Cash Today or College Tomorrow?

Enlistment Incentives and Intertemporal Choice in the Army and Navy *

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ABSTRACT

Human capital investment involves intertemporal tradeoffs. This paper examines the tradeoff by studying the choices of Army and Navy recruits between up-front cash bonuses and future college benefits. The likelihood of choosing the college benefit increases with the size of the college benefit relative to the bonus and with factors associated with future college benefit usage. Factors positively correlated with personal discount rates and with a greater likelihood of reenlistment reduce the likelihood of the college benefit. The estimates indicate that heterogeneity in individuals' underlying preferences remains an important determinant of the variation in economic outcomes.

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A. Introduction

Understanding intertemporal choices is crucial in explaining the observed variations in education, income, and wealth (Fredrick et al., 2002). Data from the U.S. military have often been useful in studying intertemporal choice because they are generated within a comparatively controlled environment. For example, Warner and Pleeter (2001) estimated personal discount rates using data from the military drawdown period of the early 1990s. During that period, a large number of individuals in mid-career at risk for involuntary separation were eligible to choose between two separation packages, one a lump-sum payment and the other a sequence of deferred annuity payments. The ability to examine large numbers of individuals facing similar choice sets provided an ideal opportunity to estimate personal discount rates and examine their correlates.

Intertemporal choice is just as critical for youth, who are still in the process of acquiring human capital. The decision of whether or not to attend college, in particular, is a function of the personal discount rate, as well as innate ability and access to capital markets. Once again, data from the military provide an opportunity to examine within a stark setting the choice between human capital accumulation – that is, deferred consumption – and current consumption.

For many years, the military Services in the United States have used enlistment bonuses (EB) and college fund benefits (CF) to attract new recruits into hard-to-fill skills. Some skills offer only EB, while some others offer only CF, which until recently could only be used upon completion of an enlistment and exit from the military. However, many Army and Navy recruits enter skills that offer both EB and CF options, in which recruits may select one or the other. It is therefore possible to estimate the sensitivity of recruits' choices to the value of EB dollars relative to deferred CF dollars.

The comparatively controlled environment provided by the U.S. military is useful in a number of respects. The observed distribution of income and wealth in society is largely a function of the distribution of human capital, which, in turn is a function of numerous factors including genetic endowment and family background. Individuals who choose to join the military tend to have more in common than randomly chosen individuals in the population as a whole (Warner, Simon, and Payne 2001). With respect to performance in high school, recruits are likely to be drawn from the middle of the class. The households in which military volunteers grow up are more likely to be headed by high school graduates than college graduates, and be from the middle of the wealth distribution and not the top or bottom. This relative homogeneity can potentially reduce the role of otherwise unobservable or difficult to measure variables in generating incentive choices. Despite this homogeneity, however, considerable variation in choices is observed even among recruits who face similar tradeoffs, which suggests that heterogeneity in individuals' underlying preferences remains an important determinant of the variation in economic outcomes.

This paper develops and estimates a simple model of enlistment incentive choice using data on large cohorts of Army and Navy enlistees who were eligible to receive either the EB or CF enlistment incentive. Fluctuations in the value of EB relative to CF across skills and over time, in response to fluctuations in the demand for recruits, give the researcher the opportunity to estimate the responsiveness of youths' choice of enlistment incentive to their relative value. The data also contain information on a number of individual recruit attributes that are likely influence incentive choice through any of three (possibly related) channels: (1) the expected returns to human capital accumulation; (2) individuals' subjective rates of time preference; and (3) the likelihood of reenlistment. This information includes demographics, schooling, AFQT score, and state of residence, the latter making it possible to control for state-specific economic conditions – as measured by relative military pay and the civilian unemployment. These individual-level data are combined with aggregate (state) data on economic conditions that can influence incentive choice through their affects on youth expectations, as well as through the distribution of unobservable (to the researcher) preferences of youth joining the military.

Empirical results indicate that recruits' incentive choices are consistent with the model. Most importantly, the value of the enlistment bonus relative to college fund has a statistically and quantitatively significant (negative) effect on the probability of taking the college fund. In addition, personal attributes associated with a greater likelihood of using college benefits in the future are associated with a greater probability, and factors associated with higher personal discount rates are associated with a lower probability of taking the college fund. Recruits from areas with higher relative military pay – recruits who are more likely to have enlisted for economic reasons – are less likely to take the college fund.

The choice analysis is carried out using data from the period FY 1988 to FY 1998, during which EB and CF were mutually exclusive. Beginning in FY 1999, the Navy began allowing recruits to choose between a pure bonus, a pure college fund, and a combination incentive (Combo) containing reduced amounts of each, followed by the Army in FY 2000. Recruits' choices during the Combo period are found to be consistent with the theory.

B. Background

The Enlistment Incentive Programs

Since the introduction of the All-Volunteer Force (AVF) in 1973, the U.S. military has competed with the civilian labor market for personnel. In contrast to private firms, which can design flexible compensation schemes to attract employees, the U.S. military compensation system must achieve a complex, sometimes conflicting variety of goals (Asch and Warner, 2001). For example, it is institutionally not feasible to attract additional recruits by raising pay for new entrants without adjusting pay throughout the ranks, making across-the-board increases in basic pay a costly recruiting tool.

To compensate for these difficulties, the U.S. Congress has granted the U.S. military Services considerable flexibility to innovate incentive programs to attract new recruits. Army College Fund (ACF), the first and best-known such program, began in the early 1980s. The Army also maintains a sizeable and complex initial enlistment bonus (EB) program, continually adjusting bonuses for specific skills and terms of enlistment in order to achieve recruiting goals.[1]

In contrast to the Army, the Navy did not offer college benefits beyond the basic Montgomery GI Bill (MGIB) until FY 1990, relying instead on initial enlistment bonuses to achieve recruiting goals, the majority of which were targeted to recruits who entered its Nuclear Field program.[2] In 1990, the Navy established Navy College Fund (NCF), beginning with a small-scale program of just two thousand seats, and expanding it over time.

Figure 1 shows the fraction of all high-quality Army recruits and all high-quality Navy recruits receiving CF and the fraction receiving EB since 1987.[3] The trends in these fractions over time mirror trends in the civilian economy as well as trends in overall recruiting targets. The fraction of Army and Navy recruits that received enlistment incentives declined during the downsizing of the U.S. military in the early 1990s and rose as the Services responded to the economic boom and rising college attendance of the late 1990s (Warner, Simon, and Payne, 2001).[4] Figure 1 shows that the fraction of high-quality recruits in both the Army and Navy receiving EB rose sharply in the late 1990s. The fraction of Navy recruits receiving the NCF rose as well, although the fraction of Army recruits receiving ACF declined.

