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Military Enlistment and Attrition

An Analysis of Decision Reversal

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PREFACE

This report is one in a series of RAND studies of the determinants of enlistment and first-term success in the military. A common thread among these studies is the use of highly detailed data on individuals which allows the testing of new hypotheses. Studies already completed concern enlistment and early attrition. The enlistment reports help define segments of the recruiting market on the basis of differences in observed enlistment behavior. In addition to underscoring the importance of employment opportunity variables, these reports draw attention to the importance of education expectations as a key factor in the enlistment equation. RAND's research on early attrition uncovered among other things the role of instability in civilian employment as a predictor of attrition. Current work is looking at enlistment decisions of women, and planned future work will examine promotion and reenlistment of women and men.

The present report builds on the previous analyses of enlistment and attrition. They are extended here by considering enlistment and attrition jointly, and by examining both early attrition and attrition at 35 months. This joint approach provides a unified perspective to help answer the question of whether active duty enlistees from different segments of the recruiting market diverge in their expected attrition during the first term of military service. Moreover, by treating enlistment and attrition together, the analysis reveals whether variables governing an individual's willingness to enlist also affect his likelihood of attrition, after controlling for his observed characteristics.

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R-3350-FMP *Educational Expectations and Enlistment Decisions*, James R. Hosek, Christine E. Peterson, and Rick Eden, March 1986.

R-3238-MIL *Enlistment Decisions of Young Men*, James R. Hosek and Christine E. Peterson, July 1985.

R-3069-MIL   *Analysis of Early Military Attrition Behavior*, Richard Buddin, July 1984.

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SUMMARY

This report presents a theoretical discussion and empirical analysis of enlistment and first-term attrition. The theoretical discussion argues that the observable roles of the enlistee and the service are not symmetric in the enlistment and attrition decisions. At the enlistment point the service does not undertake a detailed evaluation of each prospective recruit's expected productivity as a soldier, but instead relies on eligibility criteria to reject those least likely to succeed in the military. Subject to eligibility, an individual can choose whether or not to enlist. That decision can be influenced by advertising, enlistment incentives, recruiter behavior, and information about military opportunities.

With regard to attrition, however, the service no longer plays a passive role. The service, given information about the recruit's performance in training and on duty, evaluates the desirability of retaining him in service for the duration of his term. The individual similarly evaluates the desirability of remaining in service until the end of his term relative to his alternatives in the civilian sector. If either the service or the individual is sufficiently disappointed with the value of the job match prior to the end of the term, attrition can occur. This decision reversal results when actual outcomes fall far short of expectations.

The theoretical discussion gives rise to hypotheses about enlistment and attrition. The enlistment hypotheses take a supply view, treating military service as an alternative to further schooling or to work. The attrition hypotheses are inherently two-sided, considering first the value of enlistment to the individual and the likelihood that he is a poor planner, hence more prone to disappointment, and second the value of the individual to the service and the chance that the service has not planned well, i.e., that its eligibility screens were unable to identify low productivity prospects. The occurrence of attrition reflects the influence of both the individual and service hypotheses; their separate effects cannot be estimated with the available data.

Unobserved variables may link enlistment and attrition decisions. Persons with a higher "taste" for the military may be more likely to enlist and less likely to leave. Further, if persons with higher taste also turn out to be more productive, the service is less likely to discharge them. The statistical model, sequential probit, allows for the role of unobserved factors that jointly influence enlistment and attrition decisions.

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The empirical analysis is directed to the two prime recruiting markets from which the services draw high-quality male enlistees: high school seniors and nonstudent high school graduates (seniors and graduates, for short). The data come from a choice-based sample of enlistees and nonenlistees from Spring 1979; the enlistees are followed through their first 36 months of service. Sequential probit models are estimated for seniors and graduates separately, for both enlistment and six-month attrition and enlistment and 35-month attrition. The model produces estimates of the effect of individual characteristics on enlistment and on attrition, and of the error correlation between the enlistment and attrition equations. which controls for unobserved factors affecting both outcomes.

Variables determining enlistment. Confirming previous RAND analyses of enlistment decisions, the results show that enlistment is negatively related to an individual's academic ability, education finances, and employment opportunities. The education variables are more important for seniors, as one might expect, whereas the employment variables are more important for graduates. The wage variable, for example, is not significant for seniors but highly significant for graduates. Applied to the male youth population, the results imply a wide variation in the predicted probability of enlistment for seniors and graduates. Hence, the enlistment model can effectively identify the prospects more likely to enlist.

Variables determining attrition. Many variables that were important for explaining enlistment do little to explain attrition, e.g., family income, wage rate, hours of work, and job tenure. Nevertheless, a subset of the enlistment variables are determinants of attrition. Foremost are senior vs. graduate status and positive vs. negative education expectations. Earlier research showed the usefulness of these variables for defining recruiting market segments, and the fact that they are related to attrition adds to that usefulness. The table below illustrates how both enlistment and attrition rates vary by these variables. Overall, seniors are less likely to enlist than graduates, but once in, are less likely to leave. The effect of education expectations differs between seniors and graduates. Seniors expecting more education are less likely to enlist, whereas similar graduates are more likely to enlist. Among enlistees, whether seniors or graduates, attrition is a half to a third lower for those expecting more education.

The importance of education expectations for attrition may stem from several sources. Service training might substitute for further formal education; educational benefits are greater for those completing their terms; and individuals who value service training may exert more effort and achieve greater proficiency, thereby becoming more valuable

ENLISTMENT AND ATTRITION RATES
(Spring 1979 enlistment)

Group	Enlistment Rate	6-Month Attrition	35-Month Attrition
Seniors	3.9	6.6	17.7
Expect more education	3.0	4.3	13.7
Do not expect more			
education	5.6	8.5	21.6
Graduates	5.3	8.6	23.1
Expect more education	8.2	6.2	19.2
Do not expect more			
education	3.3	11.4	30.2

to the service and, in turn, the service may try harder to dissuade such individuals from leaving.

Two other key indicators of attrition are months in the Delayed Entry Program (DEP) and employment instability, defined as being unemployed at the time of enlistment or having had a spell of jobless-ness within the past 12 months. For graduates, attrition also depends on the Armed Forces Qualification Test (AFQT) score and post-school labor force experience.

Participation in the DEP may indicate that the enlistee is a good planner, less likely to be disappointed by life in the military. Equally relevant, military occupations with typically longer DEP queues tend to offer training valuable in the civilian sector and involve a major train-ing investment by the service. Together, the planning notion, the value of the job to the individual, and the size of the service's invest-ment in training act to reduce attrition.

The employment instability variable contrasts with the DEP vari-able. Persons with a history of unemployment and job changing in the civilian sector are apparently less able to evaluate accurately the qual-ity of the job match; they have a history of poor matches and it contin-ues. They may have weaker job preferences and so may be more likely to enter a lower valued occupation. They may also be individuals who lack perseverance or have immature attitudes regarding what they want from a job. Then, any given disappointment during service is more likely to cause separation. Finally, if job instability indicates lower productivity, such persons may be less valuable to the service.

Statistical dependence of enlistment and attrition. The results indicate no evidence of statistical dependence between enlistment and

attrition via unobserved variables. This accords with the view that the individual's taste for the military changes considerably from the time of enlistment to either the early or latter part of the first term, leading to virtually no correlation between these tastes, or for that matter, between initial taste and subsequent productivity in the service (beyond that correlated with the observed variables). The lack of correlation means that the selectivity inherent in the enlistment process does not create bias in the estimates of the attrition equation. By implication, an attrition equation estimated by itself can provide accurate predictions of the attrition risks of prospective enlistees.

Predicting enlistment and attrition. Like the enlistment model, the estimated model of attrition produces a wide variation in the predicted probability of attrition. The enlistment/attrition model therefore has several practical uses: (1) The attrition model could be applied to assess the attrition potential of a cohort of entering enlistees by indicating whether the cohort contained many or few attrition-prone individuals. If the potential were high but the services wanted to maintain or reduce attrition, policy or attrition management actions would be in order. (2) The enlistment model can help predict the enlistment potential of a recruiting market. In conjunction, the attrition model can aid in identifying which prospective enlistees are attrition-prone. Specifically, persons who expect more education, have a stable employment history, and are willing to wait to get the job they want are nearly three times less likely to leave. This holds for seniors and graduates. When the recruiter has a choice among prospects, he may use this new information to recruit those most likely to complete their enlistment terms. (3) The analysis does not offer information on the cost and benefits of policies intended to affect attrition or enlistment. However, by identifying individual-level determinants of both, the findings should be useful in future analyses or experiments whose objectives are to determine policy effects.

ACKNOWLEDGMENTS

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FIGURE

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I. INTRODUCTION

Military force capability depends on maintaining a sufficient supply of qualified military personnel to meet manning requirements. Supply can be expended by increasing enlistment, reducing attrition, or increasing reenlistment. This report, focusing on male active-duty personnel, represents an effort to learn more about the factors motivating men to join and remain in service throughout their first term of service. The first term comprises over 40 percent of the 1.8 million enlisted personnel and supplies all personnel for subsequent terms. Of 320,000 nonprior service enlistees entering active service each year, about 30 percent—96,000—will leave without completing their terms of enlistment.

Our goal is to model enlistment and attrition decisions jointly. We are particularly interested in identifying individual characteristics, observable at the time of enlistment, that could be used to forecast attrition behavior for enlistees and, in particular, prospective enlistees.[1] This complements earlier RAND research into the determinants of enlistment decisions (Hosek and Peterson, 1985, 1986). Specific questions for analysis include:

- What personal and family characteristics affect enlistment and attrition?
- How is the Delayed Entry Program (DEP) related to attrition?
- Are enlistment and attrition interrelated by unobserved factors at the individual level?

The earlier work on enlistment concerns two major segments of the male recruiting market, high school seniors and nonstudent high school graduates. That analysis shows that enlistment behavior differs between segments, and further, that a key determinant of the difference is whether the individual expects further education. We therefore ask if attrition also depends on these variables, and if so, why? Because our data base includes twice as many enlistees as in the earlier work plus information on each enlistee's attrition experience, we have the opportunity to verify the previous enlistment results and to consider attrition simultaneously.

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[1] As discussed later, the model is basically supply driven as our data come from a time when recruiting was very difficult. Thus, we can more closely estimate the effect of individual characteristics on enlistment and attrition.

Buddin's (1984) attrition research also influences the present study. His findings underscore the importance of job matching theory and belated information as a means of understanding attrition. We employ these ideas and find, too, that they are well suited to interpreting our empirical results. Interestingly, our results are broadly similar to Buddin's even though he includes high school dropouts while we do not. Moreover, he analyzes six-month attrition while we analyze both six-month and 35-month attrition. The first six months include basic training and, for most, all or a major part of specialized skill training. By 35 months the enlistee often has over two years' experience on assigned duties, and the period of discovery and adjustment to military life is largely complete.

Finally, by treating enlistment and attrition as a two-equation system, we can estimate the correlation between unobserved factors affecting enlistment and attrition. As discussed below, these factors may represent the "taste" for military service and the quality of the job match. If the correlation between unobserved factors is found to be unimportant, then broad variations in the composition of enlistees can occur without affecting their expected attrition experience, except as predictable from the observed variables. In addition, the lack of a correlation would mean that attrition models estimated from an enlisted population could be used to predict attrition for the youth population at large. We recognize that changes over time in attrition policy can also affect attrition, but these variables cannot be analyzed with our data.

In Sec. II we describe our conceptual models of enlistment and attrition and specify hypotheses testable with our data. Section III contains the econometric specification, the sequential probit model employed in the analysis, and a description of the data. The empirical results and their implications are discussed in Secs. IV and V. The appendices provide a glossary of variables and their means and a discussion of specification experiments.

II. A THEORETICAL MODEL OF ENLISTMENT AND ATTRITION

BACKGROUND

Enlistment and attrition decisions represent occupational choices separated in time, yet interrelated by a common set of alternatives. Enlistment involves leaving civilian life for the military. Attrition involves leaving the military for civilian life. In either case the choice is between the civilian or military "occupation." This section outlines a model of enlistment and attrition behavior which allows interdependence of these ostensibly separate decisions.

From the individual's perspective, enlistment and attrition choices are determined by comparison of utilities (values) associated with military and civilian occupations (including returning to school). Utility dominance of the civilian occupation implies one's preference not to enlist or. if enlisted, to leave the service. Dominance of the military alternative implies enlistment or nonattrition. Both decisions may represent utility maximizing occupational choice behavior.

This essential similarity suggests one type of dependence between enlistment and attrition. Specifically, "taste for military life" may represent an individual characteristic constant over time which affects both decisions. Some young men are more attracted to the military regimen, or are motivated by patriotic duty. Individuals so inclined are more likely to enlist and less likely to leave before completing their term of service. However, "taste for military life" can reflect a negative disposition to schooling or work rather than a positive disposition to the military. What matters is whether the military is *on net* more attractive than civilian alternatives.

Moreover, whatever factors or attitudes may make the military relatively more attractive to the individual may, or may not, make the individual more attractive to the military. Suppose the individual is an unproductive employee in the civilian sector. The military might not recognize this through its screening criteria and, as a result, would be willing to offer a career opportunity exceeding in value what the individual expects from civilian employers. Other things equal, he could prefer to enlist, i.e., exhibit a positive taste for military life. But once the service observed the individual in training and on duty assignment, it might want to discharge him.

