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Economic Returns to Military Service

Paul J. Andrisani and Thomas N. Daymont
Independent Contractors

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This research assesses the economic returns to military service by examining the impact of service on in-service and post-service earnings. It extends the authors' previous research in several ways. First, it builds an extensive literature review on the subject since our research was completed. The review focuses on techniques of measuring the economic returns to military service. Second, it adjusts the earnings equations for self-selection bias. Third, it extends our earlier analysis and model development to female veterans and nonveterans, where the theoretical, empirical, and econometric issues are not precisely analogous to those for men. Fourth, it uses the most military data available from the National Longitudinal Surveys of Youth.

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Economic Returns to Military Service

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FOREWORD

There is growing concerning that the skills and experiences obtained through military service have little payoff for soldiers when they leave the service. Proponents of this view often point to what might be termed "low-tech" jobs in the Army, especially in the combat arms, where skills are not thought to be generally transferable to the civilian sector. To an increasing degree, the public perception--as revealed by the Wall Street Journal, ABC's Niteline, and recent Business Week and Newsweek articles--is that military service is not a good investment for young men and women. This research attempts to quantitatively measure the economic returns to military service.

The participation of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) in this effort is part of an ongoing program of research designed to enhance the quality of Army personnel. This work is an essential part of the mission of ARI's Manpower and Personnel Policy Research Group (MPPRG) to conduct research to improve the Army's ability to effectively and efficiently recruit personnel. This research was sponsored by the U.S. Army Recruiting Command.

Results of this research have been provided to the Deputy Chief of Staff for Personnel, the Director, Program Analysis and Evaluation (DA, PA&E), the Commander, U.S. Army Recruiting Command.

EDGAR M. JOHNSON
Technical Director

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We also gratefully acknowledge the advice and encouragement of Dean William C. Dunkelberg of Temple University and his tolerance of our almost total preoccupation with this project since January, even when it conflicted with our administrative responsibilities.

ECONOMIC RETURNS TO MILITARY SERVICE

EXECUTIVE SUMMARY

Requirement:

To quantitatively determine the impact of military service on post-service earnings to answer the key question: Is choosing the military a good early career investment for young men and women?

Procedure:

This research uses data from the National Longitudinal Surveys (NLS) of youth, from which a pooled cross-section time-series data set was created. Its purpose was to assess the economic returns to military service by specifying a series of equations to examine the impact of military service on youth in terms of their in-service and post-service earnings during the All-Volunteer Force (AVF) era. Special adjustment for sample selection bias is incorporated in the estimating equations for three early career choices: the military, the civilian labor market, and college. Earnings trajectories are calculated for each choice and compared over a 9-year horizon.

Findings:

This research affirms the existence of economic returns to military service during the AVF era, especially for work-bound youths and women. For college-bound young men, the evidence is less clear, especially since (1) there is such a short time horizon after military service over which to compare veterans and nonveterans (only 3-5 years), and (2) college-bound veterans are those most likely to return to school and thus show lower earnings while there.

Mechanisms for the payoff to military service appear to include (1) the development of positive work attitudes such as self-confidence, social maturity, acceptance of legitimate authority, (2) opportunities to develop and display leadership skills in the military, (3) signaling effects that act as a substitute for educational credentials, and (4) military education and training benefits that enhance civilian earnings potential.

Specifically, the results show

(1) No veterans' penalty during the AVF era for either male or female veterans. A substantial earnings advantage for young female veterans and work-bound young male veterans was observed.

(2) The "frictional" (transitional and temporary) unemployment problems of military youths upon leaving the service appear similar to those observed for their civilian counterparts when they initially entered the civilian work force upon leaving high school.

(3) Work-bound youths definitely appeared to benefit from military service irrespective of the branch in which they served or whether it was in a combat or technical military occupational specialty (MOS).

(4) The findings for college-bound veterans were somewhat different. They suggested either no veterans' advantage or a slight penalty <u>very early in their careers</u>. However, these findings were not robust, i.e., they were sensitive to various model specifications. Also, for the college-bound youths, there was an advantage to serving in the Air Force compared to the other branches, although there was no advantage to receiving technical training rather than training in the combat arms.

(5) The steeper slope of veterans' earnings trajectories suggests the possibility that civilian employers initially undervalue skills obtained in the military, consistent with the existing job matching hypothesis models. Negative images of the military resulting from the Vietnam War and the recruiting scandals in the early AVF period may have caused employers initially to underestimate the skills and potential of veterans until they were proven in the civilian sector.

(6) The transition from school to the civilian labor market is not easy, even for veterans. Career counseling when leaving high school and the military should be improved both for veterans and nonveterans.

Utilization of Findings:

The results from this research have been used by the U.S. Army Recruiting Command as an integral part of the Army's advertising strategy to demonstrate that the military is a "good place to start" and that the Army gives youth an "edge on life." Youth who, in the AVF era, chose the military as an early career option earned as much or more than their nonmilitary peers during the 9-year period under investigation. Army advertising draws on these results to show that Army training and experience can enhance soldiers' lifetime earnings.

ECONOMIC RETURNS TO MILITARY SERVICE

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ECONOMIC RETURNS TO MILITARY SERVICE

INTRODUCTION

In an economic system in which individuals may freely choose among various employment opportunities, the efficient allocation of human resources depends upon workers making efficient career choices in pursuit of their particular employment goals. In theory, differentials in economic rewards, given variation in worker preferences, are presumed to attract individuals into those jobs in which their contribution to social product will be at a maximum.

In equilibrium, therefore, no worker could enhance either his or her own satisfaction or the total social product by making any kind of job change. But this can occur only if workers are responsive to the incentives of the marketplace and to the prompting of their particular goals--that is, if workers make wise decisions about their careers.

The purpose of this research is to analyze whether career choices about military service cause differences in subsequent labor market experience--namely annual earnings--after controlling for a wide range of measured and unmeasured dimensions of skills, abilities, and selected demographic characteristics that are known to be related to labor market experience.[1]

The reasons for an interest in this subject are straightforward and a direct result of a question such as: Is choosing the military a good career investment for young men and women to make? Some who believe that it is include those who develop the advertising programs for the military and many of the young men and women who are entering the Armed Forces with the anticipation that their training and experience will enhance their lifetime earnings.

However, many others, especially since the Vietnam era, hold the negative view that skills obtained through the military have little payoff. Proponents of the negative view often point to what might be termed "low-tech" jobs in the Army, especially in the combat arms, where skills are not thought to be generally transferable. To an increasing degree, the public perception--as revealed by media stories in the Wall Street Journal, ABC's Niteline, and the recent Business Week and New York Times articles about Joshua Angrist's (1989 and 1990) research--appears to be that military service is not a good investment for young men and women to make.

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[1]The unmeasured dimensions are controlled for by way of conventional selection bias adjustment procedures following the pioneering work of Heckman (1976).

This issue has taken on added significance since the end of the draft and the institution of the AVF in 1973 (Blair and Phillips, 1983). Young people's choices about allocating time among major activities such as schooling, the military, and the civilian labor market depend on perceptions about the degree to which these activities enhance their "human capital," i.e., their lifetime earnings capacity. In an analysis of 1980 data on youths, for example, Kim (1982b) found that the desire for occupational training and resources to finance higher education were primary factors in the enlistment decision. For these reasons, recruiting efforts by the military have increasingly emphasized the training value both of military service and the educational benefits that accrue to those who serve their country.

Unfortunately, previous research may be of only limited value in assessing the economic returns to military service during the AVF era. This is less so because the findings are mixed than because they almost exclusively pertain to bygone eras and draftees rather than true volunteers. In addition, previous research is limited because it shows clearly that the economic returns to military service vary across historical time periods, and because little of it focuses on women.

The present research uses data from the National Longitudinal Surveys (NLS) to reexamine and extend an earlier analysis of the economic returns to military service during the AVF era by Daymont and Andrisani (1986). The present research proposes to address three major tasks: (1) conduct a comprehensive and critical review of the literature, especially that bearing on the AVF period and the econometrics of sample selection bias, (2) extend our original analysis of male veterans during the AVF era to women as well, and (3) adjust our original analysis for sample selection bias.

In the next sections we provide a theoretical framework for the analysis, and review the literature. We then describe the data drawn from the NLS as well as the basic analytical strategy. Then we present empirical results extending our previous research of young men during the AVF period by first adjusting our model for sample selection biases in a variety of ways, and second by modifying our model to accommodate the special case of female veterans. Finally, we summarize the findings and conclusions of our research and their policy implications.

THEORETICAL FRAMEWORK

Human capital theory, pioneered by Becker (1964) and Mincer (1970), provides a useful framework for modeling the impact of military service on subsequent civilian labor market success. Human capital theory can be used to help explain individual variations in earnings at a point in time and over the life cycle as well as the decision to participate in schooling, military service, civilian work experience, or other major activities (e.g. Becker, 1985; Mincer, 1974; Ben-Porath, 1967; Rosen, 1972; 1976; Freeman, 1976).

According to this theory, decisions about education and training are conceptualized as "human capital" investment decisions and are analyzed in a manner similar to decisions about investing in physical or financial capital. The costs and benefits of each alternative are evaluated over some time horizon, and the individual chooses that alternative with the most favorable benefit-cost comparison. The major investments in human capital are made through schooling and training, including formal training and on-the-job training acquired through actual work experience. Worth mentioning is the fact that military training happened to be one of the examples of human capital formation proffered by Becker.

Becker theorizes that the returns to both formal and on-the-job training vary depending upon whether the training is "general" or "specific." His notion is fairly simple: general training is training that is useful in many firms besides those providing it while specific training is only of relevance to the particular employer who provided it. Interestingly, Becker used a military example when illustrating the concept of general training: "...a machinist trained in the army finds his skills of value in steel and aircraft firms...." (P. 12). Becker also used the military as an example of specific training: astronauts, fighter pilots, and missile men.

From the above, it can be suggested that the highly technical military skills with civilian counterparts consist of a large component of general training, while combat related skills compare most closely with firm-specific training. Becker's perspective on general and specific training as investments in human capital, and his examples of the military as a firm providing both types of training, form the basis for expecting a veterans' premium. At the very least, they provide a basis for expecting that the economic returns to military service are equivalent to the economic returns to civilian employment.

A second theoretical thrust comes from the work of Broom and Smith (1963) in which the notion of a "bridging occupation" was put forth. Specifically, a bridging occupation is an occupation which provides work experience allowing mobility from one occupation to another. Again, as in the case of Becker, the military was used as an illustration of an institution that provides individuals with "bridging occupations." Further, they suggest that in modern societies the bridge between military service and the civilian labor market has been strengthened by four major trends -- technology convergence between military and civilian sectors, growing similarity between military and civil administration, increasing demand for manpower, and the recognition that ex-servicemen should be assisted in finding meaningful employment after service.

Thus, based on these theoretical premises, it is reasonable to expect that military service provides, at least to a degree, the means to obtain civilian employment and enhance lifetime earnings. We therefore hypothesize that the civilian earnings of veterans will rise more quickly than the earnings of civilians of comparable ages for several reasons. First, because the initial employment problems of former servicemen are frictional and will dissipate quickly just as they did for their civilian counterpart after a transitional period.[2]

Second, many young veterans will take advantage of educational benefit programs such as the GI Bill, the Veterans Educational Assistance Program (VEAP), and the Army College Fund, and further their education after discharge.[3] This will lower their earnings soon after discharge but increase their earnings later on after they complete their education and progress in professional careers. Third, discrimination by civilian employers against veterans, especially during the 1970's, may add to the transitional problems of AVF veterans until they "prove their worth" to civilian employers.

Thus, estimates of the economic returns to military service depend critically on the point in the career at which earnings are measured. In particular, focusing on earnings soon after discharge chooses the period at which the relative earnings of servicemen are at their lowest, and hence, the greatest downward bias in estimates of the economic returns to military service occurs. For those veterans college bound, for instance, at least 8 years after leaving the service would likely be needed before comparing them with college grad nonvets working in the civilian labor market. This is because the former will have only 4 years of professional career experience in the civilian labor market (post-college) to demonstrate their civilian career earnings capacity while the latter will have had 7 years.

In addition, we should not lose sight of the fact that military service may benefit veterans in ways besides providing technical skills and education benefits. It seems likely, for example, that experience in the military helps one to accept

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[2]The ability of veterans to collect unemployment compensation may also contribute to their frictional employment problems in becoming accommodated to the civilian labor market.

[3]Forty-one percent of the servicemen in the Daymont and Andrisani (1986) study expected to be in school five years later, about twice the rate of civilians. Moreover, this 41 percent does not include those servicemen who plan to further their education after discharge, but will finish within five years. Obtaining educational benefits required participation in the VEAP program for the vast majority of their veterans, which in turn required a financial contribution on the part of the serviceman and is suggestive of a commitment to obtaining further education after discharge.

legitimate authority and responsibility and adapt to the regimentation of the workplace. In addition, many servicemen rise to positions of leadership while in the military, even during the initial term of enlistment. It is not unreasonable to expect that interpersonal and leadership skills developed in these positions are transferable to civilian organizations.

Finally, based on the theoretical framework, we expect to observe a positive role of military programs such as the Veteran's Educational Assistance Program (VEAP), the Army College Fund, and the new GI Bill through which the military provides financial assistance to help veterans invest in higher education. Certainly, some portion of the economic benefits to this education should be attributable to military service. Indeed, college education financed through military service may be thought of as another form of military training.[4]

LITERATURE REVIEW

A comprehensive literature search was conducted in four academic disciplines -- economics/econometrics, psychology, sociology, and organizational behavior/management. Over two hundred references are reviewed in Appendix I. Because of its voluminous nature, the literature is only briefly summarized below. Full citations for all studies referenced herein are attached as part of Appendix I (see References).