The use of bonuses has increased over time in both the Army and Navy. Although a full analysis is beyond the scope of this paper, it is worth noting that military manpower planning requires not only attracting new recruits, but in achieving reenlistment targets, particularly in skills that involve high training costs. Expanding CF eligibility or dollars increases the supply of recruits, but may reduce the incentive to enlist, or succeed in attracting recruits less interested in reenlistment. We speculate that this consideration has led the military to increase the number of skills and enlistment terms eligible for EB while keeping eligibility for CF relatively constant. As the value of EB rose relative to the value of CF, particularly in the Navy, the fraction of recruits opting for CF in skills that offered both options fell.

The Data

Army data were provided by the U. S. Army Recruiting Command (USAREC), and consist of all recruits entering skills and enlistment terms eligible to receive EB, ACF, or the Combo over fiscal years (FY) 1988-2000 (124,591 individuals).[5] Navy data were obtained from the Defense Manpower Data Center (DMDC), whose enlistment contract information was supplemented with information from the U. S. Navy Recruiting Command. The Navy sample consists of personnel entering Navy occupations (ratings) that were apparently eligible for either NCF or EB during the period FY 1995-2001. We say "apparently" because, unlike the Army, the Navy has not kept historical records of which ratings were eligible for the NCF. Nevertheless, it is clear from inspection of the data that Navy recruits in the Nuclear Field and the Advanced Electronics Field were eligible for either NCF or EB almost continuously since 1995. Furthermore, a handful of other highly technical ratings requiring 5 or 6-year enlistments were eligible for either NCF or EB during certain periods since 1995. Pooling all such individuals eligible for either NCF or EB resulted in a sample of 45,429 individuals.

Figures 2 and **3** plot the fractions of Army and Navy recruits eligible for CF or EB who selected the college fund benefit, along with the relative value of CF (CF/EB). In order to understand these figures and what follows, it is essential to understand that CF consists of two components. The normal college benefit -- the so-called Montgomery GI Bill (MGIB) benefit -- is available to all recruits, regardless of whether they receive EB, CF, or any enlistment incentive at all. CF programs augment the MGIB college amount with a Service (Army or Navy-funded) "kicker" amount. To take a concrete example, most ACF-eligible Army skills offer benefit amounts of $40,000 or $50,000 for an enlistment of 4 or more years. As of October 2001, the MGIB benefit for a 4-year Army recruit stood at $23,400. The ACF kicker amount was therefore equal to $16,600 for recipients of the $40,000 Army College Fund and $27,600 for recipients of the $50,000 Army College Fund.

The figures also plot the average ratio of EB to the College Fund Kicker (CFK). Because a recruit is eligible for the basic Montgomery GI Bill benefit whether she chooses EB or CF, the CFK appropriately measures the benefit of the CF option relative to EB, and not the entire amount.[6] Recruits should be more likely to elect to receive EB when its value rises relative to CFK.[7]

Over the period FY 1988-98, 46 percent of Army recruits in the sample eligible for either EB or ACF chose ACF. After rising between 1988 and 1992, the fraction selecting ACF has declined steadily (Figure 2). The early increase is apparently a result of factors other than the size of the average bonus payment relative to the ACF kicker. Over the 1988-1992 period, the average bonus payment hovered around 20-25 percent of the average ACF kicker amount. Since 1992, the average EB payment has risen to over one-third of the average ACF kicker by FY 1998. Only 13 percent of recruits eligible for either EB or ACF chose ACF in FY 2000, but about one-quarter of Army recruits eligible for EB, CF, or the Combo selected the Combo.

Over the pre-Combo period, about 45 percent of Navy recruits eligible for EB or NCF chose NCF (Figure 3). Despite a rise in the relative value of EB, the fraction taking the NCF was fairly stable. Between FY 1998 and FY 2001 period, however, EB/CFK rose from about one-third to nearly one-half. The fraction choosing NCF dropped from about 50 percent in FY 1998 to less than 10 percent in 2001. Although some of the drop is associated with a rise in the fraction of Combo takers, NCF and Combo takers combined accounted for less than 20 percent of the 1999-2001 cohort.

C. A Model of Incentive Choice

Recruits must choose between an immediate cash payment on the one hand, and the option to receive a given nominal amount of college benefits in the future. Future college benefits are discounted according to each recruit's personal discount rate (*d*) and the individual's expected length of military service (*n*). Since a substantial fraction of recruits will eventually choose to reenlist after their initial term of enlistment, *n* measures the individual's expected period of service upon entry and not just the length of the initial term.[8] An additional consideration is that only about half of military entrants ever use their college benefits.[9] Since educational benefit usage is not certain, a recruit is assumed to anticipate attending college after service with probability θ, where θ is implicitly a function of the return to education, career and family expectations, and the probability of reenlistment.

Recruits are assumed to maximize expected log-additive utility. For a recruit who enjoys period-1 (enlistment) consumption of C_1 and period-2 (post-enlistment) consumption of C_2, utility is given by $U = \ln(C_1) + \frac{\ln(C_2)}{(1+d)^n}$. Period-1 consumption is limited to military earnings.

Post-enlistment consumption (C_2) may be thought of as the present value of all post-service consumption the individual will enjoy without any post-service schooling (discounted to the date of separation). Implicit in any individual's lifetime utility maximization is a path of optimal human capital investment that equalizes the marginal benefit of investment in each time period with the marginal cost of investment. Since we do not observe the paths of post-service investment or earnings, little is to be gained by explicitly modeling these variables in the post-service period. It is sufficient for the purpose of explaining the initial incentive choice to let the recruit believe that each dollar of educational benefits earned during the initial enlistment and used during the post-service period will increase the present value (at separation) of period 2 consumption by the factor ρ.

