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Recruiting Budgets, Recruit Quality, and Enlisted Performance

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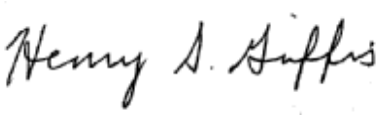

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Executive summary

Background

In FY 2006, the Navy recruited one of its highest quality accession cohorts in history; 95 percent of the recruits were high school diploma graduates, and 75 percent scored 50 or above on the Armed Forces Qualification Test (AFQT). Faced with increasing accession missions and a challenging recruiting environment, it would be extremely difficult for the Navy to sustain enlistments at these quality levels.

N10 asked CNA to investigate recruiting strategies over a long-term time horizon. N10 wanted to know what impact recruit quality would have on in-service behavior. It was looking for guidance on how recruiting resources and recruit quality could be most efficiently managed over the budget planning cycle. What would be the impact of changing recruit quality? Could resources be saved if enlistment standards were changed to balance increased recruiting costs?

Methodology

We approached this question by developing key performance indicators that could be used to evaluate changes to recruit quality. We found two performance measures that would capture the impact of recruit quality: completion of 48 months of service and rank achieved at the end of 4 years. We used promotion rate as an indicator of job performance. By controlling for cohort and ratings effects, we found that the promotion rate could serve as a measure of how different types of recruits would perform during the first enlistment.

In addition to evaluating recruit quality and performance, we observed that the Navy typically responds to the dynamic recruiting environment through another mechanism—expansion and

contraction of the Delayed Entry Program (DEP). Furthermore, we found that DEP policy also had significant relationships with our performance measures. Thus, we estimated the effect of DEP policy on recruiting costs (as measured by DEP attrition), as well as our other performance measures.

We constructed a set of scenarios for recruit quality and the size of the DEP to investigate what sorts of effects changing policies could have on performance. We based our cases on the variations that have occurred in recruit quality and DEP over the last decade. We used the average, highest, and lowest recruit quality and the average, smallest, and largest DEPs experienced over the last decade.

Using a recruiting supply model developed by Warner et al., we estimated the impact of changes in recruit quality on recruiting budgets, as well as the impact that different economic conditions would have on recruiting budgets. Finally, we examined three alternatives for absorbing a $50-million shortfall in recruiting resources: decreasing the DEP, increasing the percent of nongraduates, and lowering the AFQT standard.

Findings

We found that these scenarios produced small differences in retention but large differences in job performance. When recruit quality was high, retention increased by less than 2 percent, while job performance was more than 8 percent higher. Alternatively, when recruit quality was low, retention declined by about 1 percent, while performance was over 5 percent lower. Also, when recruit quality was low, there could be problems placing many of the recruits with low test scores, as well as filling nuclear field seats.

For DEP policy, we found that the size of the beginning-of-year DEP correlated positively with the average DEP time for contracts during that year. We found that increasing DEP time from the historical average resulted in substantial increases in both retention and job performance (as measured by promotion rates), while shrinking the DEP decreased both performance measures.

When we evaluated the recruiting resource implications of economic conditions, we found that increases in the unemployment rate would support modest changes in recruiting resources or recruit quality. For example, an increase of 1 percentage point in the unemployment rate would permit the Navy to save about $38 million in recruiting costs, or to increase high-quality recruits by 3 percentage points. Changing recruit quality within the ranges recently experienced by the Navy was consistent with large increases or decreases in recruiting resources. Increasing quality from the recent average to the FY 2006 quality level would require $114 million in additional recruiters, while reducing quality to its recent minimum could save $71 million.

We found that the changes in first-term performance produced from DEP policies were greater than those produced from recruit quality. When time in DEP was at its lowest, 48-month completion rates declined by 2.5 percent and promotion rates by 6 percent. When time in DEP reached its recent maximum, completion rates increased by 3.5 percent and promotion rates rose by nearly 9 percent.

The changes in performance produced through increasing the time recruits spend in the DEP would require large recruiting budget increases to achieve through other means. For example, the job performance gains from moving from an average to a long DEP would cost $80 million to achieve through recruiting higher quality. The retention gains that would accrue from increased time in the DEP could not be achieved through increasing enlistment standards or adding recruiting resources.

We examined three alternative policies to offset a recruiting resource shortfall: decreasing the size of the DEP, lowering the AFQT standard for high school graduates to 31, or increasing the number of B cells (non-graduates with AFQT scores of 50 or above). We found that reducing the DEP makes sense only if the shortage in resources is temporary. If the resource deficit is expected to last more than 1 year, either AFQT standards should be lowered or nongraduate quotas should be increased.

Implications and recommendations

We found that recruit quality can be related to important performance measures—notably, retention and promotion. Changes in continuation behavior are likely to be small if recruit quality changes are restricted to the ranges observed during the last decade. Job performance, as measured by promotion performance, is much more strongly affected by changes in recruit quality.

The DEP should be explicitly included in any tradeoff analysis between recruit quality and performance. The size of the DEP pool serves as both an important indicator of recruiting difficulty and a measure for performance. Permitting the DEP to shrink in size can have an impact on performance greater than simply lowering enlistment standards.

With respect to enlistment standards, accepting additional nongraduates may be preferable to simply reducing AFQT standards. The retention differences between nongraduate B cells and C cells with AFQT scores below 35 have been relatively modest, while the B cells will have higher job performance at the end of 48 months.

Introduction

Military recruiting resources are based on two broad factors: quantity and quality. Quantity is largely determined by such requirements as enlisted endstrength plans and recent retention experience. Recruit quality is measured by two dimensions: education and aptitude. The key education determinant is whether someone has received a high school diploma. These people are much more likely to complete their enlistment term than those who failed to complete high school. Aptitude is measured by the Armed Forces Qualification Test, which provides a percentile score for each candidate on a 0–99 scale. An AFQT score of 35 was the minimum accepted by the Navy during fiscal year 2007.

The Navy finished fiscal year 2006 with one of its highest quality recruiting cohorts in history. Ninety-five percent of the accessions were high school diploma graduates (HSDGs), and 75 percent scored at the 50^{th} percentile or above on the AFQT. This far exceeded the Department of Defense (DOD) requirement of 90 percent HSDGs and 60 percent scoring 50 or above on the AFQT.

These recruit quality goals will likely be difficult to sustain. Recruiting missions were scheduled to increase over the next several years. FY 2007's accession mission increased by 1,000 over the 36,000 recruited in FY 2006. FY 2008's mission was planned for 39,000 accessions, and the recruiting mission was projected to increase to 43,000 by FY 2010.

N10 asked us to examine possible strategies for managing recruit quality. The first question was, What evidence is there on the benefits of recruit quality? If recruit quality declines, what impact might it have?

Second, N10 wanted to know how sensitive recruit quality was to economic conditions. How much would recruit quality have to change to compensate for changing unemployment rates? What would it cost to maintain recruit quality as the economy changed?

We begin with a brief discussion on recent trends in recruit quality and the economy. It became apparent to us that any evaluation of recent recruiting trends must also take into account the Delayed Entry Program. The DEP plays a major factor in how the Navy adjusts to changing recruiting conditions, so we also show how the DEP has changed along with the economy.

Then we examine measures of first-term performance, and develop relationships between these measures and indicators of recruit quality, economic conditions, DEP participation, and other important explanatory factors.

Background

Recruiting is driven by economic conditions. When labor markets are tight, the military has a more difficult time finding recruits. When unemployment rises, recruiting becomes easier. The Navy has typically responded to recruiting conditions in three ways. First, additional resources can be added when recruiting becomes difficult. When unemployment is low, additional recruiters, advertising, and recruit incentives can be used to increase the number of enlistments.

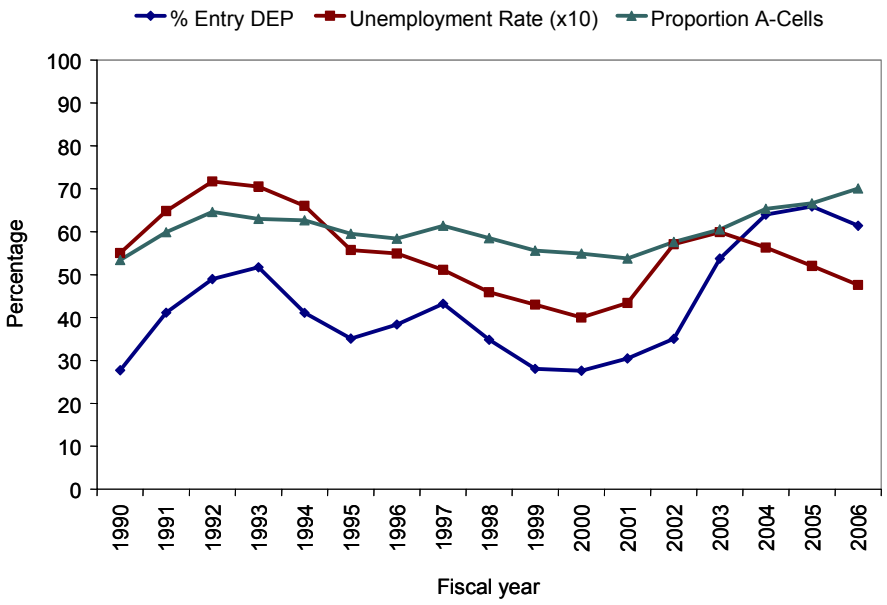
Second, the Navy can reduce its inventory of people recruited into the Delayed Entry Program. Military services typically have people sign enlistment contracts before the date they actually begin their training. When recruiting becomes difficult, the Navy can reduce the numbers of people in the DEP, effectively drawing down its inventory of people it has recruited.

A third way that the Navy adjusts to the recruiting environment is through recruit quality. Recruit quality is measured by two dimensions: education and aptitude. The key education determinant is whether someone has received a high school diploma. High school diploma graduates, or HSDGs, are much more likely to complete their enlistment term than those who failed to complete high school. Aptitude is measured by the AFQT, which provides a percentile score for each candidate on a 0–99 scale. Currently an AFQT score of 35 is the minimum accepted by the Navy.

Those recruits who score 50 or above on the AFQT and are HSDGs are the most desired type of recruits. Navy Recruiting refers to these high-quality recruits as A cells. They are also the most difficult category of person to recruit and require more recruiter effort and incentives than HSDGs with test scores below 50 (C cells) or nongraduates. The Navy currently accepts only limited numbers of nongraduates, and only those with AFQT scores of 50 or above—referred to in recruiting as B cells.

Figure 1 illustrates some of the recent trends among recruit quality, unemployment, and the DEP for FY 1990 through FY 2006. The unemployment rate (displayed here multiplied by a factor of 10 for scale) increased from FY 1990 to a high of over 7 percent in 1992, then declined through FY 2000. From FY 2000 through FY 2003, unemployment rose to 6 percent, then declined to its present level of less than 5 percent.

Figure 1. Unemployment rate, beginning-of-year DEP, and high-quality recruits, FY 1990–2006



One measure of the DEP is its size at the beginning of the fiscal year relative to that year's accession mission. This percentage, known as the beginning-of-year (BOY) DEP, is also provided on figure 1. The BOY DEP provides one indicator of the challenges faced by recruiting for the year. While changes in the recruiting mission can occur through such events as reductions in endstrength or increased retention, the chart indicates that there is also a correlation with economic conditions. For example, the BOY DEP was at its lowest levels during FY 1999 through FY 2001, which was also the same time that the unemployment rate was at its lowest point.

Figure 1 shows that the percentage of recruits who are A cells often follows economic trends as well. For example, from FY 1997 through FY 2001, the percentage of A cell recruits was decreasing along with declining unemployment and a shrinking BOY DEP.

