# Uncertainty about Job Match Quality and Youth Turnover:

# Evidence from U.S. Military Attrition

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Abstract

Between 1988 and 1988, about 15 percent of youth who signed US military enlistment contracts failed to enter service and 25 percent of entrants failed to complete two years of service. The propensity to quit is related to a number of personal attributes. This paper examines these differences from an information-theoretic perspective. We develop a simple, empirically motivated model in which some recruits are better at forecasting than others. The greater the degree of uncertainty, the more likely it is that a recruit who signs a military enlistment contract will quit. Our information-theoretic approach implies a panel probit structure of attrition. We estimate panel probit models for military attrition using data on all individuals who signed Army and Navy enlistment contracts and entered service over the period FY 1988-1998. The empirical analysis found considerable support for the model.

Keywords: youth turnover, job matching

"See, I did join the Army, but I joined a *different* Army. I joined the one with the condos and the private rooms."

*Goldie Hawn as Private Judy Benjamin speaking to Captain Lewis in* Private Benjamin (1980).

## INTRODUCTION

Mistakes are not inevitable, but they are common among youth leaving school and are embarking on a career. Topel and Ward (1992) found high rates of turnover in the early career path of the typical youth. Two-thirds of all new jobs among new workers end in the first year (p. 442). By the tenth year after entry into the labor market, more than half of young workers have held more than six jobs, and only one in twenty has held a single job for ten years (p. 448).

From among such youth the U.S. military must recruit 200,000 young men and women each year. As might be expected, there are high levels of turnover among new recruits prior to the completion of their initial term of enlistment, called attrition. Over the 10-year period between 1988 and 1988, about 15 percent of youth who signed enlistment contracts failed to enter service and 25 percent of entrants failed to complete two years of service.[1]

Studies have found that the propensity to quit during the initial enlistment is related to a number of personal attributes. Perhaps the best-known empirical regularity is the higher attrition among recruits who have not earned a high school degree (non-HSGs). The higher attrition among non-HSGs runs counter to a simple economic interpretation because high school graduates generally have superior non-military alternatives. Explanations for this apparent anomaly often appeal to the intuitive notion that HSGs display greater "perseverance" or "stick-to-it-iveness" than non-HSGs.

This paper examines these, and other, differences in attrition from an information-theoretic perspective. We develop a simple, empirically motivated model in which recruits sign

[1]Rates reported in an unpublished table available from the Defense Manpower Data Center. The Army and Navy had two-year attrition rates of 26 and 27 percent, respectively, while the Air Force and Marine Corps had attrition rates of 19 and 24 percent.

an enlistment contract when the expected gain from military service – both pecuniary and non-pecuniary – is positive. Decision reversal – that is to say, attrition – occurs when recruits find that their initial forecast of the non-pecuniary conditions of military life – more precisely, their ability to adapt to military life -- was too optimistic.

We hypothesize that some recruits are better at forecasting than others. If a forecast is too pessimistic, the individual is unlikely to sign an enlistment contract in the first place. If the forecast is too optimistic, the individual is more likely to make a decision that he will later regret. Therefore, the greater the degree of uncertainty, the more likely it is that a recruit who signs a military enlistment contract will realize, in retrospect, that he has made a mistake.

Under the maintained hypothesis of normality, our information-theoretic approach implies a panel probit structure of attrition. We estimate panel probit models for military attrition using data on all individuals who signed Army and Navy enlistment contracts and entered service over the period FY 1988-1998. Of particular interest is the variance of the error term, which we interpret – an interpretation that we justify below -- as a measure of the degree of uncertainty regarding the non-pecuniary characteristics of military life. This parameter is estimated along with the determinants of the mean probability of attrition. By estimating the attrition model separately for different demographic groups, one can observe whether the degree of uncertainty differs across demographic groups in a predictable fashion.

Of course, the question arises why uncertainty might vary across demographic groups in the first place. Information about the military is gleaned from friends and relatives, received from recruiters in person, or absorbed through advertising and the internet. We do not have sufficient information or data to estimate the underlying structure of the search process. However, we hope that the present analysis shows the promise of our general approach.[2]

[2] We approach attrition in a dynamic, multi-period framework and provide estimates of the attrition effects of factors sparsely analyzed in previous studies. Of particular interest is the effect of enlistment incentives (enlistment bonuses and college fund benefits) on attrition. Our analysis provides a large-scale test of the Salop and Salop (1976) proposition that firms can improve the quality of job matches and reduce recruiting costs with contingent compensation plans that provide more deferred compensation and less compensation up-front. Enlistment bonuses (EB) are provided up-front (after completion of initial training) while college fund benefits (CF) are available only

The remainder of the paper is organized as follows. The next section briefly discusses previous information-theoretic studies of labor market turnover. The next section presents an overview of the data, including reduced-form probit estimates of attrition. These reduced-form estimates motivate the simple information-theoretic model that follows, a model that receives considerable empirical support. The paper ends with a brief conclusion.

**PREVIOUS STUDIES**

Jovanovic (1979, 1984) and Viscusi (1979, 1980) were among the first to model labor market turnover within an information-theoretic framework.[3] In Jovanovic's (1979) model, workers decide whether to accept or turn down job offers in the presence of uncertainty about the quality of the job match. Higher initial uncertainty induces job applicants to reduce reservation wages in the hope that the match will turn out to be a good one. The cost of accepting such offers is a higher prospect of failure, that is, job separation.

Other papers have examined turnover as a function of differences in the quality of information. Simon and Warner (1992) hypothesized that workers – in their case, scientists and engineers -- who found their jobs through inside sources, such as friends and relatives who work with the firm, should have lower ex ante variance in job match quality than workers placed through outside sources, such as placement services. Consistent with their theory, their empirical analysis revealed higher starting wages and longer job tenures among those placed through inside sources. More recently, Linda Datcher Loury (2006) examined the role of information and labor market intermediaries using data from the 1979 National Longitudinal Survey of Youth.

More closely related to the present paper is work by Munasinghe (2006), who studies the effect of expectations regarding the quality of a job match on turnover dynamics, also using data from the National Longitudinal Surveys of Youth. Not surprisingly, youth with initially less favorable impressions of their job are more likely to attrite. More interestingly, less favorable

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upon successful completing of the initial enlistment. According to the Salops' story, individuals who opt for CF benefits will be individuals who have a higher prior forecast of successful completion of a first enlistment.

[3]Other researchers who use a search theoretic approach include Topel and Ward (1992), Farber and Gibbons (1996) and Neal (1999).

initial impressions are associated with steeper declines in the rate of attrition as tenure on the job increases. Munasinghe develops a theoretical model in which he posits that youth with less favorable assessments of their current job match have a higher variance of job match quality. The turnover rate for this group falls rapidly as those with poor quality matches dissolve rapidly, leaving behind those with better-than-expected job matches. For workers with initially favorable expectations, there is less scope for improvement in their job match assessments, and hence their turnover is less likely to decline with job tenure.

**Sources of Information Heterogeneity**

A major theme of this paper is that different demographic groups among military recruits may tend to have systematically different degrees of uncertainty. As pointed out in the Introduction, we do not have sufficient information or data to estimate a detailed structural model of job search. It is, however, worthwhile outlining some of the factors that might account for differences in the degree of uncertainty across individuals.

Information about the military is gleaned from friends and relatives, received from recruiters in person, or absorbed through advertising and the internet. One implication is that better-educated individuals should be better informed about the conditions of military life, and hence less likely to attrite, other things the same. This could help explain why individuals with a high school degree or better are less likely to attrite from the military than otherwise comparable high school dropouts, despite poorer civilian job alternatives.

Another source of information heterogeneity is differences in youths' job search strategies. For example, job matching models (e.g., Jovanovic 1979, Vicsusi 1979) imply that jobseekers may prefer jobs with more risk in the sense of a higher ex ante variance in job match quality because they may turn out to be better matches than they might at first appear. Thus, a high school dropout's civilian job alternatives may offer relatively low variance, but also low wages; the military alternative may appear attractive precisely because it *is* risky.

Some sources of uncertainty may be innate or specific to individuals' backgrounds. For example, military job conditions may be more uncertain for females than for males if, for example, they are less likely to have encountered the same degree of physical and mental stress prior to enlisting. A similar argument might apply to whites relative to their black and Hispanic counterparts.

Another source of information uncertainty, suggested by the epigraph, is the individual recruiter, who plays a central role in attracting youth into the military. The question naturally arises whether recruiters, who must meet numerical and quality targets, are completely forthcoming about the rigors of military life. Although one would not expect potential enlistees to have biased expectations, a lack of information could take the form of a higher degree of uncertainty. Recruiters might be able to reduce this uncertainty, but it is not obvious that it would be in their interest to do so, for the same reason that jobseekers might prefer a risky job prospect to a certain one. Generally speaking, the recruiter is not penalized for in-service attrition.[4] Communicating too much information may reduce attrition, but also chase away potential enlistees who are on the margin.

## EMPIRICAL ANALYSIS

### Data

We studied attrition during the first two years of enlisted service in the Army and the Navy. Data were provided by the Defense Manpower Data Center (DMDC) and supplemented with service-specific data on receipt of initial enlistment incentives and other variables not available in the DMDC data.[5] To assemble our data set, DMDC began with a database containing records of all enlistment contracts processed through the Military Entrance Processing Command (MEPCOM) during the period 1988-1998. Each contract in the MEPCOM file was matched to (1) an accession or DEP loss record for that individual and (2) each end-of-fiscal year DMDC

[4]All Services charge attrition from DEP to the recruiter's goal. However, only Marine recruiters are held to account for in-service attrition, and then only during initial training.

[5] Andi Dettner was the DMDC programmer who developed the primary database. We owe her a debt of gratitude for her painstaking and careful work on the database.

Active Duty Master Personnel Edit File (ADMPEF) record for the individual beginning with the fiscal year of the contract through either separation or the end of FY 2004.[6]

**Table 2** summarizes 2-year in-service attrition and survival rates in 6-month intervals. As can be seen, 73 percent of initial Army enlistees, and 71 percent of initial Navy enlistees remain after the first 2 years of service. Two important features can be gleaned. First, attrition during the first 6 months of service is nearly 3 times as high as during subsequent periods. Second, attrition in service is negatively related to time spent in DEP.

### Empirical Strategy

To motivate our theoretical model, as well as to provide a brief overview of attrition patterns, we begin by estimating simple probit models of DEP and 2-year attrition. Our full data set included nearly 900,000 Army contracts and 750,000 Navy contracts.

### Simple Probit Estimates of DEP and Two-Year In-Service Attrition

**Tables 3 and 4** contain simple probit estimates of DEP attrition and 2-year in-service attrition as a function of various individual attributes, economic characteristics of their state of residence, and characteristics of their enlistment (e.g, length of the enlistment term, receipt of enlistment incentives), family income and population density at the 3-digit Zip code level and a measure of the role of influencers in the form of percent veterans at the state level. We also included a measure of physical fitness in the form of the body mass index (BMI). All standard errors have been clustered at the state level.[7]

### Education

DMDC places recruits into 13 education categories. We define high school diploma graduates (HSDGs) as the reference category, and show the estimated marginal effects relative to

[6] Thus, individuals who signed an enlistment contract in FY 1988 can potentially appear on 17 end-of-fiscal year ADMPEFs, contracts signed during FY 1989 can appear on up to 16 ADMPEFs, and so forth.

