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Educational Benefits and Military Service: An Analysis of Enlistment, Reenlistment, and Veterans' Benefit Usage 1991-2005*

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Abstract

Educational benefits under the GI Bill have become a prime recruiting tool in today's volunteer military force. Because of haphazard annual nominal adjustments by Congress as well as significant fluctuations in college cost inflation, the real value of military educational benefits has fluctuated considerably since 1990. This paper uses data from the period 1990-2005 to estimate the sensitivity of GI Bill usage and military reenlistment to the real value of military educational benefits. We develop a model that shows how benefits affect enlistment, retention, and veterans' benefit usage. The model shows that increases in benefits will tend to attract more college-oriented youth into military service but lead such youth to separate from military service at a higher rate in order to use the benefits. The empirical work deals with this selection issue by estimating the effects of *unanticipated* changes in benefits on retention and usage. The empirical results are used to evaluate the likely impact of a recent proposal by Senator James Webb (D-VA) to dramatically raise GI Bill benefits.

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1. INTRODUCTION

Educational benefits under the GI Bill, first introduced in World War II, have become a prime recruiting tool in today's volunteer military force. Senator James Webb (D-VA) recently introduced legislation to substantially expand the GI Bill program now in effect for US military veterans. The GI Bill program currently provides veterans who serve for 3 or more years with 36 months (i.e., four standard academic years) of eligibility for a total benefit of around $38,000. His proposal would roughly double the benefit, and it would extend the current 10-year eligibility window to the lifetime of the veteran.

Senator Webb's purposes in advancing this proposal appear to be twofold. The first is to attract more youth to military service. The military services, and the US Army in particular, have experienced recruiting difficulties since the start of the Iraq War in 2003, and expanding education benefits for veterans is thought to be a way of attracting additional recruits, especially high-ability, college-bound youth who are not now interested in military service upon graduation from high school. Second, Senator Webb views the program as an investment in America's future. Evidence suggests that the World War II GI Bill had a substantial, positive impact on the amount of education acquired by returning veterans of that war [see, e.g., O'Neill (1977), Bound and Turner (2002), and Stanley (2003)].

Senator Webb's proposal raises three interesting economic questions. First, will it attract more youth into the military, especially more of the college-bound youth who are not now joining? Second, how will military retention be affected by such a program and what service personnel will be most impacted? Third, will a substantially enhanced benefit increase GI Bill usage and expand the amount of human capital acquired by veterans?

There has been some research on these questions. Recent research on military enlistment with 1990s data suggests that better educational benefits do increase recruiting, especially of more able youth [see, e.g., Warner, Simon, and Payne (2001, 2003)]. The most recent evidence about the retention effects of educational benefits -- presented in research by Smith, Sylwester, and Villa (1991), Hogan, Smith, and Sylwester (1991), and Warner and Solon (1991) -- is based on individuals who enlisted in the Army between 1974 and 1983. This research found that more generous educational benefits can hurt military retention. Only two studies have analyzed the educational benefit usage of veterans who joined the US military since the advent of the All-Volunteer Force (AVF) in 1973. One was by Angrist (1993), who examined a small sample of early AVF-era veterans who were part of the 1987 Survey of Veterans. The other was by Hogan, Smith, and Sylwester (1991), who examined the educational benefit usage of Army veterans who separated during the mid-1980s. These studies found some sensitivity of benefit usage to benefit amounts.

Our analysis is motivated by three factors. The first is that past studies of the reenlistment and usage effects of military educational benefits are now quite dated. They used data on individuals who joined the military in the 1970s and early 1980s and who separated by 1987. The second is that there does not now exist a unified economic model within which to think about enlistment, reenlistment, and educational benefit usage. We provide such a model. The model yields sharp predictions about which groups of potential recruits, current service personnel, and veterans would be most impacted by changes in educational benefits and how benefit changes such as those proposed by Senator Webb would affect overall military recruiting and retention patterns.

The third motivating factor is that significant fluctuations in the real value of military educational benefits have occurred since 1990, and data from the period since 1990 can inform us about the various economic effects of military education benefit programs. Our analysis makes use of administrative data that span the period 1988-2005 and contain annual information on every person who entered active military service from the time of entry to the time of separation or, if still in service, until the end of fiscal year (FY) 2004. For those who separated, details of educational benefit usage are available to us through June of 2005. If educational benefits do affect the retention behavior of military personnel or the educational decisions of military veterans, their effects should be apparent in data over this period.

This paper is structured as follows. The second section provides an overview of our model and its main predictions. (Due to its technical nature, the model itself is relegated to Appendix A.) The third section describes the current military educational benefits programs and documents the evolution of educational benefits and recruit participation in the military educational benefit programs over the decade-long period between 1993 and 2003. The fourth section describes in detail the data used for this study and documents trends in veterans' educational benefit usage. The fifth section studies the educational benefit usage of veterans who separated over the period 1992-2003, and includes an extensive discussion of identification issues. Section six studies the relationship between educational benefits and first-term reenlistment. We conclude the paper with a discussion of the policy implication of our findings.

To highlight our key findings, we estimate that a $10 thousand increase in MGIB benefits would increase the fraction of Army veterans who use them within two years of separation from 31 to 36 percent, and the fraction who ever use them from 57 to 63 percent.

The estimated effects for the Navy and Air Force are similar, but the estimated effects for the Marine Corps are smaller (from 29 to 33 percent after two years and from 52 to 57 percent after ten years). Our estimates of the usage effects of GI Bill benefits are similar to estimates of usage effects of other federal subsidies to federal education obtained by other researchers, including Dynarski (2002, 2003), Seftor and Turner (2002), van der Klaauw (2001), and Nielson, Sorensen and Taber (2006).

As expected by theory, the separation decisions of Army enlistees are found to be positively related to educational benefits. The association between separation and educational benefits was weaker for the other services. Also consistent with the model, enlistees with high ability, as measured by performance on the Armed Forces Qualification Test (AFQT), are found to be more likely to separate after an initial enlistment and more likely to use their educational benefits. Finally, unobservable factors that affect separation are found to be positively correlated with educational benefit usage, indicating that components of ability other than that measured by AFQT may be playing a role in enlistees' decisionmaking.

2. THEORETICAL DISCUSSION

Appendix A develops a detailed model of enlistment, reenlistment, and educational benefit usage based on the dynamic programming developed by Gotz and McCall (1984) and used by Asch and Warner (2001) and Asch, Hosek, and Clenndenning (2006). The model allows individuals to choose one of three states in each period: (1) military, (2) civilian sector without additional education, and (3) civilian sector with additional education. The model accounts explicitly for heterogeneity across youth in (1) their taste for military service and (2) their individual level of ability, which is assumed to impact the earnings of college graduates more than the earnings of non-college graduates. Higher-taste individuals are more likely to join or remain in military service. Because ability affects college payoffs more than non-college civilian or military payoffs, more able individuals are less likely to join or remain in the military, and more likely to attend college.

An increase in the expected future college benefit increases a *given youth's* likelihood of enlistment. We call this the *enlistment incentive effect* of the educational benefit. The model shows that high-ability youth are more responsive to an increase in the educational benefit than youth of lesser ability. This result gives rise to what we term the *enlistment selection effect* of educational benefits. In particular, because larger educational benefits have bigger effects on the enlistment decisions of more able youth, they can alter the ability mix of military entrants. Higher college benefits also reduce the probability of reenlistment, the effect again being stronger for high-ability individuals who have a higher propensity to attend college.

The Appendix also derives aggregate rates of enlistment, reenlistment, and educational benefit usage. Changes in educational benefits alter the taste and ability composition of the pool of entrants, and hence alter the aggregate rate at which a cohort of entrants eventually uses educational benefits. Because higher education benefits increase the likelihood that any given individual in the population will enlist, they raise the aggregate enlistment rate. However, the enlistment effect is larger for more able youth, and so higher educational benefits raise the average ability of military recruits. Finally, higher educational benefits reduce first-term reenlistment. The effects of higher college benefits on both aggregate enlistment and aggregate reenlistment reflect a combination of incentive and selection effects. Any given individual has more incentive to leave to use the benefit (the reenlistment incentive effect), but by attracting more able, more college-prone youth, higher college benefits produce a cohort of enlistees who are more prone to separation in the first place (the enlistment selection effect).

These theoretical considerations pose problems for econometric estimation of the separation and usage effects of military education benefits. Estimation that does not account for the potential change in the composition of recruits may therefore overstate the incentive effect of the benefit change. We deal with the potential endogeneity between college benefits and unobservable individual characteristics by exploiting the distinct way in which education benefits evolve over time. As will be seen in the next section, military college benefits do not always change smoothly or predictably over time. The fact that at least some portion of these changes is unpredictable provides the identifying variation necessary to estimate the pure incentive effects of education benefits. Discussion of identification is continued in section five.

3. MLITARY EDUCATION BENEFIT PROGRAMS

The primary education benefit available to military members and veterans is the Montgomery GI Bill (MGIB). This benefit is supplemented by the Services' College Fund (CF) benefits. The Montgomery GI Bill program began in July 1985 and bears the name of its sponsor, Alabama Representative Sonny Montgomery. In contrast to prior implementations of the GI Bill, the MGIB program requires recruits from all four military services to contribute $100 per month during their first year of service to be eligible for benefits.[1] Following separation, veterans have a 10-year window of eligibility within which to collect up to 36 months of benefits.[2]

An important feature of the program is that the size of the basic MGIB benefit enjoyed by military veterans is determined annually by the U.S. Congress, with participating veterans receiving the same benefit regardless of when they entered military service or began benefit usage. Unlike many federal programs that adjust benefits for inflation on a regular basis, nominal MGIB benefits have tended to be adjusted on a haphazard basis. The result is that, in real terms, the value of MGIB fluctuated substantially and somewhat unpredictably.

Figure 1 shows nominal and real MGIB amounts between 1991 and 2004 for individuals who enlisted for a term of 2 years (called 2-Year Obligors, or 2-YOs) and individuals who enlisted for terms of 3 or more years (3+ YOs).[3] Remarkably, despite average annual inflation in tuition costs of 7 percent, MGIB benefits were fixed in nominal terms between the inception of the program in 1985 and 1992. As a result, benefits declined at about a 7 percent annual rate in real terms over that period.[4]

FIGURE 1 HERE

Congress reacted to the decline in MGIB purchasing power in 1992 by raising benefits by nearly 20 percent. Over the next 6 years, Congress continued to raise benefits periodically, but only by (roughly) the increase in the overall CPI. Because, however, college tuition inflation was nearly double that of the overall CPI, the MGIB once again declined in real value. By 1998, the MGIB was worth less in real terms than it was in 1991, and, indeed, less than at its inception in 1985.

By the mid-1990s, Congress was sufficiently concerned about veterans' benefits to appoint a commission headed by Anthony Principi to study the GI Bill program in late 1996, which issued a number of recommendations in its report (Principi, 1999). The two key recommendations were that (1) the MGIB should cover the full tuition and fees at the veteran's educational institution of choice and (2) the recruit's $1200 contribution should be

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[1]In previous versions of the GI Bill, personnel were not required to contribute during their first year of service in order to be eligible for future benefits. The Vietnam-era GI Bill was terminated in December, 1976 and was replaced by a less generous educational benefits program called the Veteran's Educational Assistance Program (VEAP). VEAP required the $100 per month contribution during the first year of service, and the same requirement was carried over to the MGIB program.

[2] Benefits are paid to the veteran on a monthly basis during periods in which a veteran is enrolled in an approved educational program.

[3] We used the Consumer Price Index (CPI) for college tuition and fees, which measures changes in the purchasing power of money spent on higher education, to convert nominal dollar amounts into real, 2005 dollars.

[4]The CPI for tuition and fees increased on average by 7 percent annually over this period.

abolished.[5] These proposed changes were potentially very expensive. The first one, for example, implied that the federal government would cover a Harvard education for veterans attending that institution (and a Clemson tuition for veterans attending Clemson). Although neither of these recommendations was adopted, Congress did, in fact, increase MGIB benefits substantially in January of 1999 and again in January of 2000. Further increases were adopted in July of 2000 to take effect in 2001, 2002 and 2003. As a result, the real value of the MGIB rose substantially over the period 1999-2003. In fact, by 2003 MGIB benefits were higher in real value than at any time since 1991.

Recruits in hard-to-fill military occupation specialties (MOS), such as the Army's 11B (Infantryman) skill, may also be eligible for additional education benefits in the form of various Services' College Funds (CF). These programs are available to recruits serving in the Army, Navy, and Marine Corps. The percentage of Army recruits receiving kickers has varied considerably over time, ranging from a high of 29 percent in 1991 to a low of 7 percent in 1999. Prior to 1994, fewer than 10 percent of Navy recruits received a kicker. The Navy began expanding its kicker program in 1994, and by the late 1990s about 30 percent of Navy recruits were receiving them. Although Marine Corps recruits were eligible for kickers, in most years between 1988 and 2001 less than 5 percent of Marine Corps recruits received them. The Air Force does not have a college fund program.

The kicker program, as it was implemented over most of our data period, had two important features. First, the kicker amounts were fixed in nominal terms at the time of the enlistment contract. Thus, the real value of a given military entrant's kicker fell over time as college costs rose. Second, due to the structure of the CF program, the kicker amounts exhibit a saw-tooth pattern over the period of the data. Kicker amounts for new entrants were set as the difference between a pre-determined total dollar value of educational benefit and the MGIB amount then in effect. So, for example, if the total CF amount was $40,000 and the MGIB amount was $15,000, the kicker amount was $25,000. When the MGIB amount rose, the kicker amounts were automatically reduced, with the result that entrants in a given year received lower kicker amounts than entrants from prior years, holding constant the total nominal amount. Over the period of our data, the total college fund amounts were increased at discrete intervals to offset the declines in the kicker amounts.

Figure 2 shows average Army kicker amounts to 2-year obligors (hereafter, 2-YOs)

[5] At about the same time, the Department of Veterans Affairs commissioned the Klemm Group to evaluate the GI Bill program, which surveyed 2,018 veterans regarding GI Bill usage, satisfaction with the program, and the importance of GI Bill benefits to their decisions whether to join and whether to remain in the military.

and 4-year obligors (hereafter, 4-YOs) who received kickers over the period FY 1988-2001.[6] Recruits who obligated for four years of service received larger college fund kicker amounts than recruits who obligated for just two years. For 4-YOs who entered in FY 1992, the average value of the kickers at the time of entry was almost $45,000 (2005 $). Because of the operation of the program, the kickers declined in real value over time until, by FY 2000, the average 4-YO kicker was worth only about $26,000 at the time of entry. Kicker amounts were increased in FY 2001, and their average real value began to rise again (although they were not as high in real value as in 1992).