The following questions need to be addressed for the Navy to develop policies for adjusting recruiting resources and recruit quality as the recruiting environment changes:

1. How does recruit quality affect first-term performance?
2. What is the relationship of recruiting policies and resources over the business cycle?
3. How will changes in recruit quality, economic conditions, and DEP policy affect recruiting budgets?
4. What policies can the Navy use to address recruiting difficulties?

In the next section, we examine key relationships between characteristics of recruit quality and performance. Then we present our estimates of how much performance would change under different scenarios of recruit quality. We extend our analysis of recruiting scenarios to include changes in DEP policy because we find that time in the DEP is an important part of how the Navy responds to recruiting environments and also has significant impacts on performance. In the final sections, we estimate the recruiting costs that would be related to alternative policies and evaluate some policy alternatives that are available to address the current recruiting environment.

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Recruit quality and enlisted performance

Past research has shown a relationship between recruit quality and military performance. One of the first-term performance measures has been attrition, focusing on the percentage of recruits who fail to complete their enlistment. Education was found to be the principal agent that explained differences in completion rates. For example, Warner [1] found that recruits with less than 12 years of education left the Navy at higher rates than recruits with 12 or more years of education. High AFQT scores also were related to lower attrition. More recently, Hattiangadi et al. [2] found that recruits who were dropouts, received only a General Education Development (GED) certificate, were awarded an adult education or alternative diploma, or qualified for enlistment by completing one semester of college had much higher attrition after 3 months than HSDGs. Buddin [3] found similar results in his evaluation of enlistment characteristics and first-term success for Army soldiers.

The Armed Services Vocational Aptitude Battery (ASVAB)—a test given to all military applicants—serves two important functions. First, the AFQT, which is calculated from four subtests of the ASVAB, is used to determine enlistment eligibility. Second, other subtest combinations are used to decide whether a candidate is qualified for a specific job. These rating-specific cut scores have been determined from analyzing the performance of recruits in training [4].

While ASVAB scores have been used primarily to determine eligibility for skill training, they have also been shown to be related to attrition and other measures of job performance. Warner [1] also showed that those in AFQT Categories I and II (scores in the 65–100 percentile range) were significantly more likely to remain in the service, while those in Category IV (scores of 30 and below) were almost as likely to attrite as nongraduates. Both [2] and [3] also show that low AFQT scores are associated with higher attrition.

There has been extensive work linking ASVAB scores to other measures of job performance [5]. Armor [6] found that low-aptitude recruits in the Army were unlikely to meet minimum job performance standards, as measured by the Skill Qualification Test (SQT). The National Research Council found that, while it was difficult to link entrance tests to absolute measures of job performance, test results were shown to be related to the ranking of individuals against a number of job performance measures [7].

Promotion as a performance indicator

One indicator that has been used to measure enlisted job performance is promotion. Hiatt and Sims [8] found that ASVAB scores were related to job performance in addition to training school performance. In fact, they found that both education and AFQT category were related to probability of promotion to corporal in the Marine Corps, given survival. Cymrot [9] used promotion speed as an indicator for high performance. He examined the relationship of recruit category against the percentage promoted in the top 10 or 25 percent of a cohort at different service lengths. He found that B cells always represented a larger share of fast promoters than C cells.

Koopman [10] discusses how the promotion system in the Navy is meant to identify and reward superior performers. The promotion system is the Navy's principal means of identifying and rewarding performance; thus, it serves as an operational indicator of quality. Reference [3] and Hosek and Mattock [11] have shown time to promotion to be a useful indicator of enlisted performance. Their work has used data from all services, but especially the Army, and has found the speed with which a person is promoted to ranks E4 and E5 to be a superior indicator of soldier quality to enlistment characteristics.

The recruiting and performance impacts of DEP participation

The DEP originated as a mechanism for assisting both recruits and the services in improving the person–job match. DEP policies have also been shown to have an impact on both recruiting costs and in-service attrition. Cooke and Pflaumer [12] found that DEP length increases as DEP attrition increases, adding to recruiting costs.

Increased recruiting costs due to high DEP attrition led the Army toward policies to reduce time spent in the DEP [13].

Other studies have found that in-service attrition decreases for recruits who have spent significant time in the DEP. Cooke and Pflaumer [12] found that increasing average DEP length led to reductions in first-term attrition for the Navy, Army, and Marine Corps. Hattiangadi [2] also found that recruits with 3 or more months in the DEP experienced lower in-service attrition for all services enlisting from 1995 to 2000. Reference [3], however, found that increasing DEP length for Army recruits had little relationship to in-service attrition for recruits entering between 1995 and 2001.

Evaluating performance gains against recruiting costs

The relationship of recruit quality and recruiting costs involves the development of models that can be used to compare the tradeoffs between these two areas. Armor [6] developed the concept of a qualified man-month, based on the combination of a recruit's performance with respect to both attrition and job effectiveness.

Other approaches have shown a link between recruit quality and aggregate measures of performance. Junor and Oi [14] developed a model that relates Navy recruit quality to such measures as ship readiness indicators. The model, however, does not address recruiting-performance tradeoffs for all positions, nor did the authors directly link readiness to recruiting-quality tradeoffs. Smith and Hogan [15] developed a model to show the tradeoffs among recruit quality, recruiting resources, and job performance. Their model evaluates recruiting costs against a job performance measure along with allocation across occupational categories. Their performance measure combined hands-on job performance with continuation behavior, creating a measure analogous to Armor's qualified man-month measure. Furthermore, they aggregated performance over their job performance measure, and compared the performance output to costs that included recruiting, training, and compensation. The major weakness of their approach is the data requirements. The results from hands-on performance tests are based on a sample of job performance data that is nearly 20 years old and contained a limited number of Navy jobs.

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Approach

To evaluate the impact of recruit quality on first-term performance, we developed relationships between recruit quality and performance covering the first 4 years of service. Specifically, we examine the tradeoffs between DEP policy, recruit quality, and the ability of different quality mixes to meet recent Navy job requirements, as well as their performance during their initial enlistment.

We restricted our analysis to the first term, rather than attempting to project career impacts of differences in recruit quality. First, we were concerned about recruiting policies and tradeoffs. No doubt there are long-term impacts that can be related back to recruit characteristics, but decisions past the first enlistment invariably become mixed with retention policies, which are currently decided separately.

Second, when we analyzed the drivers of recruiting missions over the last 20 years, we found that recruiting goals were driven by planned endstrength changes and recent first-term losses. Retention rates did not directly affect recruiting goals.

Development of first-term performance indicators

We focus on two measures of first-term performance. First we used continuation behavior. Recruits who complete their enlistment are preferable to those who do not. While we could use completion rates for many different time intervals, we chose to measure continuation behavior at the 48^{th} month. This is the length of the current standard enlistment. We found very similar results when we used shorter periods, so there was no additional information gained by providing similar measures for different time periods. Also, this facilitates later analyses that combine continuation behavior with our job performance measure.

We considered several types of job performance measures. We investigated using expected performance in training. This measure could be estimated for each recruit by using the appropriate ASVAB composites for their assigned job. Results could then be scaled in relation to a normalized score for each composite. The problem would be interpreting the scores. What does it mean to increase the average composite score for the Navy by 0.1 standard deviation?

We chose to use ASVAB qualifications in another manner. We evaluated recruit quality overall, along with specific groups or recruits, against the job qualification rates. This kind of information was useful for indicating where lowering accession quality might create problems in assigning recruits to jobs.

While meeting minimum job qualifications is an important criterion for evaluating recruits, we wanted a measure that could provide some scale for evaluating performance beyond training. Another approach we considered was adapting the DOD Cost-Performance Tradeoff model to current Navy data. The problem with this approach would be the use of the hands-on job performance relationships. Here we confronted two issues. First, the original regression equations contained only a limited number of jobs. Even more important is the assumption that the relationship of AFQT, education, experience, and job performance has remained the same over the last 20 years. Relying on a small number of jobs and possibly out-of-date relationships with recruit characteristics would weaken our ability to generalize from these results.

We chose to use promotion rates as our principal measure of job or Sailor performance. This measure has a number of desirable features. The promotion system is an outcome measure that is not based directly on any information that occurs before service. The Navy Enlistment Advancement System [16] relies on such factors as results from advancement exams, promotion recommendations, and awards. This is all information that is only available once the recruit has served on active duty.

The most frequent promotion measure used has been speed of promotion [11]. Koopman [10] used the definition “fast to E5” in her development of promotion speed as an indicator of Sailor quality.

One reason she used E5 promotion speed is that in many ratings there is little variation in speed to E4; variation in speed increased in many ratings by the time significant numbers of Sailors began to compete for E5 promotions.

Promotion history is available for all recruits who remain in the Navy. However, promotion rates vary considerably by rating and by year of accession, since billet requirements and retention change over time. We will discuss shortly how we can control for such limitations in our model.

Time in DEP

In addition to estimating our two performance measures, we found it necessary to estimate the relationship of recruit quality and other explanatory factors on DEP completion. We do this for several reasons. First of all, DEP is a significant drag on recruiting productivity. During FY 2003 through 2006, 23 percent of contracts failed to access from the DEP. Time in DEP has been associated with DEP attrition [12]. We want to evaluate how changing the size of the DEP can be used to even out variations in recruiting that may be produced by economic conditions, resource fluctuations, or other sources. Changes in DEP time will affect the expected probabilities of completing the DEP and accessing. DEP loss will affect recruiting costs.

Another reason the DEP relationship should also be included in policy evaluations is the fact that DEP time has also been associated with higher completion rates once in service [12, 2]. We want to assess whether this relationship still holds, and if changing the time recruits spend in the DEP has any significant effect on in-service continuation behavior or promotion behavior.

One of the policy options we evaluate is the use of the DEP as a mechanism for managing recruiting over the business cycle. Historically, when conditions have made recruiting difficult, the size of the DEP declines; when conditions are favorable to recruiting, the DEP is increased. We develop a model of the probability that a person will complete his or her time in DEP and enter active duty as a function of policies, economic conditions, and recruit characteristics. This model

enables us to simulate the likelihood that a person will successfully complete the wait until reporting for active duty.

Time in the DEP is both a policy that could be considered for reducing recruiting costs and a policy variable that could have impact on performance. Reducing the time in the DEP will enable an immediate reduction in recruiting resources during that period. In the long term, shorter DEP lengths should result in lower DEP attrition and fewer DEP attrites to be replaced. Past research, however, has shown that shorter DEP times may result in increased in-service attrition.

DEP is included in the model in three ways. DEP size serves as an explicit policy that we will examine. Second, we estimate a model of DEP behavior—specifically, the probability that a person will complete DEP and become an accession. *Time in DEP*, which we relate to the size of the BOY DEP, is an explicit factor in this model and affects recruiting costs. Finally, time in DEP is also included as an explanatory variable in both performance equations. This permits us to also model the relation of time in DEP on continuation and promotion behavior as well.

Development of behavioral models

To evaluate alternative recruiting policies, we estimated three behavioral models: DEP completion, 48-month continuation, and promotion to E5 by the completion of 48 months.

Completion of DEP is estimated as the probability that an enlistment contract will become an accession, given a number of explanatory factors. Since time in the DEP is a policy we will examine, and a driver of recruiting costs, we developed a model of DEP completion.

We estimated the probability that a recruit would complete 48 months of active duty. This corresponds to the length of the standard enlistment contract. (Many recruits also enlist for 5 or 6 years.) Completion of this length of service is an important indicator of a successful Sailor since all recruits are expected to stay for at least this length of time. We estimate this model as a probability and include a collection of recruit characteristics, environmental variables, and other policies and conditions of service as explanatory factors.