[7] Clustering at the Army MOS or Navy Rating and Program level did not so increase the estimated standard errors on variables such as term length or enlistment incentives so as to render them insignificant. However, state-level characteristics can take on just 51 values; because the error term across individuals within a given state is likely to be correlated, clustering has a substantial impact on the estimated standard errors of these variables.

this group. For example, high school seniors were 2.4 percentage points more likely to enter the Army, and 3.0 percentage points more likely to enter the Navy than HSDGs, but attrition differences in service were minor.

***GED Holders.*** Evidence suggests that GED holders are less motivated than HSDGs, and are nearly indistinguishable from high school dropouts (Cameron and Heckman, p. 16). Our estimates support this view. GED holders were 2.3 percent less likely to enter the Army and 4.1 percent less likely to enter the Navy, and were **15 percent** more likely to attrite during the first two years of service from the Army and Navy than otherwise comparable HSDGs. Because the probit equations control for AFQT – a variable that has statistically significant, but quantitatively small effects on attrition -- the estimated differences between GED holders and HSDGs are unlikely to be capturing psychometric effects. The poorer civilian labor market alternatives of GED relative to HSDGs should, other things equal, generate *lower* attrition; the fact that they display much higher attrition suggests strongly that GED holders face higher uncertainty than HSDGs about the relative value of a military career.

***High School Dropouts.*** To see this last point, notice that non-GED, non-HSDGs were 4.1 percentage points less likely to enter the Army than HSDGs, and 4.6 percentage points less likely to enter the Navy. The in-service attrition rate differences were 13.4 percent (Army) and 15.1 percent (Navy), respectively, virtually the same as the GED-HSDG differences.

The DEP attrition probits suggest that GED holders are more stable than high-school degree near-completers – individuals with 12 years of education but no degree. For example, near completers had attrition rates in DEP 10.4 (Army) and 13.4 (Navy) percent higher than those of HSDGs. One might suspect that the DEP results may reflect demand-side factors; in particular, a youth may negotiate an enlistment contract that is contingent on earning a high school degree, a contract that may need to be renegotiated if the youth fails to earn the degree. However, attrition rates in service among near-completers were 10.1 and 13.3 percent higher in the Army and Navy than among HSDGs – a smaller differential than was observed for GED holders.

Non-HSDGs with one semester of college (but no high school degree) are about 10 percentage points more likely to attrite from either the Army or the Navy than HSDGs. This could reflect differences in either civilian labor market opportunities or uncertainty. However, the attrition pattern of college graduates suggests that uncertainty may be more important. College graduates have better civilian labor market opportunities either high school graduates or non-graduates with a semester of college, but are 2.3 percentage points more likely to enter the Army (although they are 2.2 percentage points *less* likely to enter the Navy). Moreover, college graduates had 5 percentage point lower rates of in-service attrition than HSDGs from both Services. The evidence suggests that college graduates are better informed, and non-graduates with a semester of college, less informed than high school graduates.

Adult education seems to be a poor substitute for a high school degree. Enlistees with adult education are 8.4 percentage points more likely to attrite from the Army, and 10 percentage points more likely to attrite from the Navy.

Home schooling has become increasingly popular in the U.S. The Navy, in particular, has made an effort in recent years to attract such individuals. As can be seen, home schooled individuals were estimated to be 8-10 percentage points more likely to attrite than HSDGs. However, the effects for home schooled recruits cannot be estimated with much precision due to the relatively small numbers of such recruits.

**Other Personal Characteristics**

Women had far higher rates of DEP attrition than did their male counterparts in both services – 8.5 percentage points in the Army and 10.5 percent in the Navy. Two-year attrition was also 16.6 percentage points higher among women who enlisted in the Army. However, in the Navy attrition among women was only 2.4 percentage points higher. These large differences are consistent with the hypothesis of greater uncertainty about the conditions of service among women than men both prior to and after they enter service.

Recruits who were married at the time of the enlistment contract were 1.4 percentage points more likely than single recruits to enter the Army but 1.7 percentage points less likely to enter the Navy. They also had higher rates of in-service attrition in both the Army (2.0 percentage points) and Navy (1.4 percentage points).

Recruits with higher body mass indexes (BMI) were less likely to enter either the Army or the Navy, but the estimated effects were small. However, an increase in BMI does not appear to affect two-year attrition from the Navy while each 5-point increase in BMI is associated with a 2.0 percentage point increase in two-year attrition from the Army. These BMI response differentials may reflect differences in the physical demands placed on Army and Navy personnel within the same occupational categories.

Non-whites uniformly had lower rates of DEP and in-service attrition than their white counterparts. In the Army, nonwhites were about 10 percentage point less likely to attrite in service than whites. These differences could reflect poorer civilian economic alternatives for non-whites, but could also arise from differences in the degree of uncertainty.

Higher AFQT scores were associated with higher Army DEP attrition, but the estimated effects are tiny. However, each 10-point increase in AFQT is associated with a 1 percentage point higher probability of completing two years of service in either the Army or the Navy.

**Enlistment Term Length and Enlistment Incentives**

We examine the effects of enlistment term length and enlistment incentives in the same section because these two factors are closely linked, particularly in the Navy. Individuals who are willing to sign longer initial enlistment contracts probably have more taste for military service, and lower uncertainty, both of which should be associated with lower DEP and in-service attrition. The effects of enlistment incentives, while reflecting their impact on the pecuniary returns to military service, also reflect the underlying distribution of tastes. To the extent that such incentives were decisive– for example, if recruiters use such incentives to attract reluctant enlistees – their receipt could signal recruits with lower tastes for or greater uncertainty about

military service. Thus, bonus recipients could have, somewhat counter-intuitively, higher rates of attrition.

College fund benefits are unlike bonuses in an important respect – recruits must successfully complete an enlistment to earn eligibility for such benefits. The college fund program may, therefore, induce recruits to self-select – a la Salop and Salop -- such that only recruits who (privately) know that they are more likely to complete an enlistment will opt for these benefits over an alternative enlistment incentive such as a bonus or an enlistment without an incentive.

Differences in administration of their respective enlistment incentive programs led us to enter the enlistment incentive variables differently for the Army and the Navy. The Army has historically awarded enlistment bonuses for recruits who sign for as few as three years and college fund benefits to recruits who sign for as few as two years. For the Army, dummy variables for term of enlistment and enlistment incentives were entered separately as well as interacted with one another for every combination of term and incentive. (Due to the relatively small numbers of 5 and 6-year enlistments in the Army, we grouped them together for the purposes of this analysis.)

The Navy began offering Navy College Fund (NCF) in the early 1990s, and then only to four-year enlistees. NCF was later offered to a small number of 3-YO enlistees. Early on, most of the Navy's enlistment incentives were targeted to recruits who enlisted in 6-YO Nuclear Field, Advanced Electronics Field, Advanced Technical Field programs. In the 1990s, the Navy enlistment bonus program was expanded to recruits who enlisted in 4-YO (School Guarantee) programs provided that they signed a one-year extension up front – that is, bonuses were targeted to 5 and 6-YOs. Because bonuses are targeted to 5 and 6-YO recruits, the bonus variable is not interacted with enlistment term length.

*Army***.** All effects were estimated relative to a four-year enlistment term. Army 2-YO enlistees were 1.5 percentage points less likely to enter the military, but were 3.4 percentage

points less likely to attrite.[8] Although 3-YO Army enlistees were 0.6 percentage points more likely to enter, they were slightly (0.5 percentage points) more likely to attrite in service than four-year recruits. At the longer end, 5 and 6-YO Army recruits were 1 percentage point more likely to enter service but 0.4 percent more likely to attrite in service. Again, relative to a four-year term, the net effect is a higher likelihood of entering and completing two years of service.

Army 4-YO recruits who received enlistment bonuses were significantly more likely (1.8 percentage points) to enter service, but were 2 percentage points less likely to complete two years of service. On net, then, this suggests that there is some adverse selection in the award of Army enlistment bonuses. The Army did not offer bonuses to 2-YO recruits. As can be seen, 3-YO recruits who received an enlistment bonus were significantly less likely (-2.7 = 1.8 – 4.5 percentage points) to enter military service, and were more likely (2.7 percentage points) to attrite while in service. The more negative effects of bonuses on entry of 3-YOs than entry of recruits who signed for longer terms may reflect a greater degree of initial preference uncertainty among such recruits. The estimated attrition differences between 4-YO and 5 and 6-YO enlistment bonus recipients were statistically significant but small in magnitude.

Recipients of Army College Fund who enlisted for four years were 3 percentage points more likely to enter military service and 0.9 percentage points less likely to attrite while in service. At other enlistment terms, ACF recipients were also more likely to enter than non-ACF recipients, but the differences were smaller than with 4-YOs. But the in-service attrition of both 2-YO and 3-YO ACF recipients was significant lower than the attrition of non-recipients of the same term length (over 4 percentage points in both cases).

*Navy*. As pointed out, the effects of term enlistment length and enlistment bonuses are virtually inextricably linked; nearly all 5-YO recruits have been enticed to sign a one-year contract extension up front by the offer of an enlistment bonus. Adding the two effects (-1.2 + 2.7 = 1.5 percentage points), we see that 5-YO recruits have lower DEP attrition than 4-YO

[8] Because the last several months of a 2-year enlistment spans the reenlistment window, 2YOs were coded as attriters only if their time in service was less than 21 months.

recruits who receive no bonus or college fund benefits. Furthermore, 5-YO recruits have 3.5 percentage points lower attrition in service.

Not all Navy 6-YO recruits receive enlistment bonuses or college fund benefits. DEP attrition among 6-YO EB non-recipients is about the same as that of 4-YOs, but 6-YO in-service attrition is significantly lower (by 4.2 percentage points). The net effect, then, is a much higher likelihood that an individual who signs an enlistment contract for six years will complete two years of service. Navy 6-YOs who receive enlistment bonuses – those who enlist in a nuclear field, as well as many who enlist in other technical programs (AEF, ATF, and AEC) are predicted to have 2.4 ( = 0.7 + 1.7) percentage points lower DEP attrition than 6-YO non-recipients; but two-year attrition difference is small (-0.3 = - 6.1 + 5.8).

**State and Zipcode-Level Economic and Social Characteristics**

In absence of information on family background characteristics, a number of state-level economic and social characteristics were entered as controls. As already noted, the standard errors have been clustered at the state level in order to account for possible spatial dependence of the error term.

In previous research, we have found high-quality enlistment supply to be positively related to the percentage of veterans in each state's male population age 35 and over (Warner, Simon, and Payne, 2003), a variable that we interpret as measuring the role of influencers on the enlistment decision. Our results indicate that, as expected, both DEP and in-service attrition to be lower for recruits who lived in states with higher concentrations of military veterans. Each 10 percentage-point increase in the concentration of veterans is associated with 1 percentage point lower DEP attrition and 2 percentage points lower in-service attrition from either service.