Consider now the effects of enlistment incentives on expected utility. All recruits are eligible for a basic Montgomery GI Bill college fund benefit (MGIB). A recruit who receives an enlistment bonus therefore enjoys first period consumption equal to C_1+EB, second-period consumption C_2 + ρMGIB with probability θ, and second-period consumption of C_2 with probability 1-θ.[10] A recruit who chooses the bonus has expected utility of

$$E(U_{EB}) = \ln(C_1 + EB) + \frac{1}{(1+d)^n}\left[\theta \ln(C_2 + \rho MGIB) - (1-\theta)\ln C_2\right].$$

A recruit who receives the college fund consumes C_1 in period 1, C_2+ρ(MGIB+CFK) in period 2 with probability θ, and C_2 with probability 1-θ. Such a recruit has expected utility of

$$E(U_{CF}) = \ln C_1 + \frac{1}{(1+d)^n}\left\{\theta \ln[C_2 + \rho(MGIB + CFK)] + (1-\theta)\ln C_2\right\}.$$

A recruit chooses CF if $E(U_{CF}) > E(U_{EB})$ or, after some simplification, if

$$\frac{\theta}{(1+d)^n}\ln\left[1 + \frac{CFK}{C_2 + \rho MGIB}\right] \geq \ln\left[1 + \frac{EB}{C_1}\right]. \quad (1)$$

Provided that *d*, CFK/(C_2+MGIB) and EB/C_1 are small, and taking natural logs, the recruit chooses CF when

$$\ln R - nd + \ln\theta\rho - \ln\left(\frac{C_2 + \rho MGIB}{C_1}\right) \geq 0. \quad (2)$$

where R = CFK/EB is the relative value of the college fund kicker. The likelihood of taking the college fund is increasing in R and ρθ, and decreasing in *n*, *d*, and MGIB.[11]

To convert equation (2) into a form appropriate for econometric estimation, assume for the moment that all of the variables are observable with the exception of certain unobservable factors that influence incentive choice that are assumed to be summarized by the random error term -ε.[12] An individual recruit i chooses the college fund provided that

$$\ln R_i - n_i d + \ln \theta_i \rho_i - \ln\left(\frac{C_2 + \rho_i MGIB}{C_1}\right) - \varepsilon_i \geq 0 \tag{3}$$

When ε~N(0, σ), equation (4) can be estimated using probit after normalizing by 1/σ, in which case the probability of choosing college fund is given by

$$\Pr(choose\,CF) = \Pr\left(-\frac{1}{\sigma}\ln\left(\frac{C_2 + \rho_i MGIB}{C_1}\right) + \frac{\ln R_i}{\sigma} + \frac{d}{\sigma}n_i + \frac{\ln \theta_i \rho_i}{\sigma} > \frac{\varepsilon_i}{\sigma}\right) \tag{4}$$

Several remarks are in order regarding equation (4). First, because θρ is not observable, ln*θρ* is replaced with a vector X_i of observable personal attributes and other economic factors that are associated with the likelihood of, and returns to, choosing the college fund. Second, the role played by unobservable heterogeneity can adduced by noting that the inverse of the estimated coefficient on ln*R* yields an estimate of σ; the greater the dispersion of unobservable factors, the less responsive are recruits' choices to the relative incentive amount *R*. Interestingly, though, in the absence of such heterogeneity, the effect of ln*R* is not identified![13] Third, although equation (4) suggests that MGIB be included as a regressor, we have opted instead to include FY dummies in order to pick up otherwise unobservable trends in the fraction of recruits choosing college fund. Because there is little variation within FY in MGIB (particularly holding *n* constant), the variable was dropped from the analysis. Finally, the estimate of σ (the inverse of the estimated coefficient on R) can, in principle, be combined with the estimated coefficient on the term of enlistment n_i to obtain an estimate of the discount rate in the sample, *d*. However, given the highly stylized nature of the model, this result should not be taken literally. To the extent that d and θ are negatively correlated, the estimated coefficients on the variables in X_i will tend to capture variation across individuals in both d and θ.

C. Empirical Analysis

Econometric Issues

Underlying similarities between recruits that are not observable to the researcher are likely to exist. One of the most important regards the transferability of military skills to the civilian sector, which varies by military skill (that is, occupation) (Goldberg and Warner, 1987), which affects the probability of reenlistment and hence the probability of using college benefits. Recruits within a skill may also have similar underlying discount rates, as well as tastes for work and human capital accumulation. For this reason, the error term for each individual is assumed to be given by $\varepsilon_i = \varepsilon_s + \varepsilon'_i$ where ε_s is a skill-specific influence on the recruit's incentive choice that is common to all recruits entering skill s and ε'_i is the remaining error (and is assumed to be independent of ε_s). The presence of ε_s in the error ε presents two difficulties.

First, ε_s might be correlated with the other variables included in the model, in which case the parameter estimates will be inconsistent. Such potential inconsistency can be alleviated by including skill fixed effects (occupation dummies) in the estimated model. Because the estimates from the fixed effects models were so similar to those from models without fixed effects, only the latter are reported.[14]

Second, the existence of the common component means that the observations within a skill are no longer independent, in which case standard formulae for estimating variances and covariances of the parameter estimates will tend to understate their true sampling variability. To avoid this pitfall, the standard errors of the estimates reported in Table 1 were obtained by clustering on the occupations which recruits entered.[15]

Probit Estimates of the Incentive Choice Model

Summary statistics for the variables in the model appear in **Appendix Table 1**. Probit estimates of the Army and Navy incentive choice models are contained in **Table 1**, along with estimates of ΔP (the change in the probability of selecting CF due to a change in each variable), and the asymptotic t-statistic. Each model controls for education status at the time of entry (the omitted category is high school graduate), age, AFQT, race/ethnic group (the omitted category is white), gender, term of enlistment (the omitted Army category is 3-year obligor [3-YO], and the omitted Navy term category is 5-YO), and fiscal entry year, which control for time-related factors that are unobservable in the data. The Army data span the years FY1988-1998; the omitted Army fiscal year is FY 1992. The Navy data span the years FY 1995-1998; the omitted Navy fiscal year is FY 1995.

Because the returns to college are higher when completed earlier in life, one expects individuals who chose not to attend college early on to be less likely to choose the CF option, an intuition that receives support in the data. For example, individuals who were high school seniors at the time of contract were more likely to choose CF than high school graduates (15.1 percentage points in the Army, 12.0 in the Navy); high school graduates are more likely to have entered the civilian labor market by the time they decided to join the military. Similarly, each year of age reduces the likelihood of CF choice in the Army by an estimated 2.8 percentage points, and in the Navy by 2.1 percentage points.

One expects longer enlistment terms to be associated with lower likelihoods of choosing CF because (1) the longer the enlistment term the longer the waiting period for the benefits and (2) longer-term enlistees are more likely to pursue a military career after the initial enlistment and thus less likely to anticipate using CF benefits. Army 3-YOs were about 34 percentage points more likely to choose CF than 4-YOs; 5 and 6-YOs were 36 percentage points less likely.