Skills Transfer from Military to Civilian Sectors

Based on the theoretical framework developed above, there are two ways that the armed forces can affect the possibility of skill transfer. First, the military can transfer the skills it develops to the civilian sector through the provision of general training -- e.g., through training in technical, skilled craft, clerical, and administrative specialties (see the above discussion concerning the Becker framework). In addition, general training in the military may also be transferred through the development of leadership skills and positive work attitudes -- including the inculcation of positive work behaviors such as respect for proper authority, promptness, discipline, acclimation to the regimentation of the world of work, etc.

Second, the military may also transfer skills to the civilian sector through the provision of post-service education and training benefits. Although this training is not directly

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[4]However, Angrist (1989,1990), discussed on page 2 and subsequent pages, gives no credit to the military in his model for educational assistance programs to veterans. He assumes they would have returned to school anyway and then counts as part of his veterans' penalty the fact that their schooling occurred later in life and thus has fewer years over which the returns can be accrued.

imparted while youths are in the military, they are a concomitant of an investment in military service.[5]

Several studies have addressed the issue of skills transference. Levine (1984), for example, found that employers placed more importance on youths' having positive attitudes toward work (e.g., striving to do work well) and generic cognitive skills than job-related skills. De Tray (1982) linked the job opportunities of veterans, in part, to the screening device or signaling effect of military service to employers.

Fredland and Little (1980) found that service personnel who received and later used vocational (general) training received long term earnings premiums, but military training taken but not used in subsequent civilian employment yielded no premium. And Goldberg and Warner (1987) suggested the relative impact of civilian and military experience varied by type of military training received with those veterans who received training of a general nature earning more than those who received specific training.

The most extensive reviews of military skills transference in the literature, however, were conducted by Mangum and Ball (1987 and 1989). They examined the issue over a five year period and reported several major findings. First, there was a 30% direct occupational overlap between military specialty and post-military civilian employment. Second, for young men and women who enlisted in the all-volunteer era, skill transfer was as high for military-provided training as for civilian-provided training (45-50%). They concluded, "Analysis of this data set [NLS AVF era Youth Cohort] leaves little reason to doubt the viability of the military as a training provider offering linkage to the civilian work world" (1987; p. 439).

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[5]Almost all studies, including Angrist, fail to empirically model the indirect effects of military service on civilian earnings through post-military education and training benefits. Instead, virtually all studies, especially of Vietnam era veterans, treat post-military education and training as a veterans' penalty. This is because these studies often count veterans' earnings while they are in school or training, and also because they observe a shorter time period for the returns to the education/training of veterans than nonveterans to be observed. Yet post-military education and training which is sponsored by the military is as much attributable to military service as training received while in the military, and the economic returns to post-service education/training may be considerably more valuable to veterans than was observed in most Vietnam era veterans studies. Further, since discipline and regimentation are a large part of academic success, veterans returning to school may achieve more than otherwise because of the discipline and regimentation developed through military service.

Veterans' Premium/Penalty

Previous research also suggests that the economic returns to military service vary across historical time periods. Several studies have found that the relative earnings of veterans of World War II and the Korean conflict were higher than for nonveterans (e.g., Chamarette and Thomas, 1982). Similar to some other studies, De Tray (1982) and Fredland and Little (1980) used data from the 1960 and 1970 Census Public Use Samples and found higher earnings for veterans than for similar nonveterans.

Using data from the NLS older men's sample, Little and Fredland (1979) found a significant veterans' premium for World War II veterans. Using cross sections from the 1970 census, Villamez and Kasarda (1976) and Martindale and Poston (1979) also found higher earnings for veterans of World War II and the Korean conflict than for nonveterans. In general, these studies also found that the magnitude of the veteran premium was larger for blacks than for whites and for those with less education than for those with more education, contrary to the recent findings of Laurence et al. (1989).

In contrast, studies of Vietnam era veterans have tended to conclude that there is a negative or negligible impact of veteran status on civilian earnings, and more so the former than the latter (Berger and Hirsch, 1983; Rosen and Taubman, 1982; Crane and Wise, 1987; and Angrist, 1989 and 1990).[6] Using CPS data from 1968 through 1977, for example, Berger and Hirsch (1983) found the earnings of veterans and nonveterans to be similar.[7] Disagreement also exists among studies over whether low ability individuals obtain equal, higher, or lower returns to military service (Trost and Warner, 1979; Daymont and Andrisani, 1986; and Laurence et al., 1989).

Rosen and Taubman (1982) examined the earnings of white males for the period of 1951 to 1976. They determined that Vietnam veterans had a 19% negative earnings differential, but World War II and Korean War veterans had a significant, positive advantage. Goldberg and Warner (1987) employed the Social Security earnings records of 24,000 males who separated from the armed forces in fiscal year 1971. They examined the earnings history of the sample for a five year period after separation (1972-1977) and controlled for the type of military experience gained. That is, they considered the single digit occupation group code (e.g., Infantry/Combat, Electronic Equipment Repair, Medical, Service/Supply, etc.).

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[6]Daymont and Andrisani's (1986) Vietnam era veterans study is an exception. Its differences in findings with these others are discussed below.

[7]Contrary to studies of veterans of earlier eras, Berger and Hirsch found no evidence that military service during the Vietnam War had a greater economic payoff for non-whites than for whites.

They found that the earnings differential depended upon the type of training/experience received, with the more technical training/experience yielding a return essentially equal to civilian experience of the same type; and, non-technical military experience yielding a return less than an equal amount of civilian experience. Also, a consensus does seem to exist that the returns to military service are greater for high school dropouts than for high school graduates.

Most recently, we used data from the NLS to conduct an analysis of the longer term returns to military service during the Vietnam War era (Daymont and Andrisani, 1986). Consistent with the studies reviewed above on this era, we also found a significant earnings disadvantage for young vets in the short term -- i.e., the earnings of servicemen dropped sharply at the time of separation and remained below those of comparable nonveterans for several years.

However, the civilian earnings of veterans rose rapidly thereafter and subsequently overtook the earnings of their civilian counterparts within one to four years. Once they overtook the earnings of those who never served, the higher earnings of veterans persisted until the end of the period covered by the research, approximately 19 years after high school. Thus, it was concluded that comparing vets and nonvets in the short term does not allow the veterans' long term advantage to offset their short term disadvantage. This explains and reconciles the conflicting studies on the Vietnam era, almost all of which, by necessity, focused on the short term.[8]

Furthermore, men who completed a tour of military duty and then invested in a college education earned more than men who worked in the civilian labor market and then invested in a college education. However, they earned slightly less than men who invested in a college education soon after high school, although their earnings rose faster and eventually caught up with and overtook the earnings of comparable nonvets.

Our analysis of unemployment mirrored our earnings analysis. Unemployment is high for veterans soon after separation (when they can collect unemployment compensation, carefully search for work, and consider returning to school or obtaining training) but falls to below that of their civilian counterparts within two to four years. Consistent with most previous research, we found that the economic returns to military service were greater for minorities than for whites.

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[8]Interestingly, Angrist (1989) found the same thing when using control variables/conventional instruments such as Daymont and Andrisani's rather than the lottery data from the end of the Vietnam era.

With respect to wage differentials -- i.e., veterans' premiums or penalties -- the literature review also yielded the following major observations:

• Nelson and Armington (1970) used 1960 census data and found a positive differential for veterans between the ages of 25 and 34.

• Little and Fredland (1979) used the WW II era cohort of the NLS and found a 5-10% earnings advantage for white and 13-15% advantage for black veterans, while Angrist (1990) found a 0-5% disadvantage for WW II vets.

• De Tray (1980) used the NLS Vietnam era cohort and estimated a veterans' premium as high as 10%.

• Villemez and Kasarda (1976) used 1970 Census data and estimated an earnings advantage for male veterans in general, but it varied upon the time period in which service occurred. That is, WW II veterans had the greatest positive differential; Korean veterans had a smaller, but positive advantage; and Vietnam veterans had a negative differential (or veterans' penalty).

• Schwartz (1986) studied the years 1967 and 1976 and concluded that Korean war veterans were basically the same as nonveterans, but that Vietnam era veterans were worse off.

Basically, the findings as to the existence of a veterans' premium or penalty on the surface seem diverse, somewhat contradictory, era dependent, contingent upon the particular subgroups studied, and driven by the selected data set(s) and methodologies employed by their researchers. In our opinion, however, with the exception of the Angrist studies to be discussed in detail below, the diversity and inconsistency of the findings can be reconciled as follows: Vietnam era vets definitely show a penalty in the short term, but not in the longer term. Studies of WW II and Korea focused on the longer term and generally observed premiums -- or at least equal returns to military and civilian experience.

Those studies using panel data and following veterans for a longer period of time after completion of military service more often observed the existence of a veterans' premium (WW II era studies, Korea era studies, and Vietnam era research that followed vets for almost 20 years after high school). Those using cross-sectional comparisons at a given point in time -- and close to the time of completion of military service -- often found either none or a penalty.

Most importantly, and almost always overlooked, is the fact that short term problems vets face upon initial entry or reentry into the civilian labor market are entirely understandable. Four major reasons account for the need for longer time horizons after military service before comparing the earnings of veterans and nonveterans.

First, many veterans return to school or intend to do so on either a part-time or full-time basis. A sufficient time period after the completion of both the military and schooling is essential for career earnings potential to be demonstrated.[9]

Second, it is well known that youths encounter severe transitional employment problems upon initial entry or reentry into the civilian work force. Earnings comparisons close to the point of withdrawal from the military produce downward biased comparisons because veterans are encountering normal and temporary transitional problems that nonvets also encountered -- but earlier -- and by then have overcome.

Third, the job search of young veterans is financed by Unemployment Compensation for a significant period of time. This is less often true in the case of nonveterans when they initially enter the civilian labor market.

Fourth, employer discrimination against veterans may have forced vets to "prove their worth" in order to overcome the negative attitudes about military training produced as vestiges of Vietnam and military recruiting scandals of the late 1970's.

In any event, notwithstanding these inconsistencies, only rarely were any veterans' penalties reported before the very recent work by Joshua Angrist (1989 and 1990) which has been widely reported in the popular press. These studies are more fully addressed below.

Veterans' Penalty Argument: Angrist Studies

Until 1989, with the exception of studies of Vietnam era veterans which focused on the short run, the literature produced little evidence of a veterans' penalty. Moreover, the Vietnam era studies for the most part could be explained on the basis of the short period of time after leaving the military when earnings of vets and nonvets were compared.

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[9]Although their study examined AVF veterans who enlisted prior to 1979, half of the servicemen in the Daymont and Andrisani (1986) study participated in educational benefit programs and a full 41% of them expected to be in school five years later, about twice the rate for civilians. Moreover, this 41 percent does not include those servicemen who planned to further their education after discharge, but expected to finish within five years. Obtaining educational benefits required participation in the VEAP program for the vast majority of their veterans, which in turn required a financial contribution on the part of the serviceman and is suggestive of a commitment to obtaining further education after discharge.

Angrist (1989 and 1990) not only found no veterans' premium, but concluded there was, in fact, a veterans' penalty even for WW II veterans! According to Angrist, armed forces service tends to relegate an individual to lower income levels for long periods of time after leaving the service. Further, Angrist suggested that all previous work was methodologically flawed, even the work that employed special procedures for the correction of possible selectivity bias. The methodological flaw, according to Angrist, was why his results differed so dramatically from other findings.

His use of lottery data from WW II and Vietnam allowed him to have what appears to be a "natural random experiment" research which is generally viewed on "a priori" theoretical grounds as superior to field survey approaches -- which were performed in virtually every research study cited in the literature.[10] His results call into question the advertising appeal of the military as "a great place to start."

The main conclusion of Angrist is that there is a veterans' penalty rather than premium, even for WW II veterans. This penalty is not observable when conventional techniques such as in our original research are used, or even after conventional corrections for selectivity bias are employed. Rather, only after the data are adjusted for selectivity using draft lottery data is a veterans' penalty observed.[11]

The key concern is whether the random assignment of draft lottery numbers was in fact tantamount to randomly assigning men to the veteran and nonveteran groups. If so, the natural random experimental design which the lottery presumably makes available to Angrist argues persuasively for the validity of his study. However, Angrist's data show that many at high risk of induction

[10]James Heckman (1990) disagrees on practical grounds with the "a priori" theoretical generalization about the superiority of experiments in the social sciences. He argues that for many reasons there can be no such thing as a "natural random experiment" in the social sciences. In his words (p. 302): "Ideal experiments produce ideal data. Actual experiments do not and are likely to be of limited value in evaluating many important social programs."

[11]Angrist's research shows that NLS data for the Vietnam era cohort show results that are: (1) equivalent to ours before adjusting for sample selection bias, (2) even more favorable to veterans after adjusting for sample selection bias using conventional approaches, but (3) extremely unfavorable to veterans after adjusting for sample selection bias using draft lottery data.

avoided the draft altogether while many at low risk of being drafted enlisted.[12]

Further, despite the obvious randomness of lottery data, they may not in fact have provided a natural random experiment in any real sense as a practical matter. Thus, while Angrist's approach indeed has a theoretical and conceptual advantage to the previous literature, its conclusions may well be wrong. There are a number of reasons for this:

(1) After replicating his NLS findings on the Vietnam era, we found his results to be highly sensitive to some unusual and questionable cases in his NLS sample.[13] If just a single individual from his NLS sample is removed -- a nonveteran who earned an extremely questionable $270/hour -- his veterans' "penalty" drops substantially. Other questionable cases of low earning veterans with only a month's time on active duty and unbelievably high earning nonveterans also have been observed in his data. Eliminating just 6 cases from his NLS sample eliminates his veterans' "penalty" entirely.