FIGURE 2 HERE

Because they are fixed in nominal terms, the real value of the kickers decline from the point of entry to the point of potential use. **Figure 2** shows how they decline from the point of entry to the end of the initial enlistment. The decline depends on the rate of college cost inflation, and it is evident in this figure that the decline in purchasing power of the kickers was the largest for recruits entering service in the early to mid-1990s, when college cost inflation was the largest. And, due to longer enlistment lengths, the decline is larger for 4-year recruits than 2-year recruits.

4. DATA AND TRENDS

The data used in this study were provided by Defense Manpower Data Center, and include information on every active duty enlistment contract signed at a Military Enlistment Processing Center between the fiscal years (FY) 1988 and 2001. The information from the military enlistment contract records was supplemented with two other types of information. First, the contract records were merged to annual in-service records that provide annual snapshots on military occupation, pay grade, date of latest enlistment, expiration of time in service, and other information through the end of FY 2004. Second, and more important for the purposes of this report, is information on college benefit usage through June 2005, including for each veteran the date that benefit usage began (if ever), the date that usage ended, the duration of usage in months, the total dollar value of benefits paid out, the dollar amount of College Fund benefits received (if any), and the type of educational institution attended.

The master dataset contains about 3.5 million records on individuals who signed enlistment contracts in the period FY 1988-2001. Two databases were constructed from the

[6] That is, a 2-YO is a recruit who obligates for a two-year period of active service and a 4-YO is a recruit who obligates for a 4-year period of active service.

master dataset for this report. The first database contained records on individuals who reached the end of their first-term enlistment contracts by FY 2003 and made a decision of whether to stay or leave. For example, although 1.1 million individuals signed enlistment contracts to enter the Army, only 870 thousand actually entered, the remainder being losses from the Delayed Entry Program (DEP). Of the 870 thousand entrants, about 439 thousand stayed to the ends of their initial enlistment contracts and made first-term retention decisions prior to the end of FY 2003. For the purposes of this study, retention is defined as being on active duty at least 1 year beyond the individual's initial scheduled Expiration of Term of Service (ETS) date. For example, of the 439,309 Army personnel in our dataset who reached ETS, 262,132 separated and 177,177 (40 percent) remained at least one year beyond the first-term ETS. Of those who separated, 146,378 (56 percent) used the GI Bill at some point after separation and before June of 2005.

Many individuals who use the MGIB serve more than one term of enlistment. The second dataset constructed from the master dataset contains these individuals in addition to those who separated after serving just a single term, provided that the separation occurred between 1988 and 2003 and that the individual was eligible to use the MGIB.[7] **Table 1** documents the total number of separations and MGIB use by YOS category.

TABLE 1 HERE

There are two salient features evident from **Table 1**. First, the percentage of separatees who ever used the MGIB is remarkably stable across services, ranging between 48 and 51 percent. Second, the percentage of MGIB users is significantly lower among individuals who served more than 6 years, ranging from 34 percent for the Marine Corps to 39 percent for the Air Force. Readers should bear in mind that, because anyone who separated after 1995 was not observed for the full 10-year eligibility window, the use rates in Table 1 underestimate completed use rates.

Figure 3 shows GI Bill usage during the first two years after separation among veterans with 3 or 4 years of completed service, who comprise the bulk of GI Bill users.[8] Two-year usage rates hovered around 35 percent between 1993 and 2000, and began rising sharply in 2001 for Army veterans, to 45 percent in 2002. In fact, all four services show a

[7] The second data set also includes individuals who separated prior to reaching ETS but served long enough to retain eligibility for the MGIB.

[8] The reason that we focus on the first two years is that more recent separatees have not had as much time to use the MGIB as earlier separatees, making comparisons of total usage difficult to interpret.

rise in usage after 2000.

FIGURE 3 HERE

Two-year usage trends were lower, but otherwise similar, for groups with longer completed periods of service. For example, two-year usage rates among veterans who separated prior to 1999 with 7 or 8 completed years ranged between 20 and 25 percent, and rose between 2000 and 2002 to about 35 percent.

Finally, **Figure 4** displays the cumulative MGIB usage profiles of selected separation year cohorts of Army veterans who had 3 or 4 completed years of service. Because our usage data end in 2003, it is possible to track the 1993 separation cohort for the full ten years of their eligibility window; other cohorts can only be tracked for shorter periods. The figure shows that cumulative benefit use increases at a decreasing rate with time since separation. The figure also suggests that usage rose in response to increases in educational benefits for the 2001 and 2002 cohorts.

FIGURE 4 HERE

5. EMPIRICAL ANALYSIS OF VETERANS' EDUCATIONAL BENEFIT USAGE

This section presents evidence on the effects of education benefit amounts on the likelihood of benefit usage. To do so, we employ a discrete-time hazard framework. The hazard rate is defined as the probability that a recruit begins to use the benefit in a given time period after service given that he or she has not used the benefit prior to that period. We divide the 10-year window of benefit eligibility into 10 discrete time periods, and specify the hazard rate for each period to be a function of time period and a vector of explanatory variables, the most important of which is the level of education benefits.

The discrete hazard rate for individual i at time *t*, $\lambda_{i,t}$, can be written as

$$\lambda_{i,t} = 1 - \exp\{-\exp(a_t + x_{i,t}\delta)\} \tag{1}$$

where a_t is a parameter called the *baseline hazard*, $x_{i,t}$ is a vector of explanatory variables, and δ is a vector of coefficients to be estimated, and $t = 1,...,10$. The baseline hazard is a factor of proportionality whose variation over time allows the model to fit a wide variety of time patterns of usage, including the concave profiles observed in Figure 4. In addition to the level of education benefits, the explanatory variables in $x_{i,t}$ include controls for individual-level attributes and economic conditions both at the time of enlistment and the time of potential usage.[9]

5.1 Estimating the Effects of Educational Benefits: Identification

Let $CB_{i,t}$ be the educational benefit available to the i^{th} veteran in the t^{th} year after separation. Inclusion of $CB_{i,t}$ as an explanatory variable in an equation for benefit usage is problematic insofar as our goal is to estimate the pure incentive effect of the benefit, that is, the effect on likelihood of usage for a randomly chosen military veteran. The problem arises because the estimated coefficient on $CB_{i,t}$ will measure the pure incentive effect only if $CB_{i,t}$ is independent of other, unobservable attributes of the veteran that might be related to benefit usage. But our theoretical model indicates that changes in educational benefits induce selection effects as well as incentive effects. In particular, higher educational benefits may attract military entrants who are more interested in going to college in the first place; such individuals will tend to separate at a higher rate after the initial enlistment in order to use those benefits. The estimated effect of $CB_{i,t}$ may therefore overstate the true incentive effect.[10]

We deal with the potential endogeneity between $CB_{i,t}$ and unobservable individual characteristics by exploiting the distinct way in which changes in MGIB benefits are implemented. The selection effect of the educational benefit program is related to the level of benefits that recruits *expect* to receive when they first enter military service. We saw in **Figure 2** that $CB_{i,t}$ fluctuated substantially and in an irregular fashion over the study period. Recruits cannot select into service based on factors that they cannot foresee. If the researcher

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[9] Veterans are eligible for up to 36 months of benefits. Veterans are paid only when enrolled in an approved program, so 36 months of benefit eligibility corresponds to four years of college attendance for individuals who are enrolled during the standard academic year but not during summer sessions. We studied months of benefit usage in a hazard model framework similar to the framework used to study time until benefit usage. However, our analysis of amount of benefit usage is more limited than our analysis of time to benefit usage. First, although we know when individuals began benefit usage, when they ended benefit usage, and how many months of benefits they had used by June of 2005, we are unable to observe usage month by month and link benefit in a particular month to usage in that month. We can only relate total months of usage to the benefits in effect when the individual began usage.
Second, because we cannot exploit information on the time variation in benefits while individuals are using benefits, we cannot estimate the baseline hazards for usage in a particular month (e.g., the a_t in equation 1). This is not a serious limitation because it is still possible to estimate the effects of observable variables on amount of usage (i.e., the parameter vector β in equation 1) and infer the time pattern of usage from the data.

[10] Studies of the college attendance effects of federal and state aid to education have dealt with endogeneity in various ways. One way – in what are referred to as natural experiments – is to look at changes in college attendance rates before and after major changes in student aid eligibility regulations that occurred for reasons unrelated to student participation rates. See Dynarski (2002, 2003).

can identify changes in $CB_{i,t}$ that occurred between entry and usage that recruits could not plausibly predict, the pure incentive effect of MGIB benefits can be identified from the unpredictable component of $CB_{i,t}$. The haphazard evolution of MGIB benefits leads us to believe that at least some portion of the benefit changes would not have been forecasted by recruits at the time of entry. Indeed, even a well-informed recruit who followed the legislative process closely is unlikely to have forecasted the ultimate decisions of the Congress between competing visions and pieces of legislation.

We decompose the value of $CB_{i,t}$ into two components: (1) the value expected when the veteran entered service in year τ, denoted $E(CB_{i,\tau})$, and the unanticipated change that occurred between entry year τ and future at-risk period *t*, denoted $\Delta CB_{i,t-\tau}$. In contrast to $CB_{i,t}$ or $E(CB_{i,\tau})$, these unanticipated changes -- "benefit shocks" – are, by definition, uncorrelated with unobservable veteran characteristics. The validity of this decomposition hinges, naturally, on the validity of our assumptions regarding how recruits form expectations about future educational benefit values. To assess the robustness of our empirical findings, we present our findings for several such decompositions.

Static Expectations Scenario. The base case decomposition is based on the assumption that recruits forecast the future real value of MGIB benefits to equal their real value at entry. In this case, which we call the *static expectations* scenario, $\Delta CB_{i,t-\tau}$ is simply equal to $CB_{i,t} - CB_{i,\tau}$. According to this scenario, all recruits are unable to forecast future nominal MGIB values or college cost inflation, and college fund recipients are unaware that their kickers will fall in value over time as college costs rise. In this scenario, all of the real benefit value changes that occur between entry and potential usage are therefore surprises. Although some observers will find static expectations implausible, Avery and Hoxby (2004) find evidence of "ignorance" or "naïveté" among college students confronted with complex choices regarding their educational financing. It is likely that the inability to extract information about the future may also be pervasive among young military entrants. According to this scenario, entrants from the late 1980s were unpleasantly surprised by the real benefit declines that occurred in the mid-1990s but were pleasantly surprised by the post-1999 MGIB increases (Figure 1).

Moving-Average Scenarios. We constructed two alternative scenarios that permit recruits more foresight in forecasting future real values of educational benefit amounts. In both of these scenarios, recruits forecast future college cost inflation based on past values. Using data prior to 1988, a regression of the annual college cost inflation rate on three lags of it fit the data well both in terms of fit ($R^2 = 0.75$) and in terms of the fitted equation's ability to predict the movements in college cost inflation after 1988.[11]

Figure 5 shows the annual percentage changes to the MGIB over the study period. In contrast to college cost inflation, it is unlikely that recruits are able to forecast future values of the MGIB from its past (and short) history with any degree of accuracy. We instead assumed that recruits were able to forecast future MGIB benefits based, alternatively, on 3-year or 5-year moving averages (MA-3 or MA-5) of past, present, and future MGIB benefits. That is, we assume that recruits may have information on the course of future MGIB benefits not contained in their past values.

These forecasts are graphed in **Figure 5**. To take one example, consider recruits who entered the military prior to 1991. The MA schemes lead to a forecast of positive nominal MGIB growth, in contrast to the zero growth that actually occurred. For recruits who entered in 1991, the MA schemes also lead to forecasts of positive nominal MGIB growth, but less than the 17 percent growth that actually occurred. Recruits entering between 1992 and 1996 would have forecast declining MGIB growth and recruits entering after 1996 would have anticipated higher rates of nominal MGIB growth.

FIGURE 5 HERE

5.3 Hazard Model Estimates and Marginal Effects

Equation (1) was estimated for all four services using data on three groups of veterans: (1) all veterans pooled together, (2) veterans who served for 6 years or less, and (3) veterans who served more than six years. Results for separatees who served for short and long periods were so similar to the pooled estimates that we focus here on estimates for separatees as a whole (results decomposed by length of service are available from the authors on request).

Table 2 shows the pooled model estimates by service when benefit values are based on the assumption that recruits have static expectations about the future evolution of educational benefits. The parameter estimates in **Table 2** indicate substantial variation in the likelihood that a veteran will begin MGIB usage by the variables in the model. However,

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[11] College cost inflation averaged about 7 percent per year during the study period. The fitted equation in fact gives predicted college cost inflation of around 7 percent after the 3rd or 4th forecast period regardless of the initial inflation rate.

each parameter estimate does not directly show how the probability that a veteran will begin usage by a given time since separation changes with the variable in question. To show marginal effects on probability of usage, we set all variables equal to their mean values in the data and calculated the baseline predicted probability of benefit usage for two, five, and ten years after separating from the military.[12] We then varied regressor values one at a time to obtain marginal usage effects. The next four subsections discuss these calculations in more detail.

TABLE 2 HERE

5.3.1 Effects of Changes in Educational Benefits

Table 3 contains estimates of how the predicted probability of educational benefit usage varies with the generosity of those benefits, assuming static expectations. Three sets of predictions are shown: (1) the base case, (2) a case in which the MGIB benefit at entry (that is, the anticipated benefit) increases by $10 thousand; and (3) a case in which the MGIB benefit increases in an unexpected fashion, after entry, by the same amount.

TABLE 3 HERE

Focusing first on the base case, predicted educational benefit usage was similar in the Army and Navy, with two-year usage rates of 31 and 32 percent, five-year usage rates of 47 and 48 percent, and ten-year usage rates of 57 and 58 percent. Two and five-year MGIB usage in the Air Force was similar at 31 and 45 percent, but ten-year usage was markedly lower at just 54 percent. Usage rates in the Marine Corps were somewhat lower than those for the Air Force at 29, 43, and 52 percent through two, five, and ten years, but even so, more than half of all Marine Corps veterans are predicted to use their benefits.

Raising the MGIB benefit at entry by $10 thousand is estimated to increase two-year MGIB usage by 6 percentage points in the Army, 3 percentage points in the Navy, 5 percentage points in the Air Force, and 4 percentage points in the Marine Corps. Ten-year usage rates at 10 years are predicted to increase by 7, 3, 7, and 5 percentage points, respectively. These figures show, and our broader analysis found that the estimated effects of college benefits tended to be strongest for the Army and weakest for the Navy, with the Air Force and Marine Corps in between.

Educational benefit use elasticities may be calculated from these estimates. For the Army, a $10 thousand educational benefit increase is about a one-third increase based on the

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[12]The exception was that initial term of enlistment was set to 4-years, the modal enlistment term in the data.