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It is imperative to complement the individual's utility comparison with the service's perspective. Enlistment occurs only if *both* the individual and the service are willing to enter into a contract. Similarly, fulfillment of the contract requires that the enlistee be willing to remain in the service *and* the service be willing to have him remain. Attrition arises when there is not mutual accord. Thus, if the enlistee becomes dissatisfied he can request exit through the Expeditious Discharge Program or attempt to induce separation otherwise. If the service becomes dissatisfied it has the authority to discharge the enlistee.

JOB MATCHING MODEL

For our purposes, then, enlistment and attrition decisions can be adequately described by a simple model of job matching. The general rule is that a match between worker and firm occurs when the total value of the job match exceeds the opportunity values for the worker and firm. To illustrate, suppose $V(e)_i$ represents the value of enlisting to individual i as perceived at the outset, $V(c)_i$ is the value of alternative c, $V(e)_s$ is the value to the service of enlisting the individual, and $V(k)_s$ is the value to the service of alternative k, say, enlisting a different individual. The superscript "o" indicates that the values refer to the time of enlistment. The individual is willing to enlist if

$$V(e)_i^o - V(c)_i^o > 0 \quad , \quad \text{all } c = 1, \ldots, C \quad . \tag{1}$$

Further, the service should be willing to enlist the individual if

$$V(e)_s^o - V(k)_s^o > 0 \quad . \tag{2}$$

If Eqs. (1) and (2) both hold, the match satisfies the rule that its total value exceeds the opportunity values for the enlistee and the service. In Eq. (2) the $V(k)$ should be interpreted as follows. Suppose in a given period the service has an enlistment target of k individuals and a pool of K prospects who are willing to enlist. If all K prospects were evaluated by the service and then ordered by their values, the service would select the top k prospects. The opportunity cost of enlisting any prospect would be the value of the kth prospect, denoted by $V(k)_s$.

However, the service must evaluate so many prospects that it does not conduct a detailed assessment of prospective recruits but rather relies on statistical screening. The service's policy is to specify eligibility criteria and permit those meeting the criteria to enlist if they wish. The criteria may be interpreted as measures that define the expected value of the marginally acceptable individual, i.e., the expected value of $V(k)_s$ in Eq. (2).

The criteria are of two sorts, general and occupation specific. General criteria concern general aptitude, education, medical fitness, and moral fitness and must be met by all prospective enlistees. Occupation specific criteria relate to the specific aptitudes required to become trained and proficient in the tasks essential to a particular military occupational specialty. One must meet these criteria to be permitted to enter the specialty. Typically, the prospect who is eligible in general can also satisfy the criteria for many specialties and is encouraged to enter the ones where he scored highest and which have the greatest immediate shortfall of recruits to manning requirements.

As a result of the screening policy, the enlistment decision can be better described not by the combination of Eqs. (1) and (2), but by Eq. (1) subject to the individual's eligibility. It is true that the eligibility criteria are variable in the long run, and issues arise as to what criteria are optimal and at what levels should they be set. We cannot pursue those issues with our data, which are cross-sectional, because at a given time the eligibility criteria are fixed. On the other hand, the cross-sectional fixity of eligibility criteria means that the empirical analysis of enlistment will largely reflect supply behavior.[1]

In contrast, the analysis of attrition depends on supply and demand behavior, reflecting both the individual's behavior and the service's behavior. At some point after enlistment—"period one"—the enlistee and service reevaluate the job match in light of their growing experience and information about one another. This reevaluation leads to adjustments in V's found in Eqs. (1) and (2). After the readjustment, either or both of the inequalities may no longer hold.

Why might a recruit reverse his previous enlistment decision or a service reverse its previous decision to enlist the recruit? The reversals reflect disappointments, i.e., unfulfilled expectations. Disappointments may arise because of incomplete information. Workers may be incompletely informed about job characteristics before a trial period of employment, just as employers are incompletely informed about a

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[1]The qualifier "largely" is inserted because the individual's estimation of the value of enlistment, $V(e)_i$, may be mediated by the recruiting process: recruiters may be active or passive in their pursuit of a prospect and in providing him with information about military life, availability of specific occupations, and the training and duty content of those occupations. We believe, however, that the role of such mediating factors is minimal in our data. At the time of the survey (Spring 1979), every service experienced recruiting shortfalls overall, let alone in high-quality recruits. Prospects were actively sought, and those wanting to enlist could find an opening in an acceptable occupational area without much wait. Thus, we can interpret our empirical analysis of enlistment among those generally eligible to enlist as corresponding to Eq. (1) and reflecting supply behavior.

worker's productivity.[2] The enlistee may be unhappy with his training, location, job assignment, or unit commander. He may receive a good civilian job offer, or there might be a family crisis requiring his help. The service may also be unhappy with the enlistee. Lackluster performance in boot camp, advanced training, or on duty, an unwillingness to adhere to the military code of ethics, or a health problem could lead to the enlistee's discharge. Moreover, pressure to separate first-term personnel could originate from unanticipated changes in manning requirements. The factors causing disappointment thus may lie within or outside the control of the individual or his unit command structure.

An individual could enlist with the intention of separating after he has completed his training so he can enter the civilian market with a new set of skills. However, he may find it more difficult to separate than planned, especially since such an individual would be likely to do well in training and thus the service would have a strong incentive to keep him. Having a higher value to the service should make it more difficult to instigate his own separation. However, if he were to separate, there would be no obvious penalty for doing so (unless he committed a crime in order to secure a discharge) and he would receive a normal discharge.

Given a disappointment, attrition may or may not occur. Job match theory says that separation results only when the total value of the job match becomes less than the opportunity values associated with separation, provided transfer of value between the worker's and firm's shares of total value is costless (Becker et al., 1977). If value transfer is costly, then these costs must be included in the previous statement.[3] Thus, in the military setting attrition will not occur if the value of the job match still exceeds the opportunity values plus value transfer costs. That is, attrition will not occur if:

$$\left[V(e)_t^1 - V(c)_t^1\right] + \left[V(e)_s^1 - V(k)_s^1\right] - \text{Cost} > 0 . \tag{3}$$

The implications of Eq. (3) can be discussed in terms of Fig. 1.[4] For shorter notation, let NV_i equal the net value of the job match to the

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[2]This type of job matching model is examined in Jovanovic (1979a) and Wilde (1979). Another modeling approach stresses on-the-job search and assumes that the individual knows the job characteristics with certainty but is uncertain about alternative job offers (Jovanovic, 1979b; Mortensen, 1978; Wilde, 1979). The arrival of information about outside job offers affects the individual's decision to stay or leave his current job.

[3]A transfer would be costly, for example, if the service had to reassign other personnel in order to grant the promotion or location change needed to induce the individual to remain in the service.

[4]The approach is similar to that of Hashimoto and Yu (1980), who examine the effect of wage rigidity on resource losses due to job separations.
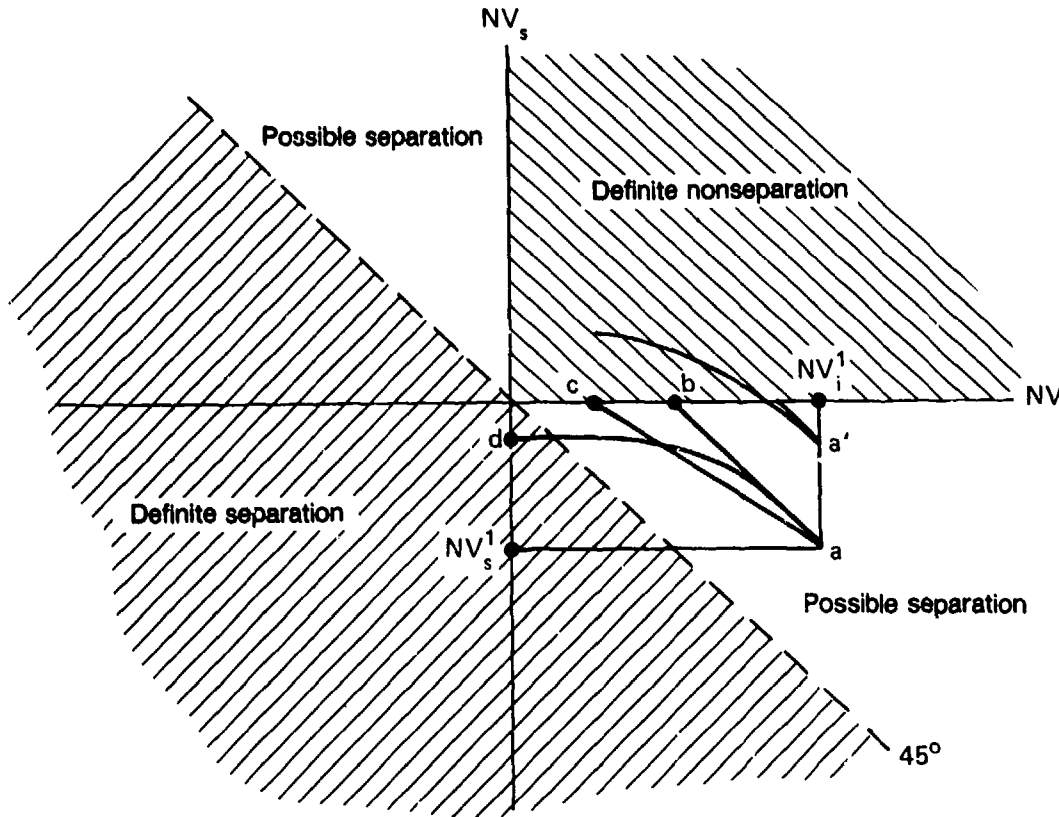
Fig. 1--Illustrative display

individual (shown in the left brackets in Eq. (3)) and NV_s equal the value of the job match to the service (right brackets). There are three cases to consider. First, suppose that at the end of period 1 NV_i and NV_s are both positive. Then the individual will definitely not leave the service. This combination case is depicted in the upper right quadrant of Fig. 1. Second, if the sum of NV_i and NV_s is negative, i.e., points below the 45 degree line in Fig. 1, then the individual definitely will separate. It is impossible for any value transfer to leave both the individual and the service with positive net values. Because there is no need for value transfer in case one and they would serve no purpose in case two, transfer costs are irrelevant in both cases. Third, in the remaining areas—labeled "Possible separation" in Fig. 1—the net value

of the job match is negative for one party, positive for the other, and the sum of the net values is positive. Whether separation occurs depends on the realized net values and the specific value transfer curve.

For example, at point a in Fig. 1 the individual could transfer some of his positive net value to the service to prevent the service from discharging him. If he transferred sufficient value to make NV_s non-negative, separation would not occur. If transfer is costless, the individual's value transfer curve is a 45 degree line running through point a, indicating a dollar-for-dollar exchange between the individual and the service up to point b or possibly beyond. Since $NV_i > NV_s$ in period 1, after the transfer the total net value of the job match will still be positive, NV_i will be positive, and NV_s will be nonnegative.

However, that might not hold if transfer is costly. Suppose the transfer curve is linear but less than dollar-for-dollar, permitting movement from point a to point c. This would prevent separation, and the transfer cost of raising NV_s to zero equals the segment cb as measured on the NV_i axis. On the other hand, if the value transfer curve is nonlinear, the tradeoff could be such that attrition would occur even though the enlistee were willing to transfer all positive NV_i to the service (see point d). Such a situation could arise, say, if the service required a significant behavioral change of the individual. Even so, the same value transfer curve applied at point a ' would result in nonattrition.

As the example suggests, value transfers may be pecuniary or nonpecuniary. The enlistee might accept a slower promotion rate than expected, resulting in a transfer of (future) dollars from himself to the service. Alternatively, he may have to modify his behavior in a way that reduces his net value and increases the service's, e.g., through greater effort on the job, a change of attitude, acceptance of a tough assignment, unpleasant location, or closer adherence to the military code of conduct. For the service the avenues of value transfer are similar—promotion rate, allocation of training opportunities, duty and location assignments, and discipline. Although these alternatives take time to accomplish, an agreement over the intent to change may be sufficient to prevent attrition.[5]

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[5]It is possible that the costs of renegotiation differ between service and enlistee, so that it would be empirically interesting to compare attrition behavior for the case of a potential "quit" ($NV_i < 0$, $NV_s > 0$) with the case of a potential "layoff" (i.e., discharge) ($NV_i > 0$, $NV_s < 0$). Our data do not support such an analysis. The military does not classify attrition as being a quit or a "layoff" but employs categories related to training, discipline, performance, and medical, and the actual assignment often seems arbitrary in the sense that several categories might be relevant, not just one. Civilian data do distinguish quits and layoffs. Antel (1985) shows that renegotiation may indeed be costly as evidenced by the fact that quit and layoff behavior in the private sector are empirically different.

Summarizing, attrition reflects an assessment of the total value of the job match relative to the enlistee's and service's opportunity values. Attrition occurs when either the enlistee or service is sufficiently disappointed that, even with some possibility for adjustment, the advantage of separation dominates. Retention results when there is no disappointment or when the disappointment can be accommodated via value transfer.

ENLISTMENT HYPOTHESES

Young men of military age face a career choice process involving a sequence of decisions about schooling, work, and enlistment. Enlistment occurs if its expected utility exceeds that of schooling and work. Human capital theory and job match theory suggest that the relative utilities of these three choices are affected by the individual's academic ability, his resources to finance further schooling, and his current employment opportunities. The following discussion of these factors draws upon Hosek and Peterson (1985).