The third behavioral model we estimated was the probability of being promoted to E5 at the end of 48 months for those still in the service. Again, we chose 48 months because it is the completion of a standard 4-year enlistment and can be combined with the continuation model to estimate the numbers of Sailors both remaining in service and performing at a high level. In recent years (FY 1999–2003 cohorts), about 31 percent of the recruits remaining for 4 years reached E5 at the 48-month point.

Promotion to E5 is based on a number of factors: standard score on Navy exams (34 percent), performance evaluations (36 percent), awards (4 percent), service in paygrade (13 percent), and passed but not advanced (13 percent) [16]. "Service in paygrade" and "passed, but not advanced" are longevity measures that are not directly related to job performance. By evaluating everyone at the same length of service, we remove the effect of those factors that depend solely on longevity, increasing the variance related to the performance-based factors.

Explanatory factors

In addition to recruit quality characteristics, such as AFQT and education, we introduced a number of other attributes of the recruit, including demographic factors, enlistment programs (GENDET, Navy College Fund, enlistment bonus, enlistment term), DEP participation, and economic conditions, as well as occupation, cohort, and location of enlistment (NRD).

We used two factors to address economic conditions: the unemployment rate at the time of contract and the relative military wage ratio (military pay divided by the civilian wage rate available to the recruit at the time of contract.) We hypothesize that the higher the unemployment rate and the wage ratio, the more attractive military service would be to the recruit, and hence the greater the likelihood that they will complete the DEP and continue their service. (Previous research [3] had found that economic measures taken at the time of contract were better explanatory factors than similar measures taken at later points in the enlistment.)

Promotions are strongly influenced by both occupation and the availability of vacancies. Those serving in overmanned ratings, or facing fewer slots due to higher retention, will experience lower promotion rates than similar people reaching promotion eligibility in other environments. We control for this effect in two ways. First, we evaluate people based on both their entry cohort and occupation. All are evaluated by year group against recruits entering the same occupation at their 48^{th} month of service. We also estimate a second equation of their probability of reaching the 48^{th} month of service, also controlling for occupation and year group. Thus, we can project the probability that a person entering a particular rating with specific characteristics, such as AFQT and education, will attain the rank of E5 within 4 years.

Results for the behavioral models

Variables and descriptive statistics

Table 1 provides the descriptive statistics for key variables for each model. Statistics for all variables are provided in appendix A.

Table 1. Descriptive statistics

Variable	DEP analysis	48-month analysis	Promotion analysis
AFQT	59.78	58.49	59.39
Senior	0.31	0.29	0.33
Nongraduate	0.03	0.04	0.03
GED or other certificate	0.04	0.05	0.03
Some college	0.02	0.02	0.02
College degree	0.02	0.02	0.02
Other education credential	0.05	0.06	0.05
Age	19.44	19.83	19.80
Months in DEP	4.17	3.07	3.40
Signed in last 5 days of month	0.32	0.33	0.32
Female X months in DEP	0.89	0.63	0.68
Senior X months in DEP	2.24	2.00	2.28
Observations	508,398	198,522	126,885
Dependent variable	.786	.639	.311
Unemployment rate	5.02	4.68	4.71
Wage ratio	0.58	0.57	0.57

The DEP completion model was estimated from 508,000 enlistment contracts during the FY 1999–2006 period. Just under 79 percent of contracts completed their DEP stay and accessed on to active duty. About 31 percent signed contracts while high school seniors. Overall

recruits spent an average of just over 4 months in DEP. The unemployment rate averaged 5 percent during this period.

Those who signed an enlistment contract during this period were followed up to determine whether they had entered active duty within a year of their initial contract. Completion of 48 months of service was estimated from data covering 198,000 people who entered active duty from FY 1999 through FY 2003. About 64 percent of accessions successfully completed 4 years of service. The average time in DEP was about 3 months for this group, and the higher DEP attrition for seniors reduced their share of the accessions to 29 percent.

Promotion to E5 used the data from 127,000 Sailors who completed 48 months of active duty after enlisting during FY 1999 through 2003. During this period, 31 percent of these Sailors reached the E5 grade level. The proportion of seniors in this data set increased to 33 percent, and the average DEP time to 3.4 months.

Full model regression results are provided in appendix A. Table 2 provides the results from the three models for variables of common interest. These include those variables that are directly related to the recruit quality and DEP policy variables that will be the focus of our analysis:

AFQT—percentile score on the Armed Forces Qualification Test

Senior—someone who signs initial enlistment contract while in high school (HS)

Nongraduate—person without HS diploma

GED—General Education Development certificate or equivalent credential

Some college—person has 1 semester of college or more, but no HS diploma

College degree—person has completed college degree

Other education credential—someone who lacks a highschool diploma but signs contract while in college

Months in DEP—months from time of contract to enlistment or DEP discharge

Signed in last 5 days of month—enlistment contract signed in last 5 days of month

Senior * months in DEP—interaction of months in DEP and senior

Unemployment rate—unemployment rate for the Navy Recruiting District (NRD) at the time of contract

Wage ratio—ratio of military wage to civilian wage in NRD at the time of contract.

The AFQT and education variables can be used to define the recruit quality variables that will be investigated against recruiting costs and performance. HSDG is the omitted education credential, with other variables being measured against it. The other education credentials are separated to see if there are differences in their continuation behavior and job performance that may warrant targeting specific types for policies. Seniors are separated explicitly to control for restrictions on their DEP behavior, but they are investigated to examine if there are any significant performance differences between them and other types of HSDGs.

In addition to having large numbers of observations, these data sets have several other attractive features. First, the size of recruit cohorts and enlistment standards were comparable to the current environment. Also, the cohorts that enlisted during this period covered both difficult and easy recruiting. While roughly comparable, changes in enlistment quality, notably AFQT standards and the percentage of nongraduates, did occur during this period. Thus, we expect that the experience from these Sailors will be applicable to the current Navy.

DEP completion

Three DEP variables are included in the model. Time in DEP is the principal factor since previous analyses have found it to be related negatively to DEP completion and positively to continuation. Senior time in DEP was modeled separately because we hypothesize that

seniors may be less sensitive to time in DEP than those recruited from the workforce. A variable for those recruited during the last 5 days of the month was used to test if they were at increased risk for either dropping from the DEP or failing to continue in service.

Since two continuous variables—time in DEP and AFQT—played an important role in our behavioral relationships, we tested several different functional forms, including quadratic terms for each variable. We had hypothesized that extreme values of either (long or short DEP times, or exceptionally high or low AFQT scores) may result in different results than those produced from a simple linear model. Also, we were investigating policies at extreme levels of DEP, and at the low end of the AFQT scale. These specifications did not prove to be significant, so we focused on linear DEP and AFQT relationships in our analysis.

We included two economic variables: unemployment rate and relative military wage rate in their district at the time they were recruited. We hypothesize that those recruited when unemployment and wage rates were high would be more likely to complete DEP and continue in service. We have no strong a priori expectation for their job performance 48 months later, but we leave the variable in the model to test if there is any relationship.

Additional variables were included in the regressions (e.g., fiscal year of enlistment or contract, NRD, and occupation) and are provided in appendix A. These additional variables will control for cohort and ratings effects that would affect the promotion-based performance regression. Many of these categorical variables could be of interest for geographic targeting of recruiting resources or for further analysis of occupational differences. These results are secondary to the analysis here but can be found in appendix A. Categorical variables, such as gender, education, and race/ethnicity, were measured relative to a male Caucasian high school diploma graduate enlisting as a yeoman (YN) from the New England area (NRD 102).

Table 2 provides the logistic regression coefficients for the DEP completion model. Variables with coefficients significantly different from 0 at the 5-percent level are marked with an asterisk. Senior and the "Other" education credential had the largest negative effect among

the education credentials. Presumably the "Other" category was large because many of the people fail to complete additional educational requirements while in DEP. We will discuss the senior credential shortly, along with its interaction with time in DEP.

Table 2. Logistic regression results[a]

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
AFQT	-0.001*	0.01*	0.03*
Senior	-1.23*	0.31*	0.04
Nongraduate	-0.03	-0.81*	-0.21*
GED or other certificate	-0.09*	-0.73*	-0.09*
Some college	-0.10*	-0.65*	-0.21*
College degree	-0.20*	0.05	-0.10*
Other education credential	-0.76*	-0.48*	-0.20*
Months in DEP	-0.07*	0.07*	0.04*
Signed in last 5 days of month	-0.19*	-0.01	0.006
Senior X months in DEP	0.15*	-0.05*	-0.03*
Unemployment rate	0.02*	0.04*	-0.04*
Wage ratio	-0.25	-0.68*	-0.97*

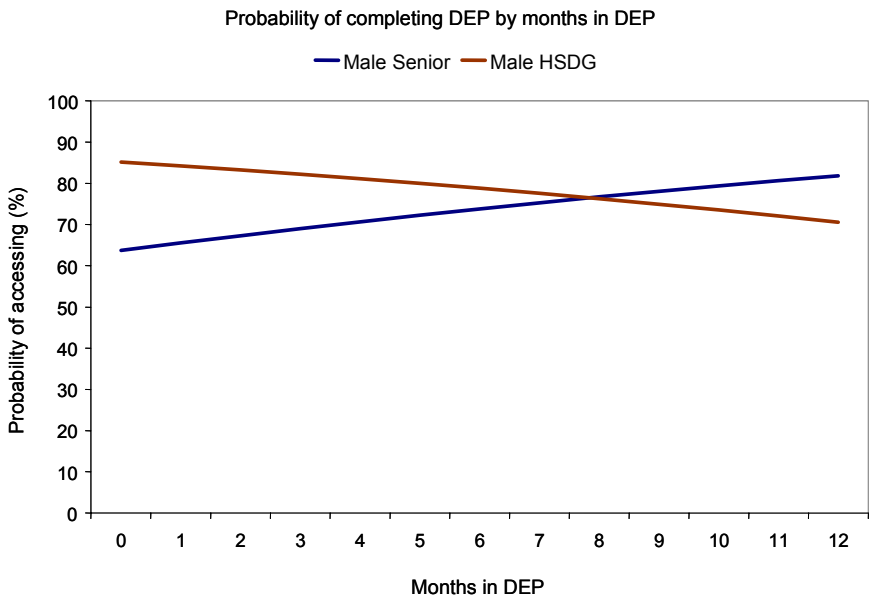
a. * indicates that coefficient is significant at .05 level.

The DEP completion coefficients are displayed in the first column of table 2. All coefficients except wage ratio were statistically different from 0 at the 5-percent level. AFQT was significant and negative but resulted in very small differences in expected completion rates. A recruit with an AFQT of 99 would experience a decreased completion rate of only about 1 percentage point less than a contract with an AFQT of 31. Only the "Other" education credential was associated with meaningfully lower DEP completion rates since this category included mostly people enlisting while in community college and would only qualify if they completed sufficient education credits. Those signing a contract in the last 5 days of the month had about completion rates about 3 percentage points lower, indicating that the placement of recruits during this time may not be as successful as during the majority of the month.

The unemployment rate was associated with higher completion rates, but the effect was small. An increase in unemployment from 4 to 6 percent would increase completion by less than 1 percentage point. The wage ratio was not significantly different from 0.

Time in the DEP plays a key role in understanding DEP completion, so we provide a graph (figure 2) of how it relates to the completion rate. We show the expected completion rates of a male HSDG and a senior based on their time in DEP. The HSDG completion rate declines as he spends more time in DEP, from 85 percent to about 65 percent after 12 months. However, the senior's likelihood of completing DEP and entering active duty actually increases slightly over time. The typical senor spends more than 6 months in DEP, so those with short DEP times are not typical and tend to include those dropping from the DEP.