One expects individuals with higher expected returns to college to be more likely to choose CF. Not surprisingly, then, college graduates were less likely to choose CF relative to high school graduates (0.20 in the Army, 0.17 in the Navy).[16] Nor is it surprising that individuals with higher AFQTs were more likely to choose CF. Each 10 points of AFQT increased the likelihood of choosing ACF by 0.5 percentage points, and NCF by 0.2 percentage points.[17]

Males enlisting in both services were less likely to choose the college fund than female recruits (about 7.7 percentage points less in the Army and 5.4 percentage points less in the Navy). This gender difference may reflect females' intentions to acquire relatively more education in the future, but it could also reflect gender differences in personal discount rates.[18] Recruits who were married at the time of contract were also less about 11 (Navy) to 20 (Army) percentage points less likely to select the college fund, a difference that could reflect differences in perceived returns to education or differences in personal discount rates.[19]

Significant racial variation in the propensity to choose the college fund exists in the Army, with Blacks less likely, and Hispanics and Other race groups more likely, than Whites to select ACF. There is less racial variation in the Navy. In fact, Blacks in the Navy sample were more likely than Whites to select the NCF.

Three variables in the model measure the relative benefits of participation in the civilian labor market: (1) an index of military pay relative to average earnings of high school graduates aged 18-24 in the recruit's state of residence, (2) the unemployment rate in the recruit's state of residence at the time of contract, (3) the youth population per square mile in the recruit's state of residence, and (4) the fraction of the state's youth population who have graduated from high school and are attending college. Higher relative pay is associated with a smaller fraction of CF takers. A 10 percent increase in relative pay was associated with a fall in percent taking ACF of 2.7 points, and a fall in the percent taking NCF by 3.6 points. Higher unemployment is associated with a greater tendency to take CF, but the estimated effect was much larger in the Navy (2.6 points increase for a of a one percentage point increase in the unemployment rate) than the Army (0.3 points). Army recruits from more densely populated areas were less likely to choose the college fund. (The Navy estimate was positive and statistically insignificant.)

Interestingly, Army recruits from states with larger fractions of youth enrolled in college were more likely to take CF. This could reflect the importance of "neighborhood effects" on recruits' incentive choices, but could also merely reflect a similarity in the distribution of underlying preferences for human capital acquisition. (The Navy estimate is negative and insignificant.)

Table 1 reports the coefficient on ln(EB/CFK), which equals -ln*R* in equation (4). Two specifications were estimated for the Army. In the first, ln(EB/CFK) was entered alone; in the second, it was interacted with enlistment term length.[20] Considering the non-interactive specification (Model 1) first, ln(EB/CFK) exerted a powerful negative effect on the likelihood of selecting the college fund. Evaluated at the sample means, a 10 percent increase in EB/CFK is estimated to reduce the probability of choosing ACF by 8.2 points.[21] Because the average Army EB was $5,800 and the average ACF kicker was $17,206 (both amounts in FY 2000 dollars), a 10 percent increase in the ratio EB/CFK corresponds to an EB increase of about $1,900. The average value of EB/CFK increased in the Army from just over 0.2 to about 0.35 in 1998 (see Figure 3), which implies a decline in the fraction taking ACF of about 12 percentage points, or about half the decline observed over the period FY 1992-1998. In the Navy, a 10 percent increase in the relative bonus (an EB increase of about $2,100) is estimated to reduce the likelihood of taking NCF by 5.4 points.

According to equation (4), (minus) the estimated coefficient on ln(EB/CF) provides a measure of $1/\sigma$, which measures the degree of unobserved heterogeneity in the population of recruits. In the case of the Army, this is equal to 1.4, and in the Navy, 1.75. To put these estimates in perspective, the standard deviation of ln(EB/CFK) is equal to 0.48 in the Army sample and 0.58 in the Navy sample. Hence, the estimated dispersion in unobserved heterogeneity is roughly three times as large as the dispersion in relative price.

Turning to the interactive specification (Model 2), the estimated coefficients on the interaction terms in the Army equation are highly significant. The (proportionate) effect of a change in EB/CFK is based on the sum of the main effect coefficient and the term interaction coefficient. The estimate for 4-YOs, minus 8.1 points, is nearly identical to the Model 1 estimate, which is not surprising considering that roughly 90 percent of the Army recruits in the sample were 4-YOs. The effect for 5 and 6-YOs were about the same as for 4-YOs (-8.2

points).[22] However, each 10 percent increase in EB/CFK is estimated to reduce the likelihood that a 3-YO enlistee takes ACF by only 1.8 percentage points, suggesting that their career expectations differ markedly from those of their longer-term counterparts.

Interpreting Incentive Choices during the Combo Period

It can be seen in **Figures 2 and 3** that significant percentages of Army and Navy recruits now choose a combination of EB and CF. In contrast to the EB-only and CF-only incentives, the Combo incentive typically offers a reduced bonus (EBC) in return for a CF kicker (CFKC) that is usually smaller than the kicker-only amount (CFK). A recruit who chooses the Combo incentive forgoes (EB-EBC) in bonus money gets the amount CFKC in return and a recruit who foregoes (CFK-CFKC) in college fund money receives EBC in return.

In terms of the simple two-period model outlined earlier, the expected utility of a recruit who selects the Combo is given by

$$E(U_{CB}) = \ln(C_1 + EBC) + \frac{1}{(1+d)^n}\{\theta \ln[C_2 + \rho(MGIB + CFKC)] + (1-\theta)\ln C_2\}.$$

A recruit will choose the Combo $E(U_{CB}) > E(U_{CF})$ and $E(U_{CB}) > E(U_B)$ hold. Some algebra reveals that the Combo dominates CF provided that

$$\Delta_{CB,CF} = \ln\left(\frac{C_2 + \rho(M + CFKC)}{C_1}\right) - \ln\theta\rho + nd - \ln\left(\frac{CFK - CFKC}{EBC}\right) \geq 0 \qquad (5)$$

In equation (5), (CFK-CFKC)/EBC is the rate at which a recruit may trade CF dollars for (Combo) bonus dollars. The higher this ratio, the lower is the incentive to forego CF in favor of the Combo. In addition, $\Delta_{CB,CF}$ (the incentive to take the Combo rather than CF) increases with n and d, and decreases with $\rho\theta$. Similarly, the Combo dominates EB if

$$\Delta_{CB,EB} = \ln\left(\frac{CFKC}{EB - EBC}\right) + \ln\theta\rho - nd - \ln\left(\frac{C_2 + \rho MGIB}{C_1 + EBC}\right) \geq 0 \qquad (6)$$

In equation (6), CFKC/(EB-EBC) is the rate at which a recruit receives (Combo) college fund dollars by foregoing bonus-only dollars. The higher is this ratio, the greater the incentive to take the Combo rather than EB. As can be seen, $\Delta_{CB,EB}$ (the incentive to take the Combo rather than EB) increases with $\rho\theta$, and decreases with n and d.