(2) Angrist's data are not at all generalizable to "true volunteers" but only to draftees and draft-induced enlistments. Hence, they are not of relevance to the AVF era but only to WW II and Vietnam. That is, veterans during that era who were not at risk of the draft but who nonetheless volunteered are not considered in his models.[14] Yet it is precisely the true volunteers during the lottery era who provide the most useful evidence of whether military service is helpful or harmful to subsequent career earnings, and have the greatest relevance to the AVF era.[15]

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[12]Many at risk of the draft avoided or were rejected for mental, physical, or religious reasons, while many who it later turned out were not at risk, volunteered or enlisted because they mistakenly thought their draft number would cause them to be drafted.

[13]We are extremely grateful to Joshua Angrist for his kind and generous assistance in making many of his computer programs available to us to assist in our replication.

[14]The applicability of Angrist's work to the AVF era is virtually nonexistent. He states that the effect of veterans' status for true volunteers is not identified and will become part of the regression error. That is, his model explicitly factors out the effect that we are trying to measure in the AVF era -- the effect of volunteering to serve in the military.

[15]Another issue is whether results based on lottery data even on true volunteers during wartime would be generalizable to peacetime, aside from the issues of cohort and period effects.

(3) The military "treatment" may not have taken as well with reluctant draftees of an unpopular war as with true volunteers. The implications for current AVF era enlistees most certainly depends more on the findings for Vietnam volunteers than draftees, if these historical data are of any relevance today at all. Thus, if the returns to volunteers and draftees could be separated, the focus should definitely be on the former rather than the latter. Yet Angrist clearly focused on the latter.

(4) As Angrist acknowledges, there were "behavioral responses to the draft." However, notwithstanding his assertions to the contrary, his model fails to consider adequately either the consequences of "draft avoidance behavior" that may have either temporarily or irreparably harmed the short term earnings of "draft avoiders" or the consequences of "rejection by the draft" for mental, physical, or religious reasons. He dismisses their relevance because of statistical tests which suggest that his findings are unaffected by draft avoidance behavior.

That is, Angrist's findings are that those "at risk" of being drafted -- many of whom were never veterans because of avoidance or rejection by the military -- earned less later than those "not at risk" of being drafted -- many of whom were either true volunteers or enlistees whose birth dates made them concerned enough about being drafted to volunteer. Since these two groups were randomly assigned on the basis of birth dates, earnings differences between them, in essence, are attributed to the military since any other differences between the groups are purportedly random.

However, draft avoiders ("at risk" nonveterans) of the Vietnam era may not have improved their lifetime earnings, relative to those "not at risk," by remaining in school to beat the draft, as Angrist contends.[16] Rather, they may in fact have "harmed" their human capital stock by investing in worthless schooling (choices of inferior colleges and major fields of study that would otherwise be ill-advised), migration strategies, etc., which lowered their lifetime or early career earnings relative to nonveterans with equal years of schooling. Thus, it may not be the military which caused them to be low earners today but rather, their choices with respect to ways to avoid or postpone the draft. Rumsberger (1987) and Verdugo and Verdugo (1989) show clearly that "surplus" education leads consistently to lower rather than higher earnings relative to "their adequately educated and undereducated counterparts" (p.629). Freeman (1976) made the same point. Further, worthless education, as opposed to more education, may in a career earnings sense be worse yet.

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[16]Others, aside from draft avoiders, who were at risk for the draft but did not serve include a goodly percentage of youths ineligible due to physical, mental, or religious reasons. They too are unlikely to be high earners in the civilian sector, on average.

Thus, the lower early career earnings of Angrist's 29-31 year old men who were at risk of the draft during Vietnam may not at all reflect military service.[17] Rather, they may reflect the adverse effects of "draft rejection"[18] and "draft avoidance" behavior on subsequent earnings, the short time horizon over which vets could return to school and catchup, and employer discrimination against and societal rejection of Vietnam vets as noted in previous sections of this report.

In sum, his studies do not deal with veterans and nonveterans, but with those "at risk of the draft" and those "not at risk." However, there are really 6 combinations of choice and risk behaviors: (1) "at risk" veterans,[19] (2) "draft avoiders," (3) "draft ineligibles,"[20] (4) "true volunteers,"[21] (5) "not-at- risk" nonveterans, and (6) volunteers whose birth dates were close enough to the draft cutoff dateline, which was not announced in advance, that they thought they would be drafted and thus, enlisted to secure a choice of branch and/or military assignment. His results may clearly be influenced by the failure to estimate differences among each of the logical behaviors rather than between those at risk and those not at risk.

(5) His veterans' penalty is only observed for whites. In fact, his findings for blacks often show a statistically significant veterans' premium about which Angrist is conspicuously silent.

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[17]In his AER study, his sample was 31-34 years of age, but only 29-31 in his NLS study.

[18]While draft rejects for mental, physical, or religious reasons may not have harmed their human capital to avoid the draft, they may have been stigmatized in the eyes of their employers as "unfit for military service". Their counterparts who were not at risk of the draft, however, may never have had their mental, physical, or religious circumstances made known to employers because, since they were not at risk, they were never rejected.

[19]Draftees in the Angrist studies may not have served in the year when called, but may have delayed entry into the military for years (if not altogether) by virtue of deferments which may have hindered rather than enhanced their career earnings.

[20]Angrist reports that a large fraction of "at risk" youths during the Vietnam war failed either the AFQT, the pre-induction physical, or both.

[21]Since it was not clear what the cutoff point would be for the draft in any given year until far into the year, many of these may have volunteered only because they expected they would have been drafted anyway.

(6) The penalty is generally not statistically significant at conventional (5%) levels with NLS data, but rather only at the 10% level. In his AER study, his observed shortfall to those at risk of the draft is about 3%, and often not statistically significant.[22] Thus, since a one tail test is clearly inappropriate unless a veterans' premium is hypothesized, Angrist's veterans' penalty both in his NLS study and AER study often appear to be questionable.

(7) His model fails to measure the indirect effects of military service through increased human capital accumulation. Education, training, and location, for example, are measured at the same time as earnings rather than at the time of induction. Thus, if military service inspires veterans to pursue further education and training or to migrate, none of these returns to military service are captured.[23] This is even more worrisome in the models which control for occupation and industry, where the effects of military service on subsequent access to better paying jobs are statistically controlled for and not credited to military service.

(8) Further, his model compares vets (who returned to school) and nonvets who are college graduates as though they both completed college right after high school. While vets ultimately may reap the same returns to college as their nonvet counterparts who went straight to college, the vets will have a shorter time horizon over which the returns to schooling can be observed in the Angrist model.[24]

(9) More than one-third of the NLS sample was "missing" in 1981, the single year Angrist studied. As a result, the representativeness of the NLS data he used is certainly in doubt in that single year which he chose to study.

(10) Angrist's study of Vietnam is limited to a single point in time, 1981. Daymont and Andrisani (1986) had shown clearly that the veterans' premium/penalty is definitely not

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[22]These 3% shortfalls are then projected up to a 15% veterans' penalty by using Wald estimators -- i.e., by using the estimates that 30% of those at risk actually served while only 20% of those not at risk actually served in the military.

[23]In the case of education, the Wall Street Journal recently reported that 2.2 million veterans of WW II returned to college on the GI Bill after the war, producing 162% more college degrees in 1950 than in 1939, and a record number that stood until 1962. Clearly at least some of the returns to the $14.5 billion dollar federal investment in the education and job training of WW II veterans should be attributed to having served in the military, contrary to Dr. Angrist's model specification.

[24]This is more worrisome for the younger Vietnam era veterans of course than for the older WW II veterans.

constant over the life cycle, but varies from a penalty shortly after discharge to an advantage later on.

(11) Angrist's 1989 study argues that veterans' status is not exogenous, but endogenous, essentially because "V hat" -- or predicted probability of being a veteran based on the lottery instrument -- is statistically significant even after actual veterans' status is controlled for in the model.[25] But "V hat" may be significant precisely because it adds explanatory power to the model (in addition to veterans' status) by explaining earnings variance within both the veterans and nonveterans groups. Consider the following:

(a) Within the veterans group the lottery data logically may be showing earnings differences between "draftees" and "true volunteers," with the latter outperforming the former -- i.e., those with "low risk of draft" birth dates earning more than those with "high risk of draft" birthdates.

(b) In addition, within the nonveterans group the lottery data logically may also be showing earnings differences between "draft avoiders" and "true nonveterans" -- that is to say those with "low risk of draft" birthdates (true nonvets) earning more than those with "high risk of draft" birthdates (what we refer to as draft avoiders).

(c) Conversely, holding lottery data constant, a veterans' premium may not be due to endogeneity at all but to the fact that veterans' status and lottery data, although correlated, are representing logically distinct concepts. Within the "high risk" group, for instance, draftees logically may outperform draft avoiders, while in the "low risk" group true volunteers may have outperformed nonveterans.

(12) Angrist's earnings model with NLS data contains few control variables, as though they were unmeasurable. Yet many were measurable but ignored. This places tremendous pressures on his statistical techniques. In his AER study, no control variables other than age and race are considered.

(13) His NLS point estimates for the veterans' penalty are logically not plausible. They suggest that the average Vietnam draft induced veteran would earn 50-60% more if he resisted serving. If true, the observable economic scars of the Vietnam War on its veterans would be obvious to all without this or any other study.

(14) In his latest work, Angrist (1990) reports more plausible results than his NLS (1989) study -- a veterans' penalty in the 15% range. But the data are quite limited in that (a) they lack the richness of the NLS, (b) they lack any control variables other than age and race, (c) the earnings measures are

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[25]This is basically the Hausman test for exogeneity.

censored, and (d) it was necessary to combine data from several sources.

(15) Even if the lottery were a true experiment -- with everyone at risk serving and those not at risk excluded from serving -- there is no pre-treatment vs. post-treatment comparison between veterans and nonveterans as would be performed in a true experiment. However, this could have been accomplished if the longitudinal richness of the NLS data had been fully exploited.

Despite these criticisms, it is likely that many will not only believe a veterans' penalty for WW II and Vietnam, but also believe that an experiment during the AVF era would likewise demonstrate a penalty. This may occur for two reasons -- Angrist's ingenious use of draft lottery data to simulate a "natural random experiment" and the general belief in the superiority of experiments.

Female Veterans

Two fairly recent societal trends, the increasing number of women entering the work force and the increasing number of women entering military service, have converged to make the issue of military service experience for women an important concern for national policy makers. Just as the question has been posed for men, a similar question arises as to whether or not military service is a good investment for young women.

A better understanding of the relationship between military experience and later career earnings for young women is important for several reasons. For instance, as the male youth cohort continues to shrink, the services are increasing their recruiting efforts directed at women, and also increasing the ceiling on the number of women who may join. College and civilian employers who compete with the military for youths are altering their recruiting strategy as well. In addition, given the realities of the feminization of poverty and risks of marital instability, rational career planning is especially important for young females.

There are, of course, varying reasons for an individual to join one of the military services -- money for college, skill training, better pay, challenge, family tradition, and an opportunity to serve the nation. Based upon a survey of new recruits entering the Army, the distribution of primary reasons for joining looked similar for women and men. Money for college and skill training were the top two categories for both (Benedict, 1987). Based upon the survey results, it appears that young women as well as young men are viewing military service, at least to a degree, as an investment in human capital.

As previously noted, many studies have examined the issue of economic returns to military service in the civilian labor market. However, most have dealt exclusively with men. Our search of the literature yielded very little on the subject of the impact of military service on post service earnings of women, especially during the AVF era. Perhaps one reason for a lack of literature on female veterans is a lack of data.

In one of the few studies on the subject, Mangum and Ball (1987) controlled for type of skill/experience obtained in the service for veterans and examined whether or not they were able to find civilian employment in a related skill. They found significant amounts of skill transfer for both male and female veterans.

For male veterans, the probability of skill transfer was lower than for civilians trained in apprenticeship and employer-provided training programs, but about the same as those trained in vocational/technical institutes, proprietary business colleges, etc. For female veterans, transfer percentages were greatest in the traditional skills of administrative/functional support. When compared to specific training for civilian females such as nursing, apprenticeship, or beauty programs, or to training programs provided by employers, female veterans had a lower rate of transfer.

They went on to suggest that the key to explaining such gender differences may be the presence of internal labor-market mechanisms which facilitate the transition from training to work in certain institutional settings.

If the early career reduction in veterans' earnings upon leaving the service results from a "veterans' penalty" (Angrist, 1989 and 1990) -- i.e., a lack of transferability of service-gained skills and experience -- rather than frictional unemployment and returning to school, one would expect to see the reduction in earnings persist over a longer period of one's career. Yet this is not what Daymont and Andrisani (1986) show with their data on male veterans and one of the key issues this study takes up for both young men and women during the AVF era.

Daymont and Andrisani (1986) showed the earnings reduction rapidly dissipating after discharge from the service. This suggests frictional unemployment which typically accompanies entry and reentry into the civilian labor market, the returning of vets to school or training (learning instead of earning), the greater availability of unemployment insurance benefits for veterans than nonveterans, and employer discrimination early in careers against veterans.

Accordingly, we hypothesize that a substantial portion of the decline is temporary and that the earnings of former servicewomen will rise more quickly than the earnings of civilians of comparable ages and education, just as was observed by Daymont and Andrisani (1986) in the case of men.

Methodological Issues: Self-selection Bias in Veterans' Studies

This section addresses the methodological issues that must be confronted in estimating a veterans' premium/penalty. The primary methodological problem is that of "self-selection".[26] First, we provide an overview of this problem in labor market studies. Second, we demonstrate that when veteran status is determined non-randomly, standard procedures for estimating the veterans' premium/penalty yield biased estimates. We develop several models of the process that generates veteran status and the observed earnings data. In the more complicated models the direction of the bias is, unfortunately, ambiguous. Finally, econometric procedures for dealing with the bias and the data required to implement these procedures are discussed.