Figure 2. Effects of DEP time on accession probability



48-month completion behavior

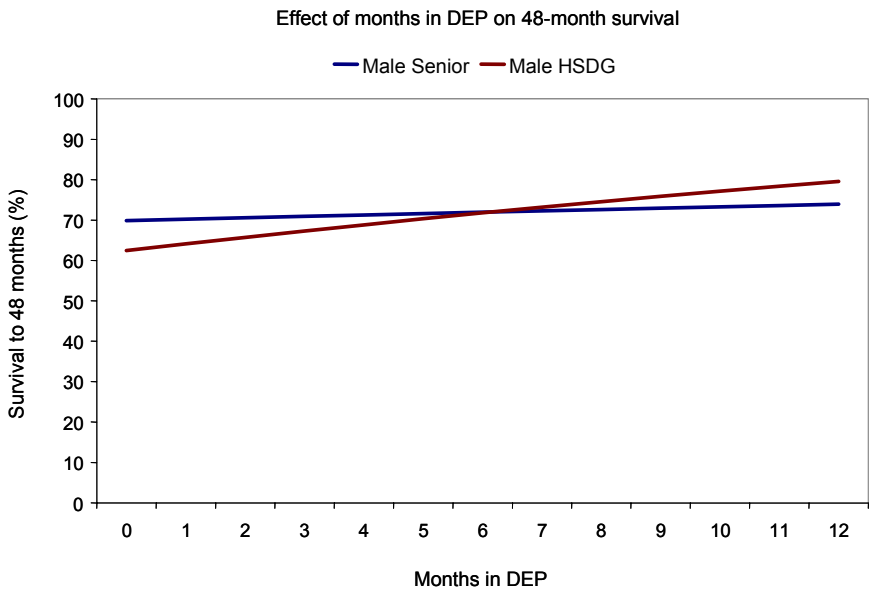
Table 2 also shows the logistic regression coefficients for completing 48 months of service, conditional upon accessing. Again, the full set of demographic and control variables are included in appendix A. Here we focus on the recruit quality, economic, and DEP policy variables.

AFQT is positively related to continuation behavior. A 30-point difference, such as from 35 to 65, would increase retention by 7 points. Seniors also are much more likely to complete 4 years of service than HSDGs, while nongraduates, GED-holders, and the "some college" category all had substantially lower completion rates than HSDGs. Both unemployment rate and relative wages were significantly related to retention. Those enlisting from districts with high unemployment were more likely to continue service, while those enlisting from areas with a low wage ratio (higher civilian wages) were less likely to do so. Both effects were small, however. A recruit from a district with unemployment 1 percentage point above average had his or her continuation rate increased by less than 1 percent, while a recruit from a district with 10 percent higher civilian wages would have a continuation rate about 1 percentage point lower. Recruits contracted during the end of the month did not experience lower in-service continuation rates.

In addition to its effects on likelihood of enlisting, DEP time also has effects on in-service continuation. Figure 3 provides the results for time in DEP for seniors and HSDGs, holding all other characteristics constant.[1] A senior's completion rate is relatively constant when examined against time in DEP. However, the completion rate of an HSDG increases substantially based on time spent in the DEP—from 62 percent for less than 1 month to 78 percent at the maximum time in DEP.

1. Age is the exception. Graduates are older than seniors, and age has an effect on completion. We used 17 as the age of a senior and 21 as the age of a graduate.

Figure 3. Effects of DEP time on 48-month survival



Promotion to E5

Table 2 also provides the regression coefficients for the probability of being promoted to E5 for those Sailors remaining in the force for 48 months. Detailed results, including coefficients for ratings and cohorts, are also provided in appendix A.

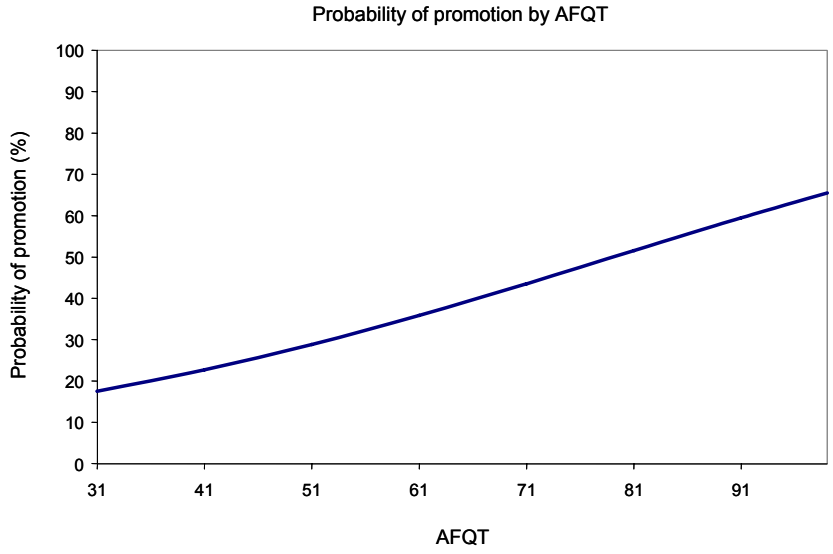
Other educational credentials experienced lower promotion rates than HSDGs and seniors. (College graduates receive automatic promotion to E2 or E3. Entry grade was entered as a separate variable in the full model, which is displayed in appendix A.) However, GED-holders performed better than other non-HSDG credential holders. They were promoted at a rate nearly 4 percentage points higher than other nongraduates.

Unemployment rate was associated with lower promotion rates, which was the opposite of the retention effect. Relative wage rate was also associated with lower promotion rates. A 10-percent higher wage ratio (10-percent lower civilian wage rate) was associated with about

a 3-percentage-point lower promotion rate. It may be that economically motivated recruits were less motivated toward a military career.

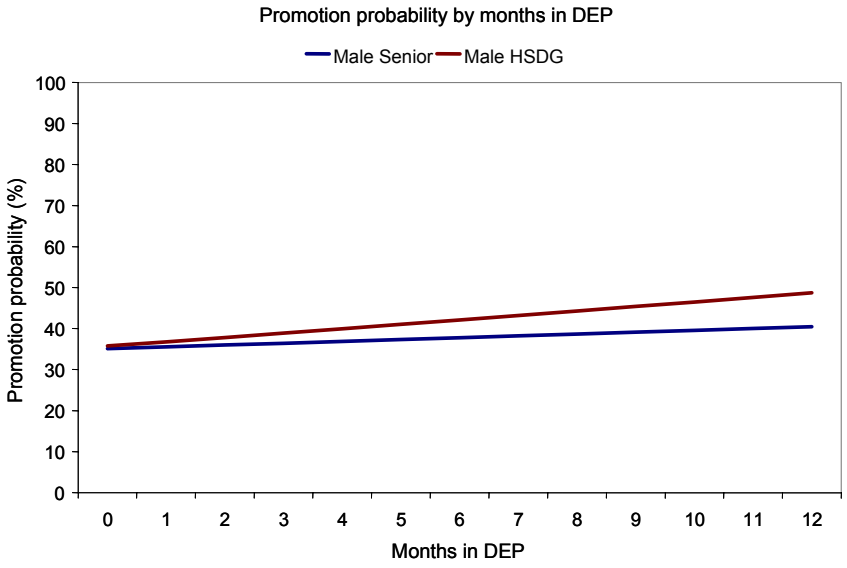
AFQT is both statistically significant and powerful in its relationship to promotion rates. Figure 4 shows the effect of AFQT on the promotion rate of an HSDG. Someone with an AFQT of 99 would have more than a 60-percent chance of being promoted, while someone with an AFQT of 31 would have less than a 20-percent chance.

Figure 4. Effect of AFQT score on promotion rate to E5



Time spent in the DEP also had a significant relationship to promotion rates for HSDGs. Figure 5 shows the probabilities of a male HSDG and a senior being promoted to E5 at their 48th month of service. The probability for a senior is relatively constant versus time in DEP. However, an HSDG who spent a year in DEP would have about a 6-percentage-point higher chance of being promoted than someone who shipped directly to the Recruit Training Center.

Figure 5. Effect of time in DEP on promotion rate to E5



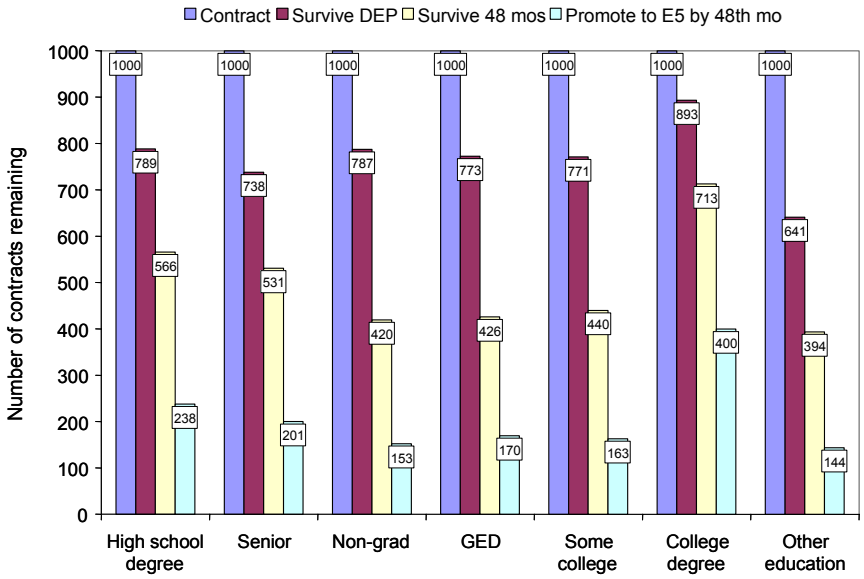
Combining probabilities—the effects of education

The equations in table 2 can be combined to make estimates of survival from contracting through 4 years of service, as well as the probability of both surviving and being promoted. Figure 6 provides an example of such projections for different educational credentials. In this case, the person is a young man with an AFQT of 65, holding constant all other characteristics, except age (17 for senior, 21 for graduate, and 25 for college degree).[2] Only those entering with a high school degree or better (seniors, HSDGs, and college degrees) have more than half of the original contracts remaining through 4 years, and more than 20 percent being promoted to E5.

The results for the lesser education credentials show that less than half of contracts continue for 48 months. The "other" credential has the lowest percentages completing 48 months and being promoted to E5. However, they actually have a higher completion rate, 61 percent, than nongraduates (53 percent) after accession.

2. Also, a college degree recipient starts as an E3.

Figure 6. Survival from contract through promotion to E5 for selected education credentials



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Results for recruit quality

Recruit quality scenarios

Given the relationships that we have established between recruit quality characteristics (AFQT and education) and performance (measured by continuation behavior and promotion rates), we constructed quality scenarios that were based on the Navy's recent experiences in changing recruit quality.

We used recent historical experience to investigate the impact of recruit quality changes for a number of reasons. First, we lack information on the value of the alternative outcomes—notably increasing retention, increasing DEP completion (and lowering recruiting costs), and increasing job performance (as measured by promotion rates). This makes it difficult to identify an optimal solution, especially if it were to fall outside the range of experience.

Second, changing quality will need to address many other conditions that are difficult to model, such as the mix of jobs to be filled and the role of applicant behavior in both the enlistment decision and job choice. Therefore, we focused on creating scenarios that reflected recent history in changing recruit quality. These scenarios will help describe a realistic range of impacts that would result from changing policies.