The propensity for further schooling is positively related to academic ability and the ability to self-finance further education, and declines with current employment opportunities. The level of education an individual obtains is related to the value of higher education to the individual (both monetary and psychic returns) and the cost of that education (direct cost for tuition, books, etc., and forgone earnings). Persons with more academic ability do better in school, thus increasing the potential returns from further education, and have a lower marginal cost from education as they are more proficient learners. Greater personal resources for financing education also reduce marginal cost because the individual can devote more time to studying instead of working to pay school costs. Persons with good employment opportunities will be less likely to forgo current earnings in hopes of higher future earnings that might result from an investment in more schooling. The propensity for work, then, should rise with wages, showing a market demand for the individual's skills, and should be positively associated with labor force experience and job tenure. Greater experience may reflect past success in the labor market, and greater tenure may indicate increased investment in firm-specific human capital. Thus, the enlistment propensity should be negatively related to one's academic ability, ability to finance further schooling, and current employment opportunities. Variables used in the enlistment model to measure these factors include age when a senior, Armed Forces Qualification Test (AFQT) score, family income, wage rate, job tenure, labor force experience, employment status, and months not employed.

We also include a variable indicating whether the individual expects to obtain more education after high school.[6] This variable should have a negative effect for seniors. In general, seniors expecting further education are likely to pursue it immediately after graduation. For graduates, on the other hand, the direction of the effect—positive or negative—is ambiguous. Graduates expecting more education have already forgone immediate post-high school education and may have done so because they had insufficient funds for college or because they wanted a break from school. The military offers training and educational benefits which could be attractive to such individuals, especially to those with financial constraints. However, if the graduate did not go on immediately to college because he wanted a break, then those items may not be attractive.

While a similar utility comparison and a comparable set of variables will determine enlistment behavior for seniors and high school graduates, we expect graduates' behavior to differ from seniors'. Graduates previously chose against military service and in favor of work or, in some cases, schooling then work. This pattern of decisions reveals that the military was not thought to be the utility-maximizing option, perhaps because these graduates faced superior work or school alternatives, or perhaps because of a relative distaste for military service. Also, graduates are better informed about employment opportunities compared with seniors; graduates will typically have several more years of labor force experience.

The foregoing suggests that seniors and graduates differ in terms of occupational preferences, as revealed from previous decisions, and information about the value of civilian employment. The services, for their part, should become aware of such differences if they correlate with productivity in service. To allow for behavioral differences between seniors and graduates, they are treated separately in the empirical analysis.

ATTRITION HYPOTHESES

Attrition depends on enlistee and service behavior, so the hypotheses reflect both sides. The enlistee should be less likely to leave the greater his ability to plan and the higher his net value of enlistment. Similarly, the service should be less likely to discharge the individual the more effective its enlistment screens and the higher the

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[6]Because the question on expected level of schooling asked only about years of regular school (i.e., public school and college), this variable refers to formal education, not technical education such as through trade schools.

service's net value of having the individual as an enlistee. Our data provide surrogates for these concepts but particular variables may represent several concepts at once.[7] We first discuss the individual, then the service.

Persons with greater ability to plan can evaluate their alternatives more accurately. That is, their initial estimate of the value is more likely to equal the true value and be more precise. The ability to plan depends on an underlying knowledge of one's occupational preferences and aptitudes. If these are poorly known, job turnover is more likely as individuals learn not only about their jobs but also about themselves. Thus, persons with a history of employment instability may be poor planners relative to those with steady employment. But planning ability should improve as labor force experience increases. Also, an individual's relatively clear occupation preferences may be indicated by his participation in the Delayed Entry Program (DEP), whereby accession can be scheduled when a training seat is available in a particular military skill (or skill area).[8]

The individual's net value of enlistment should depend on the same variables influencing the enlistment choice, i.e., variables related to academic ability, education finances, education plans, and employment opportunities. By implication, persons who are more likely to enlist should be less likely to leave the service than those less likely to enlist. But this expectation may be weakened if net value realizations during service are widely variant from initial expectations, i.e., not well predicted by information available at the time of enlistment. Prediction inaccuracy may reflect the individual's uncertainty about his preferences and strengths, as mentioned, and it may reflect the presence of job factors such as duty assignment and location for which the expected (average) values may have little relation to the specific outcomes. In addition, because the enlistment variables in our data are recorded only at the time of enlistment, they may inaccurately depict

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[7] We do not offer hypotheses on the costs of transferring value (i.e., renegotiation) as we are unsure how these costs relate to individual characteristics.

[8] With respect to enlistment, DEP participation and DEP length is somewhat endogenous. Although to the individual the minimum time to a training seat in an occupation is exogenously determined, he can select among alternative occupations. If none of the occupations have minimum DEP lengths which are satisfactory to him, i.e., he wants to enter sooner than a training seat is available, he may decide not to enlist at that time. However, we cannot examine this because for the nonenlisted sample there is no information on their DEP opportunities and how they reacted to them. With respect to attrition, there does not appear to be any clear simultaneity between the decision to enter DEP and for how long, and the decision to separate before the end of the first term. A priori, there is no reason to suspect that individuals with low attrition propensities are more likely to select longer DEP lengths; however, it does make sense that individuals who select longer DEPs might have lower attrition rates, as explained above.

actual conditions (e.g., civilian employment opportunities) a year or more later when attrition behavior is observed. The estimated relationship between the individual's initial net value and the enlistment variables may therefore differ from that between his subsequent net value and those same variables.

With respect to DEP, high value jobs tend to have longer queues. Because job value should on average increase with DEP length, attrition should decline. Even though DEP is recorded only for enlistees, this argument applies to anyone drawn from the male youth population, assuming he would have the same opportunity to participate in DEP and choose among military occupations were he to enlist.[9]

With respect to seniors versus graduates, two opposing forces are at work which may produce different attrition behavior between the two groups. First, selectivity: attrition will be higher for graduates than seniors because graduates have repeatedly rejected the military. For example, consider a graduate and a senior and assume that earlier, when the graduate was a senior, he had the same civilian labor market prospects as the senior. Given those prospects, the senior might be indifferent to enlisting but the graduate, we learn through revealed preference, chose not to enlist, hence had a lower taste for the military. In our empirical work, individual characteristics such as age, income, education expectations, and employment status serve to make seniors and graduates comparable. Thus, if graduates have on average a lower taste for the military than seniors, graduates' attrition should be higher. Further, this selectivity effect should be strongest for graduates with the longest experience in the labor force, i.e., those who kept deciding not to enlist.

Opposing selectivity is the second factor, planning ability: persons with more experience should plan more accurately, hence graduates should be less likely than seniors to err in evaluating the job match and so have lower attrition.

Turning to the service, the counterparts to planning ability are enlistment and occupation eligibility screens. For enlistment, the AFQT score serves as a proxy in our data. This score is a composite of a subset of the individual ASVAB (Armed Services Vocational Aptitude

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[9]The Armed Forces Examining and Entrance Stations (AFEES) survey from which our enlisted sample is drawn includes questions dealing with the job assignment process at enlistment which may provide preliminary information on the quality of the job match. Information includes whether the individual knew the job he wanted, if he knew the kind of job he qualified for, if he qualified for the job he wanted, if the job he wanted was not available at the time he wanted to enter, whether the job he got was different than what he had in mind, and if he didn't care what job he got. Using the AFEES data, Buddin (1984) found no significant effects on early attrition of these variables. Based on his results, we decided not to pursue those variables in our attrition analysis.

Battery) component scores, reflecting language and arithmetic skills, and is used as a measure of general aptitude. Persons in the lowest AFQT category (percentiles 1 through 9) are by law ineligible to enlist. Because neither their enlistment nor attrition behavior can be studied, they must be excluded from empirical analysis.

Persons with higher AFQT scores are eligible to enlist but the specific job choices confronting them depend on their ASVAB component scores, such as mechanical, electrical, or clerical aptitudes.[10] Ideally, occupation eligibility might be measured by the percentage of skills in the service the individual was actually eligible for based on his ASVAB component scores. Those eligible for more jobs have a higher probability of getting the specific job or skill area they want. However, this is not practical given our methodology because there is no "service" choice on which to base the variable. In addition, given the several hundred skills offered by each service, the creation of such a variable would be arduous. As a proxy for greater occupation eligibility, then, we chose to use the AFQT score as well. This score is viewed as a general measure of trainability—the higher the score, the more likely the individual will successfully complete training in whatever skill he enters. Thus, persons with high AFQT scores are more likely to be eligible for a large number of jobs, especially highly valued jobs like computer programmer and nuclear technician.

For each occupation the eligibility level is set such that persons scoring above that level are more likely to complete advanced training in the occupation. If the levels have been set effectively, there should be no relationship, or perhaps a minor negative relationship, between the individual's occupation eligibility, as proxied by AFQT, and attrition during the training months. This reflects the fact that most of the discriminating power of the proxy variable, AFQT, to predict training success has been exploited in the job allocation process. As for post-training attrition, we view AFQT less as a planning variable than an indicator of general productivity. Given their greater learning proficiency, persons with higher AFQTs should be more adept at their tasks and so less likely to be let go early for inadequate performance.

Other indicators of the individual's net value to the service include education expectations, DEP, employment instability, wage rate, and job tenure.

For education expectations, people who want to learn on the job will exert greater effort to master it. As such, their value to the military is greater and they are less apt to be discharged. This position assumes that individuals are willing to accept military training as a substitute, even though an imperfect one, for post-secondary education. If mili-

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[10]The Air Force uses its own aptitude tests to determine occupation eligibility.

tary training were viewed as a poor substitute, the effect of education expectations on attrition should be nil.

Occupations with longer DEP waits typically involve larger service-paid investments in training. To protect that investment, the service will be especially careful in screening at enlistment and during formal training. The latter could mean somewhat higher training attrition, depending on the adequacy of the enlistment screens. Once training is complete the probability of attrition should be lower, otherwise the service would reduce its return to training.

Employment instability may be a signal of generically lower productivity. Under this interpretation, employment instability results from civilian employers discovering that the individual does not perform well on the job. If so, the military too will be more apt to discharge such persons. (Above we suggested that employment instability also indicates poor planning ability.)

Wage rate and job tenure are related to the individual's civilian employment opportunities. They may also be indirect indicators of the individual's value to the service, although we consider this more speculative than for the preceding variables. Assuming the wage rate reflects productivity in the civilian sector, and if the service values the same kind of productivity, attrition should decline with wage. Longer job tenure may also indicate productivity as well as the individual's willingness to adapt to the employer. If so, attrition should decline with tenure.

Table 1 summarizes the above enlistment and attrition hypotheses from the viewpoint of the individual and the service. (The empirical variables used to implement these hypotheses are discussed in Sec. IV

Table 1

SUMMARY OF ENLISTMENT AND ATTRITION HYPOTHESES

	Individual's Net Value		Service's Net Value
Variable	Enlistment	Attrition	Attrition
Academic ability	—	+	—
Education finances	—	+	0
Education expectations (Senior/graduate)	— / ?	+ / ?	—
Employment opportunity	—	+	— (?)
Planning ability	0	—	—
Training investment	n.a.	—	—

along with the empirical results.) Any variable that increases the individual's net value of enlistment should encourage enlistment and discourage attrition. This is shown in the opposite signs in the enlistment and attrition columns under "Individual's Net Value." A more striking feature of the table is that many of the attrition predictions are opposite in sign for the individual and the service. As the pattern suggests, factors that make the individual more valuable to the service also make his nonenlistment alternatives more attractive. Empirical analysis is required to determine which effect dominates in influencing attrition.

III. MODEL, METHODOLOGY AND DATA

MODEL

We assume that enlistment represents a person's utility maximizing behavior subject to enlistment eligibility. We assume that attrition also reflects utility-maximizing behavior, but intermingled with the service's willingness to retain or separate the person. Unobserved factors such as individual preferences and personality traits are likely to interrelate these decisions. We recognize that many different unobserved factors may play a role, but for brevity refer to them collectively as "tastes."[1] Below we discuss our specific enlistment and attrition models built on the utility maximization and job matching notions described in Sec. II.

ENLISTMENT

Individuals maximize utility over occupational choices. In keeping with the previous terminology, we refer to the utility of an alternative as its value to the individual. The individual's value of enlistment may be written as $V(e) = \gamma_e X_e + \varphi_e$, where γ_e is a coefficient vector and X_e represents either choice characteristics, characteristics of the individual, or some interaction of these factors. The term φ_e is a random error representing unmeasured factors.

The individual's value of the civilian alternative is expressed as $V(c) = \gamma_c X_c + \varphi_c$. In this case X_c measures civilian opportunities, personal characteristics, or interactions of choice attributes and personal characteristics. The random error φ_c again represents unobserved factors relevant to the value.

Preferred choice is determined by comparison of the two values. Thus if $V(e) > V(c)$. or $\gamma_e X_e - \gamma_c X_c > -(\varphi_e - \varphi_c)$, we observe choice of the military alternative. Reversal of the inequality of course

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[1]That is, "tastes" will encompass (a) preferences for the military, the idea being that the more one prefers military life the higher the chance he will enlist and the lower the chance he will leave; (b) personality traits such as internal vs. external locus of control, depression, world view, substance abuse, impulse control, attitude toward authority, and so forth; (c) perseverance in fulfilling a commitment (movers vs. stayers)—in this vein enlistees show some evidence of being movers since they left civilian life to join the military; (d) productivity; (e) plans for marriage and family-rearing; and probably other factors as well. The empirical work offers some control for (c) and (d). Also, (e) might be more important for female enlistees than male, who are studied here.