Overview

The problem of self-selection in the analysis of earnings data has its origins in the work of Gronau (1974). Gronau considered the problem of estimating the return to female education. Standard procedure at the time was to delete from the analysis observations on women who did not work and for whom, therefore, no earnings data were observed, and simply estimate a regression of earnings on education. Because who chooses to work and who chooses to stay home is not random, Gronau reasoned that such a regression will give a biased estimate of the relationship between education and earnings. Women work only if their market wage opportunity exceeds their value of home time, so that the women who work will tend to be those who, for unobservable reasons, have abnormally good market wage opportunities. The mean of observed wages will overstate the mean that would have been observed if all women had worked. The overstatement of mean market wage opportunities declines as the proportion of women who work increases. And since the proportion who work rises with educational level, the overstatement is most severe at the lowest education levels. Consequently, a regression of earnings on education level will tend to understate the effect of education on earnings.[27]

Other problems of self-selection pervade the estimation of the returns to education and government training programs. Consider the problem of estimation of the return to a college education. Standard procedure is to collect a sample of data containing observations on individuals who enter the labor market after high school and others who go on to complete a college degree. In a regression for earnings that includes a "dummy" for

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[26]For an excellent review of the econometrics of this issue, see: Manski (1989). We are indebted to John Warner and Joseph Friedman for their contribution to this section of the report.

[27]Subsequent analysis have shown that the bias could run in either direction. See Smith (1980) for a compendium of studies of female earnings.

completion of a college degree, the coefficient on this "dummy" is interpreted as the earnings effect of the college degree. However, if more able individuals go to college and less able individuals terminate their education after high school, part of the estimated effect of the college degree will actually measure the effects of (unobservable) ability. The bias again arises from the fact that individuals are not randomly selected to receive college educations but choose their education levels non-randomly on the basis of factors that cannot be observed. If ability is unidimensional and the more able go to college, standard procedures will overstate the return to a college degree.[28]

Estimation of the return to government training programs such as MDTA and CETA is also plagued by the problem of self-selection. Here the bias is clear: individuals who choose to participate in such programs are likely to be individuals who have very poor job prospects. If the choice to participate in the training program is non-random, comparison of the earnings of participants with a control group of observationally equivalent non-participants will give a biased estimate of the effect of the program. In this case the analysis will be biased against finding a positive effect of the training even if an effect exists. O'Neill (1977) recognized this to be a problem for estimating the return to vocational and technical training uses of the GI Bill. For further discussion of the problem of evaluating government training programs, see Moffitt (1986) and Barnow (1986).

Previous studies of the veterans' premium/penalty may be evaluated in light of this discussion. Fredland and Little (1980), for instance, find a sizeable positive veterans' premium for World War II veterans. The majority of young males served in World War II. Those who did not are likely to have been individuals who were unable to meet the military's mental, moral, or physical screens. If the inability to meet these screens carries over to performance in the labor market, then a comparison of their earnings with earnings of veterans, who satisfied the screens, is likely to give an upward biased measure of the veterans' premium. As Berger and Hirsch (1983, p.461) note, those who were successful in dodging the Vietnam era draft may have been individuals who had better than average civilian opportunities; draftees and draft-motivated volunteers were those who had worse than average civilian opportunities (given their education level and other observable attributes). In such a case a comparison of veteran and nonveteran earnings will understate the true veterans' premium.

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[28]However, Willis and Rosen (1979) suggest that ability is not unidimensional. In their approach, people sort themselves by educational level on the basis of their comparative advantage at doing the things required of people at different education levels. Consistent with this approach, their empirical results suggest that standard procedures understate the return to a college education.

Berger and Hirsch clearly recognized the selection bias problem but did not deal with it econometrically. We now develop several models of the process that generates the observed earnings data and the econometric procedures that are implied.

Standard Procedure

Consider a sample of data that includes observations on veterans and nonveterans. Our goal is to estimate whether there is any earnings effect attributable to military service. One approach is to specify separate earnings equations for nonveterans (n) and for veterans (v):

$$Y_n = \beta_{on} + \beta'_n X_n + \varepsilon_n \tag{1a}$$

$$Y_v = \beta_{ov} + \beta'_v X_v + \varepsilon_v \tag{1b}$$

where Y denotes earnings, X denotes a vector of observable determinants of earnings and ε denotes unobservable random error. Assume that ε_v and ε_n are normally distributed with zero means and standard deviations σ_v and σ_n, respectively. Typically included in X are variables for education, experience, race, mental group, geographic region, and any other observable, theoretically plausible determinant of earnings available in the data set at hand.[29] Standard procedure is to estimate these equations by OLS, use the fitted equations to predict earnings (Y_v and Y_n) for various values of the observable regressors and then estimate the veterans' premium/penalty by the predicted difference $Y_v - Y_n$.

Assuming the regressor vectors X_v and X_n are the same, that $\beta = \beta_n = \beta_v$, and $\sigma_n = \sigma_v$, an alternative approach is to pool (1a) and (1b) into a single equation:

$$Y = \beta_{on} + \beta' X + \alpha D + \varepsilon \tag{2a}$$

where D = 1 if the observation is on a veteran and 0 if the observation is on a nonveteran. The parameter α is the veterans' premium/penalty and is equal to $\beta_{ov} - \beta_{on}$. To relax the assumption that the slope vector β is the same for veterans and nonveterans, veteran status can be interacted with X:

$$Y = \beta_{on} + \beta' X + \alpha D + \delta'(D*X) + \varepsilon \tag{2b}$$

where $\delta = \beta_v - \beta_n$. OLS estimation of (2b) will yield the same results as estimation of (1a) - (1b).

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[29]Data sets like the National Longitudinal Survey (NLS) contain an inherently richer set of observables than data sets like the Current Population Survey (CPS). For instance, in addition to military mental group category the NLS contains detailed family background data not available in the CPS.

A question that has received much attention in the econometrics literature is the conditions under which estimation of (1a) - (1b) or (2b) will yield an unbiased estimate of the veterans' premium/penalty. The answer is that the properties of the OLS estimator of (2b) depend upon the way the data are generated. If people are randomly plucked from civilian life, given the military "treatment", and then returned to civilian life (as in a completely random draft), OLS estimation (2b) will yield unbiased estimates of the veterans' premium/penalty. The reason is that random selection of people to receive the military treatment guarantees that the random error ϵ will be unrelated to the regressors included in the model, which is one of the assumptions required for OLS to yield unbiased parameter estimates.

Even if the selection is non-random, OLS may still be unbiased. Suppose in a draft environment the military only takes high school graduates or people with AFQT scores above 35 and these are the only factors that determine whether one is drafted. Then as long as these factors are included in the earnings equation the random error ϵ will still be uncorrelated with the included regressors and OLS will remain unbiased.

Models with Self-Selection

It is unlikely, however, that these conditions will ever be met, especially in an All Volunteer Force (AVF) environment. In this environment individuals are not randomly selected to receive the "treatment"; rather they must want to join and the military must want to take them. In this environment the data on veterans and nonveterans are the outcome of a process of self-selection. The fact that the data are generated non-randomly may lead to biased estimation of the veterans' premium/penalty by standard procedures and dictates the necessity for more appropriate econometric procedures. The self-selection problem and procedures for dealing with it are now more rigorously discussed.

Self-Selection at Entry Based on Earnings Maximization

The simplest model one can construct is based on the assumption that individuals make the decision to join the military according to the choice that maximizes earnings. The more general case of choice based on utility maximization is developed below. To begin, we make two additional (unrealistic) assumptions that are relaxed below. One is that enlistees are unaware at enlistment of what a period of military service will do to their future civilian earnings capacities. Second, we assume that all enlistees will leave the military after one term of service. The latter assumption permits development of a choice model based on one time period; the former assumption obviates dealing with the self-selection that might arise at the first-term reenlistment point.

For simplicity, let M be the military wage. Assume that it is known with certainty and is independent of observable or unobservable characteristics. Civilian earnings are defined by equation (1a). In this case the individual chooses to join if $M > Y_n$. He therefore joins if $M - \beta_{on} - \beta'_n X > \varepsilon_n$. If ε_n is distributed normally with mean zero and standard deviation σ_n, the probability of enlistment is $\Pr((M - \beta_{on} - \beta'_n X)/\sigma_n > \varepsilon_n/\sigma_n) = \Phi(z)$ where $z = (M - \beta_{on} - \beta'_n X)/\sigma_n$ and $\Phi(z)$ denotes the standard normal distribution function evaluated at z.[30]

Given this decision process for determining who enlists and who does not, we may derive the expected earnings of nonveterans and veterans. The expected earnings of nonveterans (i.e., expected value of either (1a) or (2b) conditional on not having enlisted is

$$E(Y_n \mid \text{don't enlist}) = \beta_{on} + \beta'_n X + E(\varepsilon_n \mid \text{don't enlist}) \quad (3)$$

It may be shown that

$$E(\varepsilon_n \mid \text{don't enlist}) = \sigma_n \phi(z)/(1 - \Phi(z)) \quad (4)$$

where $z = (M - \beta_{on} - \beta'_n X)/\sigma_n$, $\phi(z)$ denotes the standard normal density function, and $1 - \Phi(z)$ is the probability of not enlisting. Let $\phi(Z)/(1-\Phi(Z)) = \lambda_n$. The term λ_n has been termed the Inverse Mills Ratio. Therefore, expected earnings conditional on not enlisting can be written as $\beta_{on} + \beta'_n X_n + \sigma_n \lambda_n$. Since σ_n and λ_n are both positive, ε_n has a positive expectation. Consequently, conditional on the observed personal attribute vector X, the expected earnings of those who did not enlist, equation (3), will be an upward biased measure of the earnings that would have been expected had no one served. The expectation (3) is also the expectation of (2b) conditional on $D = 0$.

Consider now the expected earnings of veterans. If (1b) describes their earnings, their expected earnings are

$$E(Y_v \mid \text{enlist}) = \beta_{ov} + \beta'_v X + E(\varepsilon_v \mid \text{enlist}) \quad (5)$$

where

$$E(\varepsilon_v \mid \text{enlist}) = -\rho \sigma_v \phi(z)/\Phi(z) \quad (6)$$

and ρ is the correlation between ε_v and ε_n. Let $\phi(Z)/\Phi(Z) = \lambda_v$ denote the Inverse Mills Ratio for enlisting. The expectation (5) is also the expectation of (2b) conditional upon enlistment ($D = 1$), where $\beta_{ov} = \beta_{on} + \alpha$ and $\beta_v = \beta_n + \delta$. Since (6) is negative, the expected earnings of those who served in the military provide a downward biased measure of the earnings that would be expected if all had served. Consequently, in a sample of veterans and nonveterans sorted on the basis of earnings

[30]Notice that the probability of enlistment can be expressed as $\Pr(\text{enlist}) = \Pr(\Theta_0 + \Theta_1 M + \Theta_2 X > \varepsilon_n/\sigma_n)$ where $\Theta_0 = -\beta_{on}/\sigma_n$, $\Theta_1 = 1/\sigma_n$, and $\Theta_2 = -\beta_n/\sigma_n$.

maximization, the mean earnings of nonveterans provides an upward-biased estimate of the mean earnings that would be observed had all individuals remained nonveterans while the mean earnings of veterans provides a downward-biased estimate of the mean earnings that would be observed if all were veterans. Econometrically, OLS estimation with such a sample will lead to a downward biased estimate of the veterans' premium/penalty α as well as biased estimates of other parameters.

Self-Selection at Entry Based on Utility Maximization.

It is unlikely that enlistment decisions are based on simple earnings maximization. Individuals' preferences for the non-pecuniary aspects of military versus civilian life certainly play a major role in military enlistment decisions. Suppose an individual's utility from civilian life can be expressed as $U_n = Y_n + \gamma_n$ where γ_n is the monetary value the individual places on all the non-pecuniary aspects of civilian life. Likewise, the utility of a military enlistment is $U_m = M + \kappa'Z + \gamma_m$ where γ_m is the value the individual places on the non-pecuniary aspects of military life and Z is a vector of observable variables other than military pay that influence the utility of a military enlistment. Included in the vector Z might be the civilian unemployment rate at the time of enlistment and other factors that influence the propensity to enlist such as educational benefits, recruiters, and advertising expenditures.

The individual is assumed to join the military if $U_m > U_n$ or $M + \kappa'Z + \gamma_m > Y_n + \gamma_n$. The individual joins if $M + \kappa'Z - \beta_{on} - \beta'_nX > \varepsilon_n + \gamma_n - \gamma_m$. Let $\gamma = \gamma_n - \gamma_m$ (the individual's net preference for the non-pecuniary aspects of civilian life) be distributed with mean μ_γ and variance $\sigma^2\gamma$. The mean of the error $\varepsilon_n + \gamma$ is thus μ_γ. The probability of enlistment is thus

$$\Pr(M + \kappa'Z - \beta_{on} - \beta'_nX > \varepsilon_n + \gamma) =$$

$$\Pr(M + \kappa'Z + \beta_{on} - \mu\gamma - \beta'_nX > \varepsilon_n + \gamma - \mu\gamma) =$$

$$\Pr((M + \kappa'Z - \beta_{on} - \mu\gamma - \beta'_nX)/\sigma > (\varepsilon_n + \gamma - \mu\gamma)/\sigma) =$$

$$\Pr((M + \kappa'Z - \beta_{on} - \mu\gamma - \beta'_nX)/\sigma > u)$$

where $\sigma^2 = \sigma^2\varepsilon_n + \sigma^2\gamma + 2COV(\varepsilon_n,\gamma)$ is the variance of $\varepsilon_n + \gamma$ and $u = (\varepsilon_n + \gamma - \mu\gamma)/\sigma$. Using the notation above, the probability of enlistment is $\Phi(z)$ where $z = (M + \kappa'Z - \beta_{on} - \mu\gamma - \beta'_nX)/\sigma$. The key point here is that the probability of enlistment is affected by the net non-pecuniary preference for civilian life as well as earnings opportunities in the two sectors. A rise in the mean net non-pecuniary preference for civilian life, μ_γ, reduces the probability of enlistment.[31]

How does introduction of non-pecuniary preferences affect the expected earnings of veterans and nonveterans? It may be shown that the random error ε_n in the earnings equation for nonveterans now has expectation

$$E(\varepsilon_n \mid \text{don't enlist}) = \sigma_{\epsilon n,u}\, \phi(z)/(1 - \Phi(z)) = \sigma_{\epsilon n,u}\, \lambda_n \tag{7}$$

where $\sigma_{\epsilon n,u}$ is the covariance between ε_n and u. As in the case above of choice based on earnings maximization, the expectation of the random error ε_n will be positive if this covariance is positive. In this case the mean earnings of nonveterans will again overstate the mean earnings that would be observed if no one had served. Such will clearly be the case if ε_n and γ are positively correlated, i.e., those who have abnormally good civilian wage opportunities also have high net preferences for civilian life. The covariance $\sigma_{\epsilon n,u}$ could be negative, however, if those who have unusually high civilian opportunities (i.e., large positive values of ε_n) also have strong net preferences for military life (i.e., negative values of γ). If this covariance is negative, the mean earnings of nonveterans will understate the mean earnings that would have been observed had no one served.