We constructed three scenarios: one based on the highest mix of recruit quality recruited during the last decade, one based on the average quality, and one based on the lowest recruit quality since FY 1998. Table 3 shows the distribution of these three scenarios in terms of the mix of A cells, B cells, and C cells recruited.

We subdivided the C-cell distribution in the average and low-quality scenarios into C cells with AFQT scores of 35–49 and 31–34. Lowering the minimum AFQT standard for graduates is one of the ways that the

Navy lowers recruit quality. Currently the Navy has not been recruiting people with AFQT scores below 35, although it had done so until 2003.

Table 3. Composition of recruit quality for different scenarios

	Recruit cell (percentage)			
			C	
Scenario	A	B	AFQT of 35–49	AFQT of 31–34
Low quality	53	10	28	9
Average quality	60	7	28	5
High quality	70	5	25	0

We constructed a simulation population for this analysis. We used samples of recruits with the mix of characteristics associated with each quality group. We developed our sample populations from the FY 2006 and FY 2001 accession cohorts. We used 2006 accessions as the base since that was the most recent cohort for which we had complete information on job requirements. This enabled us to control for job requirements against a recent set of ratings.

A cells, B cells, and C cells with AFQT scores 35 and above were drawn from the FY 2006 accessions. C cells with AFQT scores below 35 were drawn from the FY 2001 accessions who were assigned to jobs that existed in FY 2006.

To further disaggregate recruit characteristics, we subdivided recruit categories by gender and whether they were still in high school. This disaggregation enabled us to evaluate a wider range of scenarios than we described here. In the past, the Navy has increased the number of women it has recruited. Also, other services (notably, the Army) have consciously changed the senior/workforce recruiting goals in the past. Thus, we differentiate between numbers of recruits enlisting while in the workforce and those enlisting while still in high school.

The proportion of women recruited in all scenarios was held constant at 18 percent. During the last decade, the percentage of accessions

who were women stayed within a narrow range and did not vary with recruiting difficulty. We found a similar situation for seniors. Despite the large changes in economic conditions, and especially the size of the BOY DEP, the proportion of recruits enlisting from high school has not varied over the last decade. Thus, we set the percentage of recruits who were seniors at 32 percent in each scenario.

Rating qualification rates and recruit quality

We first examined the relationship of recruit quality and job classification. Here we looked at two indicators: the rating qualification rate and the distribution of different types of recruits across ratings.

All ratings (except seaman)have minimum ASVAB score requirements to qualify for training, often referred to as cut scores. For example, a Ship's Serviceman (SH) must score 96 or above on a combination of the VE (Sum of Word Knowledge and Paragraph Comprehension) and AR (Arithmetic Reasoning) ASVAB subtests. About 87 percent of the FY 2006 recruits would be able to meet this standard.

While a person with a below-average AFQT score may qualify for a particular rating, and another with a higher AFQT may not, the likelihood of qualification is generally correlated with AFQT score. For example, in the FY 2006 cohort, 99 percent of A cells would meet the SH cut score, but only 50 percent of C cells would score high enough to qualify.

We applied this type of analysis by calculating the percentage of recruits who would qualify for the FY 2006 distribution of ratings. First, we calculated the probabilities that recruits from different recruit quality cells—A, B, C (35–49), and C (31–34)—would qualify for each of the ratings in the FY 2006 accession inventory, and we weighted each rating according to its share of accessions. For example, the qualification rate for a job with 1,000 recruits in it would carry ten times the weight of a job with 100 recruits. Table 4 shows the results by quality cell.

In general, the qualification rate is not particularly sensitive to the quality mix. The high-quality cohort would qualify for 66 percent of

the jobs, the average cohort qualifies for 61 percent of the jobs, and the low-quality cohort qualifies for 58 percent of the jobs. However, there could be distributional problems at both the high and low end of the quality spectrum.

Table 4. Rating qualification rates by recruit quality

Recruit category	Percentage of seats qualified for (based on FY 2006 accessions)
A cell	79
B cell	73
C cell (AFQT 35–49)	27
C cell (AFQT 31–34)	11

Table 5 lists the top ten jobs for which recruits with the lowest AFQT scores (C cells with AFQT scores of 31–34) would qualify. These ratings make up over 98 percent of the positions where C-cell (31–34) recruits could be placed. There are only two occupations where a majority would qualify: Seaman (SN), which has no ASVAB cut score requirement, and Mess Specialist (MS).

Table 5. Top ten ratings for low AFQT recruits

Rating	Percentage
Seaman (SN)	100
Mess Specialist (MS)	68
Aviation Ordnanceman (AO)	32
Aviation Boatswain's Mate-Equipment (ABE)	32
Aviation Boatswain's Mate-Fuel (ABF)	32
Aviation Boatswain's Mate-Handling (ABH))	32
Hospital Corpsman (HM)	8
Builder (BU)	27
Aircrew Survival Equipmentman (PR)	32
Equipment Operator (EO)	27

In the average-quality scenario, the 5 percent of recruits accepted in this AFQT range would dominate these ratings, making up roughly half of all recruits in these jobs. In the low-quality scenario, the C cells with AFQT 31–34 scores will make up nearly all the recruits in these ratings.

Other qualification problems could arise in the high-end jobs. The most difficult ASVAB requirements are for the nuclear field (NF). We estimated that only 9 percent of A cells would meet the NF cut scores, including virtually none of the C cells. In the high-quality scenario, there are 2.19 recruits meeting the cut score for every NF position. In the low-quality scenario, this ratio declines to 1.73. Additional recruiting resources would likely need to be targeted toward attracting high AFQT candidates, even if overall A cells decline. Thus, any savings that could be produced by recruiting lower numbers of A cells could be dampened by the NF requirements.

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Recruit quality and first-term performance

We evaluated the impact of the three recruit quality scenarios on two indicators of first-term performance: (1) completion of 4 years of active duty and (2) job performance, as measured by promotion to E5 at the end of 4 years. We disaggregated the enlistment quality groups by gender (male/female) and A and C cells by whether the recruit was still in high school at the time of contracting. This produced a total of 14 combinations of AFQT category (50–99, 35–49, and 31–34) and education (high school diploma graduate, senior, and non-graduate) in addition to gender. In these scenarios DEP policy is effectively held constant.

We took the FY 2006 recruit population for the ten recruit categories that enlisted that year as the basis for our projections of retention and performance of the high-quality scenario. For the average- and low-quality scenarios, we supplemented our analysis using recruits from FY 2001 who were C cells with AFQT scores between 31 and 34.

We took these recruit populations for each of the AFQT-education-gender combinations and projected the individual probabilities of continuation for the accession sample, and promotion for the population that had survived 48 months. Appendix B provides the weights used from the 14 groups for each of the three scenarios. Table 6 provides the outcome of these projections aggregated into each of the four major categories of enlistment quality: A cells, B cells, C cells with AFQT scores from 35 to 49, and C cells with AFQT scores from 31 to 34. Appendix B also has the separate probabilities for each of the 14 combinations. These subdivided categories will facilitate any additional analysis that may be warranted should the gender or high school composition of the recruit population change in the future.

Table 7 provides the results for the three quality scenarios. Increasing the quality over the average levels obtained during the last decade produces modest changes in retention, less than a 2-percent increase

in Sailors completing 4 years. This is expected since most of the changes in recruit quality were brought about by replacing A cells with C cells, and the attrition differences between A cells and C cells are relatively modest.

Table 6. Performance outcomes by recruit quality category

	Percentage	
Recruit category	48-month survival	48-month survival (promotion to E5)
A cell	70.4	35.7
B cell	53.3	22.6
C cell (35–49)	64.1	16.0
C cell (31–34)	58.8	9.4

Table 7. Performance outcomes for recruit quality scenarios

	Percentage		
	Low quality	Average quality	High quality
48-month completion	65.9	66.8	68.0
Difference from average	-1.3	--	1.8
49-month promotion	26.5	27.9	30.2
Difference from average	-5.0	--	8.2

Changing the proportion of A cells, however, produces much larger changes in our job performance estimate since the promotion rates of A cells are over twice that of both types of C cells. Moving from an average-quality to a high-quality scenario would result in over 8 percent more high-performing Sailors, while moving to a low-quality scenario would lead to a 5-percent performance decline.

DEP policy and first-term performance

Since time in DEP was related to our performance indicators, we separately estimated the impact of changing DEP policy on recruit performance. We analyzed the impact of the DEP by developing a set of scenarios to address DEP policy. Here we hold recruit quality constant and vary the time in DEP.

Table 8 show s selected characteristics of the DEP found over the last decade. DEP is often described in terms of entry DEP, the percentage of the fiscal year accessions already placed in the DEP at the start of the year. The average starting DEP was 42 percent, while the largest entry DEP was 65 percent, which occurred at the start of FY 2005. The smallest entry DEP occurred in FY 1999 and FY 2000. About 28 percent of the initial recruiting goal was in the DEP during those years.

Table 8. Characteristics of DEP policy scenarios

DEP size	Small	Average	Large
BOY DEP (percentage)	28	42	65
DEP time (months)			
Seniors	7.0	7.4	8.0
Workforce	1.5	2.9	4.8

We found that the entry DEP correlated closely with the average time spent in the DEP for recruits. We calculated average DEP time separately for seniors and those enlisting from the workforce (HSDGs, nongraduates, and other Tier 2 recruits.) The average time spent in DEP for seniors does not change very much even when the size of the entry DEP changes dramatically. The average DEP time for seniors only changed a few weeks for even the most extreme changes in entry

DEP. It is the workforce recruit population that undergoes the most dramatic change. The average time in DEP for workforce recruits declines from 4.8 months for a large entry DEP to 1.5 months when the DEP is small.

We took these three DEP scenarios and applied them to the FY 2006 enlistment cohort. That is, we calculated the percentage of contracts who would complete the DEP, percentage of accessions completing 48 months of service, and percentage of recruits performing at a level that would get them promoted to E5 based on our behavioral models. All enlistment characteristics were the same as existed in FY 2006 except time in DEP. While the effect of unemployment rate is small, and changes in DEP size can occur for other reasons, such as higher retention, we thought it was reasonable and consistent to change the unemployment rate as well.

Table 9 provides the changes in the three behavioral variables that occur as DEP policy changes. Completion of DEP follows as you would expect. When average DEP time is short, the percentage of contracts who complete DEP and access on to active duty is highest—over 80 percent. As DEP time increases, the projected percentage of recruits dropping from the DEP increases, resulting in only 77 percent completing the DEP and accessing when DEP length is at its longest.

Table 9. Performance outcomes for DEP policy scenarios

	Percentage		
Measure	Short DEP	Average DEP	Long DEP
DEP completion	80.4	79.1	77.0
48-month survival	61.8	63.4	65.6
Promotion rate	45.5	46.3	47.4

Table 9 also shows the impact of DEP time on the two performance indicators: completion of 48 months of service and promotion to E5. In the scenarios in which DEP time increases, the 48-month

continuation rate also increases. We observe that the increases for in-service continuation are as large as the lower DEP completion rates associated with longer DEP times. Furthermore, as DEP time increases, the percentage of accessions who are high performers also increases. This outcome was due to positive effects of DEP time on both the probability that a person would remain in the service for 4 years, as well as a separate positive direct effect on promotion itself.

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Recruit quality, DEP policy, and recruiting costs

We have shown that both recruit quality and DEP policy can have an impact on first-term Sailor performance. Furthermore, we found that DEP policy can directly affect recruiting costs through changing DEP attrition. We next explored the relationship between these policies and recruiting resources. Specifically, we sought to address the following questions on recruiting policies:

> How much could the Navy save if recruit quality was lowered?
>
> How much would the Navy save if it adjusted quality in response to changing economic conditions?
>
> What does it cost the Navy to maintain its DEP?
>
> What would it cost the Navy to achieve the performance gains produced through the use of the DEP through other means?