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implies preference for the civilian alternative. This model formulation is typical of the random utility models discussed in Amemiya (1981) or Hausman and Wise (1978). The individual's willingness to enlist may be summarized,

$$\Gamma_e X_e > \epsilon_e \quad \text{enlist} ,$$

$$\Gamma_e X_e \leq \epsilon_e \quad \text{do not enlist} . \tag{4}$$

The subscript "e" indicates the enlistment decision, Γ_e represents $(\gamma_e - \gamma_c)$, X_e are individual or choice characteristics or their interaction, and ϵ_e represents $(\varphi_c - \varphi_e)$. Applied to a sample of persons eligible to enlist, Eq. (4) characterizes enlistment supply behavior.[2]

ATTRITION

In accordance with the job matching model, attrition occurs when the total value of the job match is less than the sum of the enlistee's and service's opportunity values plus the cost of value transfer. We have no direct measures of job match values and costs, thus the explanatory variables serve as proxies. We express the attrition decision in a form similar to Eq. (4):

$$\Gamma_a X_a > \epsilon_a \quad \text{stay} ,$$

$$\Gamma_a X_a \leq \epsilon_a \quad \text{leave} . \tag{5}$$

The subscript "a" indicates the attrition decision. The parameters Γ_a quantify the relationship between the explanatory variables X_a and attrition, and this relationship will depend on how the variables relate to the individual's and service's net values less possible costs of adjustment. The error term ϵ_a represents unobserved factors affecting net values and costs.

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[2]One caveat to the supply interpretation is that recruiters can mediate the enlistment process, hence the effect of their behavior could intermingle with individual choice behavior. As mentioned earlier, we do not believe this to be a problem in the year (1979) of our data. A second caveat is that persons with low ASVAB component scores may be barred from certain military occupations. Since we use AFQT as a proxy for occupation eligibility, we control for this in the empirical work with a dummy variable for AFQT scores in the 11–30 percentile range. Persons with higher scores are by and large eligible to select among occupations, hence the AFQT coefficient for scores in the higher range, 31–100, should show the effect of AFQT on enlistment supply.

CORRELATION BETWEEN ENLISTMENT
AND ATTRITION

Our previous discussion suggests that the enlistment error term captures unobserved supply factors, i.e., tastes, while the attrition error term captures unobserved supply and demand factors. We now redefine the error terms into components:

$$-\epsilon_e = \eta_e + \nu_e \ , \tag{6}$$

$$-\epsilon_a = \eta_a + \nu_a + \psi_a \ . \tag{7}$$

The terms η_e and η_a are transient influences, one for the enlistment point and one for the point when attrition is observed. ν_e is the individual's "fixed" component at the time of enlistment. It is fixed in the sense that he might have always wanted to enlist, regardless of his circumstances, or alternatively he might have had a strong preference for a civilian occupation, so a low propensity to enlist. In contrast, η_e is the individual's transient component, reflecting immediate circumstances that influence his enlistment decision, e.g., unhappiness with his job or rejected applications to college.

The transient component η_a combines the immediate circumstances of both the individual and the service at the time attrition is observed. The individual might be dissatisfied with his current duty, pleased with his location, concerned about the chance of war, and so forth, and the service might like the individual's attitude, wish he were more proficient at his tasks, or be pressuring the individual's entire unit to increase its readiness, for example.

The term ν_a is the individual's fixed component in service. It may differ from ν_e, the fixed component at enlistment, because now the individual can condition his taste on actual experience as a soldier. If ν_e and ν_a were approximately the same, that would mean that the individual's initial expectations about his taste for military life had been borne out, or alternatively, that he had accurately forecast how well he would like being in the service. If the terms differ, then the forecast was less accurate and the role of experience more prominent.

The term ψ_a is the service's unobserved net value of the enlistee. It is defined only for the attrition equation because the service does not estimate net value at enlistment, relying instead on eligibility screens. Just as ν_a can be correlated with ν_e, so can ψ_a. That is, the enlistee's taste for military life at the time of enlistment may correlate with the military's taste for the enlistee after his productivity has been observed.

The terms η_e and η_a are assumed independent of each other and the other error components and independent across individuals. We estimate a model of enlistment and attrition (rather than nonattrition), thus the population correlation between the error term in the enlistment equation (ϵ_e) and the error in the attrition equation ($-\epsilon_a$) is given by

$$\rho = -\frac{cov(\nu_e, \nu_a) + cov(\nu_e, \psi_a)}{(var\ \epsilon_e + var\ \epsilon_a)^{\frac{1}{2}}}, \tag{8}$$

where the first term in the numerator is the covariance of the individual's initial taste and subsequent taste, and the second term is the covariance between his initial taste and the service's unobserved net value. If the latter term were absent, the correlation coefficient ρ would have to be nonpositive. In other words, individuals more likely to enlist, other things constant, would be less likely to attrite. But as shown, the correlation also depends on the second term, the covariance between ν_e and ψ_a. That covariance will be positive if persons with higher tastes to enlist turn out to have higher productivity, in which case the correlation between enlistment and attrition would again be nonpositive. But if enlistees with higher tastes tend to have lower productivity, the covariance could be negative and the correlation coefficient could be positive.

To understand the decision reversal required for attrition, the inequalities determining the joint probability of enlistment and attrition are,

$$\Gamma_e X_e > -(\eta_e + \nu_e) \quad \text{enlist}, \tag{9}$$

and

$$\Gamma_a X_a \le -(\eta_a + \nu_a + \psi_a) \quad \text{attrite}. \tag{10}$$

Holding ΓX terms constant, individuals most likely to satisfy both inequalities have a high initial taste ν_e, a low subsequent taste ν_a, and a low productivity ψ_a in the service. These are young men significantly disappointed with the military, or the military with them. Such individuals are characterized by high expectations but low actual service compatibility.

METHODOLOGY

The Nonindependent Sequential Probit Model

The sample likelihood comprises three components: nonenlistment, enlistment and completion of service term, and enlistment and subsequent attrition. For reasons just outlined, these decision levels cannot be assumed independent. The construction of the sample likelihood outlined in this section reflects this nonindependence. Assuming bivariate normality and applying the conditional probability rule, the sample likelihood components are

$$\int_{\Gamma_e X_e}^{+\infty} \varphi(\epsilon_e) d\epsilon_e \qquad \text{not enlist,} \tag{11}$$

$$\int_{-\infty}^{\Gamma_e X_e} \varphi(\epsilon_e) \int_{-\infty}^{(\Gamma_a X_a - \rho \epsilon_e)/(1-\rho^2)^{1/2}} \varphi(\epsilon_a) d\epsilon_a d\epsilon_e \qquad \text{enlist/no attrition,} \tag{12}$$

$$\int_{-\infty}^{\Gamma_e X_e} \varphi(\epsilon_e) \int_{(\Gamma_a X_a - \rho \epsilon_e)/(1-\rho^2)^{1/2}}^{+\infty} \varphi(\epsilon_a) d\epsilon_a d\epsilon_e \qquad \text{enlist/attrition,} \tag{13}$$

where φ is the univariate standard normal density function. The coefficients and errors now reflect the usual "probit" normalization.[3]

The parameters of the model may be estimated by maximum likelihood. Identification requires that at least one element of X_e is excluded from X_a. (See Lillard and Danzon (1982) for a discussion of identification of nonindependent sequential probit models.) A priori, it is not clear which variable(s) to delete because any variable affecting the individual's net value at enlistment should also affect it during service (Sec. II). Our procedure is to examine different deletions, seeking variables that prove statistically insignificant in the attrition regression and have minimal impact on the coefficients and standard errors of the other included variables. We find several variables of this sort, as explained in the next section, so in practice identification was not a problem.

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[3]The parameters and errors in the enlistment and attrition expressions have been divided by the standard deviation of their respective errors. This is innocuous because the parameters in probit models are estimable only up to a scalar, and the normalization makes the error variance unity, permitting use of the standard normal density.

The current model structure, by allowing estimation of ρ, can provide evidence of unobserved variables jointly affecting enlistment and attrition in our sample. An estimate of a zero ρ would indicate no apparent effect of such unobserved variables. By implication, the concepts we have associated with the error terms—taste for military life and ability to forecast the quality of the job match—may instead be captured by the observed variables or may be unimportant.

On the other hand, a nonzero estimate of ρ would indicate the presence of unobserved variables that affect both enlistment and attrition in our sample. Although our data base contains a great deal of information about the individual, we cannot regard it as completely describing the information available to the individual and the service. Variables unobserved in our data may be known and acted upon in the actual decisionmaking, giving rise to nonzero ρ.

The model structure also eliminates a selectivity bias that can result from estimating the attrition probit coefficients without control for previous enlistment. Specifically, when ρ is nonzero, attrition probits estimated on the assumption of enlistment and attrition independence will yield coefficients conditioned on the current enlistee sample and not relevant to the overall youth population. This bias is eliminated in the sequential probit model outlined above. Thus, the estimated attrition model can be used to forecast attrition for enlistment prospects or, if conditioned on enlistment, for that population.

DATA

To analyze enlistment and attrition, a large number of enlistees with both pre-enlistment and in-service data are required. Existing nonrandom samples of the youth population (National Longitudinal Surveys (NLS) and Current Population Survey (CPS), for example) have only a small number of enlistees in any given year because the proportion of youth enlisting is so small. A choice-based sample, however, overcomes this problem by oversampling those individuals who made infrequently observed choices. In our case, we oversample enlistees.

Our choice-based sample was constructed by pooling male respondents from two concurrent surveys, one for enlistees and one for nonenlistees. Interview responses of recent enlistees derived from the first wave of the 1979 DoD Survey of Personnel Entering the Military Service (AFEES)[4] are pooled with nonenlistee responses (i.e., nonprior service and not currently enlisted) from the National Longitudinal

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[4]Doering et al. (1980) provide a detailed description of the survey design and contents.

Study of Labor Market Behavior Youth Survey.[5] Both surveys were given in Spring 1979, ensuring compatibility. Enough similar questions were included in both surveys to allow construction of a common set of variables. Detailed discussion of the data is given in Hosek and Peterson (1983). Attrition data were added to the AFEES observations from military personnel records processed through 1984. Enlistees who could not be linked to military personnel records were dropped from the analysis.[6]

Appendix A describes the variables used in the analysis and App. B presents the variable means separately for enlistees and nonenlistees, and for those who attrited and those who did not, in the senior and graduate segments.

ESTIMATION WITH A CHOICE-BASED SAMPLE

Classical maximum likelihood estimation with a choice-based sample yields inconsistent parameter estimates. The reason is that the inclusion of an observation in the sample is conditional upon the choice outcomes the model is formulated to explain. For example, enlistees in our sample do not represent that fraction of a random sample of youths who chose military service. Rather, information pertaining to enlistees was obtained from a sample of young men who had just enlisted in the military. Inclusion of an individual in the enlistee sample thus depended on the enlistment decision we are trying to explain.

To overcome this problem we employ a pseudo-maximum likelihood estimator suggested by Manski and Lerman (1977).[7] The procedure involves weighting each component of the log-likelihood by the ratio of the population to sample proportions of individuals making the corresponding choice. This technique yields consistent parameter estimates and consistent, asymptotically efficient standard errors of the estimates.

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[5]For the NLS observations on seniors, only those currently attending the 12th grade for whom we had current employment status were used; for the NLS observations on graduates, only those who had completed 12 or more years of school, were not currently attending school, and for whom we had current employment status were used.

[6]Our analysis uses observations from survey Forms 1 and 2 of the AFEES survey, whereas earlier research (Hosek and Peterson, 1985) employs only Form 2 data. Use of Form 1 doubles the sample size for analysis of enlistment and attrition, but because of slight differences in the survey instrument formats, some variables are not available on both forms (e.g., mother's education, number of siblings) and could not be included in the present work.

[7]For other examples of estimation with choice-based samples, see Hosek (1980) and Hosek and Peterson (1985).

IV. EMPIRICAL DETERMINANTS OF ENLISTMENT AND ATTRITION

INTRODUCTION

This section presents results from our estimation of the sequential probit enlistment/attrition model. We first discuss the enlistment results, then the attrition results. The discussions are framed within the hypotheses discussed in Sec. II and are specific to the kind of variables available in our data base. As mentioned, these variables describe the individual, not the service, and we find support for the notion that a young man's willingness to enlist is negatively related to his academic ability, ability to finance further education, and his employment opportunities. Having enlisted, his chance of attrition is negatively related to his ability to plan, as evidenced by academic ability and participation in the Delayed Entry Program, and positively related to his potential for low productivity/low performance as suggested by his pre-enlistment employment instability. In addition, both enlistment and attrition depend on the individual's education expectations; seniors who expect more education are less likely to enlist, graduates who expect more education are more likely to enlist, and enlistees—seniors or graduates—who expect more education are less likely to attrite.

Theory provides little guidance on the length of the period over which attrition behavior should be observed. We therefore estimate the enlistment/attrition model for two alternative period lengths, six months and 35 months. Within the first six months of service the enlistee undergoes basic training (ranging from 6 to 10 weeks depending on the service) and begins specialized skill training in his military occupational specialty. The latter can last from a couple months to upwards of a year, depending on the specialty, e.g., infantry vs. military intelligence. In some cases no advanced training is offered, such as general detail personnel in the Navy. However, for the most part the first six months of military service involve training, and during this time the enlistee becomes familiar with the military regimen. Thus, attrition within six months often signifies either unsatisfactory training performance or dissatisfaction with military life in general.

In subsequent months, after training is completed, the enlistee is transferred to the base where he begins his duty assignment. He now becomes acquainted with the specific details of the assignment and

learns further skills on-the-job, adapting the principles and techniques taught in advanced training to his particular situation. As time passes, the enlistee and the service each accumulate information to judge whether their values of the job match lie above or below expectations, and, if need be, to resolve dissatisfactions. We believe this process is largely completed within the first three years of service and so analyze attrition at the 35-month point.[1]

SAMPLE STRATIFICATION

The sample is stratified by high school enrollment status, and separate high school senior and nonstudent high school graduate models are estimated. Sample separation of seniors and graduates is motivated by the sequential nature of youth career decisionmaking discussed in Sec. II. Recall that our previous discussion suggested that graduates are different from seniors both because of a revealed prior disinclination to enlist and better information about civilian opportunities.