The earnings of veterans may be analyzed analogously. The expected value of the random error in the veteran wage equation is

$$E(\varepsilon_v \mid \text{enlist}) = -\sigma_{\epsilon v,u}\lambda_v(\phi(z)/\Phi(z)) = -\sigma_{\epsilon v,u}\, \lambda_v \tag{8}$$

where $\sigma_{\epsilon v,u}$ is the covariance between ε_v and u. If the covariance $\sigma_{\epsilon v,u}$ is positive the error ε_v will have a negative expectation and the earnings of veterans will, as in the previous case, provide a downward biased estimate of mean earnings that would be observed if everyone was a veteran. Conversely, earnings are upward biased if $\sigma_{\epsilon v,u}$ is negative.

A Two-Period Utility Maximization Model of the Enlistment Choice

An assumption made above was that potential enlistees are ignorant of the civilian sector value of the skills received in the military. Here we show that this assumption may be relaxed without altering the basic results. The assumption that all

[31]As in the previous model the probability of enlistment can be expressed as $\Pr(\text{enlist}) = \Pr(\Theta_0 + \Theta_1 M + \Theta_2 X + \Theta_3 Z > u)$. Now, however, $\Theta_0 = -(\beta_{on} + \mu_\gamma)/\sigma$. That is, the intercept of the equation for enlistment, Θ_0, absorbs the intercept of the nonveteran earnings equation plus the mean net preference for civilian life.

enlistees must leave after one enlistment is maintained, however. Suppose that individuals discount future earnings at rate d. Suppose further that civilian earnings grow at rate g for each period of civilian sector experience. Individuals are now assumed to enlist if the present value of utility from an enlistment exceeds the present value of not enlisting.

The present value of utility from one period in the military and one period in the civilian sector is

$$\begin{aligned} U_m &= M + \kappa'Z + \gamma_m + dY_v + d\gamma_n \\ &= M + \kappa'Z + \gamma_m + d\gamma_n + d\beta_{vo} + d\beta'_v X + d\varepsilon_v. \end{aligned}$$

The present value at the enlistment decision point of two periods spent in the civilian sector is

$$\begin{aligned} U_n &= Y_n + d(1 + g)Y_n + \gamma_n + d\gamma_n \\ &= \beta_{on} + \beta'_n X + d(1 + g)\beta_{on} + d(1 + g)\beta'_n X + \varepsilon_n \\ &\quad + d(1 + g)\varepsilon_n + \gamma_n + d\gamma_n. \end{aligned}$$

The choice is therefore to enlist if

$$M + \kappa'Z - \beta_{on} + d(\beta_{ov} - \beta_{on}) - dg\beta_{on} - dg + (d\beta'_v - \beta'_n - d(1 + g)\beta'_n)X \quad > (1 + d + dg)\varepsilon_n + \gamma - d\varepsilon_v.$$

The probability of enlistment may again be written as

$\Pr(z > u) = \Phi(z)$ where $z = (M + \kappa'Z - \beta_{on} + d(\beta_{ov} - \beta_{on}) - dg\beta_{on} - dg - \mu_\gamma + (d\beta'_v - \beta'_n - d(1 + g)\beta'_n)X)/\sigma$, u is the composite error $(1 + d + dg)\varepsilon_n + \gamma - d\varepsilon_v - \mu_\gamma$ and σ is the standard deviation of u.[32]

Notice from this statement for the probability of enlistment that the veterans' premium/penalty $\alpha = \beta_{ov} - \beta_{on}$ enters positively in the enlistment decision. That is, the more likely military service is to raise one's future civilian earnings opportunities, the more likely an individual will be to enlist.[33] However, civilian wage growth enters negatively: the

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[32]Again the probability of enlistment can be written in the form $\Pr(\text{enlist}) = \Pr(\Theta_0 + \Theta_1 M + \Theta_2 X + \Theta_3 Z > u)$. Now, however, $\Theta_0 = (\beta ov + d(\beta_{ov} - \beta_{on}) - dg\beta_{on} - dg - \mu_\gamma)/\sigma$ and $\Theta_2 = (d\beta'_v - \beta'_n - d(1 + g)\beta'_n/\sigma$. The intercept Θ_0 and the slope coefficient Θ_2 absorb the parameters from the structural equations of the model, but it would be impossible to identify these parameters from estimation of the Θ's.

[33]It is apparent that potential enlistees do consider the impact of military service on future civilian opportunities. The services must frequently resort to paying enlistment bonuses or offering other incentives (e.g., enhanced educational benefits) to attract recruits into skills that do not provide transferable training. Recruiting is generally much easier into skills that do

faster is civilian earnings growth with respect to civilian experience, the less likely one will be to enlist. Introduction of a second time period leaves unaffected the expectations of the random errors in the post-service earnings equations, which are still defined by equations (7) and (8).

Correction for Self-Selection.

As is evident from the above discussion, OLS estimation of the separate earnings equations (1a) and (1b) or the pooled equation (2a) yields biased estimates of the veterans' premium/penalty when individuals are not randomly assigned to receive the military treatment. Unless individuals base enlistment decisions on earnings maximization, it is not possible to determine a priori whether OLS estimates of the premium/penalty are upward or downward biased. Methodologies for dealing with self-selection are now well developed and are reviewed in detail by Maddala (1983). As can be seen from the expectations in (4) and (6) or (7) and (8), the expected values of the errors in the earnings equations for veterans and nonveterans, respectively, contain expressions involving the probability of enlistment $\Phi(z)$. Given a random sample of potential enlistees on whom actual enlistment decisions and later civilian earnings are observed, one procedure, first proposed by Heckman (1976,1979), is to estimate a probit equation for the probability of enlistment. Variables in this equation are military pay at the time of enlistment (M), other factors that influence the propensity to enlist (Z), and the personal attribute vector (X). From this probit one can estimate z, $\phi(z)$, and $\Phi(z)$ for each observation in the sample. In a second stage the Inverse Mills Ratio variable $\phi(z)/(1-(\Phi z)) = \lambda_n$ is constructed and included in the equation for nonveterans while the Inverse Mills Ratio variable $\phi(z)/\Phi(z) = \lambda_v$ is included in the equation for veterans. These two variables account for the non-zero expectation of the random errors in the respective earnings equations. The parameter estimate on the variable λ_n in the nonveteran equation is an estimate of the covariance $\sigma_{\epsilon n,u}$ (see equation (7)) while the parameter estimate on the variable λ_v in the veteran equation is an estimate of $-\sigma_{\epsilon v,u}$ (see equation (8)).

An alternative approach makes use of the pooled equation (2b). Define the unconditional expectation of earnings in (2b) as

$$\begin{aligned} E(Y) &= (1 - \Phi(z))\ E(Y_n \mid D=0) + \Phi(z)E(Y_v \mid D=1) \qquad (9) \\ &= (1 - \Phi(z))\ (\beta'X + \sigma_{\epsilon n,u}\ \phi(z)/(1 - \Phi(z))) + \Phi(z)\ (\beta'X \\ &\quad + \delta DX + \alpha D - \sigma_{\epsilon v,u}\ \phi(z)/\Phi(z)) \\ &= \beta'X + \delta(\Phi(z)DX) + \alpha\Phi(z)D + (\sigma_{\epsilon n,u} - \sigma_{\epsilon v,u})\phi(z) \end{aligned}$$

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provide transferable training.

The steps here are to estimate a probit equation for enlistment and, for each observation in the sample, use the estimated probit equation to predict the probability of enlistment $\Phi(z)$ and the quantity $\phi(z)$. Then create $\Phi(z)DX$ and $\Phi(z)D$. Then regress Y on X, $\Phi(z)DX$, $\Phi(z)D$, and $\phi(z)$ to estimate β,δ,α, and the covariance difference $\sigma_{\epsilon n,u} - \sigma_{\epsilon v,u}$. In estimating the earnings equation (2b) this procedure simply involves the extra step of weighting the interaction variables DX and the dummy D for veteran status by the probability of enlistment $\Phi(z)$.

The purpose of this section has been to discuss in some detail the problem of self-selection bias and its implications for the analysis of veterans' earnings.

Procedures were discussed for the case in which individuals make only two choices -- enlist or not enlist. In reality, choices may be polychotomous -- upon terminating their secondary education individuals may choose between a number of service - additional schooling paths that are identified more explicitly below. Econometric procedures for handling self-selection bias in polychotomous choice models, which are generalizations of the procedures discussed above, have been developed by Lee (1983).

<u>Other Complications</u>

Still other complications arise from the above discussion. The first is relatively easy to deal with. The enlistment model assumes that an individual is observed to enlist if $U_m > U_n$. In fact, to actually enlist in a volunteer environment the individual must both want to enlist and the military must want to take him/her. This suggests that the enlistment decision should be modeled as a bivariate process (rather than a univariate process) with four outcomes (desire to enlist and military willing to accept, desire to enlist but the military rejects, etc.). It is unlikely that available data will support such a model since all we can observe with public use data is whether or not the individual enlists. But since the military's selection process is based mostly on observables such as education and mental group that will be included in the probit for enlistment, inclusion of these variables should adequately control for military selection as well as individual self-selection in the enlistment process.

The second consideration is more vexing. Not only is there a self-selection at the initial entry point, but there is self-selection at the reenlistment point as well. Since about one-third of entrants reenlist after their initial term of service, the assumption that all individuals leave after their first enlistment is clearly invalid. Models of the reenlistment decision patterned after the utility maximization approach of sections 3 and 3c above are already available in the literature (e.g., Warner and Golderg (1984)).

The biases that arise from self-selection at the first-term point can be sketched out verbally. If those who leave at the first-term point tend to be those who have abnormally good civilian alternatives, the mean earnings of those who leave after an initial enlistment will overstate the mean earnings of all who have served. The bias could be negative, however, if those who have abnormally good civilian opportunities are also ones who have such sufficiently strong net preferences for military service that they reenlist at a higher rate than those with worse civilian opportunities.

The military selection process again plays a role here. People with the worst civilian opportunities may also be failures in the military and therefore denied eligibility for reenlistment. Again, it is probably impossible to sign the bias in observed veteran earnings that is likely to arise from the self-selection at reenlistment. For our purpose in this study, since our goal is to estimate the economic returns to military service -- as opposed to only the civilian returns -- we have chosen to treat reenlistment earnings the same as civilian earnings and not model selection bias at reenlistment.[34]

Maddala (1983, pp. 278-283) discusses the estimation of models with multiple criteria for selectivity. The method is utilized in Fishe, Trost and Lurie (1981) and Sorenson (1989). If we observe veterans' earnings only for those who choose to enlist but not to reenlist, we must first estimate a (sequential) bivariate probit model for enlistment/reenlistment. The results of the bivariate probit analysis are used to construct two selectivity correction variables that are then included in the estimation of the earnings equation for veterans. Details of this procedure are found in Maddala (1983).

In the case of analysis of female earnings, the additional problem discussed above of nonparticipation arises. The problem is handled by estimation of a probit for labor force participation, construction of a selectivity variable similar to those discussed above and inclusion of this variable in the earnings equation for those for whom we observe earnings. Successful application of the method requires that we observe some variables that affect participation that do not also affect the enlistment (or reenlistment) choice. Such variables should be readily available: marital status, number of children, husband's earnings, etc., and this is the strategy we in fact employed.

[34]This was suggested to us by Wendell Wilson.

DATA

The data for our research were drawn from the National Longitudinal Surveys of Labor Market Experience of Youth (NLS).[34] The NLS has been the most utilized data set for studies of the labor market in general and is becoming increasingly utilized for studies of military manpower issues. Of the many features of the NLS that make it valuable for such purposes, the breadth and depth of the information collected on individuals and the longitudinal nature of the data stand out as most important.[35]

The cohort constitutes a representative national probability sample of the non-institutionalized population of the particular cohort as of the first survey date. The sample was drawn and personal or telephone interviews conducted by the National Opinion Research Center for the Center for Human Resource Research at the Ohio State University which maintains the data.

The NLS data include an abbreviated work history up to the time of the initial survey, an employment history for the period covered by the surveys, a wealth of information about a wide range of human capital, demographic, attitudinal, family background, economic, and environmental characteristics of respondents, as well as characteristics of the respondent's job and local labor market.