Army sample-period average of $30 thousand. We estimate for the Army a 2-year percentage usage increase of 16 percent (= (36-31)/31) due to a $10 thousand benefit increase. This implies a 2-year benefit usage elasticity of 0.48. The 5 and 10-year usage elasticities are both 0.32 and are smaller than the two-year use elasticity because most of the responsiveness to a benefit increase occurs early after separation. These elasticity estimates are of the same order of magnitude as estimates obtained from studies of the effects of federal aid to education.[13]

As we noted at the start of this section, our identification strategy presumes that the estimated effects of changes in educational benefits at entry may reflect both incentive and selection effects, while the estimated effects of unanticipated changes should reflect purely incentive effects. The estimated effects of unanticipated changes in benefits were within 1 to 2 percentage points of the estimated effects of changes in benefits at entry for the Army, and virtually identical to changes in benefits at entry for the other services.

The estimated effects just discussed assume static expectations on the part of recruits. Because of concerns discussed above about the static expectations assumption, we also estimated models that assumed that recruits' expectations about the real value of educational benefits could be described by three-year (MA-3) or five-year (MA-5) moving average scenarios. Estimates of benefit effects under these scenarios are found in **Table 4**. The main differences between the estimated benefit effects for the two MA scenarios and the static expectations scenario were found in the Army and Navy. Estimates for the Air Force and Marine Corps were virtually identical. For the Army, the estimated effects of benefits at entry (anticipated benefit changes) were about 5 percent larger under the two MA scenarios than under the static expectations scenario. The estimated effects of unanticipated benefit

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[13] Dynarski (2002) identified the effect of school aid on college attendance by comparing attendance in Georgia, which implemented its HOPE Scholarship in 1993, with attendance in other southeastern states, which at the time did not have similar school aid programs. Her estimates indicate that attendance increased by 4 to 6 percentage points for each 1,000 dollars increase in school subsidy. Similarly, Dynarski (2003) documents a sharp decrease in college attendance as a result of the discontinuation of the Social Security Student Benefit, implemented in 1965 and eliminated in 1982. This program offered monthly payments to children of deceased, disabled or retired Social Security beneficiaries while enrolled full-time in college. She estimated that each 1,000 dollars decrease in school aid was associated with a decline in college attendance of about 3.6 percentage points. This implies a point elasticity of 0.25.

Seftor and Turner (2002) analyzed the impact of the Pell grant program on college enrollment decisions of older "nontraditional" students. The Pell grant is a need-based aid aimed at both independent and dependent students. Identification of the effect is ensured by two exogenous sources of variation. First, there was an increase in grant aid in 1972 and secondly, there was a change in the definition of the independent student status that occurred in the period between 1970 and 1980. They found that introduction of the Pell grant increases college attendance by 1.3 percentage points for women and by 1.5 percentage points for men.

changes for the Army were about 25 percent larger. On the other hand, for the Navy the estimated effects of anticipated benefit changes and unanticipated benefit shocks were both slightly smaller under the two MA scenarios than under the static expectations scenarios.

TABLE 4 HERE

In the end, the estimated effects of benefit changes seem reasonably robust to assumptions about how recruits form expectations about future benefits. Whether we attribute to them static expectations at entry about future benefits, or more sophisticated expectations that make use of available information at entry, made minor differences to our estimates of their impacts on benefit usage.

5.3.2 Effects of Changes in Other Economic Factors

The hazard models in **Table 2** include a number of economic variables as controls. One economic factor likely to influence MGIB usage is the current unemployment rate -- the unemployment rate the veteran faces at a given point in time after separation. Because college non-graduates are disproportionately sensitive to economic conditions in general, we expect MGIB usage to increase when unemployment increases.

Higher unemployment is known to expand enlistment supply (Warner, Simon, and Payne, 2003). Our model suggests that, due to entry selection effects, recruits induced to enlist because of higher unemployment will be less likely to eventually use the MGIB. We therefore included as a control variable the unemployment rate in the veteran's home state at the time the veteran entered military service. Other factors that may influence MGIB usage through entry selection effects include the enlistment bonus the veteran received, relative military pay in the veteran's geographic region at the time of entry, the percentage of high school graduates in the veteran's entry state that went to college in the year the veteran entered service, and median family income in the veteran's geographic area. Empirically, we measure relative military pay (at the time of enlistment) using civilian earnings data at the Census division level.[14] Median family income is available in the 2000 Census at the 3- and 5-digit zip code levels. We used median income at the 3-digit zip code level in our analysis.[15]

As predicted by the model, higher unemployment at entry is significantly negatively related to later MGIB usage (**Table 3**). However, the estimated effects are quantitatively so

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[14]See Warner, Simon, and Payne (2003) for details on the construction of this variable.

[15] The results were invariant to the zip code measure; however, median family income was not available at the 5-digit level for some recruits (veterans) but was available at the 3-digit level for all recruits (veterans).

small that we do not need to show marginal effects for this variable. The same may be said for the entry enlistment bonus (which was observed for the Army and the Navy but not the Air Force and Marine Corps).[16] The entry enlistment bonus was associated with MGIB usage for Army veterans but not for Navy veterans. Relative military pay at entry was associated with higher MGIB usage in all 4 services. Because, in our data, relatively high military pay means relatively low earnings of high school graduates in a given Census division, the positive association of relative pay and MGIB usage may be indicative of persistent low post-service earnings opportunities of non-college graduates in the Census division from which the veteran entered service. But like the entry unemployment and bonus effects, the relative pay effects – while statistically significant – were small in magnitude.

Veterans who enlisted from zip codes with higher median family income were more likely to use the MGIB. Although the median family income measure is static (from the 2000 Census), the ranking of zip codes by median family income is not likely to change much over time, and this variable is likely to be indicative of geographic differences in education level and educational opportunities. Median family income was estimated to have a significant positive effect on MGIB use. Again, however, the estimated impact was quantitatively small.[17]

By contrast, the magnitude of the estimated effect of current unemployment was large. **Table 5** shows the estimated effects of a 2-percentage point increase in the current unemployment rate. The estimated effects of unemployment were remarkably similar across services, ranging from 3 to 4 percentage points for two-year usage, and from 4 to 6 percentage points for ten-year usage. Veterans' educational decisions are apparently quite sensitive to current economic conditions. In fact, the estimated effect of the current unemployment rate is at least five times as large as the estimated entry unemployment effect. Moreover, we found that the unemployment rate in the veteran's state of exit from the military was statistically unrelated to eventual MGIB usage. The strong significance of the

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[16]Bonus information on each recruit in our dataset were provided to us by the Army and the Navy. Although we do not have individual-level bonus data for the Air Force and Marine Corps, we know that less than 10 percent of the recruits in these services received bonuses during the period of our study and that the average bonus amounts were small in comparison to the average bonus received by Army and Navy recruits.

[17] We are unable to observe veterans' eligibility for, or receipt of school-based, state-level, and federal-level financial aid. Federal-level programs do not count MGIB benefits in assessing eligibility for needs-based aid. The effects of MGIB shocks estimated in this paper will be consistent as long as they are not correlated with the availability of other sources of financial aid. However, time-varying changes in the availability of such aid should be picked up at least in part by the time effects included in our models. We also estimated some models with state-level fixed effects, which should control for at least some part of interstate differences in the availability of financial aid, and found little effect on our results.

current unemployment rate in the entry state, coupled with the lack of significance in the current unemployment rate in the military exit state, suggests that veterans tend to move back to the entry state (or a co-located state whose unemployment rate moves together with entry state unemployment) after separation.

TABLE 5 HERE

5.3.3 Differences in MGIB Usage by Aptitude Group

A good deal of variation in MGIB usage arises from differences in mental aptitude as measured by performance on the AFQT. **Table 6** shows predicted MGIB usage rates for four aptitude groups: I-II, with AFQT scores of 65 and above; IIIA, with AFQT scores between 50 and 64; IIIB, with AFQT scores between 31 and 49; and IV, with AFQT scores between 10 and 30. Usage rates for a given level of aptitude, as well as differences in usage rates between aptitude groups, were remarkably similar across services.

TABLE 6 HERE

Individuals from higher aptitude groups are more likely to use their education benefits. The median two-year usage rate was 36 percent for individuals in aptitude groups I and II, 30 percent for individuals in group IIIA, 26 percent for individuals in group IIIB, and 22 percent for individuals in group IV. The corresponding median ten-year usage rates were 62, 54, 49, and 40 percent. In terms of median differences between aptitude groups, the two-year usage rate was 6 percentage points lower among individuals in aptitude group IIIA than among individuals in group I-II, 10 percentage points lower among individuals in group IIIB, and 15 percentage points lower among individuals in group IV. The corresponding median differences for ten-year usage rate were 8, 14, and 22 percentage points.

5.3.4 Differences in MGIB Usage by Other Demographic Characteristics

Estimation results **Table 2** show that the hazard rate for beginning MGIB usage varies significantly by martial status and the number of dependents. To save space, we characterize the effects of these variables without the use of a table. Individuals who were single when they separated were most likely to use the MGIB. They had predicted 2-year use rates ranging between 34 and 37 percent, 5-year use rates ranging between 49 and 53 percent, and 10-year use rates ranging between 59 and 64 percent, depending on service. Being married with one dependent at the time of separation was estimated to reduce use rates by 4-7 percentage points, depending upon service. Additional dependents were estimated to reduce the likelihood of use even further, by about 2-4 percentage points per dependent.

Modest differences in usage were estimated by race-ethnic group, with the primary difference being between non-Hispanic whites and all other groups (Blacks, Hispanic, and Other Race). Usage rates among non-Hispanic whites were generally lower than among otherwise comparable individuals from other groups. The differences ranged from 2 percentage points in the Air Force and Marine Corps to 5 percentage points in the Army. These results are in line with Heckman and Cameron (2001) who find that, after correcting for family background factors, blacks are actually more likely to attend college than otherwise comparable whites. In fact, our estimated racial effects could reflect the existence of differential skill accumulation prior to entering the military.

Gender differences in usage were estimated to be larger, with females being much more likely to use their educational benefits than their male counterparts. Female Navy veterans were estimated to be 5 percentage points more likely to use benefits by the 2-year mark since separation, 6 percentage points more likely by the 5-year mark, and 7 percentage points more likely by the 10-year point. Male-female differences were even more pronounced in the other services (about 6-8 percentage points by the 2-year mark, 7-10 percentage points by the 5-year mark, and 8-11 percentage points by the 10-year mark, depending upon service).

Finally, **Table 2** indicates significant differences in educational benefit usage by age of entry into the military. A consistent finding across services is that youth who entered service before the age of 20 were most likely to use educational benefits after separation. Individuals who were 20-22 years of age at entry were about 5-7 percent less likely to use benefits then those who were less than 20 years of age at entry. Those who entered between the ages of 23 and 25 were about 22 percent less likely. Finally, individuals who were 26 years of age or older were about 30-40 percent less likely to use benefits. This pattern of age effects is consistent with our model of educational benefit usage: individuals who are attracted to join the military by educational benefits do so soon after completion of high school, so that the pool of prospective future entrants consists of youth who are less motivated to join because of educational benefits.

6. FIRST-TERM RETENTION AND TWO-YEAR MGIB USAGE

This section studies the effect of educational benefits on separation from the military after the first term of enlistment. Our model shows that an increase in educational benefits at entry has both an incentive effect and a selection effect. The incentive effect refers to the increase in likelihood that an enlistee will separate after completing an initial enlistment in order to use educational benefits. The selection effect refers to the increased likelihood of attracting recruits who, other things the same, are more interested in acquiring higher education, and who would not have enlisted in absence of the benefit increase.

Because the decision to separate from the military is entwined with the decision to use educational benefits, it makes sense to examine the two decisions simultaneously. We use the well-known Heckman two-step probit model. This model consists of two equations for two binary outcome variables. Each binary outcome can take on values of 1 (if an event is observed) or 0 (if an event is not observed). The second binary outcome is observed only if the first binary outcome has a value of one. In our application, the first binary outcome is separation from the military after the first term of enlistment and the second is whether a veteran uses his or her education benefits within the first two years of separation.

In addition to estimating the effects of various explanatory variables on the probabilities of reenlistment and two-year MGIB usage, the Heckman two-step probit model controls for, and yields an estimate of, the correlation between unobservable factors that affect separation and unobservable factors that affect MGIB use. The algebraic sign and magnitude of this correlation reveals whether individuals who have underlying characteristics that make them more prone to use educational benefits are more or less likely to separate from the military, and vice versa.

Full two-step probit estimation results are contained in **Appendix C**, **Tables C-1** through **C-4**. Here we summarize the main findings. First, we estimated statistically significant, positive correlations between unobservable factors that affect separation and unobservable factors that affect educational benefit usage that ranged between 0.17 (Air Force) and 0.33 (Army). Positive correlations were expected from our economic model, and are suggestive that a component of ability not captured by aptitude score is inducing some personnel to separate in order to use educational benefits.

Measured aptitude effects are large, as evidenced by **Table 7**. The results confirm those found in the previous section, namely that MGIB usage is strongly and positively related to AFQT. More interesting are the estimated relationships between AFQT and first-term separation, shown as percentage point differences relative to recruits in category IV. Army recruits in aptitude group I-II were 8 percentage points more likely to separate than otherwise comparable recruits in category IV.[18] Recruits in group IIIA were 3 percentage

[18] Very few individuals are recruited from category IV.

points more likely to separate than those in IV.

TABLE 7 HERE

The Navy exhibits a similar pattern of aptitude effects on separation as the Army. What is interesting, though, is that once other factors are controlled for, there is little variation in the likelihood of separation by aptitude group in the Air Force or Marine Corps. Apparently, these services are doing a better job of retaining high aptitude personnel than the Army and Navy. Although the reasons are not clear, they may have to do with the nature of the jobs or the capacity of the promotion systems to identify the best personnel for advancement.

Table 8 shows the estimated effects of anticipated and unanticipated changes in education benefits between entry and separation on first-term separation and two-year MGIB usage. All of the estimated effects for the Army were statistically significant at the 10 percent level or better. The estimates indicate that a $10 thousand increase in educational benefits at entry increased the likelihood of separation after the first term by 3 percentage points, and increased the likelihood of using educational benefits within two years of separation by 8 percentage points. These effects likely reflect a combination of both the incentive and selection effect. The estimates also indicate that an unanticipated $10 thousand increase in educational benefits (after entry) increased the likelihood of separation by 5 percentage points and the likelihood of two-year MGIB usage by 9 percentage points. The effects of unanticipated increases, it will be recalled, reflect purely incentive effects.