ENLISTMENT RESULTS

Specification of the enlistment functions follows that of Hosek and Peterson (1985). Explanatory variables relevant to enlistment represent measures of academic ability, education finances, education expectations, employment experiences, and race or ethnicity. As the enlistment decision involves the comparison of the military with civilian alternatives, variables implying a greater likelihood of school enrollment, or variables that suggest higher valued civilian work opportunities, will be negatively related to enlistment choice. Race or ethnicity may be related to enlistments if discrimination in civilian opportunities exceeds discrimination in the military. Enlistment probit results are presented in Table 2.

Turning first to academic ability, older seniors are slower learners, and thus, age when senior should be positively related to enlistment. On the other hand, high AFQT implies learning proficiency, greater educational potential, and thus suggests less inclination to enlist. Age when senior and AFQT thus affect senior enlistments as expected. However, age and AFQT have no effect on graduate enlistments.

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[1]The empirical analysis considers only enlistees with terms of three, four, or six years. No five-year terms exist, and terms of two years—a small number, all in the Army—were excluded because a 35-month first-term attrition rate cannot be defined for them. Including them in the six-month analysis but not the 35-month analysis would reduce the comparability of results with little offsetting gain.

Table 2

ENLISTMENT PROBIT REGRESSION RESULTS
FOR SENIORS AND GRADUATES
(t-statistics)

Variable	Seniors	Graduates
Age when senior		
Age 17	−.275	−.0761
	(−4.02)	(−1.13)
Age 19+	.343	−.123
	(2.86)	(−1.21)
AFQT score	−.0064	−.00055
	(−3.02)	(−.29)
AFQT Category IV	−.562	−.0755
(Score 10–30)	(−3.86)	(−.59)
Live at home	.0296	−.0388
	(.20)	(−.44)
Family income	−.0145	.00117
(in thousands)	(−4.78)	(.36)
Expect more education	−.153	.315
	(−2.05)	(4.74)
Ln hourly wage	−.0588	−.445
(employed)	(−.23)	(−3.60)
Ln months on	−.0588	−.0498
job (employed)	(−1.80)	(−1.80)
Ln months since	n.a.	-.188
school		(−5.91)
Not currently	−1.09	−.819
employed	(−5.88)	(−4.30)
Months not	.132	.174
employed	(6.20)	(4.88)
Not employed	−.0320	.444
last 12 months	(−.10)	(2.01)
Some post-secondary	n.a.	−.305
education		(−3.35)
GED	n.a.	−.0464
		(−.31)
Black	.194	.419
	(2.18)	(4.74)

Table 2—continued

Variable	Seniors	Graduates
Hispanic	−.0485	−.149
	(−.48)	(−1.46)
Constant	−7.04	−.625
	(−1.95)	(−2.69)

NOTES: Coefficients are from sequential probit model of enlistment and 35-month attrition. Regression is based on a sample of 2812 seniors (2392 enlistees, 420 nonenlistees) and 3035 graduates (2326 enlistees and 709 nonenlistees). Regression also includes indicator variables for wage less than \$2.25/hr (for seniors), interaction between wage and not currently employed, low family income, income missing, and wage missing. Levels of significance: .05 $t = +1.96$; .01 $t = +2.58$.

To compute the first derivative in order to obtain an estimate of the change in the enlistment probability due to a one unit change in the explanatory variable, use the following formula: $\beta_i p_{ei}$, where β_i is the enlistment coefficient for sample i and p_{ei} is the enlistment probability for sample i. The enlistment rates in Table 5 can be converted to proportions and used for p_{ei}.

The Category IV variable indicates an AFQT score in the 10–30 percentile range. These persons receive lowest priority for most military occupations and are thus less likely to enlist, either because they are screened out of entering the service, or, if allowed to enlist, unwilling to accept those jobs for which they qualify. This conjecture is consistent with the senior enlistment results but insignificant for graduates. Assuming the services were no more likely to screen out a senior than a graduate because of a low AFQT score, the lack of an effect for graduates suggests a comparative willingness to accept the occupations offered.

Family income, defined only for those who live at home, relates to the ability to finance further education or civilian career search, so family income should be negatively related to enlistment. The results confirm a negative relationship for seniors but show no effect for graduates. Absence of a graduate effect may reflect growing independence from parents with age. It may also be indicative of selectivity, with those seniors most able to proceed to higher education having been selected out of our graduate population.

Education expectations have a strong bearing on enlistment for both seniors and graduates, although the effects are opposite in sign.

Seniors expecting more education are less likely to enlist, graduates more so. This clear distinction, we believe, reflects the selected nature of the two groups—many seniors who sought further education went on to obtain it and are absent from the graduate group. On the other hand, many graduates (about 40 percent vs. over 60 percent of seniors) still expect further education. Such graduates may not have been able to afford to go directly to college, or initially thought they did not want further education but have changed their minds, or thought that on-the-job training in civilian jobs would provide adequate skills but, again, have changed their minds.

Among the civilian employment variables, the log-wage[2] and log-tenure are most clearly interpreted. These variables measure the current job monetary reward and the likely stock of firm-specific human capital. Consistent with intuition, for graduates the wage and tenure variables are negatively related to enlistment.[3] Among seniors, whose jobs tend to be temporary and short-term in nature, there is no effect of wage on enlistment.[4] Current wage is undoubtedly a poorer measure of seniors' market earning potential than graduates', and this errors-in-variable problem would tend to bias the senior's wage effect toward zero. However, seniors with longer tenure are less likely to enlist, suggesting that they are satisfied with their civilian prospects.

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[2]The wage effect in Table 2 is for those currently employed. If the reader is interested in the wage effect for those not current employed but who worked in the previous 12 months, the coefficient and t-statistics for the *interaction* of log-wage and not currently employed are: for seniors, .407 (t - 2.73), and for graduates, .602 (t - 4.69). The overall wage effect for those not currently employed is then obtained by adding this coefficient to the wage coefficient reported in Table 2, giving wage effects of (.407 + ($-.059$)) - .348 for seniors and (.602 + ($-.445$)) - .157 for graduates. The latter, although a small positive value, does suggest that unemployed graduates are more likely to enlist, all other things equal, the higher their previous wage rate. The previous wage may be a measure of forgone earnings, hence for any given duration of joblessness, the higher wage graduate is slightly more likely to enlist. For seniors the wage effect is several times larger than for graduates. Seniors who had worked at higher wage jobs are more likely to enlist than currently employed seniors (whose wage effect is basically zero) or those who had no work experience in the past year. Given that seniors are primarily students, not full-time workers like graduates, this wage effect suggests that past wage is acting more as a selector variable for those interested in the military and not college bound, rather than a yardstick of forgone earnings.

[3]The wage elasticity for graduates is -.445. This is similar to wage elasticities estimated in aggregate supply models (see discussion in Hosek and Peterson, 1985, pp. 36–40).

[4]In previous work (Hosek and Peterson, 1985, 1986), a significant wage effect for seniors was reported. However, further analysis with the data used in that work revealed that the effect resulted from a poor imputation for missing wages within a particular subgroup of seniors, those who held short-term or short hours per week jobs. In the present analysis, missing wages are assigned zeros and a missing value indicator is included in the regression specification.

The meaning of the employment status variables probably differs for seniors and graduates. Our omitted (or base) group consists of persons currently employed, and we have indicator variables for persons who are currently jobless but who had a job within the past 12 months, and for persons who had no job over that period. Months not employed are defined for persons currently jobless but who had worked.

For graduates joblessness suggests a lack of job opportunities, whereas senior joblessness may reflect that, too, as well as a decision to concentrate on studies and school activities. Thus, currently jobless seniors as well as those who did not work may not be under the same economic duress as similar graduates. The indicator for those who did not work is insignificant for seniors but positive and significant for graduates. With respect to the indicator for the currently jobless, its interpretation should be taken in conjunction with months not employed. Although the jobless indicator suggests that unemployed seniors or graduates are less likely to enlist, we find their enlistment probability rises as number of months not working increases. We did not expect this variable to be important for seniors. The result may reflect the fact that many seniors choose to work during their senior year, and those who work fewer weeks (i.e., have more weeks of jobless-ness) would be hampered in their attempts to earn and save money for subsequent schooling or career search.

The negative effect of months since last school for graduates reflects the effects of civilian career momentum—once fixed in the civilian labor market, young men are hesitant to switch to the military.[5]

The GED variable, which is relevant only for graduates, indicates whether a young man left high school before the age of seventeen but later received a high school equivalency diploma, i.e., a certificate of general educational development (GED). These young men have revealed a distaste for formal education and thus may be more likely to substitute military experience for formal schooling; however, there is no significant difference in the enlistment probability of graduates with GEDs versus those who have traditional high school diplomas. Analo-gously, the high school-plus variable indicates graduates who had com-pleted at least a year of post-high school education. They have chosen formal schooling rather than military service as a source of education and training, and not surprisingly, they are far less likely to enlist than other graduates.

Finally, the black and Hispanic indicators control for race/ethnicity factors not otherwise represented by the regressors. As shown, blacks

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[5]For enlistees, months since last school is measured from the point at which the AFEES survey was taken, which corresponds to the date the enlistee signed his contract.

are more likely to enlist, perhaps because they perceive less discrimination, and thus greater opportunity, in the military. Hispanics, however, are no more likely to enlist than nonblack, non-Hispanics.

In summary, the results are consistent with the occupational choice theory of enlistment discussed in Sec. II. We now turn to a discussion of attrition.

ATTRITION RESULTS

Table 3 presents the attrition results and estimates of ρ, the error correlation between the enlistment and attrition equations. As mentioned, two models were estimated, one for enlistment and six-month attrition and one for enlistment and 35-month attrition. The early attrition model primarily concerns the training phase of enlistment, whereas the 35-month model spans both training and duty assignment. Of the two models, we place more confidence in the 35-month results because more attrition has occurred in the sample by then. Even though our sample of enlistees is large, relatively little attrition had occurred by the six-month point. Of 2392 senior enlistees, only 164 left within six months; of 2326 graduate enlistees, 207 left. Because of this, coefficients of some of the indicator variables (e.g., the black, Hispanic, and employment status indicators) derive from small cells and may not be accurate (although appearing statistically significant).[6] By 35 months there has been nearly three times as much attrition, and the results for all variables, including the indicators, can be viewed with greater confidence.[7]

Following the theoretical model laid out earlier, variables used in the attrition analysis represent measures of the ability to plan, of the value of the job match to the individual, of the value of the individual to the service, and of the effectiveness of service enlistment screens. Our data come from the time of enlistment, thus we cannot use information on the individual's actual performance and experiences during his first term of enlistment nor any information on the service's evaluation of

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[5]Indeed we did not try to estimate an effect for the Hispanic indicator on six-month attrition because the cells were too small

[7]We recognize that 6-month and 35-month attrition models do not describe the time path of the attrition hazard. In unreported work, we explored this issue by estimating simple probit models for 6-month and 7- to 35 month attrition, finding few differences in the coefficients of statistical or practical significance. As a result, little would be gained by, say, estimating a sequential probit model for enlistment, 6-month attrition, and 7- to 35-month attrition. Moreover, if one pursued that model, identification would require exclusion of variables from the 7- to 35-month specification that were included in 6-month attrition. We do not know what exclusions to make; in our data, the variables that presumably affect early attrition can also be expected to affect later attrition.

Table 3

ATTRITION PROBIT REGRESSION RESULTS FOR
SENIORS AND GRADUATES
(*t*-statistics)

Variable	Seniors		Graduates	
	6 month	35 month	6 month	35 month
Age when senior				
Age 17	−.0641	.0805	−.174	−.0307
	(−.56)	(.91)	(−1.52)	(−.36)
Age 19+	.321	.286	.117	−.141
	(2.37)	(2.64)	(.74)	(−1.13)
AFQT score	−.00160	−.00344	−.00353	−.00485
	(−.52)	(−1.50)	(−1.24)	(−2.21)
AFQT Category IV	.0232	.0481	.0652	−.0569
(Score 10–30)	(.25)	(.31)	(.32)	(−.37)
Expect more education	−.304	−.250	−.238	−.242
	(−2.99)	(−3.26)	(−2.24)	(−2.95)
Participated in DEP	.310	.0772	−.0594	.0405
	(1.26)	(.44)	(−.47)	(.41)
Months in DEP	−.0367	−.0383	−.0344	−.0659
	(−1.91)	(−2.33)	(−1.07)	(−2.46)
Ln months since	n.a.	n.a.	.103	.0655
school			(2.05)	(1.90)
Employment	.189	.127	.296	.297
instability	(1.82)	(1.59)	(2.51)	(3.28)
Not employed	.178	−.0380	.215	.104
last 12 months	(1.40)	(−.35)	(1.24)	(.76)
Some post-secondary	n.a.	n.a.	−.0028	−.143
education			(−.02)	(−1.30)
GED	n.a.	n.a.	.246	.245
			(1.46)	(1.79)
Black	−.208	−.161	−.169	−.111
	(−1.70)	(−1.62)	(−1.41)	(−1.10)
Hispanic	—	−.143	—	−.086
		(−.86)		(−.53)
Constant	−1.85	−.911	−1.32	−.520
	(−4.90)	(−2.96)	(−3.68)	(−1.93)
ρ	.128	.0994	.0199	.0017
	(.70)	(.73)	(.15)	(.02)

Table 3—continued

Variable	Seniors		Graduates	
	6 month	35 month	6 month	35 month
Sample size (enlistees)	2392	2392	2326	2326
Number attriting	164	433	207	565

NOTES: Coefficients are from sequential probit models of enlistment/ 6-month attrition and enlistment/35-month attrition. Levels of significance: .05 t = +1.96; .01 t = +2.58.