There were too few observations to reliably estimate the three-way choice between EB, CF, and Combo incentives in our samples. It is, however, illuminating to examine recruits' choices as functions of the relative benefit ratios in equations (5) and (6). **Table 2** shows the average incentive amounts for which bonus takers, college fund takers, and Combo takers were eligible and average values of the benefit ratios CFK/EB, CFKC/(EB-EBC), and (CFK-CFKC)/EBC they faced. These ratios vary depending on the specific skills and enlistment term lengths, as well as the programs in force at the particular time recruits enlisted.

Army recruits who chose EB-only received an average EB of $8,700. They could have opted for an average ACF-only kicker of $27,500, meaning that they could have received $3.20 in CF for every dollar of EB. Had they chosen the Combo, they would have received an average kicker of $12,800 and a bonus of $5,800, meaning that they would have received $4.40 in CF for every dollar of EB foregone. Although the Combo incentive offered a better return on foregone EB dollars than the ACF-only option, equation (6) – taking the model at face value -- was still negative.

ACF takers, by contrast, received $6.20 in CF for each dollar of EB foregone. The Combo would have allowed these individuals to purchase $1 of EB for $7.00 of CF. Again, taking the model at face value, equation (5) was nevertheless still negative for this group. Importantly, ACF takers received nearly twice as many CF dollars per dollar of EB foregone as EB takers (6.2 versus 3.2).

Figure 3 indicates that about 25 percent of Army recruits in our sample selected the Combo in FY 2000. Table 2 explains why. Combo takers could have received a pure EB worth an average of $8,700. By foregoing an average of $1,900 in EB, they received $20,700 in CF kickers, or $7.10 in CF for every dollar of EB foregone. By contrast, the tradeoff between pure ACF and pure EB options for Combo takers was only $3.50 in CF money per dollar of EB foregone.

Table 2 also suggests why a much higher fraction of the FY 1999-2000 Navy recruits -- about 80 percent -- selected pure EB. Navy EB takers would have received $2.20 of pure NCF per dollar of pure EB foregone, much less than their Army counterparts. Table 2 also shows why some Navy recruits switched to the Combo. Each dollar of pure EB foregone would earn $1.50 of pure NCF, while each dollar of Combo EB foregone was compensated for by $3.10 in Combo CF. Moreover, no CF dollars had to be foregone at all to receive Combo EB dollars! Only about 10 percent of Navy recruits took the pure NCF incentive, which is not surprising considering the relatively low rate of exchange between pure EB and pure NCF (2.2).

E. Conclusion

This paper has developed and estimated a simple model of incentive choice for Army and Navy recruits who were eligible to receive either an up-front enlistment bonus or deferred college benefits. Consistent with economic theory, recruits' incentive choices were sensitive to relative incentive amounts. In addition, incentive choice was significantly related in predictable fashion to individual characteristics associated with the likelihood of future human capital accumulation and personal discount rates.

These results should be inherently of interest to economists, policymakers, and managers of incentive programs. They also highlight the role of individual heterogeneity in generating differences in observed economic outcomes. The degree of heterogeneity is perhaps even more surprising in light of the fact that individuals who enlist in the military are a fairly select group, with broad similarities in academic, family, and financial background.

Future research can take at least two directions. First, it would be of interest to study the post-military careers of cohorts of individuals who entered the military at similar points in time, and in particular, the role played by college benefit programs in affecting subsequent education and income. Second, it is important to understand how incentive programs affect military career outcomes. Policy makers are particularly concerned with attrition, both prior to reporting to duty, as well as in service.

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Figure 1
Fraction of Army and Navy High-Quality Recruits Receiving Enlistment Incentives, FY 1988-2001

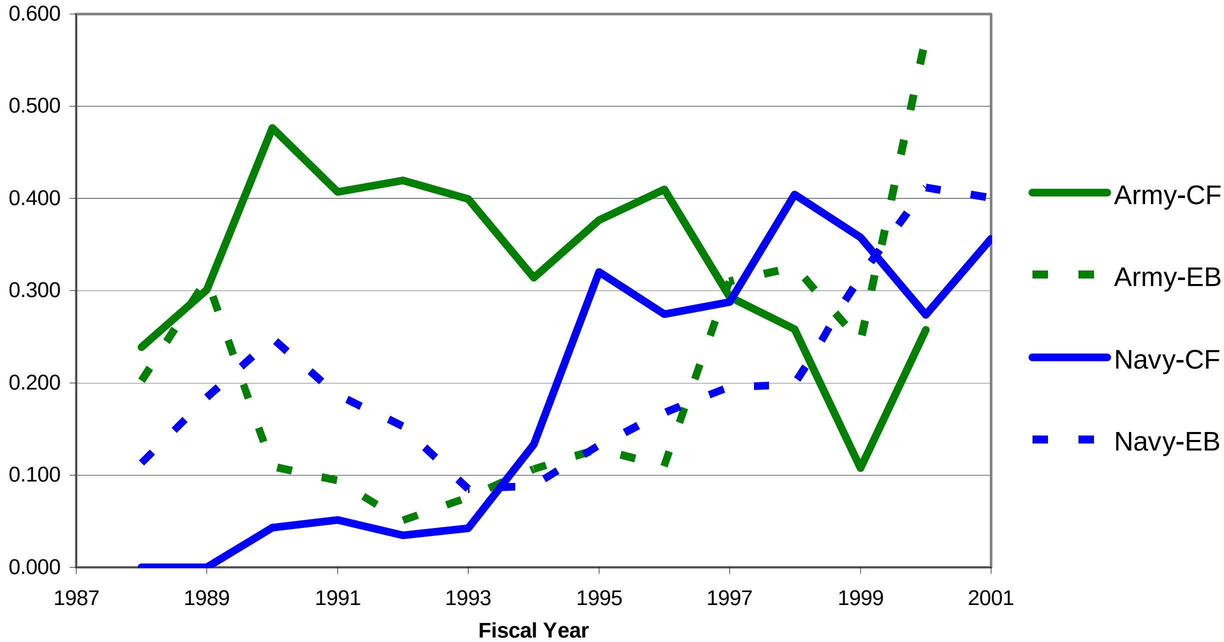

Figure 2
Army EB Relative to ACF Kicker and Fraction of Recruits Eligible for Both Incentives Choosing ACF, By FY