TABLE 8 HERE

The estimated effects of changes in educational benefits on first-term separation for services other than the Army were mixed. In our base model, which included a full set of time effects, the estimated effects of educational benefits on Air Force separation were quite large – 7 percentage points for an anticipated $10 thousand change and 12 percentage points for the same unanticipated change. These effects seemed implausibly large, and we discovered them to be sensitive to inclusion of time effects. Without time effects, educational benefit changes were estimated to have essentially no effect on Air Force first-term separation. This is probably closer to the truth given that the Air Force has never had to use educational benefits to attract recruits and its recruit quality mix has varied less over time than the quality mix in the other services (Warner, Simon, and Payne, 2003). The estimated separation effects of educational benefits were essentially zero for Navy and the Marine Corps regardless of model specification. Overall, we find evidence that Army separation is related to education benefits, but the evidence for the other services is less conclusive.

Consistent with the analysis in the previous section, the estimated effects of anticipated changes in educational benefits on two-year MGIB usage were positive and statistically significant for the Navy, Air Force, and Marine Corps. The estimated effects of unanticipated changes in educational benefits were positive and significant for the Marine Corps, positive and marginally significant for the Air Force, and statistically insignificant for the Navy. Our disappointment over the lukewarm estimated effects of unanticipated changes in educational benefits is tempered by the realization that by construction -- and in contrast to the hazard estimation carried out in the last section -- the estimation here does not account for unanticipated changes in the value of educational benefits that occurred between the first and second years of separation, or MGIB usage (and changes in education benefits) that occurred between the second and tenth year of MGIB eligibility.

We briefly highlight findings with respect to the reenlistment effects of military other covariates, such as compensation, unemployment and family characteristics. We find that each $1 thousand increase in the value of the military career reduces the likelihood of first-term separation by 1 percentage point in the Army and by 1.5 percentage points in the Navy.[19] However, the estimated effects of our military pay measure for the Air Force and Marine Corps were sensitive to the inclusion of time effects in the estimated models.

Higher rates of unemployment at the first-term reenlistment decision point are associated with lower rates of separation and higher rates of 2-year MGIB usage. Higher rates of unemployment at entry have no estimated effect on 2-year MGIB usage in three of the four services, but are associated with higher rates of separation, also in three of the four services. Consistent with our theoretical model, these estimates – although small in magnitude -- suggest that higher unemployment induces enlistment from among individuals who are less attached to military service than individuals who enlisted when unemployment was lower.

Finally, our models contained controls for marital and dependent status and gender.

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[19] The value of a military career is measured by the Annual Cost of Leaving (ACOL). The ACOL model is well-known in the military retention literature (see, e.g., Asch, Hosek, and Warner (2007) for a derivation). ACOL is the annualized net present value of a military career relative to the civilian alternative. The variable is calculated for the period beginning with the first-term decision point (that is, the end of the first term of enlistment, be it two, three, four, five, or six years) to the 20-year career point, and includes the value of military retirement pay. Civilian opportunities for each individual were based on predictions of civilian earnings based on data from the Current Population Surveys, which were permitted to vary by age, education level, race, gender, and first-term decision year. The ACOL variable is entered only in the separation equation. According to our calculations, the average value of ACOL is around $11 thousand. Over a career that encompasses 20-year retirement, military personnel enjoy an average annual pay differential of about $11 thousand compared to civilians with similar demographic attributes.

Married individuals were 21 percentage points less likely to separate from the Army than singles, 17 percentage points less likely in the Navy, 13 percentage points less likely in the Air Force, and 11 percentage points in the Marine Corps. Two additional dependents (children) reduced the predicted probability of separation further, by a relatively mild 2-4 percentage points in the Navy, Army, and Marine Corps, in that order, but a more sizeable 7 percentage points in the Air Force. Other factors the same, females were 3 percentage points more likely to separate from the Army, but no more likely to separate in the other services.

7. CONCLUSIONS

This paper analyzes the impact of a large-scale federal aid program (the Montgomery GI Bill) on veterans' decision to attend postsecondary education institutions. Our analysis reveals that an increase in the amount of the benefit significantly increases the percentage of military veterans that acquire higher education. Turning to Senator Webb's proposal, the question is to what extent this proposal will affect MGIB usage and military reenlistment. Although a complete benefit-cost analysis of this proposal is beyond the scope of our paper, the estimates provided here offer some insight regarding the direction of effects and their likely magnitudes.

His proposal, designed to increase enlistment among college-bound ("high quality") youth, would roughly double the size of benefits, which currently stand at $38,000 for a typical enlistee. Based on previous research (Warner, Simon, and Payne 2001; 2003), and supported by the formal analysis in the current paper, the proposal would, indeed, increase high-quality enlistment, as well as accomplish his other goal, that of increasing MGIB usage. Ignoring selection effects, our estimates suggest a 5 percentage-point increase in 10-year usage for each $10 thousand increase in MGIB benefits. The proposed benefit increase would therefore raise the ten-year usage among today's enlistees by about 20 percentage points, thus increasing total usage from its roughly currently 50-5 percent to 70-5 percent. Selection effects could lead to an even higher rate of usage to the extent that the composition of enlistees is altered to include more college-inclined youth.

The Department of Defense is concerned, not without reason, about the retention effects of such an increase. Our estimates (**Table 8**) suggest that Webb's proposal could reduce first-term Army reenlistment by about 12 percentage points, from its current rate of 40 percent to about 28 percent. Maintaining the desired experience distribution would require higher offsetting increases in compensation (e.g., reenlistment bonuses). As the returns to skill have risen over the last three decades, increasing fractions of American youth have been college bound. One side-effect has been to make military service relatively less attractive from a purely economic standpoint. Questions have arisen in many quarters regarding the socioeconomic representativeness of the volunteer military force. Our estimates suggest that achieving this purpose may be rather costly.

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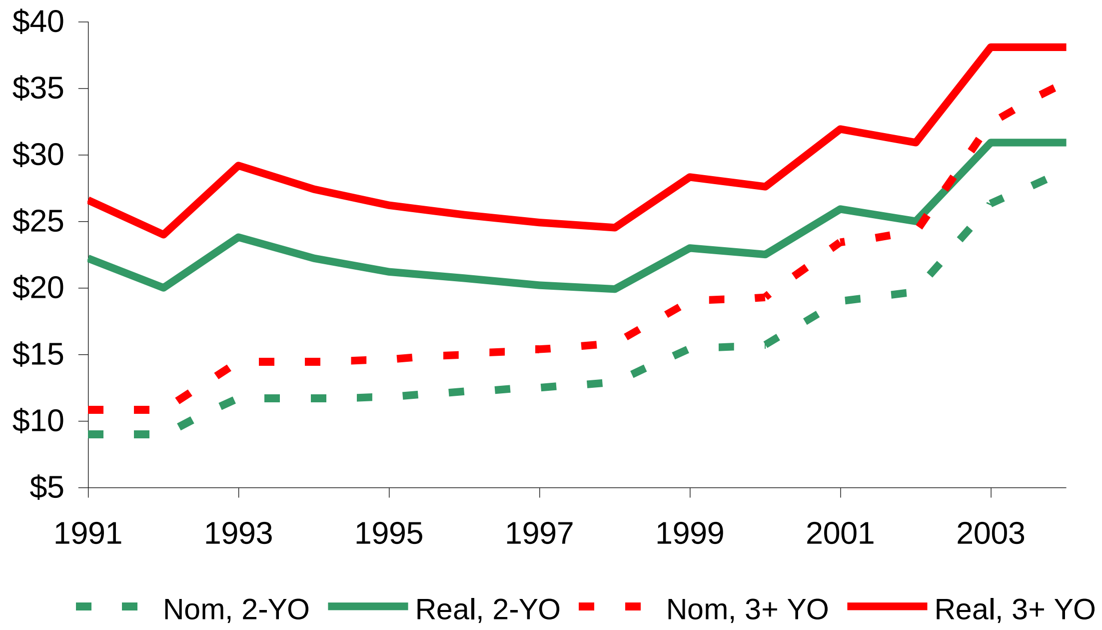
Figure 1 ***Nominal and Real (2005 $) MGIB Amounts, FY 1991-2005***



Note: Amounts shown in thousands.

Figure 2 ***Real (2005 $) Values of ACF Kicker at Entry and at Exit***

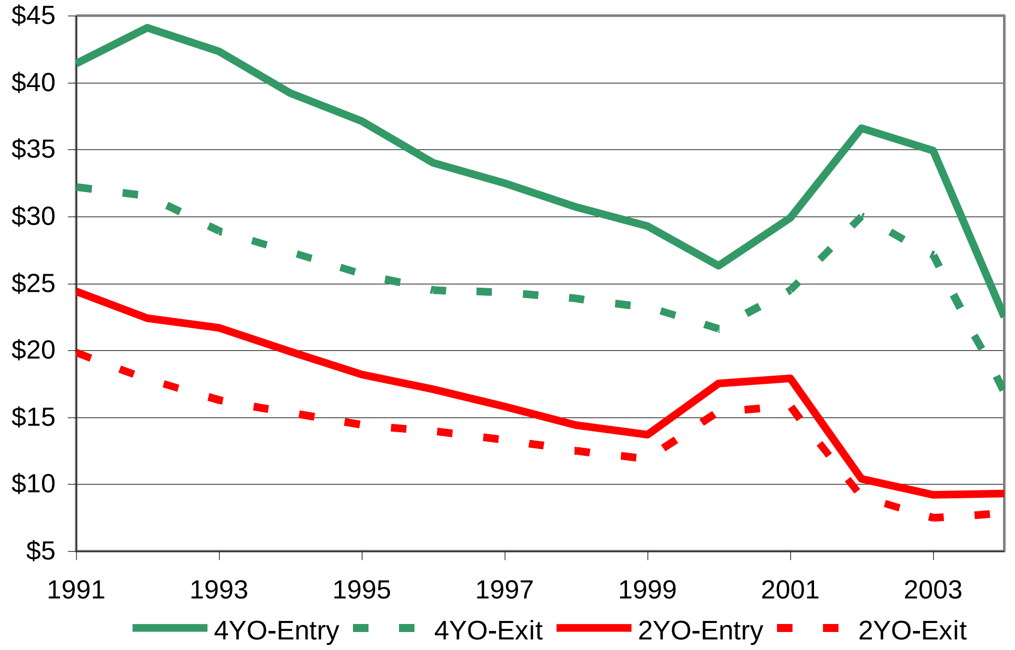


Figure 3 ***Percent of Veterans Using Educational Benefit within Two Years of Separation (3 or 4 Completed Years of Service)***

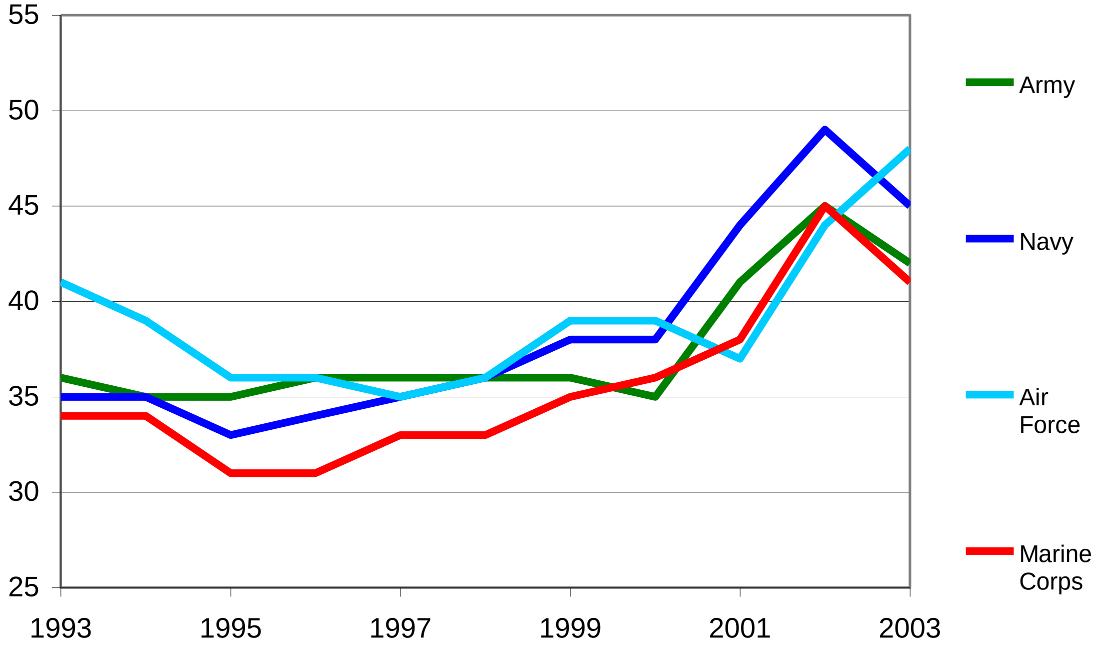


Figure 4. ***Cumulative MGIB Use of 3 and 4-Year Army Veterans by Years Since Separation***

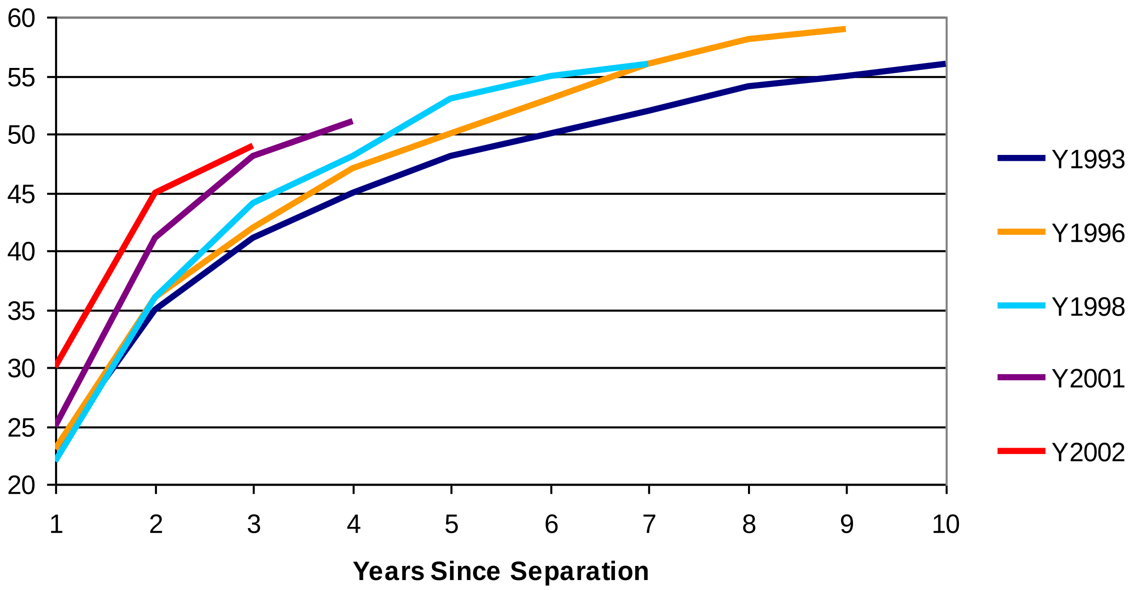


Figure 5. ***Actual MGIB Benefit Growth, Three-Year Moving Average Growth, and 5-Year Moving Average Growth***