Also as one might expect, youth from states with higher population densities and higher average family incomes, who presumably have better civilian alternatives, had higher rates of DEP and in-service attrition, although the estimated effects of population density were not always statistically significant. We also found the likelihood of entry to be positively related, and two-

year in-service attrition to be negatively related, to the percentage of a state's 17-21 year-old high school graduate (or better) population that is enrolled in college. A 10 percentage point increase in the college enrollment rate is estimated to increase the likelihood of entry by 1 percentage point and reduce the likelihood of in-service attrition by 2 percentage points. The may signal that youth who live in states with more opportunities for college attendance and who are still willing to enter service have a higher average taste for service than youth entering from states where college opportunities are poorer.

## MODELING ENLISTMENT AND ATTRITION

Attrition from the military differs from job separation in the civilian sector for several reasons. First, youth have little opportunity to search for alternatives while on the job, particularly early on in their military career, when most attrition occurs. Thus, differences in the intensity of on-the-job search, or differences in the rate of arrival of outside offers, are an unlikely explanation for most of the broad patterns of attrition. Secondly, just as the enlistment contract obligates a youth to serve a minimum term of enlistment, it obligates the military for that period of time as well. Thus, employer-initiated termination of the contract is relatively rare. Thirdly, there is relatively little uncertainty about the pecuniary component of compensation, particularly during the first two years of military service, the time period on which this paper focuses. Finally, the conditions of military life can be very different from those of civilian life. Enlisting in the military requires surrendering much of the liberty taken for granted in civilian life. Moreover, the conditions of the job itself – the degree of effort required and hazards incurred – are unlike those in other walks of life.

For these reasons, it seems reasonable to focus our model on learning about the job– especially in initial recruit training, during which most attrition occurs – as a source of military attrition. As noted in the Introduction, greater initial uncertainty about the conditions of military life will tend to induce a higher rate of attrition in service among those who sign an enlistment contract. The major theme explored in this paper is that recruits in different demographic groups

may have systematically different degrees of uncertainty. The sources of such information heterogeneity will be discussed shortly.

Given our focus on early attrition, it makes sense to abstract from career considerations and instead model the decision to serve for a single term.[9] Let the expected net value of an enlistment to a youth who has just finished schooling and entered the labor market be

$$G_0 = w^m - w^c + \tau^e$$

where $w^m$ is the pecuniary return to a term of military service, $w^c$ is the return to civilian work over the same period, and $\tau^e$ is the youth's forecast at the time of enlistment of $\tau$, the net non-pecuniary return to military service.

This paper extends the formulation of the taste factor in Asch and Warner (2001) and Hosek and Mattock (2003).[10] We suppose that $\tau$ ("tastes") has two components. The first, *p*, measures the value the individual places on patriotism, pride of service, and so on, and is known with certainty. The second is not known *a priori*, and for the purposes of discussion is referred to as the disutility of effort required on the job, *f*. The youth's expectation of $\tau$ prior to entering the military is given by

$$\tau^e = p + f^e$$

where $f^e$ is the expected disutility of effort on the job.

Youth learn the true effort requirement only after entering the military, when they update $f^e$ by drawing a shock $\upsilon$ from a distribution with mean $\mu_\upsilon$ and variance $\sigma_\upsilon^2$, where

$$\upsilon = f - f^e$$

and where *f* is the true disutility of effort. If $E[\upsilon] = \mu_\upsilon = 0$, the initial forecast is unbiased.

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[9] The papers cited show how to formulate the enlistment condition when individuals expect to remain for more than one term with a non-zero probability. Because our paper focuses on attrition within the first two years – most enlistment contracts are for 3 years and up – our simplification is not overly severe, and will hold in more general setups as well.

[10] Other models of military retention that focus on the role of preference (taste) heterogeneity include Gotz and McCall (1984), Daula and Moffitt (1995), Asch and Warner (2001), Hosek and Mattock (2003), and Asch, Hosek, and Clendenning (2005).

Both $w^m$ and $w^c$ are fixed and identical across individuals, while $\tau^e$ is assumed to be normally distributed with mean $\mu_{\tau^e}$ and variance $\sigma^2_{\tau^e}$.[11]

As noted earlier, most – but not all -- youth who sign an enlistment contract do not ship directly to duty, but spend some period of time in the Delayed Entry Program (DEP), during which time they receive no information about *f*. They do, however, receive new information in the form of a random shock, known with certainty by the recruit but not the researcher, $\varepsilon_d \sim N(0, \sigma^2_\varepsilon)$. The recruit will enter service provided

$$G_0 = w^m - w^c + \tau^e + \varepsilon_d > 0$$

and will attrite from DEP otherwise. Other recruits, called "direct ships," enter the military directly, and so do not draw a value of $\varepsilon_d$. In this case, the expected net value of military service to an enlistee who ships to duty immediately after signing an enlistment contract – a "direct ship" – is given by

$$\begin{aligned} G_1^* &= w^m - w^c + \tau^e + \upsilon \\ &= w^m - w^c + \tau \\ &> 0. \end{aligned}$$

Once in service, all recruits draw shocks $\varepsilon_t \sim N(0, \sigma^2_\varepsilon)$. Attrition occurs in period *t* if

$$G_t^* + \varepsilon_t < 0,$$

$t=1,\ldots,T$, where *T* is the number of periods of military service. These assumptions imply a panel probit framework. Define the composite error in period *t* for individual *i* as $u_{it} = \tau_i + \varepsilon_{it}$, which is the shock to individual *i*'s attrition decision in period *t*. The correlation in across adjacent time periods of the $u_{it}$ is

$$\begin{aligned} \rho &= \frac{\sigma^2_\tau}{\sigma^2_\tau + \sigma^2_\varepsilon} \\ &= \frac{\sigma^2_{\tau^e} + \sigma^2_\upsilon}{\sigma^2_{\tau^e} + \sigma^2_\upsilon + \sigma^2_\varepsilon} \end{aligned}.$$

[11] In the current (military) setting, we assume that all recruits earn essentially the same wage. In reality, pecuniary compensation can differ as a function of initial enlistment bonuses and college benefits. For the purposes of the model, we abstract from these differences, but we control for them in the empirical analysis.

The correlation $\rho$ measures the heterogeneity in updated preferences of recruits who actually enter service, and, given $w^m$ and $w^c$, has important implications for the pattern of in-service attrition. Higher levels of $\sigma_\tau^2$ (the variance of initial preferences) leads to higher initial attrition, but more steeply declining rate of attrition over time as those with lower $\tau$ depart.

**Simulations**

A simulation exercise illustrates the main ideas. Parameter values were chosen so that the model delivers predicted rates of enlistment in the youth population and rates of DEP and in-service attrition that are of the same order of magnitude as the actual values. Each simulation starts with a cohort of 100,000 youth in the civilian labor market, tracking them through the enlistment decision, the DEP period, and three in-service periods. The preference factor at the time of contract ($\tau^e$) was assumed to be normally distributed with mean $\mu_{\tau^e} = -10$, meaning that military service is more arduous, on average, than civilian employment for the typical youth, and standard deviation $\sigma_{\tau^e} = 10$.

The simulation results are contained in **Table 1.** In the first simulation, $w_m$=$w_c$=100, $\mu_\upsilon$ = 0, and $\sigma_\upsilon$= $\sigma_\varepsilon$ = 5. As can be seen, 15 percent of youth sign an enlistment contract.[12] Among those who sign a contract, 15 percent draw a sufficiently negative value of $\varepsilon_d$ to attrite from DEP and hence never enter military service. Among those who enter service, 26 percent separate after one period, 15 percent after the 2nd, and 11 percent after the 3rd period.

In general, attrition is highest early on, and declines with time as those with negative taste shocks depart, leaving those with high tastes for military service choosing to remain. The evolution of tastes is shown in **Figure 1** shows the evolution of tastes. Due to updating shocks that are drawn from a normal distribution, the distribution of tastes in the first service period (*new_tau_1* in Figure 1) is approximately normal despite the fact that the distribution of $\tau^e$ among

[12] The 15 percent join rate is somewhat higher than the actual rate, but of the right order of magnitude. Annual accessions (roughly 200,000) are equal to about 10 percent of the number of males turning 18 years old each year.

joiners is a truncated normal (*DEP_tau*).[13] The taste distributions in periods 2 and 3 become more skewed as those with lower tastes leave at a higher rate than those with more positive tastes.

The second row of **Table 1** shows the effect of increasing the degree of uncertainty, $\sigma_\upsilon$, from 5 to 10. By definition in our setup, the fraction signing an enlistment contract is unchanged. However, this mean-preserving increase in uncertainty increases the possibility of both large positive and large negative in-service shocks. Because of the higher likelihood of large negative shocks, first period attrition increases. However, because of the larger variance in updating shocks, some recruits get draws that make them more likely to stay later. As a result, unless there is some bias in preference forecasting such that the mean update shock is non-zero for those who are also subject to larger update variance, attrition in the second and third periods can actually be smaller for the group with larger update shocks.

**Testing the Model: Panel Probit Estimates**

Our simple model has a panel probit structure in which the degree of preference heterogeneity, $\sigma_\tau^2$, is estimated along with the effects of other covariates. A natural way of testing the information-theoretic model, then, is to estimate the panel probit model separately for different groups of recruits and examine the pattern of the estimates of $\sigma_\tau^2$, as implied by the pattern of estimates of $\rho$. We estimated panel probit models of attrition with normally distributed unobserved heterogeneity through (up to) 4 6-month periods.[14] Panel probit incorporates explicitly the role of unobservable heterogeneity in sorting, and has been used, for example, by Daula and Moffitt (1995) to model military reenlistment.[15] The panel probit models were

[13] See Hosek and Mattock (2003) for a similar result. They derive an approximately normal distribution of preferences among entrants from an extreme-valued distribution of preferences in the youth population. But in their model, preferences are known with certainty and not subject to updating. The near normality of the updated preference $\tau$ permits application of the panel probit technique to in-service retention decisions.

[14] It is feasible, albeit computationally burdensome, to allow the variance of the random error to vary as a function of time in the panel probit model, which might allow it to capture more accurately the time path of attrition. The present model is sufficient for testing the empirical implications of the model.

[15] Predictions of attrition from panel probit are smoother than the actual time path, under-predicting attrition early on and over-predicting later on. In work not reported here, we estimated a semi-parametric exponential hazard model in which the baseline hazard was allowed to vary in each of the 4 6-month periods. The semi-parametric exponential model permits a flexible fitting of any given baseline hazard but as Lancaster (1979) long ago demonstrated, there is a tradeoff between the precision with which one can estimate the baseline hazards and the degree of unobserved

estimated on a 1/3- random sample of entrants to reduce computing time. As in the simple probits, standard errors are clustered at the state level.