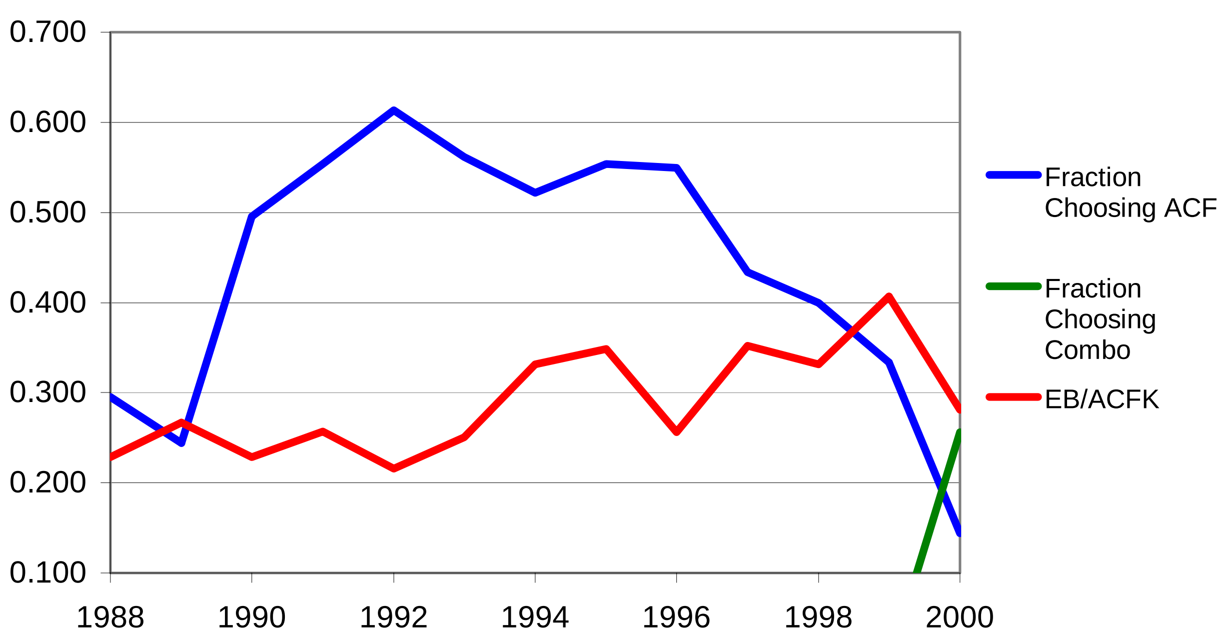

Figure 3
Navy EB Relative to NCF Kicker and Fraction of Recruits Eligible for Both Incentives Choosing NCF, By FY

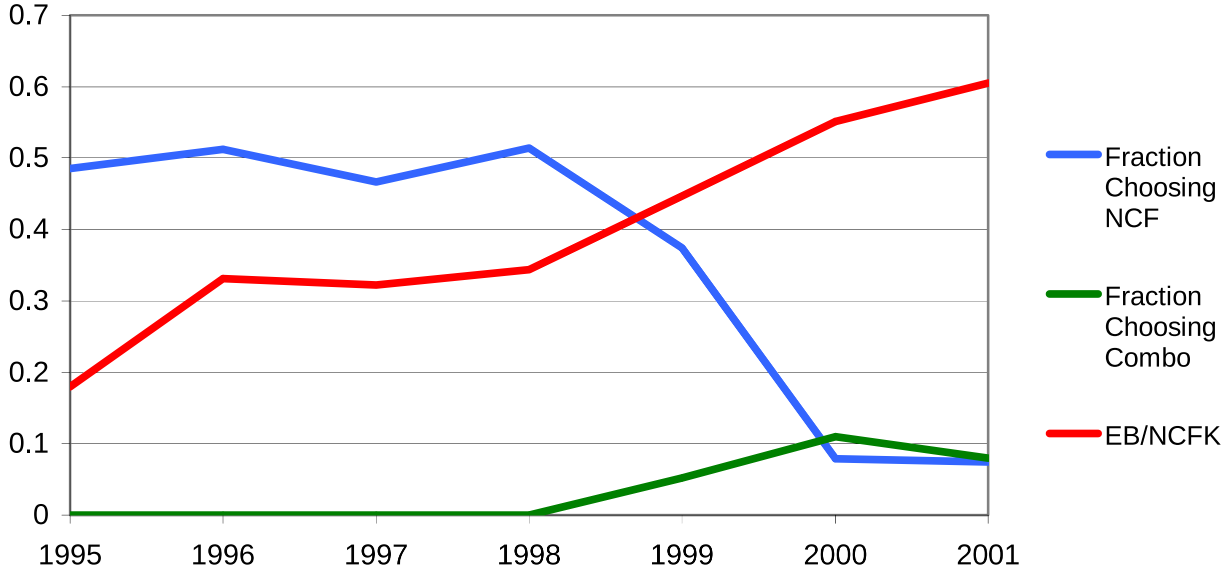

Table 1
Probit Models of Incentive Choice of Army and Navy Enlistees Eligible for CF and EB (Dependent Variable = Selected College Fund)