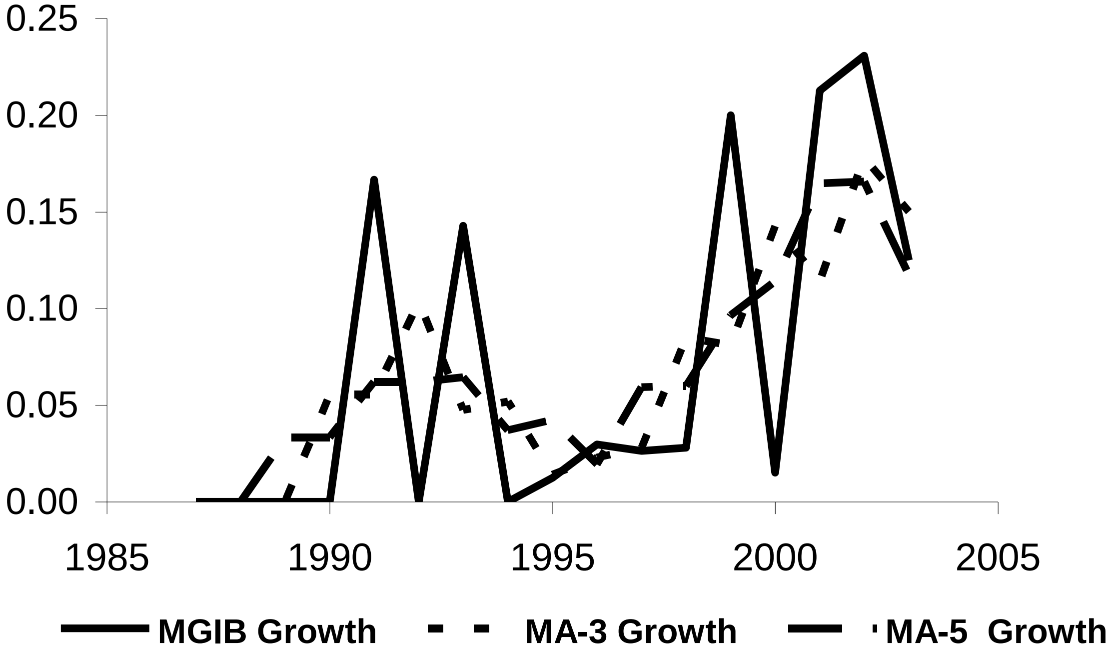


Table 1. ***Benefit Use among Eligible Veterans, by YOS Group***

	Army	Navy	AF	MC
All YOS				
Number	385,421	303,392	144,131	197,110
MGIB Users	190,779	154,915	72,531	94,764
Percent Use	49	51	50	48
<= 6 YOS				
Number	344,903	268,241	118,327	184,883
MGIB Users	175,648	141,790	62,397	90,556
Percent Use	51	53	53	49
> 6 YOS				
Number	40,518	35,151	25,804	12,227
MGIB Users	15,131	13,125	10,134	4,208
Percent Use	37	37	39	34

Table 2 *Hazard Model Estimates of MGIB Usage for All Veterans*

	Army		Navy		Air Force		Marine Corps	
	Coef	z-stat	Coef	z-stat	Coef	z-stat	Coef	z-stat
Education benefit ($1K)								
Value expected at entry	**0.020**	20.8	**0.008**	3.3	**0.019**	5.7	**0.013**	8.2
Unexpected change	**0.016**	7.7	**0.015**	5.4	**0.018**	6.0	**0.012**	3.4
Entry bonus amount ($1K)	-0.006	-4.4	-0.003	-0.9	-	-	-	-
Aptitude group (IV omitted)								
I-II (AFQT > 64)	0.598	20.3	0.667	30.5	0.680	4.3	0.607	5.7
IIIA (49 < AFQT < 65)	0.381	13.0	0.463	23.0	0.493	3.1	0.372	3.5
IIIB (34 < AFQT < 50)	0.248	9.9	0.283	14.6	0.342	2.1	0.157	1.5
Race-Ethnic Group (White omitted)								
Black	0.129	7.8	0.100	7.4	0.088	5.3	0.082	4.5
Hispanic	0.149	10.3	0.118	8.5	0.059	3.3	0.089	5.2
Other	0.224	15.6	0.137	7.4	0.111	5.6	0.077	3.9
Personal Characteristics								
Entry age 20-22	-0.054	-6.2	-0.059	-6.8	-0.102	-9.1	-0.067	-5.6
Entry age 23-25	-0.204	-12.8	-0.229	-13.0	-0.322	-18.3	-0.228	-9.1
Entry age 26 plus	-0.308	-14.2	-0.349	-16.4	-0.446	-16.4	-0.269	-6.1
Male	-0.284	-15.3	-0.177	-12.9	-0.257	-16.9	-0.215	-10.6
Married at separation	-0.117	-13.8	-0.158	-15.4	-0.193	-17.1	-0.177	-12.8
No. of dependents at sep	-0.061	-10.2	-0.096	-15.8	-0.140	-21.7	-0.091	-12.6
Some college or better	-0.265	-6.3	-0.037	-1.0	-0.333	-7.8	-0.333	-6.2
High school graduate	0.125	7.5	0.157	9.3	-0.036	-1.4	0.071	3.5
Economic Conditions								
Unem rate -- current	0.062	10.9	0.060	9.1	0.060	9.2	0.078	9.5
Unem rate -- time of entry	-0.019	-5.6	-0.007	-2.2	-0.010	-2.9	-0.017	-3.2
Mil/Civ pay ratio	0.644	9.6	0.622	10.6	0.562	9.7	0.864	11.4
CG-HSG Differential	0.202	1.8	0.390	3.5	0.276	2.8	0.389	3.0
State socio-economic characteristics								
Percent college grads	0.014	14.2	0.019	18.2	0.015	14.0	0.020	13.3
Percent veterans	0.001	0.9	0.002	2.4	0.003	3.1	0.001	0.8
Family Income ($1K)	0.003	10.3	0.002	6.2	0.002	5.6	0.002	5.8
Military occupation group (Admin omitted)								
Combat Arms	0.189	2.8	0.060	2.5	-0.018	-1.0	-0.027	-2.4
Electronic repair	0.119	2.0	-0.022	-1.2	0.013	0.9	-0.107	-3.5
Communications	0.188	3.1	0.116	7.7	0.015	0.9	-0.068	-4.0
Medical	0.305	5.5	0.289	16.0	0.170	14.3	0.113	0.9
Other technical	0.206	3.4	0.221	6.8	-0.031	-1.6	-0.051	-1.8
Mechanical equipment	0.004	0.1	-0.039	-2.5	-0.110	-9.7	-0.217	-11.0
Craftsmen	-0.085	-1.2	-0.230	-10.2	-0.287	-12.1	-0.293	-11.0
Service and supply	0.091	1.5	-0.044	-2.0	-0.059	-3.2	-0.188	-13.8
Length of initial term (4YO omitted)								
2 YO	0.200	5.1	-0.034	-0.8	-	-	-	-
3 YO	0.169	5.9	0.167	5.1	-	-	-	-
5 YO	0.030	1.3	-0.094	-5.1	-	-	-	-
6 YO	-0.064	-2.9	-0.094	-4.9	-0.206	-6.7	-0.101	-2.9
Number of completed years in service								
FT Attriter	-1.408	-22.5	-0.967	-13.8	-0.347	-3.2	-0.100	-0.7
3	-0.243	-9.2	-0.169	-2.8	0.808	7.8	0.322	2.3
4	-0.096	-2.6	0.024	0.4	0.977	10.1	0.765	5.6

5	-0.199	-5.3	-0.009	-0.2	0.926	9.5	0.735	5.4
6	-0.230	-6.0	-0.043	-0.8	0.868	9.0	0.742	5.3
7	-0.283	-7.1	-0.226	-3.8	0.645	6.6	0.596	4.3
8	-0.358	-7.5	-0.315	-5.2	0.647	6.6	0.549	4.0
9	-0.391	-7.6	-0.362	-5.0	0.498	5.0	0.439	3.0
10	-0.465	-9.5	-0.406	-5.7	0.464	4.8	0.260	1.7
11	-0.532	-8.6	-0.546	-6.9	0.378	3.9	0.096	0.4
12+	-0.656	-7.9	-0.814	-6.8				
Separation fiscal year								
1991	-	-	0.031	1.1	-	-	-	-
1992	-0.021	-0.4	0.061	1.5	-0.199	-2.5	-0.142	-1.2
1993	-0.087	-1.8	0.101	2.7	-0.139	-1.9	-0.293	-2.6
1994	-0.116	-2.4	0.112	3.0	-0.104	-1.7	-0.279	-2.6
1995	-0.097	-2.4	0.025	0.6	-0.106	-1.9	-0.236	-2.3
1996	-0.095	-2.1	0.085	1.9	-0.103	-1.8	-0.334	-3.2
1997	-0.114	-2.8	0.009	0.2	-0.175	-3.7	-0.339	-3.7
1998	-0.096	-2.4	0.038	0.6	-0.122	-2.6	-0.217	-2.2
1999	-0.092	-2.6	0.069	1.3	-0.121	-3.0	-0.238	-2.7
2000	-0.055	-1.5	0.130	1.9	-0.085	-2.2	-0.206	-2.5
2001	-0.046	-1.2	0.204	2.8	-0.067	-1.9	-0.185	-2.2
2002	0.070	2.0	0.277	3.9	0.020	0.5	-0.151	-1.7
2003	0.100	2.8	0.154	2.2	-0.033	-0.9	-0.084	-1.0
2004	0.078	2.5	-	-	0.127	3.4	-0.201	-2.5
Years since separation								
2	-0.249	-17.9	-0.235	-15.2	-0.368	-14.6	-0.347	-10.1
3	-0.692	-30.9	-0.696	-31.5	-0.745	-24.0	-0.798	-20.9
4	-0.970	-43.1	-0.978	-39.5	-1.021	-28.4	-1.086	-29.2
5	-1.172	-41.8	-1.176	-40.0	-1.266	-33.8	-1.294	-39.1
6	-1.338	-34.1	-1.317	-47.0	-1.446	-33.8	-1.469	-39.3
7	-1.467	-41.5	-1.460	-42.7	-1.531	-30.9	-1.616	-27.6
8	-1.581	-35.9	-1.581	-49.2	-1.760	-39.8	-1.752	-32.7
9	-1.812	-41.3	-1.832	-34.7	-2.073	-52.1	-1.909	-27.6
10	-2.148	-36.7	-2.087	-46.1	-2.555	-34.1	-2.282	-28.8
Intercept	-4.186	-16.8	-4.612	-20.2	-5.023	-17.2	-5.149	-15.7
Observations	190,042		174,857		144,527		115,945	
Log Pseudolikelihood	-213,063		-195,621		-150,263		-124,884	

Note: For the Army and Navy, the completed year of service coefficients are relative to a veteran with two completed years. For the Air Force and Marine Corps, coefficients are relative to a veteran with 12 or more completed years.

Table 3 ***Predicted MGIB Usage Rates: Effects of Benefit Generosity***

	2-Year	**5-Year**	**10-Year**
Army			
Base Usage Rate	31	47	57
$10K increase at entry	37	54	64
$10K unexpected change	36	52	63
Navy			
Base Usage Rate	32	48	58
$10K increase at entry	35	51	61
$10K unexpected change	37	53	64
Air Force			
Base Usage Rate	31	45	54
$10K increase at entry	36	52	61
$10K unexpected change	35	52	61
Marine Corps			
Base Usage Rate	29	43	52
$10K increase at entry	33	48	57
$10K unexpected change	33	47	57

Note: Predictions based on static expectations about future benefit amounts.

Table 4 ***Comparison of Estimated Education Benefit Effects on MGIB Usage Under Alternative Expectations Scenarios***

	Static		**MA-3**		**MA-5**	
	Coef.	**z**	**Coef.**	**z**	**Coef.**	**z**
Army						
Pooled						
Value expected at entry	0.020	20.8	0.021	28.1	0.021	28.2
Unexpected change	0.016	7.7	0.019	9.5	0.020	9.2
ACF Only						
Value expected at entry	0.015	4.2	0.015	4.0	0.015	4.1
Unexpected change	0.010	2.9	0.014	3.7	0.013	3.5
Non-ACF Only						
Value expected at entry	0.029	5.0	0.014	3.3	0.021	4.2
Unexpected change	0.011	3.0	0.011	2.9	0.011	3.0
Navy						
Pooled						
Value expected at entry	0.008	3.3	0.006	2.2	0.006	2.2
Unexpected change	0.015	5.4	0.012	4.4	0.013	4.8
NCF Only						
Value expected at entry	-0.015	2.7	-0.015	2.7	-0.016	2.7
Unexpected change	-0.014	2.6	-0.012	2.7	-0.013	2.6
Non-NCF Only						
Value expected at entry	-0.027	5.0	-0.024	4.7	-0.029	5.3
Unexpected change	0.008	2.2	-0.000	0.0	0.003	0.7
Air Force						
Value expected at entry	0.019	5.7	0.019	6.0	0.018	5.1
Unexpected change	0.018	6.0	0.018	6.0	0.018	6.1
Marine Corps						
Value expected at entry	0.013	8.2	0.014	7.8	0.014	7.5
Unexpected change	0.012	3.4	0.012	4.3	0.012	3.8

Table 5 ***Predicted MGIB Usage: Effects of Current Period Unemployment***

	2-Year	5-Year	10-Year
Army			
Base Use Rate	31	47	57
2-point unemployment increase	35	51	61
Navy			
Base Use Rate	32	48	58
2-point unemployment increase	36	52	63
Air Force			
Base Use Rate	31	45	54
2-point unemployment increase	34	50	59
Marine Corps			
Base Use Rate	29	43	52
2-point unemployment increase	33	48	58

Table 6 ***Predicted MGIB Usage by Aptitude Group***

	2-Year	5-Year	10-Year
Army			
I-II (AFQT ≥ 65)	37	53	64
IIIA (50 ≤ AFQT ≤ 64)	31	46	56
IIIB (31 ≤ AFQT ≤ 49)	27	41	51
IV (10 ≤ AFQT ≤ 30)	22	34	43
Navy			
I-II (AFQT ≥ 65)	38	55	65
IIIA (50 ≤ AFQT ≤ 64)	32	48	58
IIIB (31 ≤ AFQT ≤ 49)	28	42	51
IV (10 ≤ AFQT ≤ 30)	22	33	42
Air Force			
I-II (AFQT ≥ 65)	34	49	58
IIIA (50 ≤ AFQT ≤ 64)	29	43	52
IIIB (31 ≤ AFQT ≤ 49)	25	38	47
IV (10 ≤ AFQT ≤ 30)	19	29	36
Marine Corps			
I-II (AFQT ≥ 65)	35	50	60
IIIA (50 ≤ AFQT ≤ 64)	29	43	52
IIIB (31 ≤ AFQT ≤ 49)	24	36	44
IV (10 ≤ AFQT ≤ 30)	21	32	39

Table 7. ***Aptitude Effects on First-Term Separation and 2-Year Usage (Percentage Points)***

	I-II	IIIA	IIIB
Army			
Separation	8	3	1 (ns)
2-Year MGIB Use	19	10	7
Navy			
Separation	11	8	3
2-Year MGIB Use	18	12	6
Air Force			
Separation	3 (ns)	0	-2 (ns)
2-Year MGIB Use	16	12	9
Marine Corps			
Separation	-2 (ns)	0	2 (ns)
2-Year MGIB Use	20	13	6

Note: (ns) denotes that the estimated effect is statistically insignificant.