We focus on information heterogeneity with respect to three variables: time in DEP, race, and gender. It is possible, in principle, to specify $\sigma_\upsilon$ to be a function of virtually every variable in the empirical model. We have not done so, for a number of reasons. It is difficult to specify a priori how other factors should affect information heterogeneity. For example, should recruits who receive an initial enlistment bonus have more or less information heterogeneity than otherwise comparable recruits who receive college fund benefits, or recruits who receive no enlistment incentive? Many such factors play relatively small roles, empirically speaking, in the determination of attrition, and do not always do so consistently across the different military Services.

***Time in DEP.*** We have already noted that most recruits who enter the military do not ship to duty immediately, but enter what is known as the Delayed Entry Program (DEP) for periods of up to a year. It was seen from the tabulations in **Table 2** and from the simple probit attrition estimates in **Tables 3** and **4** that recruits with longer DEP times were less likely to attrite in service. The latter two tables also showed that recruits with longer DEP times were less likely to end up entering the service, that is, more likely to attrite from DEP. The question naturally arises how to interpret these results.

Can these effects not be explained as the result of those in DEP continuing to search for more attractive civilian wage offers? There is no reason to believe that civilian wage offers would be correlated with $\tau$ or $\upsilon$. If this is in fact the case, in-service attrition and DEP attrition would be independent of one another because the preference distributions of those who ship directly to duty would be precisely the same as those who do not. These results suggest strongly that youth acquire information about the quality of the military job match while in DEP, reducing

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heterogeneity. Relatively precise estimates of the ancillary parameter were obtained in the exponential hazard framework when the baseline hazard was restricted to be constant over the four six-month periods. Allowing the baseline hazard to vary across periods drove the estimated ancillary parameter to insignificance. Because of our focus on a structural interpretation of the estimation results, we focus on the panel probit estimates here. Other results are available on request.

the degree of uncertainty as measured by $\sigma_{\tau}^2 = \sigma_{\tau^e}^2 + \sigma_{\upsilon}^2$. Put differently, youth in DEP for longer periods of time are more likely to draw random shocks that shake out those with lower mean forecasted preferences prior to entering service.

***Education.*** As suggested by comparing the simulation results contained in Rows 1 and 3 of **Table 1**, enlistees with higher levels of education have better civilian alternatives and hence, other things the same, should be less likely to sign an enlistment contract, and more likely to attrite from DEP or in service. If, however, better-educated individuals are better informed at the time of enlistment about the level of effort required to successfully carry out military tasks in the sense that they have lower values of $\sigma_{\upsilon}$, they could be less likely to be surprised by a large update shocks and hence less likely to attrite while in service.[16]

***Race and Gender.*** Relative military pay ( $w^m - w^c$ ) is likely to be higher for nonwhites than for whites, thus implying higher rates of enlistment, and (assuming that they are no better or worse informed about the conditions of service), lower rates of DEP and in-service attrition. One might expect the same to be true for women, but their attrition both in DEP and in service, is much *higher* than that of men; the puzzle can be resolved if $\sigma_{\upsilon}$ is higher for women than men, a testable hypothesis.

***The State of the Recruiting Effort.*** We have assumed that youths' initial forecasts of the non-pecuniary aspects of military life are unbiased, that is, that the expected value of $E[\upsilon] = E[\, f - f^e \,] = 0$. During times of difficult recruiting, military recruiters, who face substantial pressure to meet their recruiting goals, might paint a rosier picture of military life than actually exists in order to entice prospects to sign enlistment contracts. Indeed, we find that in-service attrition is inversely related to the civilian unemployment rate.

***State-Level Indicators.*** We employed a number of variables measured at the state level to capture heterogeneity in tastes and information.

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[16] Another explanation is that effort costs are related (unobserved) individual ability, which reduces the effort required to get a high school degree as well as the effort required to fulfill military tasks. More able recruits, who tend to have better educations, are less likely to be unpleasantly surprised by military effort requirements.

*Percent Veterans*. One might expect attrition to be lower among recruits who lived in states with higher percentages of veterans in the population, for two reasons. First, they are likely to have non-pecuniary preferences for military service, and second, one expects them to be better informed about military service, both of which should reduce attrition.

*Family Income*. Recruits from states with higher family incomes may tend to have better civilian alternatives, and hence display higher rates of attrition.

**Table 5** shows estimates of a pooled panel probit model for each service. The estimate of $\rho$ for the Army is 0.262; the estimate for the Navy is 0.499. Both estimates are statistically significant and indicative of preference heterogeneity. The models include dummy variables for the two longer DEP times (5-21 weeks and more than 21 weeks, respectively). The estimates indicate a lower per-period attrition hazard for groups with longer DEP times. And consistent with the simple probit estimates for two-year attrition, better educated groups have lower attrition risk, as do blacks and Hispanics. Again, females have a higher attrition risk, but the quantitative difference between the genders is much bigger for the Army.

As an initial test, we estimated the model by DEP group (Tables A-1 and A-2). As can be seen, the estimates of $\rho$ do in fact tend to be smaller for recruits who spent longer times in DEP. For example, the estimated values of $\rho$ were 0.500, 0.442, and 0.261 for Navy recruits who spent 0-4 weeks, 5-21 weeks, and more than 21 weeks in DEP, respectively. The estimated values for the Army estimates were 0.357, 0.359, and 0.136. Only the differences between these groups and the longest DEP group are statistically significant, but the results are generally consistent with the information hypothesis.

Estimated effects of education, race, and gender are reasonably stable across DEP groups in these models. Because these models restrict the degree of heterogeneity to be the same within DEP group, though, the demographic and other variables can, in principle, reflect the influence of both differences in the variance of tastes as well as mean tastes.

Although we could, in principle, estimate the panel probit model separately for an arbitrarily large number of groups, considerations of computational (time) cost as well as

questions of theoretical relevance led us to divide the data into a relatively small number of groups according to education, race, gender, and, of course, time in DEP. There are 2 education groups: high (high school seniors, HSDGs, and 2- and 4-year college degree recipients) and low (dropouts, GED recipients, and so on); and 2 race groups (whites and non-whites). There are therefore 24 estimates of ρ (2 education groups x 2 race groups x 2 genders x 3 DEP groups) for each Service.

**Table 6** contains regressions of $\hat{\rho}$ on group characteristics and, in the pooled model, a service dummy. Observations in each model are weighted by group size; t-statistics are based on robust standard errors. Nearly all of the variation in $\hat{\rho}$ is explained by the group dummies. Consistent with the results above, $\hat{\rho}$ declines with time in DEP. Furthermore, it is smaller for those with high education, males (in the Army), and non-whites. These estimates imply less variation in update shocks (i.e., smaller $\sigma_\upsilon$) for these groups. Stated alternatively, the regressions in **Table 6** are consistent with the view that groups that have high early in-service attrition do so because they are subject to greater preference uncertainty prior to entry into military service.

Attrition differences may arise from differences in civilian opportunities as well as taste heterogeneity. Such differences manifest themselves as differences in intercepts by education-race-gender-DEP group, with greater taste for military service giving rise to more negative intercepts in the panel probits. **Table 7** contains regressions similar to those in **Table 6**, but with the panel probit intercepts as the dependent variable. There is little evidence of mean differences by DEP group in the Army, but direct ships in the Navy have significantly lower tastes than the two longer DEP groups. The taste for military service is higher among males in both the Army and Navy, as well as among the better- educated. Racial differences are found in the Army, with higher estimated mean tastes for non-whites, but not in the Navy. This last finding is important because it suggests that all of the racial differences in attrition found for the Navy in the simple probit and pooled panel probit models are due to unobserved heterogeneity.

Without more information, it is not possible to identify the source of these intercept differences. We speculated earlier that if some groups' initial forecasts of the military job

conditions were too optimistic, their mean update shock ($\mu_v$) would be systematically negative. Interpreted in this way, the results suggest that less-educated recruits and female recruits are more likely to underestimate the difficulty of military life (e.g., military effort requirements).

**Figures 2** through **4** display predicted attrition for selected demographic groups based on the disaggregated panel probit estimates. Differences in mean tastes or opportunity are manifested as proportional shifts in the attrition functions, while differences in the variance of tastes – that is, differences in $\hat{\rho}$ -- take the form of disproportionate changes in the slope of the attrition function. Consider, for example, the predicted attrition paths in **Figure 2** for low- and high-education nonwhite women in the Army. Because of their higher degree of taste heterogeneity, predicted attrition for the low-education group starts out higher, but declines at a faster rate, than for the high-education group. The figure also illustrates differences in attrition by gender and race.

**Figures 3** and **4** show the differences in predicted attrition by DEP category. **Figure 3** contrasts Army recruits who spent less than 5 weeks in DEP with comparable recruits who spent more than 21 weeks in DEP. Early attrition is higher among the low DEP-time group, but declines more rapidly due to the greater taste heterogeneity among this group. **Figure 4** shows the same pattern for the Navy, as well as showing the lower degree of heterogeneity, and hence lower attrition rate, among non-whites who spent less than 5 weeks in DEP. Interestingly, there is virtually no racial difference in predicted attrition among recruits who spent more than 21 weeks in DEP.

## CONCLUSION

This paper has modeled first-term enlisted attrition as the result of learning that conditions on the job are more arduous than expected. The model predicted that attrition among individuals who are better-informed about job conditions should be less likely to attrite, while less-informed individuals should have higher initial attrition and more steeply declining attrition profiles. The empirical analysis found considerable support for the model. For example, recruits with a high

school degree were less likely to attrite than high-school dropouts and GED holders, despite lower civilian economic opportunities, and males were less likely to attrite than females. We also found blacks to be better informed – put differently, less likely to be unpleasantly surprised – than whites. Perhaps the most striking confirmation of the model regards the relationship between attrition and time spent in the Delayed Entry Program (DEP) prior to entering service, with longer DEP times associated with lower subsequent rates of attrition in service.

This last result has important implications for current military manpower policy. The length and lethality of the second Iraq war has strained the existing force, the Army in particular, which along with the Marine Corps has borne the brunt of the conflict. As public support for the mission in Iraq has declined, the Army has missed its recruiting targets in recent months. In response, the Army has reduced the time that newly signed recruits spend in the DEP in order to place them in service more quickly. In addition to reducing the pipeline of future manpower supply, our empirical results suggest that the result will also entail higher attrition in service. The Army recognizes the problem and has adjusted basic training to reduce attrition.[17] It remains to be seen whether this adjustment in training policies reduces attrition longer term.

[17] See "To Keep Recruits, Boot Camp Gets a Gentle Revamp," The Wall Street Journal, February 15, 2006, p. A1. Less harassment by drill instructors, more counseling for those at high risk for attrition, and shorter marches are among the changes the Army has implemented to reduce boot camp attrition. The report says that 6-month attrition has fallen from 18 percent in 2004 to 11 percent more recently as a result of these policies. Notice that the 18 percent 6-month attrition rate for 2004 is considerably higher than the 14.2 percent rate for FY 1988-98 Army entrants reported in Table 2.