Estimating recruiting costs

We used a recruiting supply model developed by Warner et al. [17] to obtain estimates of relationships of key resource, economic, and environmental variables on recruit supply. Warner et al. estimated their model using Navy data on enlistments, as well as explanatory factors from 1987 through 2003.

We used the Warner model to estimate (a) the impact of changes to the unemployment rate on the recruiting budget and (b) the marginal costs of recruiting additional high-quality Sailors. For example, unemployment rate was positively associated with the number of high-quality recruits. A 1-percentage-point increase in the unemployment rate, which would be a 20-percent relative increase if the rate

was 5 percent, would be a associated with a 5.8-percent increase in high-quality recruits.

We evaluated the impact of supply factors at their FY 2003 resource levels. We focused on the unemployment rate for economic conditions and recruiters for resources.

Recruiters may not necessarily be the most cost-effective resource for making marginal changes to recruiting. In fact, we discuss the marginal costs of other recruiting resource alternatives in appendix C as well. Nevertheless, the number of recruiters makes up the largest segment of the Navy's recruiting resources, and it is the resource planned to increase to meet higher enlistment requirements that will occur through FY 2010. Thus, we used the marginal cost of A cells obtained from adding recruiters to evaluate the cost of resource alternatives.

For example, at FY 2003 levels, we estimate that a 10-percent increase in the unemployment rate would result in slightly less than 700 additional high-quality recruits to the Navy. Similarly, an increase of recruiters by 10 percent (about 460) would yield 1,363 more high quality enlistments. Based on recruiter and recruiter support costs from CNRC [18], we calculate that an additional high-quality recruit would cost $25,400 in FY 2007 dollars.

The costs of changing recruit quality and unemployment

We were able to use these supply elasticities and recruiter cost data to estimate the resource impact of changing economic conditions on resource costs. We make our estimates using the FY 2010 accession mission, which is expected to be 43,000. We calculate the impact of a change in the unemployment rate of 1 percentage point from a starting value of 5 percent. Based on the unemployment elasticity, a 1-percentage-point reduction of unemployment would decrease the high-quality enlistment supply by 1,300 to 1,750 recruits, depending on the quality goal. We calculated that this supply deficit could be offset by adding additional recruiters. To offset the impact of an unemployment decline for an accession cohort of average quality would require $38 million in FY 2007 dollars.

We can extend this analysis to estimate the different recruiting costs for alternative quality mixes as well. (See Golfin et al. [19] for an example of an analysis of the tradeoffs between recruiting savings from changing the quality mix.) Based on the calculation of costs for recruiting additional A cells, we can also calculate the cost of increasing recruit quality over the average, as well as the savings from reducing quality. We project that the high-quality scenario would cost $114 million over the cost of an average-quality scenario, and that the Navy could save $71 million by reducing quality.

Table 10 shows the results for incremental recruiting resources for different quality mixes and economic scenarios. A policy that lowered quality during times of low unemployment and raised quality during periods of high unemployment could, in theory, reduce the variability of recruiting budgets. We estimate that a change of 1 percentage point in the unemployment rate would translate into a change of about 3 percentage points in A cells. For example, an increase of the unemployment rate from 5 percent to 6 percent could support an increase of recruit quality of A cells from 60 percent to 63 percent.

Table 10. Resource impact on recruiting of quality and economy

	Unemployment rate		
	4 percent	5 percent	6 percent
Low quality ($M)	-37	-71	-104
Average quality ($M)	+38	--	-38
High quality ($M)	+158	+114	+70

Recruiting costs and DEP policy

A similar resource analysis can be extended to the costs and benefits of altering the size of the DEP. Decreasing the DEP size produces two types of savings. First, there is an immediate one-time saving from not having to replace recruits. There is also a continuing saving that results from maintaining a shorter DEP. Fewer people will need to be recruited in the future because more contracts will leave the DEP for active duty.

There may be additional savings in recruiter effort as well since each recruiter will have fewer people to keep track of; however, we have no measurements of how much time a recruiter spends meeting with DEP members. A significant portion of this time is spent in group meetings, where the marginal effort per recruit is low. Also, there is anecdotal evidence that having an active DEP pool can be advantageous to a recruiter as a source of leads.

In table 11, we estimate the costs of these two types of recruiter effort. Reducing the DEP from average length (42-percent entry DEP) to small (28 percent) would save $92 million from reducing the number of A cells recruited. (This cost estimate is based on the high-quality recruiting scenario.)

Table 11. Resource and performance impacts of DEP policy

	Small DEP	Large DEP
One-time savings ($M)	92	-151
Annual savings ($M)	8	-13
Retention change (%)	-2.5	+3.5
Performance change (%)	-3.5	+5.1

The reduction in DEP attrition would also produce savings. We estimated these savings based on the recruiter and advertising budgets divided by the gross number of contracts. (Incentive costs are not applicable to DEP attrites.) The DEP loss reduction would reduce annual recruiting costs by $8 million.

Table 11 also summarizes the impact of DEP policy on retention and job performance. For example, reducing DEP time from average to small would reduce retention by 2.5 percent and performance by 3.5 percent. Increasing DEP time would produce a 3.5-percent gain in retention and a 5.1-percent gain in performance.

Using the relationships developed between recruit quality and our performance indicators, we can evaluate the costs of obtaining these changes in performance through changing the mix of recruits. The performance gain from increasing the DEP time from average length

to the longest observed could also be achieved by increasing recruit quality. Since performance, as measured by promotion rate, is most directly affected by AFQT, we could most effectively increase performance by substituting A cells for C cells. This job performance gain would cost $80 million to achieve through adding A cells. Similarly, we could compensate for the job performance loss by reducing DEP time through recruiting 2,350 A cells at a cost of $60 million.

We examined achieving the retention effects of DEP policy through substituting B cells for A cells. The attrition reductions produced by longer DEP time would be extremely difficult to achieve through other means. We did not find it feasible to achieve these retention effects through changes that would be feasible to implement. For example, eliminating all B cells would not improve retention as much as lengthening the DEP.

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Comparison of policy alternatives

Navy recruiting is currently experiencing recruiting difficulties. We evaluated three policies for reducing recruiting costs:

- Increase B cells by 5 percent
- Increase C cells by 5 percent
- Reduce the entry DEP by 7 percent.

All three options would reduce the recruiting requirement by the same number of recruits and save the Navy about $50 million in recruiting effort. Increasing the number of C cells with low AFQT scores or the number of B cells would result in the reduction of an equal number of A cells since current recruit quality is above policy limits for HSDGs and recruits with high AFQT scores. For FY 2008, which has an accession mission of 39,000, this would amount to a reduction of 1,950 A cells. Reducing the DEP would affect all categories of recruits equally. To reduce A-cell recruits by 5 percent—when A cells make up 70 percent of recruits—the DEP would need to shrink by about 7 percent.

Table 12 shows the impact of each alternative on retention and job performance. Increasing C cells would have a slight impact on retention, reducing retention by about 400 at the 4-year point. However, this option would reduce job performance by more than 4 percent. Recruiting additional B cells would reduce retention by slightly more than 1 percent, or about 500 people, but would result in a job performance reduction of only 2 percent.

Reducing the DEP by 7 percent would also produce eventual reductions in first-term performance. Based on our analysis of the impact of shorter DEP time, we project that there would be a reduction in retention of 1.1 percent and a reduction in job performance of 1.6 percent.

Table 12. Performance outcomes of three scenarios for reducing recruiting costs

Policy	Percentage	
	Retention	Job performance
Reduce DEP by 7 percent	-1.1	-1.6
Increase B cells by 5 percent	-1.3	-2.2
Increase C (31–34) cells by 5 percent	-0.8	-4.4

All of these options would reduce recruiting costs by about $50 million in the first year. Changing the recruit quality mix through recruiting either more C cells or B cells will continue the savings and performance impacts for each subsequent year. However, reducing the DEP would not produce any substantial resource savings for the next year. (There will be a small recruiting saving due to lower DEP attrition.)

At the end of 1 year, the smaller DEP/shorter DEP time policy would have produced a smaller impact on job performance than the other two policies and about the same effect on retention. However, the savings would be largely one-time savings only. In the second year of implementation, all three of these policies will continue to produce lower retention and job performance. However, the policies that increase B cells or C cells will save an additional $50 million, while the DEP policy will not. Continuing the DEP drawdown would result in lower retention than increasing B cells to 10 percent of recruits, and within 3 years the impact on job performance would be greater than adding 5 percent C cells with AFQTs under 35.

Conclusion

We have identified several key relationships among recruiting resources, recruit quality, and the DEP. These relationships are simply an extension of previous relationships that have been developed in these areas by other researchers. Nevertheless, this analysis has some new implications for personnel policies, based on the current situation.

First, the impact of enlistment standards and recruit quality is surprisingly small with respect to continuation behavior. The largest effect found on 48-month continuation behavior was less than 2 percent, which is often in the range of year-to-year cohort fluctuations. Such effects can be important since the recruiting and training costs of replacing Sailors who don't complete their enlistments can be substantial.

The quality improvements of time in the DEP turn out to be more substantial than those obtained directly from raising enlistment standards. Retention effects of 2.5 percent or more have occurred in recent years through the DEP alone.

Job performance effects from changing recruit quality proved to be much larger than retention effects. What we do not know is the relative importance of retention versus job performance.

It is possible to quantify the tradeoff between the unemployment rate and recruit quality, but there are two problems with applying this knowledge. First, forecasting the unemployment rate is difficult in any circumstances, let alone in the time it takes to plan recruiting missions. Second, the unemployment rate is only one of many external factors that affect recruiting supply. A more realistic approach would be to use the DEP as an indicator of recruiting difficulty and manage recruiting according to the size of the DEP.

The DEP serves as both a monitor of recruiting difficulty and an important, although indirect, performance measure. When the DEP begins to shrink, there will be performance decreases in the future, with respect to both retention and promotion. A decrease in the DEP for more than 1 year is a strong indicator to review enlistment standards, as well as recruiting resources.

Since the effects of decreasing the time in DEP of workforce recruits accumulate over the years, it is prudent to revise enlistment standards before the DEP inventory declines too far. The cumulative effects of 2 or more years of decreasing the time in DEP of the average recruit will reduce first-term performance more than lowering enlistment standards.

Lowering recruit quality can provide a way to increase enlistments quickly and maintain a healthy DEP pool. If the projected recruiting difficulty is expected to last more than 1 year, it may be preferable to increase the number of accessions with low AFQT scores or without high school diplomas rather than continue to shrink the DEP.

Within the current DOD quality standard (90 percent HSDG, 60 percent AFQT 50 or above), it is possible to increase either B cells or C cells. The mix of additional B and C cells recruited will depend on such issues as the nature of the jobs to be filled, the diversity impact, and the tradeoffs between retention and job performance. If the costs of attrition are most dominant, HSDGs with AFQT scores below 35 would be preferred; if technical job performance is the major concern, increasing the number of B cells may be the most attractive alternative. Also, B cells may benefit from additional screening policies. For example, B cells could be required to spend some minimum time in DEP, or specific groups (e.g., GEDs) could be targeted. Such screening policies could improve the long-term attractiveness of such recruits.