Table 8. ***Education Benefits Effects on Separation and MGIB Usage (Percentage Points)***

	$10K increase in expected entry amount	$10K unanticipated increase between entry and separation
Army		
Separation	3	5
2-Year MGIB Use	8	9
Navy		
Separation	-3 (ns)	5 (ns)
2-Year MGIB Use	2	-3 (ns)
Air Force		
Separation	7	12
2-Year MGIB Use	3	2 (ms)
Marine Corps		
Separation	0	0
2-Year MGIB Use	6	4

Note: (ns) denotes that the estimated effect is statistically not statistically significant; (ms) denotes that the estimated effect is statistically marginally significant.

APPENDIX A: MODELING ENLISTMENT, REENLISTMENT, AND EDUCATIONAL BENEFIT USAGE

This appendix develops a structural model of enlistment, reenlistment, and educational benefit usage. The model helps understand how educational benefits affect the likelihood that youth will enlist in the military and the likelihood that personnel will remain in the military rather than separate to use the benefits. The model is based on the dynamic programming approach to retention decisions first developed by Gotz and McCall (1984) and later refined and extended by Asch and Warner (2001) and Asch, Hosek, and Clenndenning (2006). In the typical dynamic programming model, individuals have two choices in each period – remain in the military or leave for civilian sector. The model is generalized to allow individuals to choose (or occupy) one of three states in each period: (1) military, (2) civilian sector without additional education, and (3) civilian sector with additional education.

Model Setup and Definitions

Consider a cohort of youth that becomes eligible for military service in period 1 after, say, graduation from high school. At the beginning of this period, each youth must decide whether or not to join the military. Those who do not join the military must decide whether to pursue additional education or enter the civilian labor market without more education. Those who join the military serve an initial (or first-term) enlistment for the remainder of period 1. At the beginning of period 2, the first-term enlistees decide whether to reenlist for a second term or separate. Those who separate may either enter the civilian labor market and (1) begin working or (2) return to school and use the military education benefit to which they became entitled as a result of their service during period 1.

In theory, youth who did not enter the military in period 1 may join the military for an initial enlistment at the beginning of period 2. This would includes those who worked in a non-college position in period 1 and those who chose to go to college in period 1. To simplify the analysis, we assume that enlistment can occur only in period 1 and that youth who do not enlist in period 1 cannot join in future periods. We also assume that the period of a college education is the same as the period of a military enlistment. Since a term of military enlistment is typically four years and a college degree typically takes a similar amount of time to complete, this assumption is not unrealistic.

Let i denote the i^{th} individual in the population of individuals eligible for military service and let the factor γ_i represent this individual's net taste for military service. It represents the per-period value to the individual of the difference between the non-pecuniary aspects of military life and the non-pecuniary aspects of civilian life. A value of γ of $5,000 indicates that the individual places a $5,000 higher value on the non-pecuniary aspects of military life than she places on the non-pecuniary aspects of civilian life. The net value that an individual places on military service is influenced by many underlying influences, including how the individual values pride of service, exposure to danger, and the loss of personal freedom due to military regimentation. Some individuals will place a higher weight on the positive aspects of service than the negative aspects of service and will therefore have positive values of γ while for others the reverse is true. Individuals are assumed to form their attitudes about (i.e., tastes for) military service at the beginning of period 1.

At the beginning of each period, individual i forms expectations about the values of military pay, civilian earnings without a college degree, and civilian earnings with a college degree that he or she will receive in the current period and in each future period. These expected compensation values are denoted by $w_{i,t}^{m}$, $w_{i,t}^{n}$, and $w_{i,t}^{c}$, respectively. In any given period, these expected compensation values depend on other factors. For example, expectations about future military pay depend on the structure of the military compensation system and on the individual's expectation about the military rank that he or she will occupy at each future point. Military as well as civilian opportunities are likely to depend on the individual's ability, which is denoted in the model by the term ψ. Ability can influence military earnings in the current period, and each future period, by affecting the individual's likelihood of promotion.[20] While able non-college graduates may earn more in the civilian sector than less able non-college graduates, intuition and economic analysis indicates that ability has the largest influence on earnings of college graduates. That is to say, earnings of college graduates vary more with ability than the earnings of non-college graduates.[21]

Earnings typically grow with experience, so the expected earnings in a given state depend on the amount of experience in that state as well as the time previously spent in other states. For example, thus the individual who joins the military in period 2 will earn less in that period than will a military member who joined in period 1, and the civilian earnings of military veterans may depend on how many years they spent in the military.[22]

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[20]To keep the model presented here simple, we do not explicitly model the promotion process. See Asch and Warner (2001) for an explicit analysis of the relationships between ability, promotion (rank), and military earnings.

[21]See Rosen and Willis (1979) and Willis (1986) for analysis of the relationship between ability and earnings and explanations for why the variation in earnings due to ability increases with education level.

[22]For evidence of the effect of military service on veterans' earnings, see the studies discussed in Asch, Hosek,

In any period t, random factors will influence the decisions to join or remain in the military, work in the civilian sector without a college education, or pursue a college degree. Let $\varepsilon_{i,t}^{m}$, $\varepsilon_{i,t}^{n}$, and $\varepsilon_{i,t}^{c}$ represent the values of these random factors. These shocks represent per-period, unobservable events that affect the individual's choices.

Value Functions

At the beginning of each period t, an individual must choose to join or remain in the military, work in the civilian sector without a college education, or pursue a college degree. The expected values of these options are denoted by $E(V_{i,t}^{m})$, $E(V_{i,t}^{n})$, and $E(V_{i,t}^{c})$, respectively. The realized value of the military option is given by

$$V_{i,t}^{m} = \gamma_i + w_{i,t}^{m} + \beta E_t(V_{i,t+1}) + \varepsilon_{i,t}^{m} = E(V_{i,t}^{m}) + \varepsilon_{i,t}^{m} \tag{1}$$

where β is a personal discount factor and $E_t(V_{i,t+1})$ is the expected value of the individual's optimal choice in the next period. The term $E_t(V_{i,t+1})$ is the expected lifetime value of individual *i's* lifetime wealth at the beginning of period $t+1$.

The value of the non-college option in any period is given by

$$V_{i,t}^{n} = w_{i,t}^{n} + \beta E_t(V_{i,t+1}) + \varepsilon_{i,t}^{n} = E(V_{i,t}^{n}) + \varepsilon_{i,t}^{n}. \tag{2}$$

Because earnings grow with experience, the value of the civilian non-college wage in the current period will depend on current experience in the non-college "sector" as well as on the time previously spent in the military.[23]

Now consider the value of the college option ($V_{i,t}^{c}$). Let C denote the cost to the individual of a college education and let CB denote the college benefit an individual has earned as a result of military service. If an individual has not yet attended college or entered military service, the value of the college option at period t will be given by

$$V_{i,t}^{c} = -C + \beta E_t(V_{i,t+1}) + \varepsilon_{i,t}^{c} = E(V_{i,t}^{c}) + \varepsilon_{i,t}^{c} \tag{3}$$

where $E(V_{i,t}^{c}) = -C + \beta E_t(V_{i,t+1})$ is the expected value of the college choice for youth without prior military service, which is equal to the expected discounted value of wealth after completion of the college degree in period t+1 minus the cost of the education (which is incurred in period t). An individual who has completed one or more periods of military

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and Warner (2006) and Asch and Warner (1996).

[23]We rule out the possibility that individuals who have previously earned a college degree will work in the future at non-college graduate wages.

service is eligible for a college benefit, thus modifying the value of the college option to:

$$V_{i,t}^{c} = CB - C + \beta E_t(V_{i,t+1}) + \varepsilon_{i,t}^{c} = E(V_{i,t}^{c}) + \varepsilon_{i,t}^{c} \tag{4}$$

where $E(V_{i,t}^{c})$ now accounts for the educational subsidy to which they are entitled.

Individuals who have served in the military typically do not re-enter military service. That is, individuals typically do not return to the military once they have made the transition from the military to the civilian sector. Under the assumption that returning to the military is not permitted, $E(V_{i,t}^{n})$ and $E(V_{i,t}^{c})$ are equal to the discounted sum of their respective future wage streams, with

$$E(V_{i,t}^{n}) = \sum_{s=t}^{T} \beta^{s-t} w_{i,s}^{n} \tag{5}$$

and

$$E(V_{i,t}^{c}) = CB - C + \sum_{s=t+1}^{T} \beta^{s-t} w_{i,s}^{c}. \tag{6}$$

An individual who is currently in the military forms expectations about civilian options using equations (5) and (6), respectively.

Optimizing individuals choose the option with the highest value. Therefore, the payoff $V_{i,t}$ is the maximum of the payoffs to the three choices:

$$V_{i,t} = max\left\{E(V_{i,t}^{m}) + \varepsilon_{i,t}^{m}, E(V_{i,t}^{n}) + \varepsilon_{i,t}^{n}, E(V_{i,t}^{c}) + \varepsilon_{i,t}^{c}\right\} \tag{7}$$

The expected value at time t of the optimal choice at time $t+1$ is given by

$$E_t(V_{i,t+1}) = E\left[max\left(E(V_{i,t+1}^{m}) + \varepsilon_{i,t+1}^{m}, E(V_{i,t+1}^{n}) + \varepsilon_{i,t}^{n}, E(V_{i,t+1}^{c}) + \varepsilon_{i,t+1}^{c}\right)\right] \tag{8}$$

With an assumption about the distribution of the random shocks, this expected value can be given a specific form. In particular, we assume that the random shocks follow the extreme value distribution with location parameter a and dispersion parameter b. The cumulative density function of the extreme value distribution is given by $F(\varepsilon) = exp(-e^{(a-\varepsilon)/b})$. Under this assumption about the random shocks, $E_t(V_{i,t+1})$ has the convenient, mathematically tractable solution

$$E_t(V_{i,t+1}) = b\left\{a/b + \varsigma + \ln\left[\exp\left(E\left(V_{i,t+1}^{m}\right)/b\right) + \exp\left(E\left(V_{i,t+1}^{n}\right)/b\right) + \exp\left(E\left(V_{i,t+1}^{c}\right)/b\right)\right]\right\} \tag{9}$$

where ς is Euler's constant (0.5776).[24] This expression for expected future wealth

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[24]Euler's constant ς is the expected value of the extreme value distribution when $a = 0$ and $b = 1$. In order for the random shocks to be centered around 0, i.e., have zero expected values, $a = -b\varsigma$.

($E_t(V_{i,t+1})$) is easily computed from the expected values for the three choices. If the extreme value distribution is centered around zero, equation (9) simplifies to

$$E_t(V_{i,t+1}) = b \ln\left[\exp\left(E\left(V_{i,t+1}^m\right)/b\right) + \exp\left(E\left(V_{i,t+1}^n\right)/b\right) + \exp\left(E\left(V_{i,t+1}^c\right)/b\right)\right].$$

Individual Choice Probabilities

Consider an individual who has not yet joined the military or is currently serving in the military. The individual's probability of joining, or remaining in service, is given by the logistic function

$$P_{i,t}^m = \frac{e^{E(V_{i,t}^m)/b}}{e^{E(V_{i,t}^m)/b} + e^{E(V_{i,t}^n)/b} + e^{E(V_{i,t}^c)/b}} \tag{10}$$

(See Ben-Akiva and Lerman (1985) for a derivation of the logistic choice probability of the form given by equation (10) from expected utility of the form given in equation (9)). This probability is easily computable from the expected values of the choices. Likewise, the probabilities of choosing the civilian sector without a college education and the civilian sector with a college education are given, respectively, by:

$$P_{i,t}^n = \frac{e^{E(V_{i,t}^n)/b}}{e^{E(V_{i,t}^m)/b} + e^{E(V_{i,t}^n)/b} + e^{E(V_{i,t}^c)/b}} \tag{11}$$

and

$$P_{i,t}^c = \frac{e^{E(V_{i,t}^c)/b}}{e^{E(V_{i,t}^m)/b} + e^{E(V_{i,t}^n)/b} + e^{E(V_{i,t}^c)/b}} \tag{12}$$

The probabilities $P_{i,t}^m$, $P_{i,t}^n$, and $P_{i,t}^c$ depend on an individual's tastes for military service (γ) and on his or her ability (ψ). Intuitively, higher-γ individuals are more likely to join the military or remain in service. In the model, a higher value of γ increases the military payoff $E(V_{i,t}^m)$ and thus increases $P_{i,t}^m$ while reducing $P_{i,t}^n$ and $P_{i,t}^c$. How ability affects the choice probabilities depends on how it affects earnings in each sector. While earnings in all three states may increase with ability, it is likely that the college payoff $E(V_{i,t}^c)$ increases the most. If this is in fact the case, $P_{i,t}^c$ will increase with ability while $P_{i,t}^m$ and $P_{i,t}^n$ decline.

Because of the assumption that individuals who leave military service for the civilian sector cannot return, equations (11) and (12) are only relevant to individuals who are not yet veterans. Because returning to military service is ruled out, veterans choose the maximum of the college and non-college options in each post-service period. The expected value of the maximum of these two choices is analogous to equation (9) and the probability of college attendance is again logistic:

$$P(C=1 \mid S_{i,t}=1) = \frac{e^{E(V_{i,t}^{c})/b}}{e^{E(V_{i,t}^{c})/b} + e^{E(V_{i,t}^{n})/b}} \tag{13}$$

(In this expression, $S_{i,t}=1$ indicates that the individual is a military veteran.) The probability of attending college clearly rises with $E(V_{i,t}^{c})$, which from equation (6) depends on the cost of college attendance, the military education benefit, and individual ability ψ. An important implication of equation (13), though, is that a veteran's probability of college attendance does not depend on the veteran's military preference factor γ.