Thanks to funding from the Department of Defense, the NLS youth data also contain a special military subsample as well as comprehensive and detailed information on the military experiences of all respondents. This information includes but is not limited to branch, dates that each regular or reserve enlistment began and ended, military occupation, pay grade and income, type and amount of military training, reserve or guard activities, formal education received while in the service, reasons entered military, reasons left military, future military and civilian plans, type of discharge, enlistment and reenlistment bonus received, civilian job offer at time of discharge, whether the respondent returned to the same employer after active duty with the Reserves or National Guard, satisfaction with military service, GI Bill, Veterans Educational Assistance Program (VEAP), and Army College Fund benefits, and whether military skills were used on the civilian job.

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[34]For a complete description of the NLS data set, see Center for Human Resource Research, Handbook, 1988.

[35]The longitudinality of the NLS data allow us to compare the earnings trajectories of men and women (with and without military service) over a number of years rather than only at a single point in their careers. Most other studies, including Angrist (1989 and 1990), focus on only a single point in time.

Unfortunately, because the military subsample was discontinued after 1984 the length of time over which veterans and nonveterans can most effectively be compared during the AVF era is abbreviated. This cohort has been interviewed annually since 1979 and includes approximately 13,000 men and women between the ages of 14 and 21 in the first survey year. Thus, the members of our youth sample were 23-26 in 1984, the latest year for which data are available for the full subsample of veterans.

ANALYTICAL STRATEGY

Our basic analytical strategy is derived from the human capital model of earnings distribution developed by Becker (1964) and Mincer (1974). In the human capital model, earnings are a function of investments in productive skills and abilities; hence the investments comprise one's stock of human capital. The principal investments considered in their model are schooling and training. Post-degree investments in schooling and training are thought to decline continuously over the course of the life cycle because they require time (opportunity costs) and the payoff period during which returns can be realized declines with age.

It should be noted that we control in our models for schooling, training, and a host of other human capital, demographic, attitudinal, family background, and environmental variables. In addition, we adjust our models for unmeasured variables by way of conventional sample selection bias adjustment techniques.[36] Thus, we are testing whether early career choices (military vs. college vs. civilian labor market) affect later labor market success or whether they merely *reflect* human capital, demographic, attitudinal, family background, and environmental differences that would have given rise to later career success anyway.

Our strategy is to model separately the earnings trajectories of young men and women who, after leaving high school, make different choices about whether to enter the military, college, or the civilian labor market. In modeling the earnings trajectories, we estimate earnings equations as a function of choice and life cycle variables, military experience variables, and the wide range of human capital, demographic, attitudinal, family background, and environmental control variables.

Thus, one of our first tasks was to partition the sample into three groups corresponding to the military, college and civilian early career choices youths made. A guiding factor in developing these definitions of early career choices was that we were mainly concerned with the major activity chosen by these

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[36]See the last subheading of section III, Methodological Issues: Self-Selection Bias in Veterans' Studies for a detailed discussion of these techniques.

youths during the early years after high school. The military group included young men and women who entered the military and completed a tour of duty by age 23.[37]

Individuals were considered to have completed a tour of duty if they served at least 33 months. This length of time was chosen to allow individuals with three-year enlistments who are released early to still be counted as completing their term. Very few individuals who enlisted during the period in which the members of our sample enlisted, 1974 to 1984, enlisted for a tour of duty of less than three years. Also, it appears that very few individuals who had longer enlistments and who remained in the service for at least 33 months subsequently attrited.

Young men and women were included in the college group if they completed 16 years of schooling by age 23. Youths who did not meet either of these criteria were included in the civilian labor market group.

In order to take advantage of the longitudinal nature of the NLS data and to better analyze earnings trajectories, we created a pooled cross-section time-series data file. That is, the data file contained up to six observations for each respondent, one for each of the six survey years between 1979 and 1984.

These surveys were generally conducted in the spring of the year and assessed annual earnings for the previous calendar year. We originally included an observation for an individual in a given year if the individual was not enrolled in school during the year, had wage and salary earnings of at least $1,000, was at least 19 years old, and had information on key factors such as education.

In our analysis which adjusted for selectivity biases, we relaxed these assumptions and included those enrolled in school (with control variables added to the model) and adjusted for those with low earnings (with appropriate selectivity bias adjustment for the censored earnings). As will be discussed below, the conclusions were not altered.

<u>Model Specification</u>

To begin to model earnings trajectories for the military, college, and civilian samples of young men and women, we estimate earnings equations on our pooled cross-section time series data set covering years 1979 to 1984. The dependent variable was annual wage and salary earnings.

Annual earnings were adjusted to 1985 dollars based on the U.S. Bureau of Labor Statistics estimate of average weekly

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[37]Attriters were excluded from the analysis.

earnings for production or non-supervisory workers on non-agricultural payrolls (Monthly Labor Review, 1986).[38]

Several sets of explanatory variables were included in the model. The first set of explanatory variables included the three choice variables (military, college, or civilian labor market) and the next set comprised life cycle variables to model the changes in earnings over the life cycle for our three groups of young men and women.[39] Thus, we included time since high school (THS) which is simply the number of years between the year the respondent left high school until earnings were observed. To allow for likely curvilinear effects, we also included squared (THSQ) and cubed terms (THSCB) for time since high school.

For individuals who completed at least four years of college we measured time since college. More specifically, to model differences in the earnings trajectories between young men choosing the college and civilian options, we included three variables: a college completion dichotomous term (TCDUM), a linear time since college term (TCLN), and a squared time since college term (TCSQ). Observations for the years that individuals were still in college were excluded from the analysis, initially, and the results reexamined after including them. Individuals choosing the military or civilian options were coded 0 on all the college variables.

To model differences in the earnings trajectories between those young men and those young women choosing the military and civilian options, respectively, we included 5 variables. The first was a dichotomous variable (INMIL) coded 1 for the observation year if and only if the individual had entered the military but had not yet been discharged as of the observation year. The second was a dichotomous variable (TMO) coded 1 for

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[38]It is fairly common to use the logarithm of annual earnings as the dependent variable in earnings equations. A primary motivation for this practice is that distributions of earnings tend to be skewed to the right and correspond more closely to a log-normal distribution than a normal distribution. However, here we are analyzing earnings for young men and include individuals with annual earnings as low as $1000. In addition, earnings are truncated in the NLS data to be no greater than $75,000. As a consequence, the distribution of log earnings is actually more skewed than is the distribution of earnings. In addition, the goodness of fit of the earnings model was better than the log-earnings model. For these reasons, we used the linear earnings specification.

[39]We modelled career choices both by way of completely stratified samples based on their career choices and by way of dummy variables in pooled models (within sex groups). The former method allowed the model to be fully interactive. The results and conclusions did not differ substantively between the specifications.

the observation year if and only if the individual was discharged during the observation year. The third was a dichotomous variable (TMDUM) coded 1 for the observation year if and only if the individual had been discharged in a year prior to the observation year. The fourth, and fifth variables were linear (TMLN) and squared (TMSQ) measuring the number of years since the individual was discharged and earnings were being observed. Young men choosing the college or civilian options were coded 0 on all military variables.

In order to handle the situation in which a youth completed his or her initial tour of service, but opted to reenlist, we treated the case as equivalent to discharge. The reason for so doing is that our main purpose is to determine the economic returns to investing in a tour of active duty in the military soon after high school. Accordingly, economic returns to military service accrue to veterans by virtue of the option to reenlist. Hence, the earnings of servicemen during second and subsequent enlistments are treated the same as subsequent civilian labor market earnings -- i.e., as the potential payoff to an investment in a tour of duty in the military after high school.[40]

As would be expected, the majority of our military sample participated in educational benefits programs.[41] Since many of these youths will be investing in their education after discharge, their initial participation in the civilian labor market may be less extensive, less intense, and hence, less rewarding financially in the short run. If so, veterans' subsequent earnings, especially for college bound vets, may well be understated.

We would however expect this post-service investment in education to have a long-run payoff, and indeed, observed such a payoff in our 1986 study of Vietnam era vets 19 years out of high school. To model differences in the civilian earnings trajectories for those who did and did not participate in

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[40]Since military earnings are observed to exceed civilian earnings early in careers for work bound youths, other things equal, this may make a work bound veterans' premium appear better than if reenlistees were excluded. However, since for college bound youths military earnings did not exceed civilian earnings early in careers, the opposite is likely to be true for them.

[41]Forty-one percent of the servicemen expected to be in school five years later, about twice the rate of civilians. Moreover, this 41 percent does not include those servicemen who plan to further their education after discharge, but will finish within five years. For the vast majority of veterans, obtaining educational benefits required participation in the VEAP program, which in turn required a financial contribution on the part of servicemen, and is suggestive of a commitment to obtaining further education after discharge.

educational benefits programs, we included a dichotomous educational benefits term (EDBEN) and an educational benefits times years since military interaction term (EDBENLN) in our equations.

We also included, as previously noted, a number of human capital, demographic, attitudinal, family background, and environmental factors in the model so that they would capture the effects of choosing the military, college, or civilian labor market after high school, rather than the effects of differences in the individuals making the different choices.

Thus, we include measures of educational attainment through high school and whether the individual obtained a high school diploma. Since all members of the sample, military and civilian, took the ASVAB battery of tests, we were able to categorize them into aptitude categories based on their Armed Forces Qualification Test (AFQT) score. We also include measures of whether health problems limited the amount or kind of work that youths could perform.

Demographic, attitudinal, family background, and environmental variables measured in the model included being black, Hispanic, or white; degree of self-confidence and motivation; mother's education; number of siblings; currently living in the south; center city or suburban residence currently (as opposed to residing outside of a metropolitan area); Southern residence at age 14; whether an adult male was in the household at age 14; the amount of reading material that was in the home at age 14; and, finally, a series of dichotomous variables to indicate the year in which earnings were being observed.[42]

To more accurately model the shape of life cycle effects we added selected linear and curvilinear terms -- years since college, years since college squared; years since high school, years since high school squared, years since high school cubed. Although these additional terms are needed, in our judgment, the high degree of collinearity among the linear, squared, and cubed terms implies that the value of a given coefficient may vary considerably depending upon the values of the other terms in the model.

Thus, for each strata the coefficients must be interpreted together. In order to do so, we calculated earnings trajectories for the first nine years after high school for each possible choice (military, college, civilian labor market, or work in the home) within each strata (i.e., for each subset who in fact chose military, college, etc.). These earnings trajectories are standardized in that they control for the human capital,

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[42]In the case of the young women, variables for marital status and dependents are also included in the analysis. Table 1A presents a complete listing of all variables in the analyses and a brief definition.

demographic, attitudinal, family background, and environmental variables in the model as well as unmeasurables that are captured through statistical adjustments for sample selection biases.

More specifically, the expected earnings trajectories are calculated as follows:

$$Y_{ct} = \sum_i \beta_i X_i + \sum_j \gamma_j Z_{cjt}$$

where:

Y_{ct} = expected earnings t years after high school if they had made choice c.

X_i = mean or standard value for the i^{th} control variable (human capital, demographic, attitudinal, family background, or environmental).

Z_{cjt} = mean or standard value for the j^{th} career-life cycle variable for choice c and for the t^{th} year after high school.

β_i = the regression coefficient for the i^{th} control variable.

γ_j = the regression coefficient for the j^{th} choice-life cycle variable.

For example, for choice = "civilian" and t = 3, the "time since high school" linear, square, and cubic terms equal 3, 9, and 27 respectively, and all other z's = 0. As another example, for choice = "military" and t = 2, the "time since high school" linear, square and cubic terms equal 2, 4, and 8 respectively; the "in military" term equals 1, and all other z's = 0. For choice = "military" and t = 8, the "time since high school" linear, square, and cubic terms = 8, 64, and 512 respectively; the "completed military tour," " years since military," and "years since military squared" terms = 1, 5, and 25 respectively; and all other z's = 0.

The earnings model was estimated separately and the earnings trajectories calculated separately for each of three groups (those who actually chose the military, those who actually chose college, and those who actually chose the civilian labor market). Thus, for each group we estimated the expected (or hypothetical) trajectories of what their earnings would have looked like if they had made each of three choices.

These standardized earnings trajectories will vary somewhat depending on when individuals enter and leave the military or college. We assume that individuals who choose to go to college enter the year they leave high school and graduate four years later. Similarly, we assume that servicemen enter the military the year they leave high school and complete their tour of duty three years later.

Model Adjustments for Sample Selection Biases

The analysis assumes that young men face three major career alternatives when they graduate from high school: military service (MIL), college (COL), or the civilian labor market (CLM). Young women, however, are assumed to face four alternatives: the three faced by men and a fourth, work in the home (HOM). Our model assumes and tests for whether the choice among these alternatives is non-random. We hypothesize that the choices youths make are based on a wide range of observed and unobserved attributes of skills, abilities, demographic and family background characteristics.

In addition to affecting the choices youths make, these variables are known to be related to subsequent labor market experience. The general issue of selection bias was discussed above in the section on conventional approaches to modelling for sample selection biases (see page 31). Here we describe the specific procedure adopted in our analysis.

