments. But, mission was not included in the enlistment rate and the enlistment supply model of this study because it cannot be accurately predicted for use in forecasting. And

the goal of this study was to forecast the impact of educational benefits on enlistment supply. However, as the models in Table VII indicate, mission may be considered when evaluating recruiting policy options.

TABLE VII

RESULTS OF THE ARMY HIGH-QUALITY ENLISTMENT SUPPLY MODEL MODEL WITH THE VARIABLE MISSION

Independent Variable	Model 1[a]	Model 2[b]
Unemployment	0.345 (.014)	0.397 (.009)
Pay ratio	0.437 (.033)	0.461 (.024)
Recruiters	0.460 (.022)	0.485 (.014)
Percent Minority	-0.091 (.006)	-0.091 (.005)
Qualified Population	0.052 (.019)	0.118 (.013)
Mission	0.455 (.012)	0.369 (.008)
Army College Fund	0.142 (.013)	0.138 (.012)
Enlistment Bonus	0.091 (.009)	0.173 (.018)
Second Qtr	0.084 (.033)	N/A
Third Qtr	0.228 (.033)	N/A
Fourth Qtr	0.048 (.033)	N/A
R^2	.747	N/A
Root M.S.E.	.236	.998

* Figures in parenthesis are standard errors.
** Note all variables are statistically sngnificant for $p > 0.0001$.
a-- Model uncorrected for autocorrelation, utilizing OLS.
b-- Model corrected for autocorrelation, using Parks Method.
N/A Not applicable.

LIST OF REFERENCES

1. Office of the Chief of Naval Operations, Memorandum Ser 136C1/9U570778, to LT Roy Crowe, USN, Subject: Information for Thesis Topic, 30 June 1989.

2. The Rand Corporation, Report 3350-FMP, Educational Expectations and Enlistment Decisions, by Joseph R. Hosek et al, March 1986.

3. The Rand Corporation, Report 2671-MRAL, The Multiple Option Recruiting Experiment, by Gus W. Haggstrom et al, November 1981.

4. The Rand Corporation, Report 2935-MRAL, Enlistment Effects and Policy Implications of the Educational Assistance Test Program, R. L. Fernandez, September 1982.

5. Goldberg, L. and Greenston P., "Economic Analysis of Army Enlistments: Policy Implications", Army Manpower Economics, C. L. Gilroy ed., Westview Press, 1986.

6. Daula, Thomas V. and Smith, D. Alton, "Recruiting Goals, Enlistment Supply, and Enlistments in the U.S. Army, Army Manpower Economics, C. L. Gilroy ed., Westview Press, 1986.

7. U.S. Army Research Institute for the Behavioral and Social Sciences, The Economic Determinants of Military Enlistment Rates, by Charles Dale and Curtis Gilroy, September 1983.

8. Center for Naval Analyses, Research Memorandum CRN 87-145, Issues in Estimating Enlistment Supply, Peter F. Kostiuk, pp. 5-10, August 1987.

9. Warner, John T., "Interservice Effects in Military Recruiting Programs: Competition or Cooperation? An Analysis of Navy and Army Enlistments During the Period FY 1981-86", Mimeo 1989.

10. SAS Institute Inc., SUGI Supplemental Library User's Guide, 1983 Edition, Cary, N.C.: SAS Institute Inc., pp. 373-374, 1983.

11. Gujarati, Damodar N., Basic Econometrics, 2nd ed., McGraw-Hill Book Co., pp. 145-146, 1988.

12. U.S. Army Recruiting Command, Draft Copy, The Optimal Allocation of Army Enlistment Incentives by MOS: Analyses of CY86-CY87 Experience, Impacts of Non-Monetary Guidance Counselor Incentives and PC Software, by Richard C. Morey et al, 1 May 1989.

13. The Rand Corporation, Report 3252-FMP, Forecasting Enlistment Supply: A Time Series Cross Sectional Model, by Robert F. Cotterman, pp. 35-36, July 1986.

14. U.S. General Accounting Office, High Cost of Military Attrition Can Be Reduced, 16 February 1979.

15. U.S. Army Recruiting Command, Research Note 86-1, Costs and Benefits of Quality Soldiers: A Critical Review of the CBO Report, Quality Soldiers: Cost of Manning the Active Army, by Jurl Toomepuu, September 1986.

16. Scribner, Barry L. et al, "Are Smart Tankers Better? AFQT and Military Productivity Armed Forces and Society, v. 12, No. 2, Winter 1986.

17. Fagan, Thomas W., "Comparative Cost Alternative Forces in the U.S. Army", Army Manpower Economics, C. L. Gilroy ed., Westview Press, pp. 350-351, 1986.

18. Telephone conversation between Carl Kannapel, Navy Recruiting Command, and LT Roy W. Crowe, USN, 17 November 1989.

19. Department of the Navy FY 1991 OSD/OMB Budget Military Personnel, Navy (MPN), Justification Estimates, p. 59, September 1989.

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