Effects of Educational Benefits on Individual Choice Probabilities

Equation (10) specifies the probability that an individual will enlist in the military ($t=1$) or remain (reenlist) in the military ($t>1$). Likewise, for someone who is currently in the military, equations (11) and (12) specify the probability that an individual will separate to work in the non-college civilian labor market and separate to attend college, respectively. These transition probabilities depend on military compensation policy and other factors that are exogenous to the military, including the cost of college attendance and expected earnings in the civilian labor market. The effects of various compensation policies are straightforward to derive. This section focuses on the expected effects of educational benefits (*CB*) and college costs (*C*).

The effect of an increase in college costs (C) on either enlistment ($t=1$) or reenlistment ($t=2$) is obtained by differentiating equation (12) with respect to *C*. The effect is given by

$$\frac{\partial P_{i,t}^{m}}{\partial C} = \frac{P_{i,t}^{m} P_{i,t}^{c}}{b} \tag{14}$$

A higher cost of college attendance increases the probability that a youth will enlist in the military and that an enlistee will remain in the military, and the magnitude of the effect is larger for individuals with higher probabilities of college attendance. An implication of this result is that an increase in college costs has a larger effect on the decisions of high-ability individuals than low-ability individuals. The effect of college costs on enlistment and reenlistment is also larger for individuals who have higher probabilities of enlistment and reenlistment to start with. This implies that a change in college costs has more effect on the enlistment and reenlistment decisions of high-γ individuals than low-γ individuals. Also, a lower variance of the error terms (lower *b*) increases the probability of reenlistment.

Now consider the effect of an increase in the expected future college benefit on the probability that a youth will enlist in period 1. This effect is given by

$$\frac{\partial P_{i,1}^m}{\partial CB} = \frac{\beta P_{i,1}^m (1 - P_{i,1}^m) P_{1,2}^c}{b} \tag{15}$$

An increase in the expected future college benefit increases a *given youth's* likelihood of enlistment. We call this the *enlistment incentive effect* of the educational benefit. The effect depends non-linearly on the youth's likelihood of enlistment prior to the benefit increase ($P_{i,1}^m$). Because the product $P_{i,1}^m(1-P_{i,1}^m)$ equals 0.25 when $P_{i,1}^m = .5$ and declines as $P_{i,1}^m$ deviates from .5, the effect of a college benefit increase is largest for youth with a 50 percent chance of enlistment. Youth with a high or low initial chance of enlistment (i.e., a high or low initial $P_{i,1}^m$) are less affected by the increase in college benefits.

Most importantly from equation (15), the effect of *CB* on a youth's likelihood of enlistment increases proportionately with the youth's probability of using the benefit in period 2. That is, educational benefits have larger incentive effects on the enlistment of youth who are more likely to take advantage of the benefit! An implication is that high-ability youth will be more responsive to an increase in the educational benefit than youth of lesser ability.[25] This result gives rise to what we term the *enlistment selection effect* of educational benefits. The enlistment selection effect implies that because larger educational benefits have bigger effects on the enlistment decisions of more able youth, they can alter the ability mix of military entrants.[26]

While higher college benefits raise the probability of enlistment, they also reduce the probability of reenlistment. The reenlistment effect of an increase in college benefits is given by

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[25] Since educational benefits are not received until individuals separate, the enlistment effect of a rise in the military educational benefit also depends on the personal discount factor β. Youth with high personal discount rates (low β) respond less to a change in the value of the educational benefit.

[26] Warner, Simon, and Payne (2001, 2003) found that the Army and Navy College Fund programs had significant positive effects on the percentage of military recruits who are high quality (there defined as recruits who are high school graduates or better and score 50 or above on the AFQT). Our model provides the theoretical basis for why educational benefits improve the enlistee quality mix.

$$\frac{\partial P_{i,2}^{m}}{\partial CB}=\frac{-P_{i,2}^{m}P_{i,2}^{c}}{b} \qquad (16)$$

The adverse reenlistment effect of an increase in CB is stronger for individuals with a higher propensity to attend college.

Aggregate Rates of Enlistment, Reenlistment, and Education Benefit Usage

Aggregate rates of enlistment and reenlistment of a youth cohort may be derived from the individual transition probabilities in the youth cohort. Discussion of aggregation is important because, unlike individual probabilities, aggregate rates are not independent of previous values. To make this point clearer, holding constant an individual's military taste and ability, his or her probability of remaining in service after completion of a given period of service is independent of what the individual was paid in previous periods. At the aggregate level, however, this is not true. Because changes in compensation alter the taste and ability mix of personnel who survive to a given period, aggregate retention in that period will not be independent of compensation in previous periods. Similarly, if a change in educational benefits changes the composition of the pool of entrants (measured in terms of tastes and abilities), the aggregate rate at which a cohort of entrants eventually uses educational benefits will not be independent of the educational benefits recruits anticipated at entry.

A given youth who becomes eligible for military service in period 1 has a probability of military enlistment given by equation (10). As shown in the previous section, individual enlistment probabilities vary with tastes, abilities, military compensation policy, and other exogenous factors. Let $g(\gamma,\psi)$ be the joint probability density (i.e., relative frequency) of γ and ψ in the population of potential entrants. Tastes and abilities may be correlated, but we have no *a priori* hypothesis about the direction of correlation. The aggregate fraction of youth who are expected to enlist in period 1, denoted below as $E(P_{i,1}^{m})$ or e, and is given by

$$E(P_{1}^{m})=e=\int\int P_{i,1}^{m}g(\gamma,\psi)d\gamma d\psi. \qquad (17)$$

The expected enlistment rate is simply a weighted average of the individual probabilities of enlistment in the youth cohort, where the weights are based on the relative frequency of different combinations of tastes and ability in the cohort.

Each individual who enlists in period 1 has a probability $P_{i,2}^{m}$ of reenlisting at the start of period 2. The aggregate fraction of the youth population that is expected to enlist in period 1 and reenlist in period 2 is given by the weighted average of these individual probabilities:

$$E(P_1^m P_2^m) = \int\int P_{i,1}^m P_{i,2}^m g(\gamma,\psi) d\gamma d\psi. \tag{18}$$

The probability that an individual enlists in period 1 and separates in period 2 to attend college is given by $P_{i,1}^m P_{i,2}^c$. Therefore, the aggregate rate at which youths enlist in period 1 and attend college in period 2 is given by

$$E(P_1^m P_2^c) = \int\int P_{i,1}^m P_{i,2}^c g(\gamma,\psi) d\gamma d\psi. \tag{19}$$

Likewise, the expected fraction of youth who enlist in period 1 and then separate in period 2 to enter the non-college labor market is given by

$$E(P_1^m P_2^n) = \int\int P_{i,1}^m P_{i,2}^n g(\gamma,\psi) d\gamma d\psi. \tag{20}$$

Military enlistees can remain for another period (term of enlistment), separate to use college benefits, or separate to enter the non-college civilian labor market. The (conditional) rates at which first-term personnel reenlist, separate to go to college, and separate to enter the non-college labor market are defined as r_2, $coll_2$, and $nocoll_2$, respectively. These rates are computed as follows:

$$r_2 = \frac{E(P_1^m P_2^m)}{E(P_1^m)} \tag{21}$$

$$coll_2 = \frac{E(P_1^m P_2^c)}{E(P_1^m)} \tag{22}$$

$$nocoll_2 = \frac{E(P_1^m P_2^n)}{E(P_1^m)}. \tag{23}$$

Finally, fraction of veterans who attend college (use educational benefits), is given by

$$usage_2 = \frac{E(P_1^m P_2^c)}{E(P_1^m P_2^c) + E(P_1^m P_2^n)}. \tag{24}$$

The analysis has derived expected probabilities through two periods. It is straight-forward to extend the analysis beyond the second period to obtain the expected probability of serving three terms, serving two terms and then going to college, etc.

The aggregate enlistment effect of a change in *CB* is given by the differentiation of equation (17) with respect to the college benefit. The result is the weighted average of the individual effects given by equation (15):

$$\frac{\partial e}{\partial CB} = E\left[P_1^m (1 - P_1^m) P_2^c\right] \beta / b > 0. \tag{25}$$

Higher college benefits increase the rate of enlistment from the youth population. The overall effectiveness of college benefits in inducing a higher rate of enlistment is proportional to the expected product $E\left[P_1^m(1-P_1^m)P_2^c\right]$. The aggregate enlistment effect of the college benefit shown by equation (25) imbeds both the enlistment incentive and enlistment selection effects alluded to earlier.

College benefits affect the ability mix of military entrants. Expected ability in the youth population is given by

$$E(\psi)=\int\int\psi g(\gamma,\psi)d\gamma d\psi \qquad (26)$$

while expected ability in the population of military entrants is given by

$$E(\psi \mid enlist)=\int\int\psi P_{i,1}^m g(\gamma,\psi)d\gamma d\psi. \qquad (27)$$

Due to the enlistment selection effect, higher college benefits raise the enlistment probabilities of more able youth more than they raise the enlistment probabilities of lesser-able youth. As a result, the average ability of entrants -- $E(\psi \mid enlist)$ -- increases when college benefits increase.

The expected first-term reenlistment rate is given by equation (21). The effect of *CB* on this rate is given by the differentiation of equation (21) with respect to CB(not shown to save space) . The result, $\partial r_2 / \partial CB$ is strictly negative, and imbeds both the incentive and selection effects discussed earlier.

The effect of CB on the rate at which youth join and then separate to use the benefit is given by differentiation of equation (19) with respect to CB. This derivative is unambiguously positive. Finally, the rate at which veterans' benefit usage changes as benefits change is given by differentiation of equation (24) with respect to CB. This derivative is also unambiguously positive.

Full-blown estimation of this structural model would require estimation of the joint distribution of tastes and ability in the youth population and the variance parameter b. Because of its complexity, we eschew such estimation in this paper in favor of the more direct reduced form analysis found in the main body of the paper. Nevertheless, the structural model is a useful guide to understanding how recruiting, reenlistment, and benefit usage are affected by educational benefits.

APPENDIX B: SAMPLE MEANS FOR VETERANS DATA

	All	MGIB Users	All	MGIB Users	All	MGIB Users	All	MGIB Users
Sample Size	385,421	190,779	303,392	154,915	144,131	72,531	197,110	94,764
Aptitude group								
I-II (AFQT ≥ 65)	40.3	46.6	41.4	45.3	55.3	59.0	39.6	45.3
IIIA (50 ≤ AFQT ≤ 64)	29.0	28.9	24.4	24.4	29.2	28.3	28.1	27.9
IIIB (31 ≤ AFQT ≤ 49)	28.2	22.8	31.6	28.1	15.3	12.7	31.9	26.6
IV (20 ≤ AFQT ≤ 30)	2.4	1.7	2.7	2.2	0.2	0.1	0.4	0.2
Race-Ethnic group								
White	66.9	66.5	69.0	68.0	79.5	78.5	66.7	67.1
Black	21.2	20.4	17.2	16.9	11.6	11.8	11.5	11.4
Hispanic	4.0	4.5	9.2	10.1	5.0	5.4	10.6	11.7
Other	7.9	8.5	6.3	6.8	6.5	7.1	17.2	16.5
Educational status at entry								
Some college or better	2.9	1.9	1.7	1.5	3.1	2.7	0.7	0.6
High school graduate	89.5	91.9	90.7	92.1	94.5	95.0	94.8	95.3
Non high school graduate	7.6	6.2	7.6	6.4	2.4	2.3	4.5	4.1
Other personal characteristics								
Average age at entry	20.0	19.7	19.6	19.4	19.6	19.5	19.1	19.0
Average age at separation	23.9	23.4	24.0	23.7	24.3	24.1	23.3	23.2
Male	84.0	82.1	84.0	82.1	73.6	70.7	94.2	93.4
No. of dependents at sep	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Marital status at sep	33.6	28.4	32.2	28.5	46.3	42.2	40.3	35.4
First term attriter	7.9	3.1	8.5	4.6	9.1	3.8	6.4	3.9
Length of Initial Term								
2 YO	9.9	13.7	7.7	8.2				
3 YO	30.9	31.5	11.0	11.3				
4 YO	47.5	45.2	55.6	55.6	90.7	93.4	94.6	94.5
5 YO	7.0	6.0	9.0	8.2				
6 YO	4.7	3.7	16.6	16.7	9.3	6.6	5.4	5.5

APPENDIX C: HECKMAN TWO-STEP PROBIT MODEL ESTIMATION

Table C-1 ***HeckProb Estimates of GI Bill Usage and Reenlistment (Army)***

	MGIB Usage				Separation			
	Coef	**z-stat**	**Mg. Eff.**	**X bar**	**Coef**	**z-stat**	**Mg. Eff.**	**X Bar**
Education benefit ($1K)								
Value expected at entry	0.023	22.6	0.008	29.97	0.008	10.1	0.003	29.97
Unexpected change	0.025	7.4	0.009	2.47	0.012	5.1	0.005	2.47
Entry bonus amount ($1K)	-0.002	-1.4	-0.001	1.03	-0.001	-0.6	0.000	1.03
ACOL ($1K)					-0.032	-12.6	-0.012	11.31
Aptitude group (IV omitted)								
I-II (AFQT > 64)	0.514	18.0	0.188	0.38	0.205	7.3	0.077	0.38
IIIA (49 < AFQT < 65)	0.285	10.3	0.105	0.29	0.089	3.4	0.033	0.29
IIIB (34 < AFQT < 50)	0.192	8.5	0.070	0.30	0.036	1.5	0.014	0.30
Race-Ethnic Group (White omitted)								
Black	-0.031	-2.2	-0.011	0.24	-0.164	-8.2	-0.063	0.24
Hispanic	0.139	9.1	0.051	0.08	0.094	5.1	0.035	0.08
Other	0.235	14.5	0.088	0.04	0.000	0.0	0.000	0.04
Personal Characteristics								
Entry age 20-22	-0.033	-4.2	-0.012	0.28	0.077	8.7	0.029	0.28
Entry age 23-25	-0.179	-12.2	-0.062	0.09	0.098	5.5	0.036	0.09
Entry age 26 plus	-0.230	-14.2	-0.079	0.05	0.063	2.4	0.024	0.05
Male	-0.080	-4.9	-0.029	0.86	-0.071	-3.8	-0.027	0.86
Married at ETS	-0.255	-18.7	-0.090	0.37	-0.497	-10.7	-0.190	0.37
No. of dependents at ETS	-0.073	-8.4	-0.026	0.96	-0.039	-1.3	-0.015	0.96
Some college or better	-0.263	-8.0	-0.089	0.03	0.296	10.9	0.105	0.03
High school graduate	0.135	8.0	0.047	0.89	-0.039	-2.6	-0.015	0.89
Economic Conditions								
Unem rate -- current	0.025	6.6	0.009	5.57	-0.014	-5.1	-0.005	5.57
Unem rate -- time of entry	-0.007	-1.9	-0.003	5.81	0.008	2.5	0.003	5.81
Mil/Civ pay ratio	0.422	8.9	0.152	1.04	-0.159	-2.8	-0.060	1.04
CG-HSG Differential	-0.174	-1.9	-0.063	1.62	-0.073	-1.1	-0.027	1.62
State socio-economic characteristics								
Percent college grads	0.013	14.3	0.005	33.76	0.000	-0.1	0.000	33.76
Percent veterans	-0.004	-4.5	-0.002	40.84	-0.001	-1.0	0.000	40.84
Family Income ($1K)	0.003	9.6	0.001	41.04	0.003	12.4	0.001	41.04
Rank at ETS (E4 omitted)								
Less than E4					1.347	38.7	0.385	0.17
E5					-1.117	-20.6	-0.423	0.16
More than E5					-2.361	-27.6	-0.619	0.01
Military occupation group (Admin omitted)								
Combat Arms	-0.029	-1.9	-0.010	0.32	0.286	19.0	0.106	0.32
Electronic repair	-0.127	-5.4	-0.044	0.06	0.169	10.5	0.062	0.06
Communications	-0.007	-0.4	-0.002	0.13	0.225	12.2	0.082	0.13
Medical	0.117	5.5	0.043	0.06	0.038	1.7	0.014	0.06
Other technical	0.004	0.2	0.001	0.03	0.172	9.0	0.063	0.03
Mechanical equipment	-0.183	-12.7	-0.064	0.15	0.130	8.5	0.048	0.15
Craftsmen	-0.207	-7.8	-0.071	0.02	0.228	9.8	0.082	0.02
Service and supply	-0.098	-5.3	-0.035	0.12	0.120	6.8	0.045	0.12
Rho	0.334							
Observations	395,307							
Retained	156,888							
Separated	238,419							

Note: Model included complete set of separation year effects and term of enlistment effects.