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**Table 1. Simulations of DEP Attrition and In-Service Attrition**

| Parameter Values | | | % Join | % Attrition in Period | | | |
|---|---|---|---|---|---|---|---|
| $w^m$ | $w^c$ | $\sigma_u$ | | *DEP* | *1* | *2* | *3* |
| 100 | 100 | 5 | 15 | 15 | 26 | 15 | 11 |
| 100 | 100 | 10 | 15 | 15 | 32 | 13 | 8 |
| 100 | 110 | 5 | 6 | 17 | 28 | 16 | 13 |

Note: $\mu_{\tau^e} = -10$ and $\sigma_{\tau^e} = 10$

**Table 2. In-Service Attrition and Survival**

| | Attrition | | | | Survival | | | |
|---|---|---|---|---|---|---|---|---|
| **A. Army** | | DEP Group | | | | DEP Group | | |
| | All | 1 | 2 | 3 | All | 1 | 2 | 3 |
| 0-6 Months Svc | 0.142 | 0.159 | 0.148 | 0.119 | 0.858 | 0.841 | 0.852 | 0.881 |
| 7-12 Months Svc | 0.049 | 0.053 | 0.050 | 0.044 | 0.816 | 0.796 | 0.809 | 0.842 |
| 13-18 Months Svc | 0.053 | 0.067 | 0.055 | 0.038 | 0.773 | 0.743 | 0.765 | 0.810 |
| 19-24 Months Svc | 0.056 | 0.065 | 0.055 | 0.050 | 0.729 | 0.695 | 0.723 | 0.770 |
| **B. Navy** | | | | | | | | |
| 0-6 Months Svc | 0.156 | 0.195 | 0.162 | 0.126 | 0.844 | 0.805 | 0.838 | 0.874 |
| 7-12 Months Svc | 0.057 | 0.072 | 0.057 | 0.048 | 0.796 | 0.747 | 0.790 | 0.832 |
| 13-18 Months Svc | 0.055 | 0.073 | 0.056 | 0.043 | 0.752 | 0.693 | 0.746 | 0.796 |
| 19-24 Months Svc | 0.059 | 0.074 | 0.058 | 0.051 | 0.708 | 0.641 | 0.703 | 0.756 |

Note: DEP Group 1: <5 weeks; DEP Group 2: 5-21 weeks; DEP Group 3: >21 weeks.

**Table 3. Simple Probit Estimates: Army Contracts, FY 1988-98**

| | Entered the Army? | | | Attrited In First Two Years? | | |
|---|---|---|---|---|---|---|
| **Independent Variable** | **Marginal Effect** | **z** | **Variable Mean** | **Marginal Effect** | **z** | **Variable Mean** |
| ***Economy Wide Pecuniary Factors*** | | | | | | |
| Relative Military Pay | 0.006 | 0.26 | 1.050 | -0.010 | -0.27 | 1.04967 |
| Unemployment Rate | 0.005 | 4.03 | 5.896 | -0.002 | -1.35 | 5.92316 |
| ***Education (Omitted: Tier 1 HS Diploma Grad)*** | | | | | | |
| Tier 1 In-High School | 0.024 | 5.31 | 0.321 | -0.003 | -1.18 | 0.292 |
| Tier 1 Adult Ed | 0.006 | 1.25 | 0.007 | 0.084 | 6.14 | 0.007 |
| Tier 1 One Sem Coll | 0.000 | -0.14 | 0.016 | 0.099 | 13.22 | 0.017 |
| Tier 1 Associate Deg | 0.023 | 5.51 | 0.008 | -0.041 | -7.21 | 0.008 |
| Tier 1 College Degree | 0.023 | 6.82 | 0.022 | -0.050 | -8.59 | 0.022 |
| Tier 2 HS Attend Cert | 0.023 | 0.89 | 0.000 | -0.012 | -0.21 | 0.000 |
| Tier 2 Occ Cert | 0.014 | 0.49 | 0.000 | -0.007 | -0.21 | 0.000 |
| Tier 2 Corresp Cert | 0.066 | 1.02 | 0.000 | 0.154 | 1.75 | 0.000 |
| Tier 2 Home Schooler | 0.027 | 0.49 | 0.000 | 0.087 | 2.23 | 0.000 |
| Tier 2 GED | -0.023 | -8.64 | 0.045 | 0.154 | 38.03 | 0.047 |
| Tier 2 Near Completion | -0.104 | -12.66 | 0.008 | 0.101 | 10.10 | 0.007 |
| Tier 3 Non-HSG | -0.041 | -7.82 | 0.013 | 0.134 | 16.10 | 0.013 |
| ***Personal Characteristics*** | | | | | | |
| AFQT | 0.000 | -4.52 | 59.305 | -0.001 | -22.54 | 59.223 |
| Male | 0.085 | 30.39 | 0.818 | -0.166 | -59.06 | 0.831 |
| Black | 0.012 | 3.02 | 0.232 | -0.087 | -13.25 | 0.234 |
| Hispanic | 0.009 | 2.78 | 0.064 | -0.100 | -16.89 | 0.064 |
| Other | 0.011 | 4.08 | 0.036 | -0.070 | -11.07 | 0.036 |
| Married | 0.014 | 8.64 | 0.094 | 0.020 | 7.38 | 0.097 |
| Contract Age | -0.004 | -11.35 | 20.046 | 0.001 | 1.94 | 20.116 |
| Body Mass Index | 0.000 | -1.65 | 24.706 | 0.004 | 22.70 | 24.748 |
| ***Time in DEP*** | | | | | | |
| Predicted DEP Time | -0.006 | -34.42 | 18.147 | | | |
| 5-21 Weeks in DEP | | | | -0.019 | -8.08 | 0.409 |
| >21 Weeks in DEP | | | | -0.037 | -15.18 | 0.306 |
| ***Enlistment Term Length (Omitted: 4-YO)*** | | | | | | |
| 2-YO | -0.015 | -3.52 | 0.084 | -0.034 | -7.95 | 0.082 |
| 3-YO | 0.006 | 2.84 | 0.278 | 0.005 | 3.04 | 0.279 |
| 5 or 6-YO | 0.010 | 4.60 | 0.120 | 0.004 | 2.38 | 0.119 |
| ***Enlistment Incentives*** | | | | | | |
| Bonus | 0.018 | 7.39 | 0.112 | 0.020 | 11.31 | 0.114 |
| Bonus*3-YO | -0.045 | -14.34 | 0.009 | 0.007 | 1.25 | 0.009 |
| Bonus*5 or 6-YO | -0.007 | -2.08 | 0.017 | 0.000 | -0.06 | 0.017 |
| Army College Fund (ACF) | 0.030 | 11.05 | 0.225 | -0.009 | -5.39 | 0.224 |
| ACF*2-YO | -0.014 | -3.36 | 0.065 | -0.040 | -8.35 | 0.064 |
| ACF*3-YO | -0.026 | -9.26 | 0.072 | -0.035 | -9.29 | 0.071 |
| ACF*5 or 6-YO | -0.023 | -3.63 | 0.003 | 0.011 | 1.13 | 0.003 |
| ***State and Zipcode-Level Characteristics*** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Youth in College | 0.001 | 2.82 | 61.204 | -0.002 | -3.32 | 61.181 |
| Male Vet Pop (% age 35+) | 0.001 | 3.42 | 41.460 | -0.002 | -3.02 | 41.551 |
| Population Density (3-digit Zip) | -0.002 | -1.67 | 0.626 | 0.002 | 1.00 | 0.624 |
| Family Income (3-digit Zip) | -0.006 | -4.92 | 4.100 | 0.005 | 3.55 | 4.095 |
| ***Military Occupation Group (Omitted: Administrative)*** | | | | | | |
| Combat Arms | -0.001 | -0.70 | 0.303 | 0.037 | 20.50 | 0.307 |
| Electronics Equipment Repair | 0.005 | 2.54 | 0.054 | 0.014 | 4.58 | 0.054 |
| Communications & Intelligence | 0.004 | 2.02 | 0.137 | 0.005 | 2.52 | 0.137 |
| Medical | 0.007 | 4.23 | 0.075 | -0.005 | -2.06 | 0.074 |
| Other Technical | 0.005 | 1.46 | 0.027 | 0.003 | 0.92 | 0.027 |
| Administrative | -0.006 | -3.34 | 0.147 | -0.002 | -1.04 | 0.148 |
| Electrical/Mechanical Equip | -0.012 | -5.67 | 0.020 | 0.030 | 7.24 | 0.020 |
| Craftsmen | -0.005 | -3.15 | 0.125 | 0.029 | 14.70 | 0.124 |
| ***Fiscal Year Interval (Omitted = FY 1988-89)*** | | | | | | |
| FY 1990-93 | -0.008 | -3.87 | 0.357 | 0.062 | 18.19 | 0.363 |
| FY 1994-96 | -0.025 | -5.80 | 0.241 | 0.074 | 10.41 | 0.235 |
| FY 1997-98 | -0.036 | -5.12 | 0.175 | 0.070 | 7.61 | 0.169 |
| | | | | | | |
| Number of Observations | 882,872 | | | 747,812 | | |
| Log-Likelihood | -360,691 | | | -418,564 | | |
| Dependent Variable Mean | 0.847 | | | 0.270 | | |

Note: Standard errors clustered on state.