Other variables tried but found to have no significant effect on attrition were: hourly wage, tenure on current job, weekly hours, live at home, family income, term of enlistment, and service indicators.

To compute the first derivative in order to obtain an estimate of the change in attrition probability due to a one unit change in an explanatory variable, use the following formula: $\beta_i p_{ai}$, where β_i is the coefficient for sample i and p_{ai} is the average probability of attrition in sample i. The attrition rates reported in Table 5 can be converted to proportions and used for p_{ai}.

the individual. Attrition behavior, then, is based on attributes and conditions existing at enlistment, which, in turn, could allow the service to evaluate a prospective recruit's attrition potential.

Although effects differ between seniors and graduates and early versus late attrition, the major correlates of attrition emerge as age when senior, AFQT score, education expectations, length of participation in DEP, and employment instability.[8]

Beginning with age when senior, the coefficients on the age 17 and age 19+ indicators contrast attrition experience with that of persons who were 18 years old when seniors. As mentioned, older seniors tend to be academically slower and have lower AFQT scores. Thus, their cognitive achievement is less, and that in turn *might* be related to

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[8]In 1979 a misnorming of the AFQT was discovered. The norming error had gone undetected for several years, and by 1979 the services, particularly the Army, were enlisting a larger number of low score enlistees than intended. The misnorming problem was most prevalent in the Category IV range (AFQT scores in the 10–30th percentiles). A number of enlistees who appeared to be in Category IIIb (31–49th percentiles) were in fact Category IVs. This problem probably has little effect on our results. We are studying enlistees with at least a high school education, which in effect excludes many Category IVs from our analysis. Moreover, evidence from other attrition studies shows that AFQT score has little effect on attrition and that high school completion is the major determinant. The possibility remains that the large number of Category IVs exerted an indirect effect on the attrition behavior of our sample, but this is guesswork. As far as we know, the services had no special programs to separate the Category IVs, and indeed during the first year or two of service the dimensions of the norming error were still being established.

various factors which we mention but which are not quantified in our data: absenteeism, delinquency, unsupportive home environment, and frequent family moves from one location to another. Therefore, we would expect that such individuals might be poorer planners and be poor performers in the military, and thus have higher risk of attrition. Indeed, the results show that among the senior segment, older seniors are more likely than 18 year olds to attrite within six or 35 months; however, there are no significant age effects among graduates.[9]

For graduates there is a variable that complements age when senior, i.e., months since completing education. This variable reflects post-school labor force experience. On the one hand, persons with more experience should be better planners, more accurately estimating the value of a job match and so less likely to attrite. On the other hand, persons spending month after month in the civilian sector have, in effect, repeatedly chosen not to enlist. This may be due to the successful development of skills in the civilian sector or a lower taste for military life. As a result, the expected value of the military job match should decline as months since education increases. Consequently, even if these people accurately forecast the expected value, random disappointments with the military may be more likely to lead to attrition. That is what we find: The attrition probability rises with months since completing education.

We did not expect AFQT score to be significantly related to six-month attrition and in fact it is not. As discussed in Sec. II, this is because the assignment of enlistees to occupations depends directly or indirectly on AFQT as a proxy for occupation eligibility. However, for post-training experience on assigned duty, AFQT may represent the capability to adapt proficiently to local circumstances and equipment. The enlistee is hence less likely to be disappointed with the value of his service experience and, similarly, the service is less likely to be disappointed with the enlistee, thus raising the value of the job match for both the individual and the service. For 35-month attrition we do find a negative AFQT effect for both seniors and graduates, but only the graduate effect is significant.

Recruits who expect more education, who are looking to the military to either provide the educational benefits they need to finance further education or provide the desired training, should be more likely to apply themselves and want to do well in their jobs, raising their value to the military and reducing their probability of attrition. Indeed, we

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[9]Buddin (1984), which pooled students and nonstudents, high school graduates and dropouts, found a significant positive effect of age at enlistment on early attrition.

find that education expectations are negatively related to attrition.[10] This is true universally for seniors and graduates and early and late attrition. It appears that military formal and on-the-job training may fulfill the enlistee's demand for further education.[11] In addition, the desire to accrue educational benefits fosters completion of the enlistment contract as the maximum benefits can only be achieved if the individual fulfills his end of the contract.[12] Either way, the value of the job match is greater for those desiring further education, and such enlistees have an incentive not to leave.

We employ two variables to capture the influence of the Delayed Entry Program (DEP). One was an indicator for enlistees who participated in DEP and the other was a continuous variable for months in DEP given participation. Although the DEP indicator is never significant,[13] months in DEP has a negative effect on attrition. This effect is significant for 35-month attrition of seniors and graduates and six-month attrition of seniors but not graduates. Interestingly, the DEP

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[10]Black and Fraker (1986), using the 1972 NLS High School and Beyond data linked to military personnel records, estimated an attrition model that included indicators for whether the individual (in 1972) planned to attend a vocational school or junior college, and whether he would attend a four-year college. Their results show a significant negative effect on three-year attrition as education expectations rise, with the indicator for four-year college having a much larger and more significant negative effect on attrition than the junior college/vocational school indicator. The period of their study overlapped with the GI Bill, and they also found a significant negative effect if the individual said he planned to use the GI Bill.

[11]Among graduates who said that their main reason for enlisting was to get training and/or money for college, 72 percent expected to obtain further schooling; among those who enlisted for other reasons, 55 percent expected further education. For seniors, the figures were 55 and 41 percent, respectively. Tabulating differently, among graduates who expect more education, 65 percent said that their main reason for enlisting was to get training or money for college, compared with 47 percent of those not expecting to obtain further schooling. For seniors, the figures were 71 and 59 percent, respectively.

[12]Individuals participating in the Veterans Educational Assistance Program (VEAP) paid a minimum of $50 per month into the program, with the service paying twice the individual's contribution. Benefit months depend on the number of in-service months—the longer an individual stays in and contributes, the more educational funds he has when he leaves the service. In our data we had no information on who actually participated in VEAP and for how long (the individual could start and stop contributions at any time), thus we could not explore a specific "educational benefits" effect. For half of our enlisted sample, we did have information on whether at enlistment they planned to participate in VEAP. Among those who planned to participate in VEAP, 78 percent expected further education, and among those not planning to join VEAP, only 30 percent expected further education. For seniors, the figures were 72 percent and 24 percent, for graduates 82 percent and 35 percent. Thus, the "expect more education" indicator appears to proxy the desire for educational benefits among enlistees.

[13]The DEP indicator is still insignificant even when months in DEP is dropped from the equation. This insignificance is not surprising as the vast majority of recruits in our data enter DEP: over 90 percent of the seniors and over 80 percent of the graduates participated in DEP.

months effect intensifies for graduates as the first term progresses much more than for seniors, as evidenced by the much larger graduate coefficient.[14] Thus, at 35 months the graduate effect is about three-fourths greater than the senior effect.

We think the importance of months in DEP arises primarily from two factors. First, compared with those shipping directly from the enlistment processing station, enlistees entering DEP may be more methodical planners. They may have firmer preferences about their careers and hence about the relevance of certain training to their career plans. By a priori narrowing the field of acceptable occupations, the planner reduces the probability of a negative surprise that could result in attrition. By the same token, the planner reduces the service's chance of having to cope with a malcontent. Second, the length of time in DEP depends on the value of the occupation to the individual. Apart from enlistment incentives such as bonuses and supplemental educational benefits, the military pays all enlistees according to the same schedule, regardless of the value of the occupation to enlistees. As a result, nonprice rationing occurs: enlistees are willing to wait longer for more valuable occupations. Moreover, since higher valued occupations are proxied by longer DEP queues, enlistees in such occupations are less likely to experience a reversal that would induce them to attrite. Similarly, the service can ensure against attrition by being especially selective in setting the eligibility requirements for these occupations and in assigning enlistees to them, again lessening attrition.[15]

An additional factor must be considered when evaluating the effect of length of DEP on attrition: selectivity. About 4.5 percent of those entering DEP do not ultimately access into the military. Thus, some individuals are selected out of the enlisted population, presumably those with lower values for military job match. This selectivity suggests

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[14]Using first derivatives to represent the change in the probability of 35-month attritions given a one-month increase in DEP, the decrease in attrition is .016 for graduates and .007 for seniors. The derivatives have been evaluated at mean attrition rates for each group, i.e., for graduates and for seniors (see Table 5).

[15]In the analysis, we explored the possibility of an interaction between DEP months and education expectations. The results suggested that time in DEP has no effect on the attrition of seniors or graduates expecting more education. One interpretation of this is that DEP role as an indicator of ability to plan may be superseded by positive education expectations, which explicitly reflect an individual's planning. Moreover, the insignificance of DEP months for those expecting more education suggests that such persons were often able to enter the occupations of their choice, i.e., the occupations most highly valued by them. If so, the role of DEP as proxy for high value occupations is also superseded by education expectations. By this logic, we would conclude that DEP months supplement by distinguishing good planners or high value occupations among enlistees who have no expectations for further education.

that the effect of DEP on attrition might be overestimated for prospective enlistees, i.e., the general male youth population.[16]

The employment instability indicator represents enlistees who either were jobless at the time of enlistment or, though currently employed, had been jobless at least once in the preceding 12 months.[17] As discussed earlier, such individuals may be uncertain of their desired careers or poor evaluators of the value of the job match, or have low productivity. All of those characteristics tend to lower the net value of the job match, thus increasing the chance of a major disappointment with the job for either the individual or the service. Results in all cases show a positive effect of employment instability on attrition. The effect is nearly significant for seniors and strongly significant for graduates at both six and 35 months.

With respect to race, the black and Hispanic graduates are no more likely than whites to attrite, thus offering no compelling evidence that, after controlling for other characteristics, these graduate groups are more likely to stay in service because of differentially lower discrimination (differentially superior opportunities) in the military than the civilian sector. Among seniors, the significance level of the black coefficient is higher but still not significant at the standard 5 percent test. Thus, here too, race does not appear to be a major factor explaining attrition.

As a side note, in comparing the effects of variables on six-month versus 35-month attrition, one might ask whether the structure of attrition at 35 months is the same as at six months, except that three times more people leave. If in comparing the first derivatives at six months and at 35 months the value for 35 months were approximately three times that for six months, it would suggest that the effects on attrition are the same for both time horizons. However, we find that the ratio of the first derivative at 35 months to that at six months ranges from two to six, implying that the structure may be different between the six-month and 35-month attrition horizons. This, of course, is a crude test and does not provide definitive proof of structural differences.

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[16]Buddin (1984) found that when losses from DEP were added to the data and treated as early attrition, the effect on attrition of being in DEP vanished. However, in that analysis only a DEP indicator was used and not length of DEP. Also, Buddin did not analyze seniors and graduates separately, and further, his data include high school dropouts.

[17]We experimented with other characterizations of employment instability, e.g., indicators for currently jobless, currently employed but jobless sometime in the last 12 months, and currently jobless and jobless again sometime in the last 12 months. This alternative specification did not perform better than the simple, single variable approach we adopted.

A variety of other variables were also tried in the attrition specification but always proved trivial and hence were deleted from the final specification. In addition, their inclusion or exclusion had minimal effects on the coefficients of the other variables. The notes to Table 3 list the variables tried and dropped. Most notable among these dropped variables were family income, hourly wage, job tenure, and service indicators. Family income, through its effect on education finances and job search funding, was expected to have a positive effect on attrition. An individual disappointed with the military life may be more likely to leave if there is the potential for financial support from his family to ease the transition back into the civilian sector. However, our results revealed no significant effect of family income on the individual's probability of attrition. The hypothesized effect of hourly wage and job tenure was ambiguous: for the individual, higher wages and longer tenure suggest higher value civilian alternatives, but for the services such individuals may have higher value due to that revealed higher productivity. Thus, the individual might be more likely to leave but the service would be more willing to keep him. Whether the lack of any significant effect of these variables results from the individual and service effects cancelling each other out, we cannot say. It may be that pre-enlistment wage and job tenure are poor measures of the individual's current civilian job opportunities and service productivity. Finally, inclusion of service indicators had no significant effect on attrition for either seniors or graduates. In addition, their inclusion had no appreciable effect on the coefficients of the other attrition variables. Thus, it does not appear that differential attrition rates among the services are driving the attrition results.

The final parameter of interest is ρ, the error correlation between the enlistment and attrition equations. Our results uniformly show that ρ is usually quite small and never attains statistical significance at conventional levels. Thus, there appears to be no significant correlation between the unmeasured variables in the two equations. Recalling Eq. 3), one interpretation is that there is no covariation between the individual's initial taste for service and his subsequent taste, and between his initial taste and the service's subsequent estimate of his net value, controlling for observed characteristics. The lack of connection between initial and subsequent tastes, at either six months or 35 months, suggests an important role for actual military experience in shaping the individual's taste. Given that role, it is less surprising that the individual's initial taste is also unrelated to his unobserved net value to the service. The results offer no direct support for the idea that once accounts for the effects of the observed variables, persons who are more likely to enlist are also more likely to stay.

Similarly, there is no obvious support for the notion that persons more likely to enlist are poorer productivity risks for the military, again controlling for observed variables.