	Army						Navy		
	Model 1			Model 2			Model 1		
Variable	**Estimate**	**ΔP**	**t-Stat**	**Estimate**	**ΔP**	**t-Stat**	**Estimate**	**ΔP**	**t-Stat**
Intercept	-0.4628		-1.31	-0.3983		-1.14	0.2440		0.53
High School Senior	0.3929	0.151	28.51	0.3929	0.151	28.60	0.3126	0.120	11.27
Attended College	0.0428	0.016	1.97	0.0430	0.017	1.95	-0.2966	-0.114	-5.19
Adult Diploma	-0.1098	-0.042	-5.21	-0.1098	-0.042	-5.26			
Associate Degree	0.0256	0.010	0.66	0.0204	0.008	0.53	0.0048	0.002	0.08
College Degree	-0.4972	-0.191	-3.01	-0.4955	-0.191	-2.99	-0.4461	-0.172	-17.95
Age	-0.0730	-0.028	-18.88	-0.0730	-0.028	-18.74	-0.0548	-0.021	-8.10
AFQT	0.0138	0.005	12.20	0.0136	0.005	12.68	0.0048	0.002	2.73
Male	-0.1972	-0.076	-2.59	-0.2105	-0.081	-2.81	-0.1410	-0.054	-2.03
Married	-0.5323	-0.205	-32.82	-0.5334	-0.205	-33.49	-0.2967	-0.114	-5.32
Black	-0.1063	-0.041	-1.26	-0.1051	-0.040	-1.25	0.1210	0.047	4.93
Hispanic	0.1396	0.054	2.36	0.1395	0.054	2.37	0.0265	0.010	1.06
Other Race	0.2241	0.086	3.62	0.2243	0.086	3.65	0.0372	0.014	0.96
FY1988	-0.9095	-0.350	-2.29	-0.9131	-0.352	-2.30			
FY1989	-1.0047	-0.387	-3.36	-1.0107	-0.389	-3.37			
FY1990	-0.3880	-0.149	-4.29	-0.3946	-0.152	-4.36			
FY1991	-0.1228	-0.047	-2.34	-0.1299	-0.050	-2.45			
FY1993	-0.0698	-0.027	-0.48	-0.0720	-0.028	-0.49			
FY1994	-0.1360	-0.052	-0.89	-0.1552	-0.060	-1.02			
FY1995	-0.0898	-0.035	-0.82	-0.1185	-0.046	-1.13			
FY1996	-0.2371	-0.091	-1.78	-0.2459	-0.095	-1.92	0.4982	0.192	4.70
FY1997	-0.3762	-0.145	-1.66	-0.3982	-0.153	-1.73	0.3061	0.118	4.37
FY1998	-0.5556	-0.214	-2.34	-0.5557	-0.214	-2.28	0.4250	0.164	5.59
Army 3-YO	0.8854	0.341	12.70	1.5315	0.590	11.51			
Army 5 or 6-YO	-0.9411	-0.362	-3.60	-1.9681	-0.758	-3.44			
ln(EB/CFK)[1]	-0.7077	-0.082	-9.46	-0.2185	-0.018	-2.11	-0.5676	-0.054	-6.99
ln(EB/CFK)*4-YO[1]				-0.4745	-0.081	-4.40			
ln(EB/CFK)*5-6YO[1]				-1.1396	-0.082	-3.71			
Rel Mil Pay[1]	-0.6743	-0.260	-5.91	-0.6812	-0.262	-5.95	-0.9399	-0.362	-2.16
Unemployment Rate	0.0071	0.003	1.92	0.0071	0.003	1.91	0.0667	0.026	11.53
Percent in College	0.0165	0.006	7.22	0.0165	0.006	7.16	-0.0029	-0.001	-5.25
Population Density[2]	-0.9000	-0.347	-4.35	-0.9000	-0.347	-4.35	0.7000	0.270	0.87
Sample Size	120,865						29,177		
Mean CF Take Rate	0.464						0.447		
Log-Likelihood	-67,092.2			-66,918.6			-18,199.4		

[1]Effect of a 10% increase in variable. EB/CFK effects in Model 2 are evaluated at the term-specific mean CF take rates (.80 for 3-YOs, .45 for 4-YOs, and .15 for 5&6-YOs).
[2]Population density measured in 1,000s.

Table 2

Average Incentive Amounts (in $1,000s) and College Fund-Enlistment Bonus Trade-Offs, Army and Navy Recruits Eligible for Both Incentives During the Combo Period

	Mutually Exclusive CF, EB		Combo Amounts		Price Ratios		
Army in FY 2000	**CFK**	**EB**	**CFKC**	**EBC**	**CFK/EB**	**CFKC/ (EB-EBC)**	**(CFK-CFKC)/ EBC**
EB Takers	$27.5	$8.7	$12.8	$5.8	3.2	4.4	2.5
ACF Takers	$24.2	$3.9	$4.7	$2.8	6.2	4.3	7.0
Combo Takers	$30.7	$8.7	$20.7	$5.8	3.5	7.1	1.7
Navy in FY 1999-2000							
EB Takers	$20.0	$9.2	$12.8	$4.8	2.2	2.9	1.5
NCF Takers	$16.0	$7.3	$12.8	$4.2	2.2	4.1	0.8
Combo Takers	$13.4	$8.9	$13.4	$4.6	1.5	3.1	0.0

Appendix Table 1: Summary Statistics

	Army				Navy			
Variable	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Demographics								
High School Senior	0.364	0.481	0	1	0.395	0.489	0	1
Attended College	0.026	0.158	0	1	0.001	0.025	0	1
Adult Diploma	0.019	0.138	0	1	…	…	…	…
Associate Degree	0.011	0.106	0	1	0.014	0.117	0	1
College Degree	0.024	0.154	0	1	0.022	0.148	0	1
Age	19.90	2.88	17	35	19.08	2.47	17	35
AFQT	69.51	13.74	50	99	83.22	10.32	50	99
Male	0.907	0.290	0	1	0.958	0.202	0	1
Married	0.118	0.323	0	1	0.033	0.178	0	1
Black	0.118	0.322	0	1	0.084	0.277	0	1
Hispanic	0.051	0.220	0	1	0.066	0.249	0	1
Other Race	0.032	0.175	0	1	0.069	0.253	0	1
Enlistment Length								
Army 3-YO	0.082	0.275	0	1	…	…	…	…
Army 5 or 6-YO	0.038	0.191	0	1	…	…	…	…
Relative Value of College Fund								
ln(EB/CFK)	-1.365	0.476	-2.759	-0.196	-1.345	0.576	-2.736	-0.253
ln(EB/CFK)*4-YO	-1.206	0.634	-2.708	0	…	…	…	…
ln(EB/CFK)*5-6YO	-0.048	0.266	-2.708	0	…	…	…	…
Military/Civilian Career								
Rel Mil Pay	1.044	0.065	0.815	1.22	1.060	0.048	0.969	1.18
Unemployment Rate	5.662	1.396	2.100	11.90	5.122	1.103	2.300	9.30
Percent in College	61.598	5.403	48.560	76.49	63.662	5.243	53.208	76.49
Population Density	12.157	20.550	0.058	645.44	11.937	18.023	0.058	553.08
Years								
FY1988	0.086	0.281	0	1	…	…	…	…
FY1989	0.114	0.317	0	1	…	…	…	…
FY1990	0.100	0.301	0	1	…	…	…	…
FY1991	0.074	0.262	0	1	…	…	…	…
FY1993	0.066	0.249	0	1	…	…	…	…
FY1994	0.069	0.253	0	1	…	…	…	…
FY1995	0.089	0.285	0	1	…	…	…	…
FY1996	0.072	0.258	0	1	0.238	0.426	0	1
FY1997	0.127	0.333	0	1	0.293	0.455	0	1
FY1998	0.152	0.359	0	1	0.291	0.454	0	1

Footnotes

[1] The average Army initial enlistment bonus (EB) for recruits (conditional on receiving a bonus) in FY 2000 was about $7,800.