Appendix A: Regression results

Table 13. DEP continuation regression

Variable	Coefficient	Standard error	P-value
Intercept	-2.09*	0.1139	<.0001
AFQT	-0.001*	0.0003	0.0008
Senior	-1.23*	0.0166	<.0001
Nongraduate	-0.03	0.0238	0.2329
GED or other certificate	-0.09*	0.0190	<.0001
Some college	-0.10*	0.0255	<.0001
College degree	-0.20*	0.0255	<.0001
Other education credential	-0.76*	0.0161	<.0001
Female	-0.03*	0.0149	0.0483
Married	0.06	0.0322	0.0726
Number of children	0.06*	0.0186	0.0021
Age	-0.01*	0.0013	<.0001
Hispanic	0.04*	0.0112	0.0002
Black	0.03*	0.0104	0.0029
Native American	-0.01	0.0151	0.5087
Asian & Pacific Islander	0.21*	0.0183	<.0001
Other ethnicity	-0.11*	0.0412	0.0067
Months in DEP	-0.07*	0.0016	<.0001
Signed in last 5 days of month	-0.19*	0.0075	<.0001
Female X months in DEP	-0.08*	0.0023	<.0001
Senior X months in DEP	0.15*	0.0024	<.0001
1.5-year obligation	0.21*	0.0375	<.0001
2-year obligation	0.06	0.0726	0.4367
3-year obligation	0.13*	0.0228	<.0001
5-year obligation	-0.08*	0.0321	0.0170
6-year obligation	-0.01	0.0289	0.7687
Enlistment bonus recipient	0.22*	0.0089	<.0001
Navy College Fund recipient	0.24*	0.0122	<.0001
Entry paygrade E-2	1.05*	0.0324	<.0001
Entry paygrade E-3	0.45*	0.0272	<.0001
Unemployment rate	0.02*	0.0070	0.0033
Wage ratio	-0.25	0.1902	0.1962

Table 13. DEP continuation regression (continued)

Variable	Coefficient	Standard error	P-value
FY99	-0.01	0.0158	0.6543
FY00	0.03	0.0163	0.1035
FY01	-0.09*	0.0157	<.0001
FY02	-0.18*	0.0176	<.0001
FY03	-0.27*	0.0195	<.0001
FY04	-0.34*	0.0186	<.0001
FY05	-0.24*	0.0184	<.0001
FY06	-0.14*	0.0229	<.0001

Table 14. 48-month continuation regression

Variable	Coefficient	Standard error	P-value
Intercept	0.42	0.1471	0.0042
AFQT	0.01	0.0004	<.0001
Senior	0.31	0.0244	<.0001
Nongraduate	-0.81	0.0256	<.0001
GED or other certificate	-0.73	0.0223	<.0001
Some college	-0.65	0.0309	<.0001
College degree	0.05	0.0452	0.3149
Other education credential	-0.48	0.0220	<.0001
Female	-0.20	0.0176	<.0001
Married	0.11	0.0268	<.0001
Number of children	0.04	0.0207	0.0666
Age	-0.005	0.0021	0.0305
Hispanic	0.32	0.0160	<.0001
Black	0.17	0.0139	<.0001
Native American	-0.12	0.0235	<.0001
Asian & Pacific Islander	0.70	0.0279	<.0001
Other ethnicity	0.62	0.1283	<.0001
Months in DEP	0.07	0.0033	<.0001
Signed in last 5 days of month	-0.01	0.0104	0.2429
Female X months in DEP	0.003	0.0037	0.4565
Senior X months in DEP	-0.05	0.0043	<.0001
2-year obligation	-0.51	0.3394	0.1314
3-year obligation	-0.17	0.0929	0.0663
5-year obligation	-0.23	0.1363	0.0952
6-year obligation	-0.06	0.0398	0.1275
Enlistment bonus recipient	-0.11	0.0118	<.0001
Navy College Fund recipient	0.10	0.0501	0.0581
Entry paygrade E-2	0.41	0.0131	<.0001
Entry paygrade E-3	0.47	0.0171	<.0001
Unemployment rate	0.04	0.0094	0.0001
Wage ratio	-0.68	0.2463	0.0060
FY00	0.15	0.0144	<.0001
FY01	0.12	0.0144	<.0001
FY02	0.12	0.0181	<.0001
FY03	-0.02	0.0301	0.5012

Table 15. Promotion to E5 regression

Variable	Coefficient	Standard error	P-value
Intercept	-2.29	0.1471	0.0042
AFQT	0.03	0.0004	<.0001
Senior	0.04	0.0244	<.0001
Nongraduate	-0.21	0.0256	<.0001
GED or other certificate	-0.09	0.0223	<.0001
Some college	-0.21	0.0309	<.0001
College degree	-0.10	0.0452	0.3149
Other education credential	-0.20	0.0220	<.0001
Female	-0.17	0.0176	<.0001
Married	0.31	0.0268	<.0001
Number of children	0.11	0.0207	0.0666
Age	0.02	0.0021	0.0305
Hispanic	-0.08	0.0160	<.0001
Black	-0.35	0.0139	<.0001
Native American	-0.09	0.0235	<.0001
Asian & Pacific Islander	-0.04	0.0279	<.0001
Other ethnicity	-0.34	0.1283	<.0001
Months in DEP	0.04	0.0033	<.0001
Signed in last 5 days of month	0.01	0.0104	0.2429
Female X months in DEP	-0.03	0.0037	0.4565
Senior X months in DEP	-0.01	0.0043	<.0001
2-year obligation	-0.22	0.3394	0.1314
3-year obligation	0.16	0.0929	0.0663
5-year obligation	-0.34	0.1363	0.0952
6-year obligation	0.76	0.0398	0.1275
Enlistment bonus recipient	0.02	0.0118	<.0001
Navy College Fund recipient	-0.09	0.0501	0.0581
Entry paygrade E-2	0.60	0.0131	<.0001
Entry paygrade E-3	1.04	0.0171	<.0001
Unemployment rate	-0.04	0.0094	0.0001
Wage ratio	-0.97	0.2463	0.0060
FY00	-0.25	0.0144	<.0001
FY01	-0.54	0.0144	<.0001
FY02	-0.76	0.0181	<.0001
FY03	-0.86	0.0301	0.5012

Table 16. Descriptive statistics

Variable	DEP analysis	48-month analysis	Promotion analysis
AFQT	59.78	58.49	59.39
Senior	0.31	0.29	0.33
Nongraduate	0.03	0.04	0.03
GED or other certificate	0.04	0.05	0.03
Some college	0.02	0.02	0.02
College degree	0.02	0.02	0.02
Other education credential	0.05	0.06	0.05
Female	0.19	0.18	0.18
Married	0.02	0.05	0.05
Number of children	0.03	0.06	0.05
Age	19.44	19.83	19.80
Hispanic	0.16	0.15	0.17
Black	0.19	0.20	0.20
Native American	0.06	0.05	0.04
Asian & Pacific Islander	0.05	0.05	0.06
Other ethnicity	0.01	0.002	0.002
Months in DEP	4.17	3.07	3.40
Signed in last 5 days of month	0.32	0.33	0.32
Female X months in DEP	0.89	0.63	0.68
Senior X months in DEP	2.24	2.00	2.28
1.5-year obligation	0.01	--	--
2-year obligation	0.003	0.0002	0.0002
3-year obligation	0.03	0.003	0.003
5-year obligation	0.16	0.16	0.16
6-year obligation	0.13	0.14	0.15
Enlistment bonus recipient	0.42	0.45	0.44
Navy College Fund recipient	0.13	0.13	0.14
Entry paygrade E-2	0.02	0.20	0.22
Entry paygrade E-3	0.02	0.16	0.19
Unemployment rate	5.02	4.68	4.71
Wage ratio	0.58	0.57	0.57

Table 17. Regression results[a]—NRDs (NRD 102 excluded)

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
NRD 103	0.06	-0.05	-0.07
NRD 104	-0.05	0.17*	-0.01
NRD 112	-0.01	--	--
NRD 113	0.02	--	--
NRD 114	0.01	--	--
NRD 115	-0.02	-0.07	-0.05
NRD 116	-0.12*	0.0007	-0.10*
NRD 118	-0.04	-0.21*	--
NRD 119	0.03	-0.14*	-0.12*
NRD 120	-0.02	-0.18*	0.02
NRD 122	0.06	-0.17*	--
NRD 134	0.09	--	--
NRD 148	-0.15*	--	--
NRD 221	0.12	--	--
NRD 225	-0.03	--	--
NRD 228	0.44*	--	--
NRD 230	-0.004	--	--
NRD 231	0.004	--	--
NRD 232	-0.02	--	--
NRD 236	-0.15*	--	--
NRD 237	0.02	--	--
NRD 238	-0.17*	--	--
NRD 239	0.23*	--	--
NRD 240	0.08	--	--
NRD 246	-0.06	--	--
NRD 247	-0.03	--	--
NRD 310	-0.21*	-0.27*	-0.10
NRD 312	-0.08*	-0.04	-0.05
NRD 313	-0.20*	-0.08	-0.14*
NRD 314	-0.20*	-0.25*	-0.04
NRD 322	-0.23*	-0.13*	0.001
NRD 334	-0.34*	-0.31*	-0.09
NRD 342	-0.20*	-0.22*	--
NRD 348	-0.01	0.11*	0.22*
NRD 521	-0.14*	-0.20*	0.02
NRD 527	-0.09*	-0.19*	-0.09
NRD 528	0.14*	0.16*	0.19*

Table 17. Regression results[a]—NRDs (NRD 102 excluded) (continued)

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
NRD 529	-0.04	0.07	0.01
NRD 531	-0.18*	-0.22*	-0.12*
NRD 532	-0.12*	-0.22*	-0.08
NRD 547	-0.12*	-0.30*	-0.001
NRD 825	-0.18*	0.04	0.16*
NRD 830	-0.02	0.15*	0.11*
NRD 836	-0.08*	0.09*	0.13*
NRD 837	-0.01	-0.01	0.06
NRD 838	0.05	-0.07	0.03
NRD 839	0.02	0.09*	0.05
NRD 840	-0.05	0.002	-0.06
NRD 846	-0.14*	-0.11*	-0.03

a. * indicates that coefficient is significant at .05 level.