Although our results imply the virtual absence of enlistment/attrition error correlation, we undertook several additional experiments with specification to see if the size and significance of the error correlation was affected. These involved expanding the list of enlistment variables to include more factors that should only affect enlistment and not attrition. This is designed to help deal with identification problems. An additional experiment related to identification involved fixing rho at various values to see the effects on the other coefficients and the fit of the equation. These experiments did not change the basic results of our analysis, i.e., the near-zero size of ρ, its lack of statistical significance, and the importance of education expectations, DEP, and employment instability as predictors of attrition. These experiments and their results are discussed in App. C.

V. POLICY IMPLICATIONS

Our findings suggest two policy applications—attrition forecasting for a cohort of entering enlistees, and enlistment screening for high attrition-risk prospects. The results should also be useful for designing analyses or experiments on alternative attrition policies as well as policies to obtain fewer attrition-prone recruits. After discussing these points, we consider how our results could be implemented by the recruiting community.

ATTRITION RISK AMONG ENLISTEES

The analysis shows that a small set of factors can reveal a wide range of attrition risk among enlistees. These factors are, primarily, senior/graduate status, positive/negative education expectations, stable/unstable civilian employment history, and short/long participation in DEP.[1] Additional factors include AFQT, especially for graduates, and months in the labor force (graduates only). Table 4 illustrates how well the four primary factors describe attrition risk.

Table 4 presents an index of attrition risk for seniors and graduates for both early and 35-month attrition. Each index shows the relative risk of attrition. We prefer an index because a service's personnel management policies probably do not affect relative risk even though they can change the average level of attrition from year to year. The table first divides enlistees into seniors and graduates, then further divides them into groups by education expectations, length of DEP, and employment instability. The predicted attrition probability is computed for each person using the full set of regression variables, and then the average prediction is calculated for each group. Each index uses the risk group with the lowest predicted probability of attrition as the base group (i.e., index = 100).

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[1]Because these primary factors are related to desire for education and training, trainability, persistence and planning, and well-defined job preferences, we expect they would be important correlates of attrition under any policy environment.

Table 4

ATTRITION INDEX FOR SENIORS AND GRADUATES
(Predicted attrition rate in parentheses)

Risk Group	Percent Enlistees in Group		6-Month Attrition		35-Month Attrition	
	Senior	Graduate	Senior	Graduate	Senior	Graduate
Expect more education Long DEP No employment instability	10	10	100 (.018)	261 (.047)	100 (.074)	180 (.133)
Expect more education Long DEP Employment instability	7	6	133 (.024)	427 (.077)	126 (.093)	278 (.206)
Expect more education Short DEP No employment instability	16	25	144 (.026)	356 (.064)	131 (.097)	247 (.183)
Expect more education Short DEP Employment instability	13	20	178 (.032)	517 (.093)	164 (.121)	346 (.256)
Not expect more education Long DEP No employment instability	11	6	228 (.041)	467 (.084)	174 (.129)	301 (.223)
Not expect more education Long DEP Employment instability	7	4	272 (.049)	628 (.113)	206 (.153)	388 (.287)
Not expect more education Short DEP No employment instability	23	16	317 (.057)	617 (.111)	223 (.165)	374 (.277)
Not expect more education Short DEP Employment instability	13	13	372 (.067)	861 (.156)	269 (.199)	499 (.369)

NOTE: Long DEP is defined as more than three months in DEP for seniors and more than one month for graduates. These are the median DEP lengths for seniors and graduates, respectively. Median DEP length for seniors in our data is a function of when the data were collected. Because the AFEES survey was administered in April and May, seniors still had to finish school before entering. Thus their median DEP is higher than graduates because of timing rather than a difference in behavior.

The table shows a wide range of attrition across groups for both seniors and graduates.[2] For instance, predicted attrition varies by a factor of 2.7 (100 to 269) for 35-month attrition among seniors and 2.8 (180 to 499) among graduates. Even greater differences are apparent at the six-month point. The lowest risk group for both seniors and graduates consists of those who expect more education, have longer than average time in DEP, and have no employment instability (e.g., current unemployment or unemployment in the last year). The highest risk group contains, as might be expected, those with exactly the opposite characteristics.

The table also includes information on the percentage of enlistees in each risk group in 1979. These percentages may have changed in recent years but at least our data afford a baseline. Also, 90 percent of current enlistees enter service with a high school diploma. The fact that nondiplomates have a higher attrition rate is thus of less relevance today than in the late 1970s when they constituted about 40 percent of enlistees. Because we consider persons who would enter service with a diploma, i.e., seniors and graduates, our analysis is valuable for forecasting attrition among today's enlistees.[3]

Use of our model for forecasting attrition would give the services a better idea of the attrition potential of an entering cohort of enlistees. Although such a forecast is naive in the sense that it holds attrition policy constant, the forecast itself could trigger a policy response. Knowing the attrition potential of an enlistee cohort seems most useful in a situation of deteriorating enlistment and reenlistment conditions but constant or increasing force strength objectives, i.e., when the opportunity cost of losing an enlistee is relatively high. Reducing attrition would then be a paramount concern, not only to maintain force strength but also to prevent enlistment requirements from rising higher than necessary. The effort required to reduce attrition would presumably be greater the higher a cohort's potential for attrition, although we do not know this from our analysis.

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[2] The differences in predicted attrition are also affected by any intergroup differences in the other explanatory variables in the attrition equation. However, since education expectations, DEP length, and employment instability are the strongest predictors of attrition, the effect of such differences in the other explanatory variables is probably minor.

[3] Other data show that the senior/graduate enlistee ratio has shifted. According to the Defense Manpower Data Center, in 1980 there was one senior for every three graduates, but by 1984 the ratio had changed to one to two. The total number of senior and graduate enlistees remained practically the same (about 250,000). Our results imply that the shift toward more seniors should slightly lower the attrition rate of recent cohorts. We found that the 35-month attrition rate for seniors overall was about three-fourths that of graduates overall. On this account, the attrition *rate* among enlistees entering with a high school diploma should have been 2 percent lower for the 1984 cohort than the 1980 cohort.

The data requirements for attrition forecasting entail two variables not currently collected by the services—education expectations and employment instability. Of these two, the payoff to education expectations seems greater because of its prominent role in enlistment as well as attrition. Also, because individuals may be sensitive to questions about employment instability, an indirect approach might be necessary. Enlistment records already contain information on age, senior vs. graduate, AFQT, race, sex, and DEP participation.[4]

Because our analysis is based on the experience of a single cohort of enlistees facing similar (but unrecorded) attrition policies, we have not been able to isolate the effects of specific policy actions. Nevertheless, our research provides useful information for future analysis of attrition policy. The information is twofold. First, we identify individual characteristics related to attrition. These characteristics should be controlled to clarify the separate effect of the attrition policy. Second, we find that the attrition regression was unaffected by selectivity bias. As a result, attrition policy analysis can proceed independently of enlistment analysis, and the policy findings for one enlistee cohort should be applicable to another cohort even though it differed in composition. Together, these findings should improve the design and reduce the cost of attrition policy analysis.

ATTRITION RISK AMONG PROSPECTIVE RECRUITS

Historically, the major attrition distinction has been between high school dropouts and graduates, with dropouts having twice the attrition rate of high school graduates. In the context of our model, this suggests that dropouts have lower productivity in service, are poorer planners, or both. When military pay and enlistment incentives increased during the early 1980s, the services had an opportunity to improve the quality of their recruits. As a result, the demand for those completing high school rose sharply and the demand for dropouts fell just as sharply.[5]

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[4]Our model specifies age when senior and, for graduates, months since schooling was completed. Available service data can offer an acceptable approximation to these variables. For seniors, age at enlistment of course equals age when senior; for graduates, however, age when senior would have to be approximated. Age at enlistment minus 18 can be used to proxy months since schooling for graduates.

[5]The increase in the percentage of enlistees who were high school graduates was expected to reduce the attrition rate significantly. But as Sec. II emphasizes and Buddin (1985) argues, the attrition rate depends on service policies, not only the composition of enlistees. Although attrition fell, the reduction was about half of what would have been predicted from composition changes alone. Apparently, service policies operated to retard the decline, probably increasing training and duty performance standards as the higher-quality waves of enlistees entered service.

Similar logic suggests that differences in attrition *among* high school graduates may reflect differences in their productivity or ability to plan. Recruits who leave early are a poorer investment on average than recruits who complete their terms. Our results provide information with which to identify enlistment prospects who are prone to attrition. Such persons typically do not expect more education, have poorly articulated occupational objectives, unstable employment (e.g., current unemployment or unemployment in the previous 12 months), and lower AFQT scores.

As with attrition policy, the merit of pursuing recruits with a lower chance of attrition depends on the costs and benefits of doing so. At present we do not know the incremental cost of decreasing the number of attrition-prone recruits, and a controlled trial (experiment) may be needed to gain the desired information. Likewise, we do not know the incremental benefits, although that is probably a harder question to study because it involves the development of value measures. Still, by jointly analyzing enlistment and attrition and providing results that help identify attrition-prone individuals, our work provides a backdrop for experimental design and implementation.

Finally, an interesting finding is that the guidance for selecting recruits with a low attrition risk is closely related to the definition of recruiting market segments emerging from earlier work (Hosek and Peterson, 1985). This relationship adds to the usefulness of market segments as defined by seniors versus graduates and education expectations. To illustrate, Table 5 presents enlistment, six-month attrition, and 35-month attrition for the segments. Note that education expectations have an opposite effect on enlistment for seniors and graduates but the same, negative effect on attrition. Seniors who expect more education are less likely to enlist and less likely to leave, whereas graduates who expect more education are *more* likely to enlist and less likely to leave. But attrition is higher for graduates than seniors, especially at 35 months. For both seniors and graduates attrition is lower by at least a third for those expecting more education. In 1979, 48 percent of the senior enlistees expected more education, compared with 64 percent of the graduate enlistees. These percentages may have increased during the 1980s because of the supplemental educational benefits (e.g., the Army College Fund) and the introduction of the New GI Bill. Also, although not shown in the table, in any of the segments, persons with longer DEP and no history of employment instability have lower attrition risks.

Table 5

ENLISTMENT AND ATTRITION RATES FOR SENIORS AND
GRADUATES BY EDUCATION EXPECTATIONS

	Enlistment Rate	6-month Attrition Rate	35-month Attrition Rate
Seniors	3.9	6.6	17.7
Expect More	3.0	4.3	13.7
Do Not Expect	5.6	8.5	21.6
Graduates	5.3	8.6	23.9
Expect More	8.2	6.2	19.2
Do Not Expect	3.3	11.4	30.2

USEFULNESS TO THE RECRUITING COMMUNITY

The preceding discussion leads naturally to the issue of how the recruiting community can put these results to use. In addition to providing a supply of recruits, a major objective of the recruiting community has always been to provide quality recruits, especially high school graduates, as they have long been known to have much lower attrition rates than nongraduates. We have already commented on two uses of our research that should be of interest to the manpower community at large—predicting attrition of enlistees and prospective enlistees. For the recruiting community, the most immediate application of our work comes in evaluation of the relative enlistment probability of recruiting prospects. Our results can usefully discriminate among prospects' enlistment probabilities, both between and within the senior and graduate segments. This has been described elsewhere (Hosek and Peterson, 1985, 1986). In the following, we suggest additional applications, each of which would require some change from status quo recruiting procedures. The suggestions are linked by the idea that recruiting strategy should consider prospective attrition, not only the total number of recruits and percent high quality. While this is not a new idea, it remains relevant and we have new findings to offer on its behalf. For concreteness we limit discussion to the variables having the strongest effect on attrition: senior vs. graduate status, education expectations, DEP time, and employment stability. What roles can these variables play in recruiting strategies?

The recruiting community already recognizes the senior versus graduate distinction. Considerable effort is expended to obtain the name,

address, and phone number of every senior. This information helps recruiters to identify and contact prospective recruits and to target mailings about service opportunities and enlistment incentives. Also, recruiters can follow up on prospects choosing not to enlist when they are seniors. As mentioned earlier, about 90 percent of today's active duty enlistees have at least a high school education. Of these, approximately two in five enlist as seniors, and the vast majority of the remainder enlist as nonstudents, i.e., they are not enrolled in post-secondary school. Perhaps half of the nonstudent high school graduates enlist within a year of high school, a fact attesting to the importance of the recruiter's being able to follow up on a prospect. In addition, as we state above, our enlistment regressions show how enlistment behavior differs for seniors and graduates, and within each of these segments the results provide ample power to distinguish the better prospects from the worse. Recruiters could use our results to evaluate prospects, thereby helping ensure that they work their "portfolio" of prospects to produce the highest yield of recruits subject to their recruiting goals.

Some confusion might arise over the value of the education expectations variable for seniors. Its effects on enlistment and attrition are opposite, suggesting that the pursuit of seniors expecting more education could lead to fewer enlistees, granted that they are less likely to leave early. As a result, the effect on manyears of service during the first term is ambiguous. This ambiguity does not arise for graduates. Graduates who expect more education are more likely to enlist and stay, so expected manyears increase.

Nevertheless, confusion about the usefulness of education expectations for seniors may be misplaced. It is clear from Congressional action and service policy that the services, particularly the Army, seek enlistees who desire more education. Evidence comes in the form of enlistment incentives offering educational aid: the GI Bill, the Veterans Education Assistance Program, the New GI Bill, and the Army College Fund, for example. Although our data do not permit a test of the proposition, it is probably true that educational benefits draw primarily young men who expect to obtain more education and have difficulty financing it. If so, educational benefits serve to attract enlistees—graduates *and* seniors—having a lower probability of attrition. Moreover, because certain educational benefits are targeted on hard-to-fill specialties, expected manyears in them rise not only because a higher percentage of enlistees entering them have high school educations, but because those enlistees also tend to expect more education.