[2] Also in contrast to the Army, the Navy required EB recipients to enlist for terms of 5 or 6 years.

[3] High-quality recruits are high school graduates who score 50 or better on the Armed Forces Qualification Test (AFQT). Prior to 1998, recruits had to be high-quality to be eligible for an enlistment incentive. In the face of recruiting difficulties in the late 1990s, the Army and Navy began offering EB to some high school graduates who scored between 35 and 49 on the AFQT.

[4] Warner, Simon, and Payne (2001) estimated the elasticity of high-quality enlistment with respect to unemployment to be about 0.35. The drop in the unemployment rate from 6 percent in 1995 to 4 percent in 2000 is estimated to have reduced high-quality enlistment by about 10 percent, amounting DoD-wide to 14,000 high-quality recruits per year. They also estimated that the rise in college attendance from 1987-1997 reduced enlistments by a similar amount.

[5] In principle, the Army pre-Combo data extend through fiscal year (FY) 1999. But due to a change in enlistment contract reporting systems in FY 1999, not all recruits who received an enlistment incentive could be identified. We therefore use FY 1988-1998 data in the incentive choice analysis.

[6] Recruits by default receive Montgomery GI Bill college benefits, with the proviso that they contribute $100 per month during the first year of enlistment. Recruits may elect *not* to receive these benefits by signing a waiver. In practice, participation is nearly universal.

[7] The institutional structure of the college benefit programs potentially plays an important role in the choice of incentive. Kicker amounts are based on the difference between the total ACF or NCF dollar benefit and the Montgomery GI Bill dollar benefit in effect at the time of the enlistment contract. By law, the Montgomery GI Bill college benefit has been indexed to inflation since 1993. (In practice, this indexation is not perfect, and in some years did not occur at all.) As the nominal Montgomery GI Bill benefit rises over time, the kicker amounts paid by the Services decline. For example, the Montgomery GI Bill college benefit for a four-year enlistment increased in FY 2002 from $19,600 to $23,400, causing kicker payments for a given total college fund amount to fall automatically by $3,800. Unless Services respond by increasing

College Fund amounts, increased GI Bill college benefits raise the relative value of the enlistment bonus, and hence reduce the likelihood that recruits will elect to receive the College Fund.

[8]Asch and Warner (2001) model military career lengths as outcomes of a stochastic process. Here we are simply assuming that individuals form expectations about their career lengths at entry, thus treating n as a given.

[9]About 45 percent of FY 1989 entrants had used GI Bill benefits as of April 1999 (Klemm, 2000). Data provided by the DoD Actuary (U.S. Department of Defense, 2001) indicate that around 60 percent of eligible separatees will eventually use benefits within the 10-year post-separation window allowed by law. Neither of these sources distinguishes between usage rates of basic GI Bill recipients and CF recipients. In the only formal study of this question, Hogan, Smith, and Sylwester (1991) found a 38 percentage point higher usage rate among CF recipients during the first three years after service.

[10]By assuming that bonus dollars are consumed in the first period, we rule out the possibility that recruits will take the bonus, invest in a financial asset, and then finance a college education with the accumulated fund. If, for example, $R = 3$ and $n = 4$, the individual would have to earn a 31 percent annual return on investment for a bonus-financed college education to equal a college fund-financed education.

[11]Since $\ln\rho\theta$ approaches $-\infty$ as θ approaches 0, the likelihood of choosing the college fund approaches 0 as well.

[12] Tannen (1987) provided an early analysis of the Army's incentive programs. He suggested that "work-oriented" recruits will select the EB and "education-oriented" recruits will select the college fund. His discussion seems to imply no substitutability between these incentives. In our model, "work-oriented" ("education-oriented") individuals are simply those with negative (positive) values of ε, and the degree of substitutability is determined by the standard deviation of ε.

[13] Other factors equal, in the absence of unobservable heterogeneity, all recruits who face a given value of $\ln R$ would choose the same incentive. The percent of recruits choosing CF (say) would

not vary smoothly with ln$R$; rather, there would exist some critical value of ln$R$ that would cause all recruits to switch from CF to EB.

[14] There are literally hundreds of military occupations. To keep the number of estimated parameters manageable, fixed effects models were estimated on a sample of 97,656 observations limited to 24 Army skills containing at least 1,000 recruits.

[15] To be specific, Army estimates were clustered on Army Military Occupation Specialty and Navy estimates were clustered on Navy Program (e.g., Nuclear Field, Advanced Electronics and Computer Field, etc.).

[16] The coefficients in the probit model reflect the net influence of the variables in the model on the personal discount rate and the likelihood of educational benefit usage. More education reduces personal discount rates (Warner and Pleeter, 2001), so the finding that additional education reduces the propensity to take the college fund implies that the effect of education on the likelihood of using education benefits outweigh its effect on the personal discount rate.

[17] In both the Army and Navy samples AFQT ranges from 50 to 99, so the true effect of AFQT may be greater. The Navy sample consists primarily of individuals going into the Navy's most selective skills, so the variation in AFQT is very limited.

[18] Warner and Pleeter (2001) estimated males to have higher personal discount rates than females.

[19] Warner and Pleeter (2001) found married individuals to have higher discount rates than single individuals.

[20] Since all of the Navy recruits are all long-term enlistees, EB/CFK was not interacted with term.

[21] The change is calculated as $\Delta P = \beta\phi((\ln((EB+\Delta EB)/CFK) - \ln(EB/CFK))$ where β is the probit coefficient on the variable ln(EB/CFK) and ϕ is the ordinate of a standard normal distribution for the given value of P.

[22] Despite the large negative interaction coefficient for the 5 and 6-YO group, the estimated response to a 10 percent increase in EB/CFK is about the same as for 4-YOs because 85 percent of this group is taking the bonus already compared with about 45 percent for the 4-YOs.