**Table 4. Simple Probit Estimates: Navy Contracts, FY 1988-98**

| | Entered the Navy? | | | Attrited In First Two Years? | | |
|---|---|---|---|---|---|---|
| Independent Variable | Marginal Effect | z | Variable Mean | Marginal Effect | z | Variable Mean |
| ***Economy Wide Pecuniary Factors*** | | | | | | |
| Relative Military Pay | -0.011 | -0.59 | 1.046 | -0.011 | -0.37 | 1.046 |
| Unemployment Rate | 0.005 | 3.95 | 5.920 | -0.006 | -3.77 | 5.927 |
| ***Education (Omitted: Tier 1 HS Diploma Grad)*** | | | | | | |
| Tier 1 In-High School | 0.030 | 10.34 | 0.369 | -0.005 | -2.16 | 0.345 |
| Tier 1 Adult Ed | -0.017 | -2.76 | 0.013 | 0.103 | 19.61 | 0.013 |
| Tier 1 One Sem Coll | -0.009 | -2.14 | 0.013 | 0.099 | 12.26 | 0.014 |
| Tier 1 Associate Deg | 0.006 | 0.79 | 0.006 | -0.050 | -4.46 | 0.006 |
| Tier 1 College Degree | -0.022 | -4.22 | 0.010 | -0.055 | -5.14 | 0.010 |
| Tier 2 HS Attend Cert | 0.010 | 0.53 | 0.001 | 0.105 | 5.54 | 0.001 |
| Tier 2 Occ Cert | -0.007 | -0.19 | 0.000 | 0.027 | 0.50 | 0.000 |
| Tier 2 Corresp Cert | -0.055 | -0.79 | 0.000 | 0.148 | 1.45 | 0.000 |
| Tier 2 Home Schooler | -0.024 | -0.75 | 0.000 | 0.100 | 1.89 | 0.000 |
| Tier 2 GED | -0.041 | -9.35 | 0.029 | 0.148 | 27.88 | 0.031 |
| Tier 2 Near Completion | -0.134 | -20.19 | 0.019 | 0.133 | 18.21 | 0.015 |
| Tier 3 Non-HSG | -0.046 | -8.74 | 0.024 | 0.151 | 22.92 | 0.025 |
| ***Personal Characteristics*** | | | | | | |
| AFQT | 0.000 | 1.06 | 57.164 | -0.001 | -8.75 | 57.195 |
| Male | 0.105 | 38.84 | 0.829 | -0.024 | -9.99 | 0.844 |
| Black | 0.017 | 4.48 | 0.210 | -0.045 | -6.22 | 0.213 |
| Hispanic | -0.001 | -0.36 | 0.087 | -0.038 | -3.50 | 0.086 |
| Other | 0.009 | 2.21 | 0.063 | -0.070 | -4.06 | 0.064 |
| Married | -0.007 | -3.02 | 0.040 | 0.014 | 2.71 | 0.040 |
| Contract Age | -0.003 | -15.74 | 19.757 | 0.004 | 6.05 | 19.810 |
| Body Mass Index | -0.001 | -4.74 | 24.469 | 0.000 | -0.31 | 24.478 |
| ***Time in DEP*** | | | | | | |
| Predicted DEP Time | -0.006 | -40.43 | 21.803 | | | |
| 5-21 Weeks in DEP | | | | -0.051 | -35.51 | 0.289 |
| >21 Weeks in DEP | | | | -0.088 | -33.41 | 0.428 |
| ***Enlistment Term Length (Omitted: 4-YO)*** | | | | | | |
| 3-YO | -0.017 | -9.54 | 0.127 | -0.013 | -5.63 | 0.129 |
| 5-YO | -0.012 | -5.21 | 0.092 | -0.035 | -8.62 | 0.089 |
| 6-YO | 0.003 | 1.64 | 0.118 | -0.042 | -14.23 | 0.121 |
| ***Enlistment Incentives*** | | | | | | |
| Bonus | 0.027 | 12.29 | 0.059 | -0.001 | -0.33 | 0.061 |
| Navy College Fund (NCF) | 0.007 | 2.91 | 0.077 | -0.061 | -19.18 | 0.077 |
| NCF*3-YO | -0.005 | -0.65 | 0.007 | 0.028 | 3.38 | 0.007 |
| NCF*5-YO | 0.027 | 3.70 | 0.004 | 0.036 | 3.17 | 0.004 |
| NCF*6-YO | 0.017 | 3.77 | 0.015 | 0.058 | 10.28 | 0.015 |
| ***State and Zipcode-Level Characteristics*** | | | | | | |
| Percent Youth in College | 0.001 | 3.12 | 61.353 | -0.002 | -5.00 | 61.350 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Male Vet Pop (% age 35+) | 0.001 | 3.81 | 41.620 | -0.002 | -4.52 | 41.652 |
| Population Density (3-digit Zip) | -0.001 | -1.49 | 0.716 | 0.000 | 0.15 | 0.720 |
| Family Income (3-digit Zip) | -0.004 | -3.58 | 4.156 | 0.005 | 3.22 | 4.154 |
| ***Military Occupation Group (Omitted: Administrative)*** | | | | | | |
| Combat Arms | 0.007 | 2.41 | 0.267 | -0.031 | -8.98 | 0.273 |
| Electronics Equipment Repair | 0.012 | 5.39 | 0.197 | -0.030 | -9.92 | 0.200 |
| Communications & Intelligence | 0.018 | 7.31 | 0.100 | -0.043 | -15.68 | 0.101 |
| Medical | 0.021 | 9.14 | 0.075 | -0.078 | -25.24 | 0.073 |
| Other Technical | 0.034 | 6.63 | 0.007 | -0.063 | -7.90 | 0.007 |
| Electrical/Mechanical Equip | 0.003 | 1.38 | 0.199 | -0.017 | -4.90 | 0.195 |
| Craftsmen | -0.003 | -0.93 | 0.050 | -0.029 | -5.63 | 0.048 |
| Supply & Service Handlers | -0.011 | -4.15 | 0.042 | 0.028 | 6.90 | 0.042 |
| ***Fiscal Year Interval (Omitted = FY 1988-89)*** | | | | | | |
| FY 1990-93 | 0.014 | 6.17 | 0.349 | 0.066 | 19.17 | 0.348 |
| FY 1994-96 | 0.011 | 3.11 | 0.241 | 0.097 | 14.45 | 0.241 |
| FY 1997-98 | 0.000 | 0.00 | 0.151 | 0.052 | 5.44 | 0.149 |
| | | | | | | |
| Number of Observations | 619,803 | | | 520,990 | | |
| Log-Likelihood | -261,015 | | | -307,292 | | |
| Dependent Variable Mean | 0.840 | | | 0.294 | | |

Note: Standard errors clustered on state.

**Table 5:**
**Panel Probit Estimates of Army and Navy Attrition Using the Full Samples**

| | Army | | Navy | |
|---|---|---|---|---|
| | **Parm Est** | **Std Error** | **Parm Est** | **Std Error** |
| ***Time in DEP:*** | | | | |
| **5-21 Weeks** | -0.070 | -10.66 | -0.184 | -17.80 |
| **>21 Weeks** | -0.132 | -14.32 | -0.313 | -26.46 |
| ***Economy Wide Pecuniary Factors (Time of Contract)*** | | | | |
| Rel Mil Pay | 0.043 | 0.94 | -0.150 | -2.24 |
| Unemp Rate | -0.010 | -4.71 | -0.020 | -6.32 |
| ***Education (Omitted: Tier 1 HS Diploma Grad)*** | | | | |
| Tier 1 in HS | -0.005 | -0.57 | -0.023 | -2.02 |
| Tier 1 Adult Ed | 0.191 | 6.39 | 0.305 | 9.57 |
| Tier 1 One Sem Coll | 0.271 | 14.02 | 0.284 | 8.97 |
| Tier 1 Assoc Deg | -0.133 | -4.35 | -0.247 | -4.79 |
| Tier 1 College Deg | -0.097 | -5.05 | -0.196 | -4.73 |
| Tier 2 GED | 0.392 | 32.18 | 0.482 | 22.87 |
| Tier 2 Near Complete | 0.279 | 9.69 | 0.415 | 13.48 |
| Tier 2 HS Attendance | | | 0.328 | 2.97 |
| Tier 3 Non-HSG | 0.329 | 14.92 | 0.483 | 20.19 |
| ***Personal Characteristics*** | | | | |
| AFQT Score | -0.004 | -22.21 | -0.003 | -11.92 |
| Male | -0.447 | -60.42 | -0.079 | -7.33 |
| Black | -0.303 | -42.48 | -0.189 | -17.70 |
| Hispanic | -0.338 | -28.28 | -0.154 | -10.31 |
| Other | -0.266 | -17.69 | -0.289 | -16.57 |
| Contract Age | 0.008 | 7.25 | 0.018 | 10.58 |
| Married at Contract | 0.049 | 5.13 | 0.062 | 3.11 |
| Body Mass Index | 0.006 | 19.78 | 0.001 | 0.84 |
| ***Enlistment Term Length (Omitted: 4-YO)*** | | | | |
| Two Yr Contract | -0.021 | -0.94 | | |
| Three Yr Contract | 0.036 | 4.41 | -0.030 | -2.28 |
| Five Yr Contract | 0.005 | 0.44 | -0.121 | -7.25 |
| Six Yr Contract | -0.017 | -1.28 | -0.140 | -8.93 |
| ***Enlistment Incentives*** | | | | |
| Bonus | 0.049 | 4.73 | -0.030 | -1.53 |
| College Fund | -0.034 | -3.07 | -0.193 | -11.98 |
| Bonus*3-YO | -0.007 | -0.26 | | |
| Bonus*5 or 6-YO | 0.037 | 1.57 | | |
| ACF*2-YO | -0.093 | -3.54 | | |
| ACF*3-YO | -0.141 | -9.13 | | |
| ACF*5 or 6-YO | 0.052 | 1.11 | | |
| ***State and Zipcode-Level Characteristics*** | | | | |
| Percent College | -0.005 | -6.67 | -0.009 | -8.70 |
| Veteran Percent | -0.005 | -5.97 | -0.007 | -5.98 |
| Population Density | 0.005 | 3.15 | 0.005 | 2.50 |

| | | | | |
|---|---|---|---|---|
| Family Income | 0.020 | 6.57 | 0.017 | 4.00 |
| ***Military Occupation Group (Omitted: Administrative)*** | | | | |
| Combat Arms | 0.077 | 7.95 | -0.169 | -9.34 |
| Electronics | 0.050 | 3.61 | -0.153 | -8.29 |
| Communications | -0.012 | -1.14 | -0.225 | -11.23 |
| Medical | -0.038 | -3.06 | -0.360 | -15.83 |
| Other Technical | -0.001 | -0.06 | -0.263 | -5.14 |
| Elect Equip Repair | -0.024 | -2.24 | -0.084 | -4.64 |
| Craftsman | 0.078 | 3.89 | -0.158 | -6.48 |
| Supply & Service | 0.074 | 6.96 | 0.042 | 1.75 |
| ***Fiscal Year Group (Omitted: FY 1988-89)*** | | | | |
| FY 1990-1993 | 0.220 | 27.08 | 0.246 | 21.53 |
| FY 1994-1996 | 0.221 | 21.48 | 0.379 | 25.43 |
| FY 1997-1998 | 0.209 | 17.17 | 0.267 | 14.32 |
| Intercept | -0.894 | -9.73 | -0.554 | -4.03 |
| $\rho$ | 0.262 | | 0.499 | |
| $\sigma^2_t$ | 0.595 | | 0.998 | |
| Sample Size | 235,776 | | 173,869 | |
| Log-likelihood | -214,163.7 | | -165,744.6 | |

**Table 6. Regression of $\hat{\rho}$ on Group Characteristics**

| | Pooled | | Army | | Navy | |
|---|---|---|---|---|---|---|
| | **Parm Est** | **t-Stat** | **Parm Est** | **t-Stat** | **Parm Est** | **t-Stat** |
| Dep Group 1 | 0.582 | 13.64 | 0.508 | 11.31 | 0.545 | 11.42 |
| DEP Group 2 | 0.546 | 12.36 | 0.482 | 9.45 | 0.491 | 10.44 |
| DEP Group 3 | 0.374 | 8.26 | 0.295 | 4.32 | 0.323 | 5.96 |
| High Education | -0.102 | -4.24 | -0.111 | -3.87 | -0.090 | -2.55 |
| Male | -0.154 | -4.60 | -0.242 | -7.17 | -0.053 | -1.77 |
| White | 0.156 | 5.25 | 0.226 | 8.37 | 0.090 | 3.56 |
| Army | -0.102 | -4.34 | | | | |
| Standard Error | 0.067 | | 0.054 | | 0.047 | |
| $R^2$ | 0.972 | | 0.981 | | 0.989 | |
| Sample Size | 47 | | 23[a] | | 24 | |

Notes:
t-statistics based on robust standard errors; regressions weighted by sample size.
[a]Equation contains 23 observations because panel probit model for high education, non-white, males in DEP group 3 would not converge.