The general setting of the problem is outlined in Lee (1983) and can be stated briefly as follows. Consider the following polychotomous choice model with J categories and J regression equations for earnings:

$$Y_{1j} = \beta_j X_j + \varepsilon_j$$
$$Y^*_{2j} = \gamma_j Z + \varepsilon_j$$

The dependent variable Y_{1j} is observed if and only if alternative j is chosen. The choice depends on the value of Y^*_{2j}, which is unobserved. Instead, we observe an indicator variable Y_2 with values 1 to J. We assume that the probability that Y_2 is observed is determined by the multinomial logit model.[43] The model for determination of Y_2 is

$$Prob[y_{2i} = j] = \exp(\gamma_j z_i) / [1 + \sum_{k=1}^{K} \exp(\gamma_k z_i)]$$

[43]More typically, and following Heckman (1976), sample censoring or selection bias models generally utilize a probit functional form rather than the logit. However, in a multinomial setting the logit is much easier to estimate and Lee (1983) has shown that the results and conclusions are practically the same. For these reasons we have used the multinomial logit model. For a more complete discussion of the approaches, see Lee, Lung-Fei, "Generalized Econometric Models with Selectivity," Econometrica, Vol 51, No. 2 (March, 1983) pp. 507-511.

where 'i' indexes the observation and 'j' indexes the 'choice' or outcome.[44] Selection is based on $Y_{2i} = j$. For convenience below, we drop the observation subscript i. The implied regression equation for estimation, as derived by Lee, is:

$$Y_{1j} = \beta' X + (\rho_j \sigma_j)\, \phi[H_j(\gamma_j Z)] / \Phi[H_j(\gamma_j Z)] + \eta_j$$
$$Y_{1j} = \beta' X + (\rho_j \sigma_j)\, \lambda_j + \eta_j$$
$$Y_{1j} = \beta' X + \theta_j \lambda_j + \eta_j.$$

The function H(.) is the inverse of the standard normal CDF evaluated at $Prob[Y_2 = j]$ (in Lee's paper this function is denoted as J(.)). The function H is the crucial link between the multinomial logit and the probit analysis which is more common. The functions $\phi(.)$ **and** $\Phi(.)$ are the PDF and CDF of the standard normal distribution, respectively.

The two step estimation technique is as follows:
Step 1. Estimate the multinomial logit by maximum likelihood, retaining the coefficients, and calculate the full set of predicted probabilities.

Then, select those observations for which Y_2 takes the value in question (e.g., $Y_2 = 1$ -- military sample). For these observations, compute λ_j by obtaining first the predicted probability, P_j, and then calculate H_j by $H_j = \Phi^{-1}(P_j)$. Then,

$$\hat{\lambda}_j = \phi(H_j) / \Phi(H_j)$$

Step 2. Consistent estimates of β **and** θ_j are obtained by least squares regression of Y_1 on X and $\hat{\lambda}_j$.

Put differently, to adjust for the endogeneity of early career "choices" of college, military or the civilian labor market, we first estimated a multinomial logit model of the choice process and computed "lambdas" for each member of the sample.[45] We then stratified the sample on the basis of the possible choices and estimated separate earnings equations within each strata with lambdas correcting for selection bias on the basis of each choice. The instruments in the choice equation (excluded from the earnings equations) included several family background variables pertaining to age 14 and year of birth. In addition, all other variables in the earnings equation were also included in the choice model.

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[44]This embodies a number of assumptions about the joint and marginal distributions of disturbances in the model. For a more complete discussion, see Lee's paper.

[45]Recall that in the case of the young women there is a fourth early career choice possibility considered: work in the home.

Furthermore, since there were a number of low earners and "zero earners" in our sample, especially veterans returning to school after military service, we also adjusted for sample censoring in each earnings equation within each strata by way of the Heckman procedure. In this case, we estimated a binomial logit on whether a respondent had earnings below $1,000 per year or not, and calculated a lambda to correct for the censoring of these low earners from each earnings equation within each strata. Again, several family background variables pertaining to age 14 were included as instruments in the censoring model, as were dummy variables for the choices.[46]

THE RESULTS FOR AVF ERA YOUNG MEN

In Figure 1, the results are presented for AVF era young men without any adjustments for sample selection biases. As hypothesized, and consistent with the findings from our previous research, the earnings of veterans exceed those of nonveterans during their service in the military, drop below those of nonveterans for a brief period after discharge, and then catchup and overtake the earnings of nonveterans thereafter. Discounting the earnings streams of the average veterans, nonveterans, and college youths over the first nine years after high school to present value (by 4%/year) suggests that those who chose the military earned more than comparable others who chose to be "work bound." The college choice, however, appears to have little payoff during this period since there is too little time for the returns to education to appear.

The full results of this analysis and all others on both young men and women are presented in Tables 1A through 9H, which also show the importance of a number of other factors aside from military service in relation to career choices and subsequent earnings. These include AFQT scores, motivation, having a high school diploma as opposed to being a dropout, health, the presence of reading materials in the home while growing up, a male presence in the home while growing up, and race, all of which are statistically significantly related to career choices and subsequent earnings.

The use of statistical correction models to adjust for sample selection biases in terms of the endogeneity of early career choices and censored earnings (low earners) are presented in Figure 2. Their application did not alter our basic findings and conclusions about the economic returns to military service. Numerous sensitivity analyses performed on our model showed that

[46]These variables were excluded of course from the earnings equations. An implicit assumption here is that the unobserved factors that determine early career choices are not correlated with the factors that determine labor force participation. Further research might test this assumption by following the procedures outlined in Fishe, Trost, and Lurie, 1981.

our conclusions were not sensitive to various alternative specifications of the model or sample.

As can be seen by a comparison of Figures 1 and 2, and unlike the phenomenal inconsistencies between results adjusted and unadjusted for selection biases summarized by Lewis (1987), the results of our analyses apparently are not bedeviled by this problem. The findings adjusted and unadjusted for selection biases are essentially the same despite the fact that a number of the "lambdas" in the earnings equations are statistically significant.[47]

The findings in both figures also show that the "frictional" (transitional and temporary) adjustment problems of military youths upon leaving the service appear to be similar to those observed for their civilian counterparts when they entered the civilian work force upon leaving high school a few years earlier.

The sustained steeper slope of veterans' earnings trajectories suggests the possibility that civilian employers initially undervalue skills obtained in the military.[48] Negative images of the military resulting from the Vietnam War and the recruiting scandals of the AVF during the late 1970's may have caused employers to underestimate the skills and potential of veterans until they were proven in the civilian sector. The same may hold true today given the attention of the media to recent findings of a veterans' penalty (Angrist, 1989 and 1990). Career counseling at time of exiting high school and the military could be improved both for veterans and nonveterans.

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[47]The complete results of the choice and censoring models for young men are presented in Tables 2A and 2B. They show that choices were significantly related to having a high school degree, motivation, AFQT scores, health, family background, and race. Being a low earner in the censoring model tended to be statistically significantly related to VEAP benefits, enrollment status, AFQT scores, family background, health, race, and having a high school diploma. The factors significantly related to earnings among veterans (Table 2D, with descriptive statistics in Table 2C) include: enrollment status, AFQT scores, motivation, VEAP benefits, race, health, family background, and a high school degree. For the "work bound" young men, the same factors tended to be related to subsequent earnings(Table 2E, with descriptive statistics in table 3A).

[48]The result that veterans' initial civilian earnings are lower, but their wage growth faster, is consistent with the job matching models of Jovanovic (1979 and 1984, Journal of Political Economy). In his models, employers pay lower initial wages to employees whose productivity is thought to be uncertain, but then raise their wages more through time as true productivity is revealed.

In Figure 3, the same relationships are reestimated at the mean values for the average nonveteran who did not choose college. Again, the findings are remarkably consistent with those in Figures 1 and 2.

In Figures 4 and 5, the model is again reestimated, but this time at the mean values for the average "low quality" veteran and the average "high quality" veteran.[49] The conclusions for work bound (low quality) youths were not sensitive to various alternative model specifications (Figure 4). Thus they are at odds with the conclusions of the recent HumRRO study on the economic returns to veterans of lower aptitude (Laurence et al., 1989), possibly because the HumRRO study focused on a group of lower quality than those studied here.

The findings for college bound veterans are somewhat different, however, in several respects. First, they suggest either no veterans' advantage or a very slight veterans' penalty early in careers. The most likely explanation for the lack of veterans' advantage for college bound youths is insufficient time after the completion of military duty to observe veterans returning to school and attaining their civilian earnings potential. Forty-one percent of all servicemen, for example, and an even greater percentage of the college bound, expected to be in school five years later. This was about twice the rate for civilians.[50]

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[49]The complete results are presented in Tables 4A, 5A, and 9A-9H. These quality distinctions refer to whether the youths are Category I-IIIa high school grads or not, i.e., whether they are what the Army refers to as "college bound" or "work bound" youths. The data also supported the Army's Dual Market Hypothesis. Statistical tests (Chow tests) showed that "college bound" and "work bound" youths are different in the ways they respond to market incentives and make career choices. Work bound youths definitely appeared to benefit from military service irrespective of the branch in which they served. They also benefitted irrespective of whether they served in a combat MOS, a technical MOS, or some other type of MOS.

[50]Daymont and Andrisani (1986) show this same pattern of economic returns to military service for Vietnam era vets in the early years after the service, but then show veterans catching up later, even to civilians who attended college immediately after high school. Moreover, the 41 percent referred to does not include those servicemen who plan to further their education after discharge, but who will finish within five years. In addition, obtaining educational benefits required participation in the VEAP program for the vast majority of the veterans, which in turn required a financial contribution on the part of the servicemen and is suggestive of a commitment to obtaining further education after discharge.

The findings for the college bound also suggested that "high quality" enlistees were considerably underpaid while in the military. Measured annual earnings while in the military should have greatly exceeded civilian earnings for two major reasons, yet the data in Figure 5 show they hardly exceeded them at all for the college bound youth. Two explanations are possible. First, the imputed value of quarters and subsistence (room and board) was added to pay in calculating military earnings. Since quarters and subsistence were valued on the basis of cost, it is likely that their imputed value exceeds the value attached to them by youths in the service, many of whom might reasonably have expected free room and board at home.[51]

Second, military youths encountered no unemployment while in the military while their civilian counterparts experienced substantial unemployment rates (upwards of 20%) during much of the period studied.[52] Yet, despite these tremendous advantages, "high quality" youths earned little more while they were in the service than their civilian counterparts.

In summary, our research affirms the existence of economic returns to military service during the AVF era for young men. For college bound young men, the evidence is less clear, especially since there is such a short time horizon after military service over which to compare veterans and nonveterans (only 3-5 years) and college bound veterans are those most likely to return to school and thus show lower earnings while doing so.

Branch and MOS Effects

In Tables 9A-9H, we report the results obtained when we examined the effects of branch and MOS choices on earnings. This analysis was conducted separately for the "high quality" and "low quality" samples of veterans and nonveterans because of the Army's Dual Market strategy of recruiting and placing recruits differently based on AFQT and high school diploma criteria.

Army veterans within the work bound group fared no better or worse in subsequent earnings than other veterans, and they fared equally well irrespective of whether they served in combat jobs while in the military. Similarly, among college bound youths, only Air Force veterans outperformed Army veterans, which is possibly attributable to our not controlling for selection

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[51]Also, it is possible, of course, these youths were not underpaid if they received transferrable training or post-service educational/training benefits that compensated. However, at least with respect to post-service educational/training benefits, this is unlikely to have occurred because of the elimination of the GI Bill during the late 1970's and early 1980's.

[52]For black youths, unemployment rates often exceeded 40% during the late 1970's and early 1980's.

biases -- i.e., unmeasured ability differences among youths which affected their choices of branch.

Finally, there is no evidence among the college bound youths that service in the combat arms is any less worthwhile than service in military jobs which provided technical training. This is entirely consistent with employer surveys (Owen Butler, CED, 1988), which suggest that the skills most important to employers when hiring youths are not the technical but the behavioral skills which one would expect to be developed through the completion of a tour of military service, regardless of MOS.

THE RESULTS FOR AVF ERA YOUNG WOMEN

The estimated effects of the choice and life cycle variables on the earnings of young women are shown in Figure 6[53], which are estimated for the average female member of the sample without any adjustment for selection biases. In terms of the impact of a tour in the military on the earnings of young women, our initial results indicate a strong positive effect.

Also, while in the military female veterans appear to have been more generously rewarded than ostensibly comparable females who chose the civilian labor market. However, it should be kept in mind that a substantial portion of the large difference while in the military is attributable to the imputed value of quarters and subsistence in dining facilities for the military sample. One might question if the servicewomen themselves value such in-kind compensation as barracks and military dining halls to the same degree as the Government. Nonetheless, the advantage is greater than exists among young men and is likely due to the fact that pay equity is more widespread in the military than civilian sector.

Unlike the findings for young male veterans, which indicated a drop in earnings upon discharge and took them below the civilian sample, these results show no veterans' disadvantage during the discharge year. This is rather surprising since we expected frictional unemployment to not only have a dampening effect, but to pull the earnings below comparable civilians who had been in the labor market all along.

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[53]The complete results of all of our analyses for young women are presented in Tables 6-8.

The complete findings for this analysis are reported in Table 6B.[54] In general, they show the same variables having a statistically significant relationship with earnings as was observed for the young men. A major surprise is the earnings trajectory for the college sample. As expected, it rose sharply at the four-years-after-high-school-graduation point, but flattened shortly thereafter except for inflationary and economy-wide productivity increases which have been adjusted for. Further, it did not surpass the earnings of the military sample at any point in our analysis.

In Figures 7 and 8, the findings are shown with adjustments for both types of selection biases discussed above, and estimated for both the average female veteran (Figure 7) and the average female noncollege civilian (Figure 8). As was the case with the young men, the conclusions about the effects of military service on subsequent earnings remain the same: veterans either out performed the nonveterans in earnings or at least did as well.

The complete analyses upon which these figures are based are reported in Table 7 and can be briefly summarized as follows. First, choices among the military, college, civilian labor market, and "work in the home" options available to these young women were statistically significantly related to the presence of a high school degree, motivation, AFQT scores, literature in the home while growing up, health, growing up in the South, city vs. suburban vs. rural neighborhoods, the presence of siblings, and race. Being a low earner was likewise related to many of the same variables as for the young men.

Again, as observed for the young men, the conclusions concerning the effects of military service during the AVF era did not differ between the models estimated with and without corrections for selection bias. This is despite the fact that in some earnings equations the "lambdas" -- i.e., correction factors for selection biases -- were statistically significant. Thus, unlike most other studies, these findings are not bedeviled by selection bias despite the fact that choices were related to unmeasurables.