Table C-2 ***HeckProb Estimates of GI Bill Usage and Reenlistment (Navy)***

	MGIB Usage				Separation			
	Coef	**z-stat**	**Mg. Eff.**	**X bar**	**Coef**	**z-stat**	**Mg. Eff.**	**X Bar**
Education benefit ($1K)								
Value expected at entry	0.006	2.2	0.002	28.60	-0.007	-1.5	-0.003	28.60
Unexpected change	-0.009	-1.4	-0.003	3.21	0.012	1.1	0.005	3.21
Entry bonus amount ($1K)	0.010	3.0	0.003	0.69	0.009	2.2	0.003	0.69
ACOL ($1K)	-	-	-	-	-0.038	-12.7	-0.015	11.45
Aptitude group (IV omitted)								
I-II (AFQT > 64)	0.500	30.7	0.176	0.39	0.283	9.4	0.109	0.39
IIIA (49 < AFQT < 65)	0.328	22.2	0.117	0.25	0.196	7.7	0.075	0.25
IIIB (34 < AFQT < 50)	0.173	13.8	0.060	0.33	0.071	2.8	0.028	0.33
Race-Ethnic Group (White omitted)								
Black	-0.036	-3.0	-0.012	0.20	-0.199	-7.9	-0.078	0.20
Hispanic	0.113	7.7	0.040	0.09	0.110	7.6	0.042	0.09
Other	0.155	8.8	0.055	0.07	-0.164	-11.6	-0.065	0.07
Personal Characteristics								
Entry age 20-22	-0.026	-3.4	-0.009	0.27	0.042	4.5	0.016	0.27
Entry age 23-25	-0.165	-11.1	-0.055	0.07	0.015	0.8	0.006	0.07
Entry age 26 plus	-0.276	-10.8	-0.088	0.04	-0.109	-3.6	-0.043	0.04
Male	-0.006	-0.4	-0.002	0.85	0.112	6.0	0.044	0.85
Married at ETS	-0.247	-17.1	-0.084	0.37	-0.402	-5.7	-0.157	0.37
No. of dependents at ETS	-0.094	-9.7	-0.033	0.98	-0.027	-0.6	-0.011	0.98
Some college or better	-0.009	-0.3	-0.003	0.02	-0.059	-1.3	-0.023	0.02
High school graduate	0.136	7.7	0.046	0.91	-0.074	-4.0	-0.028	0.91
Economic Conditions								
Unem rate -- current	0.015	2.9	0.005	5.52	-0.022	-4.1	-0.009	5.52
Unem rate -- time of entry	-0.001	-0.4	0.000	5.97	0.004	0.9	0.001	5.97
Mil/Civ pay ratio	0.412	7.1	0.142	1.03	-0.121	-1.7	-0.047	1.03
CG-HSG Differential	-0.098	-1.2	-0.034	1.63	0.166	2.1	0.065	1.63
State socio-economic characteristics								
Percent college grads	0.014	11.5	0.005	33.90	-0.002	-1.9	-0.001	33.90
Percent veterans	-0.003	-2.4	-0.001	41.29	0.002	1.8	0.001	41.29
Family Income ($1K)	0.003	8.7	0.001	41.63	0.002	6.5	0.001	41.63
Rank at ETS (E4 omitted)								
Less than E4	-	-	-	-	1.071	21.8	0.370	0.27
E5	-	-	-	-	-0.975	-18.1	-0.374	0.23
More than E5	-	-	-	-	-1.703	-14.0	-0.520	0.01
Military occupation group (Admin omitted)								
Combat Arms	0.062	2.3	0.022	0.13	0.207	4.5	0.079	0.13
Electronic repair	-0.070	-3.8	-0.024	0.14	0.118	2.3	0.045	0.14
Communications	0.080	5.5	0.028	0.11	0.182	6.4	0.070	0.11
Medical	0.086	3.5	0.030	0.08	-0.553	-10.9	-0.218	0.08
Other technical	0.118	3.5	0.042	0.01	-0.085	-2.8	-0.033	0.01
Mechanical equipment	-0.050	-3.1	-0.017	0.32	0.177	7.6	0.068	0.32
Craftsmen	-0.244	-13.4	-0.079	0.06	0.218	5.0	0.083	0.06
Service and supply	-0.081	-4.1	-0.027	0.05	-0.105	-3.9	-0.041	0.05
Rho	0.249							
Observations	323,654							
Retained	139,689							
Separated	183,965							

Note: Model included complete set of separation year effects and term of enlistment effects.

Table C-3 ***HeckProb Estimates of GI Bill Usage and Reenlistment (Air Force)***

	MGIB Usage				Separation			
	Coef	z-stat	Mg. Eff.	X bar	Coef	z-stat	Mg. Eff.	X Bar
Education benefit ($1K)								
Value expected at entry	0.012	2.9	0.003	24.77	0.018	5.1	0.007	24.77
Unexpected change	0.008	1.6	0.002	3.26	0.030	3.8	0.012	3.26
ACOL ($1K)	-	-	-	-	-0.003	-1.0	-0.001	10.48
Aptitude group (IV omitted)								
I-II (AFQT > 64)	0.572	4.4	0.163	0.53	0.075	1.1	0.029	0.53
IIIA (49 < AFQT < 65)	0.383	2.9	0.117	0.30	-0.013	-0.2	-0.005	0.30
IIIB (34 < AFQT < 50)	0.281	2.1	0.087	0.17	-0.043	-0.7	-0.017	0.17
Race-Ethnic Group (White omitted)								
Black	-0.045	-2.5	-0.013	0.14	-0.346	-12.7	-0.131	0.14
Hispanic	0.063	3.1	0.019	0.05	0.039	2.3	0.015	0.05
Other	0.067	3.1	0.020	0.07	-0.097	-6.3	-0.038	0.07
Personal Characteristics								
Entry age 20-22	-2.974	-17.7	-0.260	0.05	-0.500	-2.8	-0.181	0.05
Entry age 23-25	-2.414	-11.1	-0.222	0.02	-0.501	-2.5	-0.180	0.02
Entry age 26 plus	-0.257	-7.3	-0.067	0.02	-0.038	-0.9	-0.015	0.02
Male	-0.083	-3.2	-0.024	0.77	-0.016	-1.6	-0.006	0.77
Married at ETS	-0.227	-13.8	-0.066	0.52	-0.241	-6.8	-0.094	0.52
No. of dependents at ETS	-0.151	-22.3	-0.044	1.06	-0.091	-4.2	-0.036	1.06
Some college or better	-0.304	-7.8	-0.078	0.03	0.207	6.0	0.082	0.03
High school graduate	-0.103	-4.2	-0.031	0.94	-0.070	-3.1	-0.028	0.94
Economic Conditions								
Unem rate -- current	0.012	1.7	0.004	5.31	-0.025	-4.9	-0.010	5.31
Unem rate -- time of entry	-0.005	-0.8	-0.001	5.90	0.014	3.6	0.006	5.90
Mil/Civ pay ratio	0.320	4.4	0.093	1.04	-0.179	-3.0	-0.070	1.04
CG-HSG Differential	0.067	0.5	0.019	1.63	-0.002	0.0	-0.001	1.63
State socio-economic characteristics								
Percent college grads	0.012	9.7	0.003	33.72	-0.001	-0.8	0.000	33.72
Percent veterans	0.000	-0.4	0.000	41.38	-0.003	-3.2	-0.001	41.38
Family Income ($1K)	0.002	3.4	0.001	41.16	0.003	7.9	0.001	41.16
Length of initial term (4YO omitted)								
6 YO	-0.170	-7.1	-0.046	0.05	0.251	4.7	0.099	0.05
Rank at ETS (E4 omitted)								
Less than E4	-	-	-	-	0.615	12.0	0.241	0.14
E5	-	-	-	-	-1.493	-13.6	-0.412	0.08
More than E5	-	-	-	-	-1.302	-12.6	-0.356	0.00
Military occupation group (Admin omitted)								
Combat Arms	0.000	0.0	0.000	0.09	0.376	13.2	0.149	0.09
Electronic repair	-0.004	-0.2	-0.001	0.11	0.150	9.1	0.059	0.11
Communications	-0.001	-0.1	0.000	0.07	0.165	8.8	0.065	0.07
Medical	0.190	6.7	0.058	0.10	0.202	8.3	0.080	0.10
Other technical	-0.035	-1.1	-0.010	0.05	0.360	22.0	0.143	0.05
Mechanical equipment	-0.096	-6.6	-0.027	0.24	0.066	5.4	0.026	0.24
Craftsmen	-0.191	-8.0	-0.051	0.06	0.285	8.1	0.113	0.06
Service and supply	-0.032	-1.2	-0.009	0.10	0.223	8.6	0.088	0.10
Rho	0.174							
Observations	179,417							
Retained	99,855							
Separated	79,562							

Note: Model included complete set of separation year effects.

Table C-4 ***HeckProb Estimates of GI Bill Usage and Reenlistment (Marine Corps)***

	MGIB Usage				Separation			
	Coef	z-stat	Mg. Eff.	X bar	Coef	z-stat	Mg. Eff.	X Bar
Education benefit ($1K)								
Value expected at entry	0.017	12.3	0.006	25.22	0.000	0.0	0.000	25.22
Unexpected change	0.012	2.6	0.004	3.16	0.005	0.7	0.001	3.16
ACOL ($1K)	-	-	-	-	-0.006	-1.5	-0.002	10.70
Aptitude group (IV omitted)								
I-II (AFQT > 64)	0.556	7.6	0.199	0.39	-0.063	-1.0	-0.019	0.39
IIIA (49 < AFQT < 65)	0.348	4.9	0.126	0.28	0.005	0.1	0.001	0.28
IIIB (34 < AFQT < 50)	0.170	2.3	0.061	0.32	0.077	1.3	0.023	0.32
Race-Ethnic Group (White omitted)								
Black	-0.051	-2.5	-0.018	0.13	-0.323	-9.8	-0.105	0.13
Hispanic	0.075	5.4	0.027	0.12	0.007	0.4	0.002	0.12
Other	0.061	3.5	0.022	0.11	-0.098	-5.2	-0.030	0.11
Personal Characteristics								
Entry age 20-22	-0.020	-2.7	-0.007	0.22	0.119	9.8	0.035	0.22
Entry age 23-25	-0.138	-6.8	-0.047	0.05	0.141	4.8	0.040	0.05
Entry age 26 plus	-0.206	-4.7	-0.068	0.01	0.054	1.4	0.016	0.01
Male	-0.047	-1.6	-0.017	0.95	-0.025	-0.7	-0.007	0.95
Married at ETS	-0.228	-12.9	-0.079	0.46	-0.283	-3.4	-0.085	0.46
No. of dependents at ETS	-0.103	-10.4	-0.036	1.08	-0.071	-1.7	-0.021	1.08
Some college or better	-0.189	-3.5	-0.063	0.01	0.455	9.1	0.112	0.01
High school graduate	0.057	2.9	0.020	0.95	0.005	0.2	0.001	0.95
Economic Conditions								
Unem rate -- current	0.021	3.0	0.007	5.32	-0.025	-4.9	-0.007	5.32
Unem rate -- time of entry	0.002	0.4	0.001	5.96	0.014	3.2	0.004	5.96
Mil/Civ pay ratio	0.610	9.9	0.214	1.03	-0.304	-4.5	-0.091	1.03
CG-HSG Differential	0.094	0.9	0.033	1.63	0.228	1.9	0.068	1.63
State socio-economic characteristics								
Percent college grads	0.019	12.8	0.007	34.22	0.002	1.6	0.001	34.22
Percent veterans	-0.001	-1.0	0.000	40.88	0.001	0.4	0.000	40.88
Family Income ($1K)	0.003	7.1	0.001	42.17	0.002	6.6	0.001	42.17
Length of initial term (4YO omitted)								
6 YO	-0.032	-1.1	-0.011	0.05	1.067	18.7	0.203	0.05
Rank at ETS (E4 omitted)								
Less than E4	-	-	-	-	0.881	24.8	0.221	0.27
E5	-	-	-	-	-1.372	-26.6	-0.484	0.19
More than E5	-	-	-	-	-3.085	-20.0	-0.770	0.00
Military occupation group (Admin omitted)								
Combat Arms	0.015	1.3	0.005	0.33	0.436	22.6	0.123	0.33
Electronic repair	-0.200	-8.0	-0.067	0.06	-0.852	-11.8	-0.308	0.06
Communications	-0.040	-3.0	-0.014	0.08	0.077	1.9	0.023	0.08
Medical	-0.300	-1.1	-0.096	0.00	-0.953	-5.1	-0.353	0.00
Other technical	0.000	0.0	0.000	0.02	0.270	7.5	0.073	0.02
Mechanical equipment	-0.204	-13.2	-0.069	0.17	-0.184	-3.6	-0.057	0.17
Craftsmen	-0.233	-10.3	-0.077	0.03	0.217	9.8	0.060	0.03
Service and supply	-0.138	-11.7	-0.047	0.16	0.165	12.0	0.047	0.16
Rho	0.276							
Observations	181,368							
Retained	53,100							
Separated	128,268							

Note: Model included complete set of separation year effects.