**Table 7. Regression of Intercept Estimates on Group Characteristics**

| | Pooled | | Army | | Navy | |
|---|---|---|---|---|---|---|
| | **Parm Est** | **t-Stat** | **Parm Est** | **t-Stat** | **Parm Est** | **t-Stat** |
| Dep Group 1 | -1.161 | -12.43 | -1.474 | -15.98 | -0.884 | -7.48 |
| DEP Group 2 | -1.303 | -14.01 | -1.512 | -14.93 | -1.164 | -11.08 |
| DEP Group 3 | -1.300 | -12.22 | -1.554 | -12.6 | -1.111 | -9.45 |
| High Education | -0.309 | -4.93 | -0.223 | -3.31 | -0.402 | -7.17 |
| Male | -0.203 | -3.98 | -0.208 | -3.93 | -0.212 | -2.77 |
| White | 0.091 | 1.65 | 0.219 | 4.51 | -0.055 | -0.90 |
| Army | -0.087 | -1.41 | | | | |
| Standard Error | 0.171 | | 0.179 | | 0.127 | |
| $R^2$ | 0.992 | | 0.992 | | 0.992 | |
| Sample Size | 47 | | 23 | | 24 | |

Notes:
t-statistics based on robust standard errors; regressions weighted by sample size.
[a]Equation contains 23 observations because panel probit model for high education, non-white, males in DEP group 3 would not converge.

## Appendix A: Panel Probit Estimates by DEP Group

**Table A-1. Army Panel Probit Estimates Through First Two Years of Service**

| | DEP Group 1 | | DEP Group 2 | | DEP Group 3 | |
|---|---|---|---|---|---|---|
| **Variable** | **Coeff** | **z** | **Coeff** | **z** | **Coeff** | **z** |
| ***Economy Wide Pecuniary Factors (Time of Contract)*** | | | | | | |
| Rel Mil Pay | -0.199 | -2.1 | 0.007 | 0.1 | 0.258 | 3.4 |
| Unemp Rate | -0.015 | -3.3 | -0.015 | -4.1 | 0.006 | 1.6 |
| ***Education (Omitted: Tier 1 HS Diploma Grad)*** | | | | | | |
| Tier 1 in HS | 0.071 | 2.1 | -0.009 | -0.6 | 0.015 | 1.1 |
| Tier 1 Adult Ed | 0.220 | 4.2 | 0.223 | 4.8 | 0.095 | 1.0 |
| Tier 1 One Sem Coll | 0.286 | 8.3 | 0.304 | 9.9 | 0.276 | 5.3 |
| Tier 1 Assoc Deg | -0.144 | -2.3 | -0.165 | -3.5 | -0.188 | -2.5 |
| Tier 1 College Deg | -0.194 | -4.7 | -0.262 | -8.4 | -0.256 | -5.3 |
| Tier 2 GED | 0.429 | 20.8 | 0.441 | 21.5 | 0.425 | 9.4 |
| Tier 2 Near Complete | 0.190 | 2.1 | 0.309 | 7.3 | 0.301 | 6.4 |
| Tier 3 Non-HSG | 0.447 | 11.8 | 0.375 | 9.1 | 0.108 | 2.3 |
| ***Personal Characteristics*** | | | | | | |
| AFQT Score | -0.005 | -14.2 | -0.005 | -17.3 | -0.003 | -10.5 |
| Male | -0.531 | -33.1 | -0.511 | -41.0 | -0.395 | -30.0 |
| Black | -0.374 | -25.8 | -0.341 | -27.8 | -0.226 | -18.0 |
| Hispanic | -0.423 | -16.8 | -0.383 | -19.0 | -0.255 | -12.5 |
| Other | -0.294 | -9.5 | -0.327 | -13.0 | -0.198 | -7.3 |
| Contract Age | 0.007 | 3.3 | 0.009 | 4.8 | 0.006 | 2.0 |
| Married at Contract | 0.072 | 4.4 | 0.056 | 3.6 | 0.035 | 1.3 |
| Body Mass Index | 0.014 | 14.4 | 0.004 | 9.4 | 0.023 | 17.6 |
| ***Enlistment Term Length (Omitted: 4-YO)*** | | | | | | |
| Two Yr Contract | 0.017 | 0.4 | -0.026 | -0.6 | -0.039 | -1.0 |
| Three Yr Contract | -0.005 | -0.3 | 0.016 | 1.2 | 0.013 | 0.8 |
| Five Yr Contract | 0.034 | 1.3 | 0.047 | 2.3 | -0.035 | -1.9 |
| Six Yr Contract | 0.029 | 1.0 | -0.030 | -1.3 | -0.016 | -0.8 |
| ***Enlistment Incentives*** | | | | | | |
| Bonus | 0.046 | 2.3 | 0.062 | 3.4 | 0.018 | 0.9 |
| Army College Fund | -0.020 | -0.8 | -0.033 | -1.7 | -0.051 | -3.2 |
| Bonus*3-YO | 0.008 | 0.1 | 0.004 | 0.1 | 0.104 | 2.1 |
| Bonus*5 or 6-YO | 0.076 | 1.7 | 0.010 | 0.3 | 0.039 | 0.9 |
| ACF*2-YO | -0.174 | -3.2 | -0.068 | -1.4 | -0.063 | -1.5 |
| ACF*3-YO | -0.119 | -3.1 | -0.093 | -3.4 | -0.123 | -5.2 |
| ACF*5 or 6-YO | -0.090 | -0.8 | 0.044 | 0.6 | 0.104 | 1.5 |
| ***State and Zipcode-Level Characteristics*** | | | | | | |
| Percent College | -0.005 | -3.6 | -0.005 | -4.3 | -0.006 | -4.8 |
| Veteran Percent | -0.004 | -2.2 | -0.007 | -4.6 | -0.005 | -3.6 |
| Population Density | 0.010 | 3.6 | 0.001 | 0.2 | 0.008 | 2.5 |
| Family Income | 0.022 | 3.5 | 0.016 | 3.2 | 0.021 | 4.1 |
| ***Military Occupation Group (Omitted: Administrative)*** | | | | | | |
| Combat Arms | 0.146 | 6.5 | 0.120 | 6.5 | 0.062 | 3.5 |
| Electronics | 0.093 | 2.9 | 0.100 | 4.1 | 0.031 | 1.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Communications | 0.036 | 1.5 | 0.017 | 0.8 | 0.009 | 0.5 |
| Medical | 0.001 | 0.0 | -0.018 | -0.8 | -0.019 | -0.9 |
| Other Technical | -0.027 | -0.7 | 0.075 | 2.4 | 0.005 | 0.2 |
| Elect Equip Repair | 0.047 | 2.0 | -0.003 | -0.1 | -0.038 | -2.0 |
| Craftsman | 0.103 | 2.4 | 0.110 | 3.2 | 0.086 | 2.6 |
| Supply & Service | 0.137 | 5.8 | 0.095 | 4.9 | 0.070 | 3.6 |
| ***Fiscal Year Group (Omitted: FY 1988-89)*** | | | | | | |
| FY 1990-1993 | 0.168 | 10.4 | 0.276 | 18.1 | 0.265 | 19.1 |
| FY 1994-1996 | 0.178 | 7.9 | 0.305 | 16.9 | 0.251 | 14.2 |
| FY 1997-1998 | 0.190 | 7.9 | 0.319 | 14.4 | 0.208 | 9.8 |
| Intercept | -0.728 | -3.8 | -0.764 | -4.8 | -1.692 | -10.4 |
| $\rho$ | 0.357 | | 0.359 | | 0.136 | |
| $\sigma^2_\tau$ | 0.554 | | 0.559 | | 0.157 | |
| Sample Size | 61871 | | 95228 | | 71847 | |
| Log-likelihood | -60903.3 | | -87006.8 | | -59123.1 | |