Table 18. Regression results[a]—ratings (YN excluded)

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
ABE	-0.02	-0.37*	0.29*
ABF	-0.01	-0.32*	-0.80*
ABH	-0.16*	-0.16*	-1.50*
AC	0.09	0.04	0.72*
AD	0.05	-0.04	-0.47*
ADMN	0.22	-0.20	-0.31
AE	0.18*	-0.03	-0.39*
AEC	0.15*	-0.22*	-1.81*
AECF	0.09	-0.04	-1.86*
AG	0.10	-0.12	-0.30*
AIC	0.26*	0.09	0.57*
AIR	0.26*	0.02	0.85*
AIRC	0.10	0.13	0.05
AIRR	0.13*	0.03	0.73*
AK	0.02	-0.13	0.65*
AM	0.08*	0.04	-0.22*
AME	0.02	0.02	0.20
AMH	0.19	-0.14	-0.99*
AMS	0.07	-0.22	-0.27
AN	0.17*	-0.11*	-0.70*
AO	-0.07	-0.19*	-0.14
AORD	0.49*	-0.31	-0.21
AS	0.04	-0.06	-0.36*
AT	0.18*	-0.11	-0.55*
AV	0.04	0.07	-0.74*
AW	-0.13	-7.36	
AZ	-0.07	-0.21*	1.28*
BM	0.14	--	
BMA	0.20*	-0.14	-1.94*
BU	-0.03	-0.01	-0.12
CE	-0.05	0.08	-0.15
CM	-0.02	-0.05	-0.08
CONT	0.50*	0.70	-0.86
CT*	0.06	0.07	0.45*
CTA	0.16	0.12	1.37*
CTI	0.48*	0.12	-0.50*
CTM	0.22*	0.12	-0.27*

Table 18. Regression results[a]—ratings (YN excluded) (continued)

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
CTN	0.87	--	
CTO	0.07	0.08	-0.35*
CTR	0.10	-0.37	0.67
CTT	0.20*	-0.05	0.76*
DC	-0.03	-0.09	0.52*
DK	-0.05	-0.21*	-0.28*
DT	0.11*	0.21	-2.05*
EA	-0.06	0.37	-0.31
ELCL	0.48*	-0.30	-1.08*
ELCT	0.17	-0.48	0.69
EM	0.05	-0.09	-0.41*
EN	-0.01	-0.18*	-0.02
ENGR	0.12	-0.005	-0.18
EO	-0.11	-0.04	0.53*
EOD	0.18	--	
ETS	0.20	-0.20	0.44
EW	0.14*	-0.14	0.25*
FN	0.07	-0.25*	-0.55*
FT	0.49	-0.27	1.21*
GM	0.02	-0.13*	1.24*
GSE	0.02	-0.01	-0.88*
GSM	-0.04	-0.26*	-0.42*
HCMB	0.22	-0.32	-0.37
HM	0.16*	0.17	-1.66*
HMDA	-0.26*	--	
HT	-0.04	-0.17*	0.85*
IC	0.07	-0.23*	-0.28*
IS	0.13*	0.02	0.68*
IT	0.14*	0.08	1.76*
JO	0.002	0.03	0.36
LI	0.06	-0.20	1.29*
LLE	0.21*	-0.22*	0.29*
MA	0.06	-0.09	0.94*
MC	-0.04	--	
MCHA	0.24*	0.08	-1.00*
MED	0.44*	0.08	-1.36*
MM	0.02	-0.27*	-0.60*

Table 18. Regression results[a]—ratings (YN excluded) (continued)

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
MMS	0.09	-0.23*	1.55*
MN	-0.01	-0.18	0.22
MR	-0.02	-0.09	1.49*
MS	-0.10*	-0.42*	-0.16
MSS	-0.05	-0.62*	-0.24
MT	0.20*	-0.14	-0.80*
MU	1.36*	0.90*	-1.00*
NAV	0.25	-0.41*	0.65*
ND	-0.11	--	
NF	0.22*	-0.15*	-0.69*
OPCM	0.53*	0.15	0.94*
ORDN	0.40	0.50	0.73
OS	0.06	-0.18*	2.07*
PC	-0.13	-0.32	-0.84*
PH	0.12	0.05	-0.49*
PN	-0.05	-0.15	-0.30*
PR	-0.01	-0.10	0.83*
PS	0.18	--	
QM	-0.12*	-0.42*	1.03*
RM	0.11*	-0.10	1.13*
RP	-0.07	-0.15	0.13
SB	-0.39	--	
SEC	0.28*	-0.04	0.58*
SECF	0.33*	-0.18	1.34*
SENG	--	--	
SH	-0.21*	-0.39*	-0.40*
SK	-0.04	-0.20*	0.93*
SKS	0.04	-0.74*	0.66*
SM	0.06	-0.26*	1.01*
SN	0.07*	-0.23*	0.16*
SO	-0.04	--	
SPE	0.16	-0.31	-0.14
SPSV	0.09	-0.48*	-0.13
SS	0.04	-0.41*	0.53*
ST1	0.08	-0.58*	-0.22
ST2	0.19*	-0.11	0.93*
ST3	-0.20	-0.44	0.25

Table 18. Regression results[a]—ratings (YN excluded) (continued)

Variable	DEP continuation coefficient	48-month continuation coefficient	E5 promotion coefficient
ST4	0.12	-0.04	-0.53*
ST5	0.36	-0.49	-0.37
ST6	-0.36	-0.002	-7.10
ST7	-0.06	-0.24	-0.20
ST8	0.26	-0.30*	0.04
ST9	0.14*	-0.13	0.39*
STG	0.15*	-0.26*	-0.12
STS	0.22	0.03	-0.56*
SW	-0.07	0.01	0.21
TM	0.20*	-0.15	0.88*
UT	-0.10	0.13	0.15
YNS	0.08	-0.54*	1.51*

a. * indicates that coefficient is significant at .05 level.

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Appendix B: Scenario weights and regression results by recruiting category

Table 19. Scenario weights by recruiting category

	Percentage		
	Low quality	Average	High quality
Male			
A cell senior	13.6	15.5	18.4
A cell high school diploma graduate	29.0	32.9	39.0
B cell	9.0	6.6	4.9
C cell AFQT 35-49 senior	7.3	7.3	6.3
C cell AFQT 35-49 high school diploma graduate	15.6	15.6	13.4
C cell AFQT 31-34 senior	2.4	1.3	0.0
C cell AFQT 31-34 high school diploma graduate	5.0	2.8	0.0
Female			
A cell senior	3.3	3.6	4.0
A cell high school diploma graduate	7.1	7.6	8.6
B cell	0.9	0.7	0.5
C cell AFQT 35-49 senior	1.6	1.7	1.6
C cell AFQT 35-49 high school diploma graduate	3.4	3.5	3.3
C cell AFQT 31-34 senior	0.5	0.3	0.0
C cell AFQT 31-34 high school diploma graduate	1.1	0.6	0.0

Table 20. Regression probabilities by recruiting category

	Percentage		
	48-month completion	Pro-motion	48-month completion and promotion
Male			
A cell senior	73.6	50.4	37.1
A cell high school diploma graduate	70.1	52.1	36.5
B cell	53.9	42.8	23.1
C cell AFQT 35-49 senior	68.6	26.6	18.3
C cell AFQT 35-49 high school diploma graduate	63.2	24.6	15.6
C cell AFQT 31-34 senior	66.9	17.6	11.8
C cell AFQT 31-34 high school diploma graduate	55.8	15.2	8.5
Female			
A cell senior	70.1	44.7	31.4
A cell high school diploma graduate	65.7	47.8	31.4
B cell	47.2	38.2	18.0
C cell AFQT 35-49 senior	65.1	23.5	15.3
C cell AFQT 35-49 high school diploma graduate	58.1	23.8	13.8
C cell AFQT 31-34 senior	63.2	16.3	10.3
C cell AFQT 31-34 high school diploma graduate	53.0	15.6	8.3

Appendix C: Recruit supply analysis

We used the Warner, Simon, and Payne [17] enlistment supply elasticities to generate the recruiting costs associated with unemployment rate and recruiters. The model includes not only elasticities for unemployment rate and recruiters but a wide range of other factors, including recruiting resource variables, demographic factors, and other economic variables, such as wage rate and family income.

Table 21 lists the model coefficients. Recruiters, along with advertising, was estimated as an elasticity based on a per-youth population basis. Navy College Fund (NCF) was estimated as an effect based on the percentage of recruits receiving NCF benefits. The enlistment bonus elasticity was not significant at the 5-percent level.

Table 21. Model coefficients from [17]

Explanatory variables	Type	Coefficient
Recruiting resources		
Recruiters/population	Elasticity	0.57
Advertising dollars/population	Elasticity	0.076
Goal/recruiter	Elasticity	0.41
NCF—percentage taking	Effect	0.184
Expected EB per A cell	Elasticity	0.024
Other service high quality/pop.	Elasticity	-0.13
Economic factors		
Military/civilian pay	Elasticity	1.173
Unemployment	Elasticity	0.29
Median family income	Elasticity	-0.784
Demographics		
College attendance	Elasticity	-1.01
Percent black	Effect	1.473
Percent Hispanic	Effect	1.424
Qualified Military Available (QMA)	Effect	1.774
Percent veterans	Elasticity	1.475
Population density	Effect	-0.002

Other supply factors estimated included other service recruiting and goals per recruiter. Table 21 also provides the coefficients for demographic variables. We applied the model to recent recruiting history to assess the contributions of different factors to supply. We examined FY 1992–2003, which covered the post-cold-war era during which the unemployment rate exhibited its greatest relative changes. We divided this period into one of declining unemployment (FY 1992–2000) and one of rising unemployment (FY 2000–2003).

The impact of a factor on recruit supply is a product of both the elasticity, or effect, of a variable and its relative change. Table 22 shows the percentage change in the various supply factors in each period. During FY 1992–2000, unemployment declined by 44 percent, and it increased by nearly 50 percent from FY 2000–2003. Variables that were estimated as effects are listed with their absolute change. For example, the percentage of NCF recipients increased by 25.5 points during this period, from less than 5 percent to over 30 percent.

Table 22. Changes in explanatory factors: FY 1992–2003[a]

Explanatory variables	FY00 vs. FY92	FY03 vs. FY00
Recruiting resources		
Recruiters/population	30.8%	-7.2%
Advertising/population	493.8%	34.0%
Goal/recruiter	-15.7%	-30.2%
NCF—percentage taking	25.5	-19.1
Expected EB per A cell	160.2%	50.1%
Other service HQ/population	-24.8%	15.1%
Economic factors		
Military/civilian pay	0.0%	6.7%
Unemployment	-44.2%	49.8%
Median family income	15.3%	-2.8%
Demographics		
College attendance	4.9%	2.3%
Percent black	0.008	0.001
Percent Hispanic	0.031	0.011
Percent QMA	0.006	-0.001
Percent veterans	-20.6%	-7.9%
Population density	-0.75	0.267

a. Changes in percentage terms (elasticity variables) & absolute terms (effect variables).

Table 23 shows the effect of each supply variable on enlistment supply from FY 1992 through FY 2000. During this period, selected for its large decline in unemployment, we see that the impact of unemployment rate was to decrease high-quality supply by 12.8 percent. However, the decline in veteran population actually contributed to a much larger decline, and the rise in family income also produced a large decline in supply.

Table 23. Impact of supply factors on the high-quality enlistment rate: FY 1992–2000

Supply factor	Impact (percentage)
Advertising/population	37.5
Recruiters/population	17.5
NCF—percentage taking	4.7
Percent Hispanic	4.4
Expected EB per A cell	3.8
Other service HQ/population	3.2
Percent black	1.2
QMA	1.0
Military/civilian pay	0.0
Population density	0.0
College attendance	-4.9
Goal/recruiter	-6.5
Median family income	-12.0
Unemployment	-12.8
Percent veterans	-30.3

Table 24 provides similar results for FY 2000 through FY 2003. During this period, the increase in the unemployment rate did explain the largest single portion of the supply increase. However, continued reductions in veteran population and recruiter goals more than offset the unemployment effect. One needs to be cautious in focusing on a single factor in considering recruit supply.

Table 24. Impact of supply factors on the high-quality enlistment rate: FY 2000–2003

Supply factor	Impact (percentage)
Unemployment	14.4
Military/civilian pay	7.9
Advertising/population	2.6
Median family income	2.2
Percent Hispanic	1.6
Expected EB per A cell	1.2
Percent black	0.1
QMA	-0.2
Population density	-0.0
Other service HQ/population	-2.0
College attendance	-2.3
NCF—percentage taking	-3.5
Recruiter/population	-4.1
Percent veterans	-11.6
Goal/recruiter	-12.4

The elasticities and effects from the Warner model can be used to generate marginal costs for obtaining high-quality recruits. We used the FY 2003 recruiting year (the last one for which we had model data available) and estimated the number of additional recruits that would be produced from a 10-percent increase in recruiters, advertising, enlistment bonuses, and NCF. We adjusted costs to reflect FY 2007 dollars. We find that the costs of recruiting an additional A cell are as follows:

- Navy College Fund—$11,700
- Recruiter—$25,400
- Advertising—$54,500
- Enlistment bonus—$155,300.

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