In other words, our findings about education expectations may help explain why educational benefits are effective incentives. First, they

expand the recruiting market to include more persons who are education-oriented, and second, persons from that segment of the market are more likely to complete their terms (even though they may be in hard-to-fill skills). It is probably fair to say that the major motivations behind educational benefits have been market expansion and skill channeling. Our findings suggest that if instead there had been concern about attrition and unit turbulence, it would make sense to increase the percentage of enlistees who have low expected attrition. One way of doing that would be to offer educational benefits.

Some believe DEP time is largely uncontrollable by the recruiting community. In this view, DEP time is determined as follows. Manpower requirements in a skill lead to a flow of training seats (slots), and the supply of recruits to the skill then determines the length of DEP time. This view ignores the ability of the recruiting community to influence supply to a skill area, even if it cannot influence the flow of training seats. Apart from this shortcoming, the implicit rule of behavior allows the recruit to choose any available training seat, so long as the service is willing to offer it (i.e., the recruit qualifies) and it is not too distant (e.g., more than 12 months away).

Our results suggest that this rule could be modified by setting minimum DEP times. The minima could vary by skill, and for popular skills they would be irrelevant in practice because actual DEP time would always tend to exceed the minimum. The idea behind the minimum would be to encourage the recruit to think more carefully about entering the skill, or more broadly, entering the service. This policy would undoubtedly cost the services some recruits. However, it would tend to discourage those least sure of their decisions and so most likely to leave before completing their terms. By "separating" such people early, processing and training resources will be conserved. The tradeoff is between fewer recruits and lower first-term attrition. Experimentation would be essential to determine the value of a policy of minimum DEP times and to define the most appropriate minima by skill.

Finally, the finding that attrition is greater for persons with a history of employment instability suggests the importance of providing such recruits thorough counseling about skill opportunities and service life. Recruiters may need to make a point of asking about employment history, not to deny entry to the service, but to identify prospects who would benefit from more extensive career counseling. As with DEP minima, this too may result in fewer enlistees, but the ones who enter the service should have more accurate expectations about the payoff to enlistment and so be less likely to leave early. In addition, for any recruit thought to be an attrition risk, additional counseling could be

undertaken at the time of accession. The effects of more extensive counseling could be analyzed by experimentation.

The usefulness of these enlistment/attrition results, then, lies in helping the recruiting community assess which prospects are more likely to enlist *and* complete their first term. Applications suggested by the research should therefore aid recruiters in meeting their enlistment goals and attracting "better," less attrition prone recruits. Some of the suggestions can be implemented fairly easily, while others require closer examination and perhaps experimentation to determine their benefits and costs.

Appendix A

GLOSSARY OF VARIABLES

Age when senior
Two dummy variables: one takes the unit value if respondent was age 17 or less when he was a senior in high school; second takes the unit value if respondent was 19 or older.

AFQT score
Percentile score (correctly normed) for the Armed Forces Qualification Test based on the 1979 ASVAB (Armed Services Vocational Aptitude Battery) for the AFEES (enlisted sample) and on the 1980 ASVAB scores for the NLS (nonenlisted sample). This percentage is zero for those with percentile scores 10 to 30. Individuals with scores below 10 were not eligible to enlist.

AFQT Category IV
Dummy variable takes the unit value if scores are in the range 10 to 30.

Black
Dummy variable takes the unit value if respondent is black.

DEP
Dummy variable takes the unit value if respondent entered the Delayed Entry Program (DEP).

Months in DEP
Variable measures the months spent in the Delayed Entry Program.

Employment instability
Dummy variable takes unit value if respondent is currently unemployed, but worked in last year, or had a spell of unemployment in the last year.

Expect more education
Dummy variable takes the unit value if respondent expected more education at the time of enlistment.

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Family income	Parental income in thousands of dollars given that respondent lived with parents. These values represent midpoints of income categories from the questionnaire. Value of this variable is zero for parental income below $5200 or when respondent lived apart from his parents. Two dummy variables were included in specifications with family income to control for these zero values.
GED	Dummy variable taking the unit value if the respondent received a Graduate Equivalency certificate after leaving high school before age 17. Applies only to graduate sample.
Hispanic	Dummy variable taking the unit value if the respondent is Hispanic.
Live at home	Dummy variable taking the unit value if the respondent lives with his parents.
Log months on job (employed)	Natural log (Ln) of months on current job if respondent is employed. The value of this variable is zero if the respondent is not currently employed.
Log hourly wage (employed)	Natural log of hourly wage respondent received on his current job. In the senior sample this variable, as are all the employment related variables, is zero for observations below $2.25/hour. These observations represent anomalies and have been removed from the sample by zeroing out their values and including a dummy variable taking the unit value to control for the zero values.
Months not employed	Months since the respondent's last job if he is not currently employed but has worked in the last 12 months. Value of the variable is zero if not currently employed or has not worked in last 12 months.
Log months since school	Natural log of the months since the respondent was last enrolled in high school or college measured from the date of the survey. Applies only to the graduate sample.

Not employed last 12 months	Dummy variable taking the unit value if respondent did not have a job in the last year.
Not currently employed	Dummy variable taking the unit value if individual had a job in last 12 months but is not currently employed.
Some post-secondary education	Dummy variable taking the unit value if respondent has completed more than 12 years of education. Applies only to the graduate sample.

Appendix B

MEANS FOR SENIORS AND GRADUATES

Table B.1

MEANS FOR SENIORS AND GRADUATES BY ENLISTMENT STATUS

	Seniors		Graduates	
Variable	Nonenlisted	Enlisted	Nonenlisted	Enlisted
Age 17 when senior	.5375	.3545	.4766	.4260
Age 19 or more when senior	.0430	.1267	.1086	.1187
AFQT score (31–100)	66.2483	58.6953	64.2497	62.1696
Category IV indicator	.2446	.2950	.2137	.2922
Lives at home	.9552	.9083	.6948	.7105
Family income (in $ thousands)	25.8518	19.1703	22.0036	20.1634
Expects more education	.6187	.4849	.4311	.6430
Hourly wage (natural log)	1.1490	1.1397	1.5125	1.3330
Months employed (natural log)	1.7467	1.8062	2.2476	1.8606
Months since last school (natural log)	n.a.	n.a.	2.8223	2.3451
Not currently employed	.2501	.2417	.1075	.2506
Months not employed	4.8151	6.6779	2.6483	5.3642
Not employed in last 12 months	.1156	.2161	.0198	.1629
Some post-HS education	n.a.	n.a.	.1528	.1502
GED	n.a.	n.a.	.0432	.0806
Black	.1119	.2366	.0868	.2610
Hispanic	.0495	.0596	.0413	.0422
Participated in DEP	.0000	.9422	.0000	.8209

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Table B.1—continued

Variable	Seniors		Graduates	
	Nonenlisted	Enlisted	Nonenlisted	Enlisted
Months in DEP	n.a.	3.2094	n.a.	1.8820
Employment instability	n.a.	.4015	n.a.	.4169
Hourly wage	3.2059	3.1706	4.8250	3.9707
Months employed	i2.0762	11.3390	17.6876	12.5922
Months since last school	n.a.	n.a.	21.5561	16.1737
Wage < $2.25/hr	.1675	.0383	n.a.	n.a.
Family income < $5200	.0364	.0921	.1135	.0810
Family income missing	.1594	.2132	.1631	.1745
Hourly wage missing	.2459	.1206	.1420	.1483

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Table B.2

MEANS FOR ENLISTED SENIORS AND GRADUATES BY
ATTRITION STATUS AT 35 MONTHS

Variable	Seniors		Graduates	
	Nonattrited	Attrited	Nonattrited	Attrited
Age 17 when senior	.3540	.3569	.4304	.4127
Age 19 or more when senior	.1156	.1782	.1228	.1058
AFQT score (31–100)	59.0495	56.7517	62.9695	59.2259
Category IV indicator	.2750	.3865	.2687	.3672
Lives at home	.9101	.8999	.7183	.6858
Family income (in $ thousands)	19.1047	19.5134	20.1119	20.3513
Expects more education	.5078	.3786	.6733	.5463
Hourly wage (natural log)	1.1388	1.1444	1.3348	1.3262
Months employed (natural log)	1.8106	1.7852	1.9056	1.7003
Months since last school (natural log)	n.a.	n.a.	2.3101	2.4566
Not currently employed	.2365	.2660	.2370	.2941
Months not employed	6.6851	6.6480	5.3727	5.3422
Not employed in last 12 months	.2184	.2053	.1611	.1687
Some post-HS education	n.a.	n.a.	.1632	.1087
GED	n.a.	n.a.	.0728	.1055
Black	.2367	.2363	.2583	.2698
Hispanic	.0608	.0541	.0429	.0401
Participated in DEP	.9430	.9385	.8237	.8119
Months in DEP	3.2800	2.8801	1.9498	1.6628
Employment instability	.3933	.4399	.3913	.4982

Table B.2—continued

Variable	Seniors		Graduates	
	Nonattrited	Attrited	Nonattrited	Attrited
Hourly wage	3.1642	3.2041	3.9767	3.9484
Months employed	11.3238	11.4120	12.8731	11.5901
Months since last school	n.a.	n.a.	15.8941	17.0637
Wage < $2.25/hr	.0381	.0396	n.a.	n.a.
Family income < $5200	.0897	.1043	.0739	.1061
Family income missing	.2025	.2631	.1706	.1871
Hourly wage missing	.1117	.1622	.1429	.1656

Appendix C

ADDITIONAL EXPERIMENTS WITH THE DATA

The sensitivity of the error correlation, rho, to specification was examined through two experiments, one expanding the list of enlistment variables and one decreasing the list of attrition variables. The objective of increasing the list of enlistment variables was to improve identification within the sequential probit model. This required adding variables which presumably only affect enlistment and would not be expected to have any effect on attrition. The variables we added to the enlistment equation were geographic-based, accounting for socioeconomic conditions in the area the individual lived. These included the following:

Percent veterans in county of residence

Percent of labor force employed in manufacturing in county of residence

Percent of labor force employed in service and retail industries in county of residence

Percent unemployed in county of residence

Indicator for county of residence having more than 40 percent of its population in rural areas

Median family income in county of residence

Indicators for South, West, and East regions of the country

Cyclical employment measure for the state (1979 deviation in state employment from state employment trend line)

Number of recruiters per youth population in the Military Enlistment Processing Station (MEP)

Percent share of youth population that were high school seniors and recent high school graduates in the MEP

Such variables would not be expected to affect attrition as they probably have little bearing on the attributes and attitudes the individual carries into military service. Also, because they are tied to residence at enlistment and not residence during service, their values may not be relevant to the period in which the attrition decision occurs.

The addition of these geographic variables (in varying combinations as well as all together) to the specification listed in Table 2 proved to have little impact on the error correlation: it remained insignificant. Although some of the variables had a significant effect on enlistment, the colinearity among them makes it difficult to determine whether the variable is truly significant. The effects would tend to change as the mix of variables changed.

The inclusion of these variables allowed us to lengthen the list of attrition variables to include more individual characteristics, characteristics also appearing in the enlistment equation (e.g., employment-related variables). With the attrition equation expanded, the estimate of rho remained zero for graduates but showed a small positive error correlation for seniors at 35 months.[1] However, the expansion of the enlistment and attrition equations tends to push the limits of the capability of our relatively small nonenlisted population (420 seniors and 709 graduates) for estimating parameters. Therefore, we hesitate to accept the validity of that result for seniors.

The second experiment involved shortening the list of attrition factors to just those that are routinely available from enlistment records maintained by the services. Our data go beyond the routine set and so may account for factors that would normally be unreported in such records. We therefore reestimated the model with the reduced set of variables to see if the error correlation became significant. Variables in the attrition equation consisted of age at entry, AFQT score, race, and, for graduates only, years since school, some postsecondary education, and GED. Separate models were run for seniors and graduates for six-month and 35-month attrition. Again, the correlation coefficient was insignificant in every case.

Another experiment involved running a specification where the list of explanatory variables was the same for the enlistment and attrition equations but fixing the value of rho. We tried values of rho over the range from −.6 to .6.[2] The objective was to see what impact assumed values of rho would have on the fit of the model and on the estimates of the parameters. The results showed virtually no change in the log likelihood as the value of rho changed, suggesting that rho has little impact on the general fit of the model. The signs of variables did not change as rho varied, though there were occasional changes in the level of significance. However, it is to be expected that the further away from "true" rho that one sets its value, the magnitudes of the

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[1]Their rho estimate was .29 with a t-statistic of 1.88, which is usually considered on the verge of statistical significance.

[2]In this exercise, none of the county and state level variables was included in the specification.

coefficients must change to compensate for that difference. Overall it is not clear what should be read into such a sensitivity analysis given that a priori it is not clear what value of rho should be assigned. For rho fixed near zero (in the range -.1 to .1), the estimates and their significance were virtually the same as when we let rho be a free parameter to be estimated.

Basically, the results of these experiments continue to suggest that there is no error correlation between the enlistment and attrition equations. The estimates of rho for graduates were always near zero and statistically insignificant, and those for seniors, though often small and positive (i.e, in the range from 0 to .1) were statistically insignificant except in the borderline case mentioned above. In addition, despite specification changes, the main predictors of attrition discussed in Sec. IV continued to be the important factors affecting attrition—education expectations, DEP, and employment instability.

The results of these experiments are available from the authors upon request.

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