**Table A-2. Navy Panel Probit Estimates Through First Two Years of Service**

| | DEP Group 1 | | DEP Group 2 | | DEP Group 3 | |
|---|---|---|---|---|---|---|
| **Variable** | **Coeff** | **z** | **Coeff** | **z** | **Coeff** | **z** |
| ***Economy Wide Pecuniary Factors (Time of Contract)*** | | | | | | |
| Rel Mil Pay | -0.166 | -1.5 | -0.010 | -0.1 | 0.036 | 0.5 |
| Unemp Rate | -0.027 | -4.9 | -0.016 | -3.2 | -0.008 | -2.3 |
| ***Education (Omitted: Tier 1 HS Diploma Grad)*** | | | | | | |
| Tier 1 in HS | 0.093 | 2.7 | -0.001 | -0.1 | -0.007 | -0.6 |
| Tier 1 Adult Ed | 0.249 | 5.6 | 0.313 | 6.4 | 0.300 | 6.4 |
| Tier 1 One Sem Coll | 0.246 | 5.6 | 0.308 | 6.3 | 0.192 | 3.8 |
| Tier 1 Assoc Deg | -0.251 | -3.3 | -0.211 | -2.7 | -0.212 | -2.9 |
| Tier 1 College Deg | -0.211 | -3.5 | -0.143 | -2.5 | -0.140 | -2.5 |
| Tier 2 GED | 0.459 | 16.7 | 0.485 | 15.1 | 0.446 | 10.6 |
| Tier 2 Near Complete | 0.279 | 3.9 | 0.383 | 8.6 | 0.375 | 11.1 |
| Tier 2 HS Attend Cert | 0.362 | 2.5 | 0.351 | 2.3 | 0.288 | 1.7 |
| Tier 3 Non-HSG | 0.458 | 14.7 | 0.511 | 13.9 | 0.277 | 6.1 |
| ***Personal Characteristics*** | | | | | | |
| AFQT Score | -0.004 | -9.8 | -0.002 | -5.3 | -0.003 | -9.4 |
| Male | -0.044 | -2.4 | -0.062 | -3.4 | -0.107 | -8.3 |
| Black | -0.225 | -12.8 | -0.189 | -10.8 | -0.111 | -8.7 |
| Hispanic | -0.147 | -5.8 | -0.154 | -6.3 | -0.119 | -7.0 |
| Other | -0.300 | -10.2 | -0.282 | -9.9 | -0.185 | -9.1 |
| Contract Age | 0.022 | 8.9 | 0.010 | 3.8 | 0.019 | 6.9 |
| Married at Contract | 0.048 | 1.8 | 0.036 | 1.2 | 0.049 | 1.5 |
| Body Mass Index | -0.001 | -0.4 | 0.002 | 0.9 | 0.001 | 1.0 |
| ***Enlistment Term Length (Omitted: 4-YO)*** | | | | | | |
| Three Yr Contract | 0.020 | 1.0 | 0.002 | 0.1 | -0.026 | -1.4 |
| Five Yr Contract | -0.096 | -3.3 | -0.119 | -4.5 | -0.131 | -7.8 |
| Six Yr Contract | -0.184 | -7.0 | -0.177 | -7.1 | -0.128 | -7.6 |
| ***Enlistment Incentives*** | | | | | | |
| Bonus | -0.110 | -3.8 | -0.120 | -4.3 | -0.033 | -1.7 |
| NCF | -0.148 | -5.2 | -0.287 | -10.9 | -0.112 | -6.3 |
| ***State and Zipcode-Level Characteristics*** | | | | | | |
| Percent College | -0.008 | -4.7 | -0.007 | -4.3 | -0.007 | -6.5 |
| Veteran Percent | -0.008 | -4.1 | -0.006 | -3.3 | -0.005 | -3.4 |
| Population Density | 0.006 | 1.9 | 0.006 | 1.7 | 0.005 | 1.7 |
| Family Income | 0.031 | 4.3 | 0.011 | 1.6 | 0.010 | 2.0 |
| ***Military Occupation Group (Omitted: Administrative)*** | | | | | | |
| Combat Arms | -0.240 | -6.9 | -0.155 | -5.1 | -0.100 | -4.6 |
| Electronics | -0.154 | -4.2 | -0.093 | -3.0 | -0.116 | -5.5 |
| Communcations | -0.196 | -4.9 | -0.228 | -6.6 | -0.161 | -7.1 |
| Medical | -0.414 | -8.8 | -0.358 | -8.9 | -0.239 | -9.7 |
| Other Technical | -0.179 | -1.5 | -0.306 | -3.6 | -0.173 | -3.2 |
| Elect Equip Repair | -0.083 | -2.2 | -0.007 | -0.2 | -0.072 | -3.6 |
| Craftsman | -0.186 | -3.7 | -0.138 | -3.3 | -0.079 | -2.9 |
| Supply & Service | 0.041 | 0.9 | 0.071 | 1.7 | 0.019 | 0.7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Not Elsewhere Class | -0.473 | -2.9 | -0.020 | -0.2 | 0.048 | 0.7 |
| Unknown | -0.048 | -1.3 | -0.016 | -0.5 | -0.051 | -2.2 |
| ***Fiscal Year Group (Omitted: FY 1988-89)*** | | | | | | |
| FY 1990-1993 | 0.187 | 9.9 | 0.195 | 10.6 | 0.251 | 18.7 |
| FY 1994-1996 | 0.340 | 14.3 | 0.339 | 14.2 | 0.334 | 18.5 |
| FY 1997-1998 | 0.261 | 9.0 | 0.298 | 9.6 | 0.191 | 8.5 |
| Intercept | -0.511 | -2.2 | -0.901 | -4.0 | -1.156 | -7.2 |
| $\rho$ | 0.500 | | 0.442 | | 0.261 | |
| $\sigma^2_\tau$ | 1.001 | | 0.792 | | 0.353 | |
| Sample Size | 57814 | | 56748 | | 86880 | |
| Log-Likelihood | -62448.1 | | -54924.1 | | -75284.6 | |

**Figure 1. Conditional Taste Distributions**

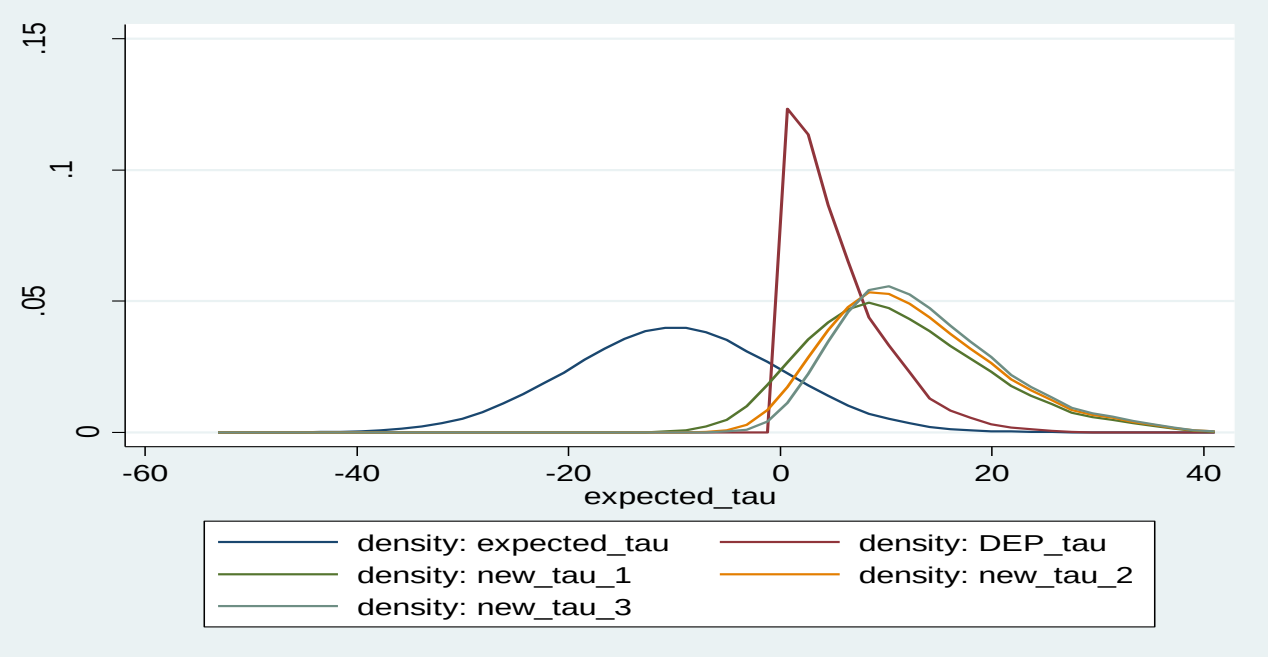


**Figure 2: Predicted Army Attrition by Period**

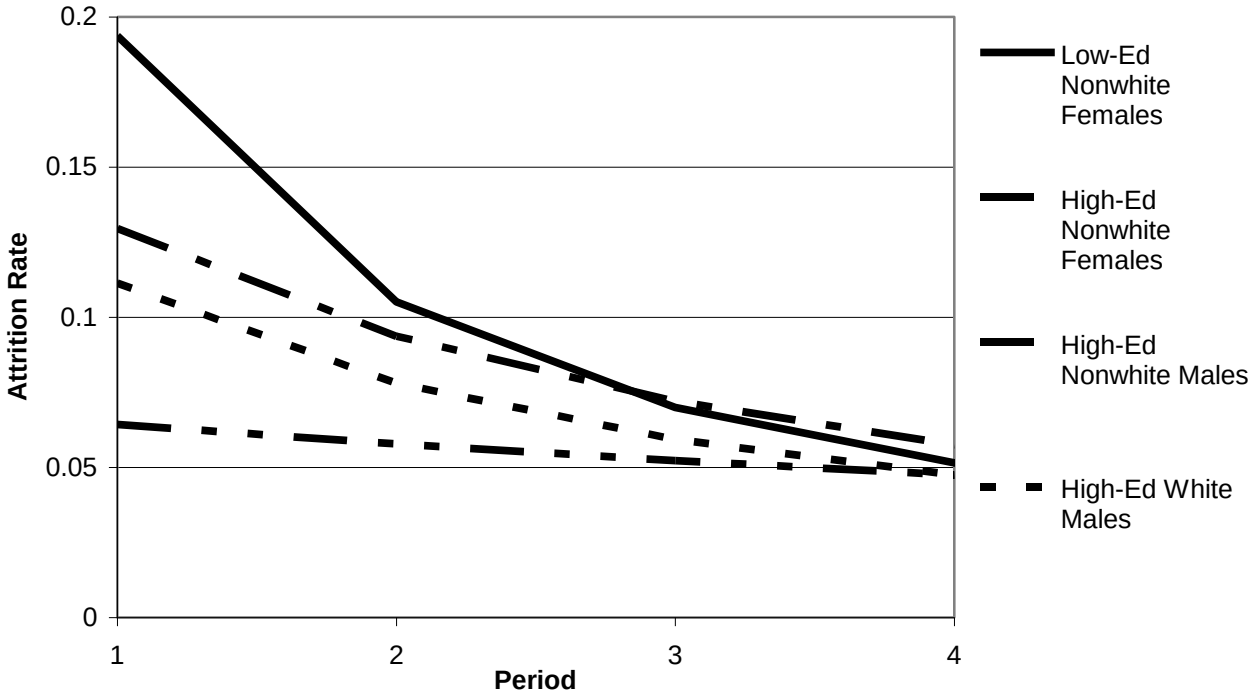

**Figure 3: Predicted Army Attrition Differences Between DEP Groups 1 & 3**
**(Hi Ed = 1, Male = 1, White = 1)**

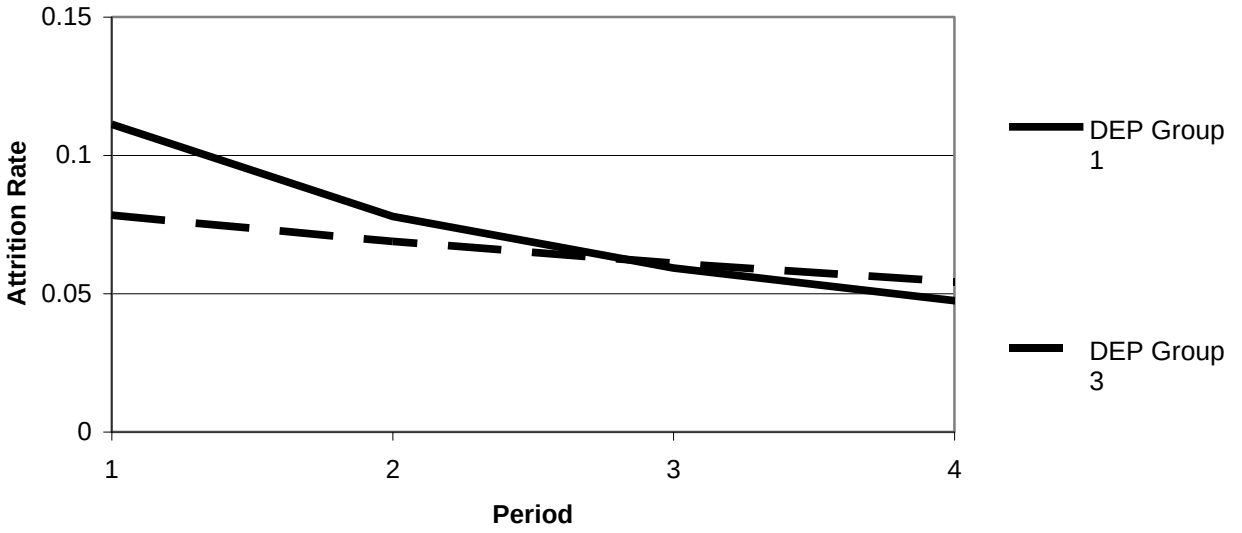


**Figure 4: Predicted Navy Attrition by Period**