That is, while there is self selection in the data affecting early career choices, the unmeasurables which differ between the military and civilian youths and which apparently affected their choices -- for both the male and female cohorts -- are not responsible for the subsequent observed earnings

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[54]For women, we did not perform separate analyses for "high quality" and "low quality" youths, or analyses of branch or MOS differences. These issues are of considerably greater importance in the case of the young men since only men were recruited for and assigned to the combat arms. Moreover, stratifying the military sample of women on the basis of quality is more tenuous than was the case for men because of the much smaller size of the military sample of women.

differences. Put differently, while there are omitted variables affecting early career choices of young men and women during the AVF era, they are not responsible for the earnings differences observed between veterans and nonveterans.

CONCLUSIONS AND POLICY IMPLICATIONS

This analysis has focused on the economic returns to military service for young men and women during the volunteer force era. Data for the study came from the NLS youth cohort who were interviewed annually from 1979 through 1984. The data were organized into a pooled cross-section time-series file. They were then used to model earnings trajectories for both young men and young women who make different choices after leaving high school about whether to enter the military, college, or the civilian labor market.[55]

The major findings of this analysis can be summarized briefly as follows:

(1) The use of statistical correction models to adjust for sample selection biases did not alter our basic findings and conclusions about the economic returns to military service from our earlier study. Numerous sensitivity analyses performed on our model showed that our conclusions were not sensitive to various alternative specifications of the model or sample. Two types of sample selection bias adjustments were incorporated into our model.

(2) No veterans' penalty during the AVF era was observed for either male or female veterans. A substantial earnings advantage for young female veterans and "work bound" young male veterans was observed.

(3) The "frictional" (transitional and temporary) unemployment problems of military youths upon leaving the service appear similar to those observed for their civilian counterparts when they initially entered the civilian work force upon leaving high school.

(4) Work bound youths definitely appeared to benefit from military service irrespective of the branch in which they served or whether it was in a combat or technical MOS.

(5) The conclusions for work bound youths were not sensitive to various alternative model specifications. Thus they appear to be at odds with the conclusions of the recent HumRRO study on the economic returns to veterans of lower aptitude (Laurence et al., 1989), possibly because the HumRRO study focused on lower quality veterans than in our study.

[55]In the case of young women a fourth early career option was also considered: work in the home.

(6) The findings for college bound veterans were somewhat different. They suggested either no veterans' advantage or a slight penalty very early in careers. However, these findings were not robust -- i.e., they were sensitive to various model specifications. Moreover, the results are likely to be attributable to the short time period over which these veterans might return to school and thereafter reap any returns either to schooling or military service. Forty-one percent of all servicemen, and an even greater percentage of the college bound, expected to be in school five years later. This was about twice the rate for civilians.

(7) Also, for the college bound youths, there was an advantage to serving in the Air Force compared to the other branches, although there was no advantage to receiving technical training rather than training in the combat arms.

(8) The findings for the college bound youth segment also suggested that "high quality" enlistees were considerably underpaid while in the military. Measured annual earnings while in the military should have exceeded civilian earnings for two major reasons. First, room and board are valued as part of military earnings. Second, military youths encountered no unemployment while their civilian counterparts experienced substantial unemployment rates during much of the period studied.[56] Yet "high quality" youths earned no more than their civilian counterparts while they were in the service, despite these tremendous advantages.

(9) The sustained steeper slope of veterans' earnings trajectories suggests the possibility that civilian employers initially undervalue skills obtained in the military, consistent with the job matching hypothesis models of Jovanovic (1979 and 1984). Negative images of the military resulting from the Vietnam War and the recruiting scandals of the AVF during the late 1970's may have caused employers initially to underestimate the skills and potential of veterans until they were proven in the civilian sector. The same may hold true today given the attention of the media to recent findings of a veteran's penalty (Angrist, 1989 and 1990).

(10) The transition from school to the civilian labor market is not easy, even for veterans. Career counseling at time of exiting high school and the military should be improved both for veterans and nonveterans.

(11) In the voluminous literature uncovered, there are very few studies that show a "veterans' penalty." Angrist (1989 and 1990) virtually stands alone in this regard. Most show either that veterans do slightly better or at least as well as comparable nonveterans. A number of serious reservations about

[56]Unemployment rates generally exceeded 40% for black youths during this period.

the Angrist methodology are noted, e.g., his study is not directly generalizable to the AVF era or to volunteers as opposed to draftees, and his penalty is often small, statistically insignificant, and sensitive to a few very questionable cases of "outlier" observations. Nor is it the natural random experimental design it appears on the surface to be.

In summary, our research affirms the existence of economic returns to military service during the AVF era, especially for work bound youths and women. For college bound young men, the evidence is less clear, especially since there is such a short time horizon after military service over which to compare veterans and nonveterans (only 3-5 years) and college bound veterans are those most likely to return to school and thus show lower earnings while doing so.

Mechanisms for the payoff to military service appear to include: (a) the development of positive work attitudes such as self-confidence, social maturity, acceptance of legitimate authority, (b) opportunities to develop and display leadership skills in the military, (c) signaling effects which act as a substitute for educational credentials, and (d) military education and training benefits that enhance civilian earnings potential.

Future research can build upon the present study in several ways. First, it can examine alternative ways of classifying youths based on their early career choices. Many youths did not make clear cut choices early in their careers. Second, attriters from the military, attriters from the NLS data base, and reenlistees could be studied further to see if they affect the findings. Third, data for longer periods than nine years after high school are needed before firm conclusions about veterans can be made, especially since so many plan on returning to school. Finally, NLS veterans in the AVF era are mainly from the late 1970's -- i.e., before the substantial improvement in recruit quality, especially in the Army. Hence, future research should also focus on AVF veterans of the 1980's to see if either period effects, cohort effects, or soldier "quality" effects impact our findings.

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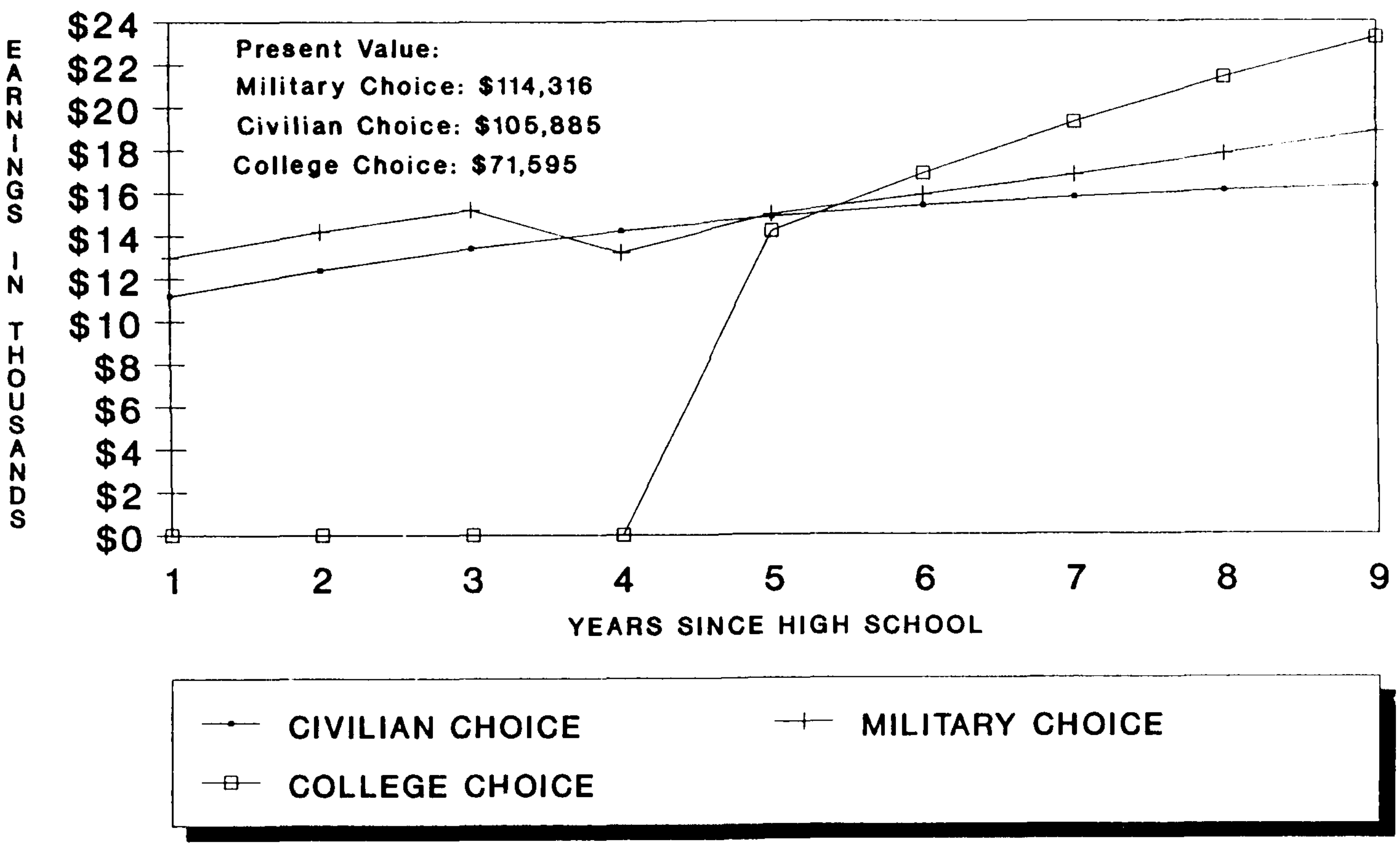
APPENDIX A:

FIGURES AND TABLES

FIGURE 1

YOUNG MEN'S PROJECTED EARNINGS BY CHOICE: AVERAGE YOUNG MEN

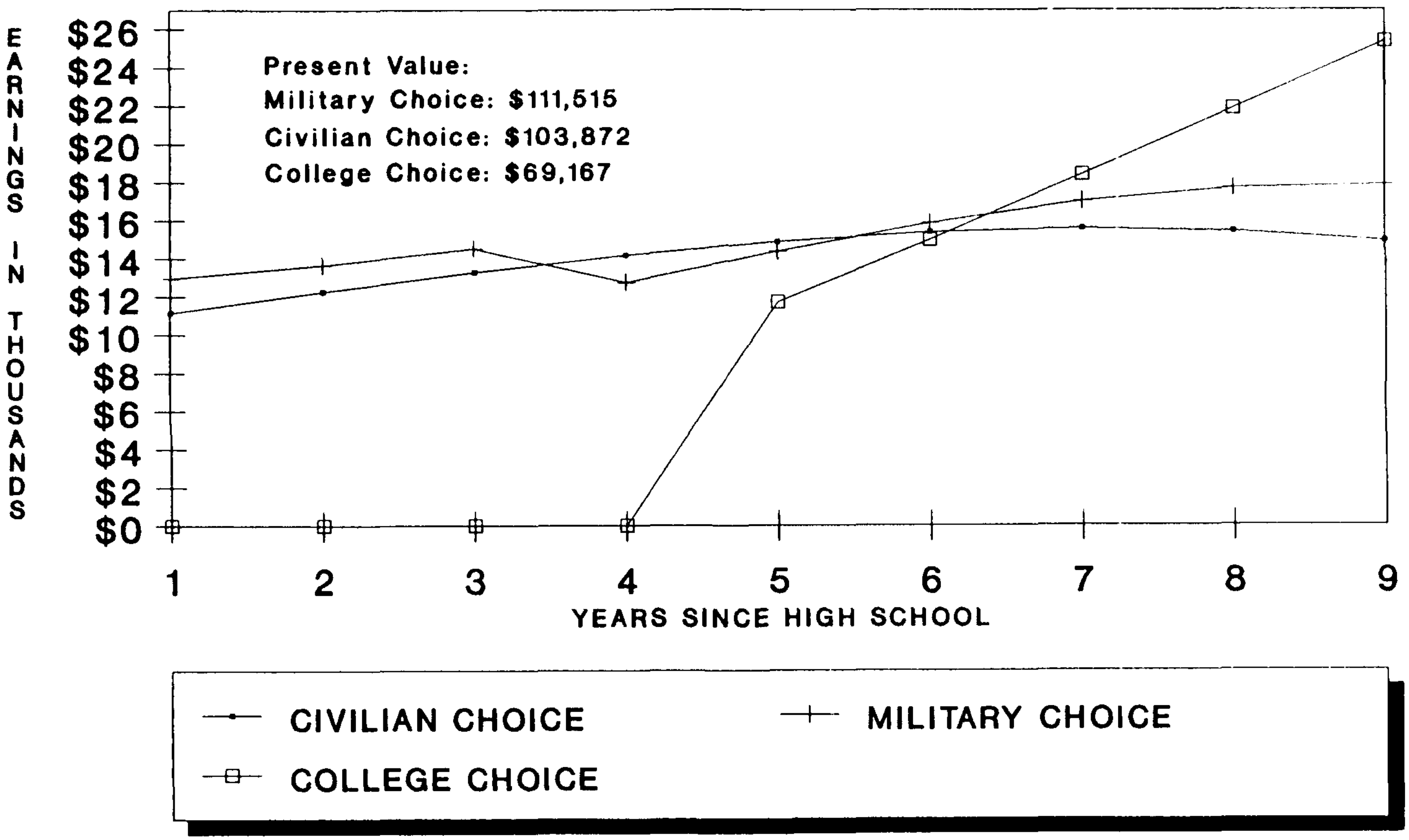
NO SELECTIVITY ADJUSTMENT



See Tables 1A, 1B, and 1C for complete results.

FIGURE 2

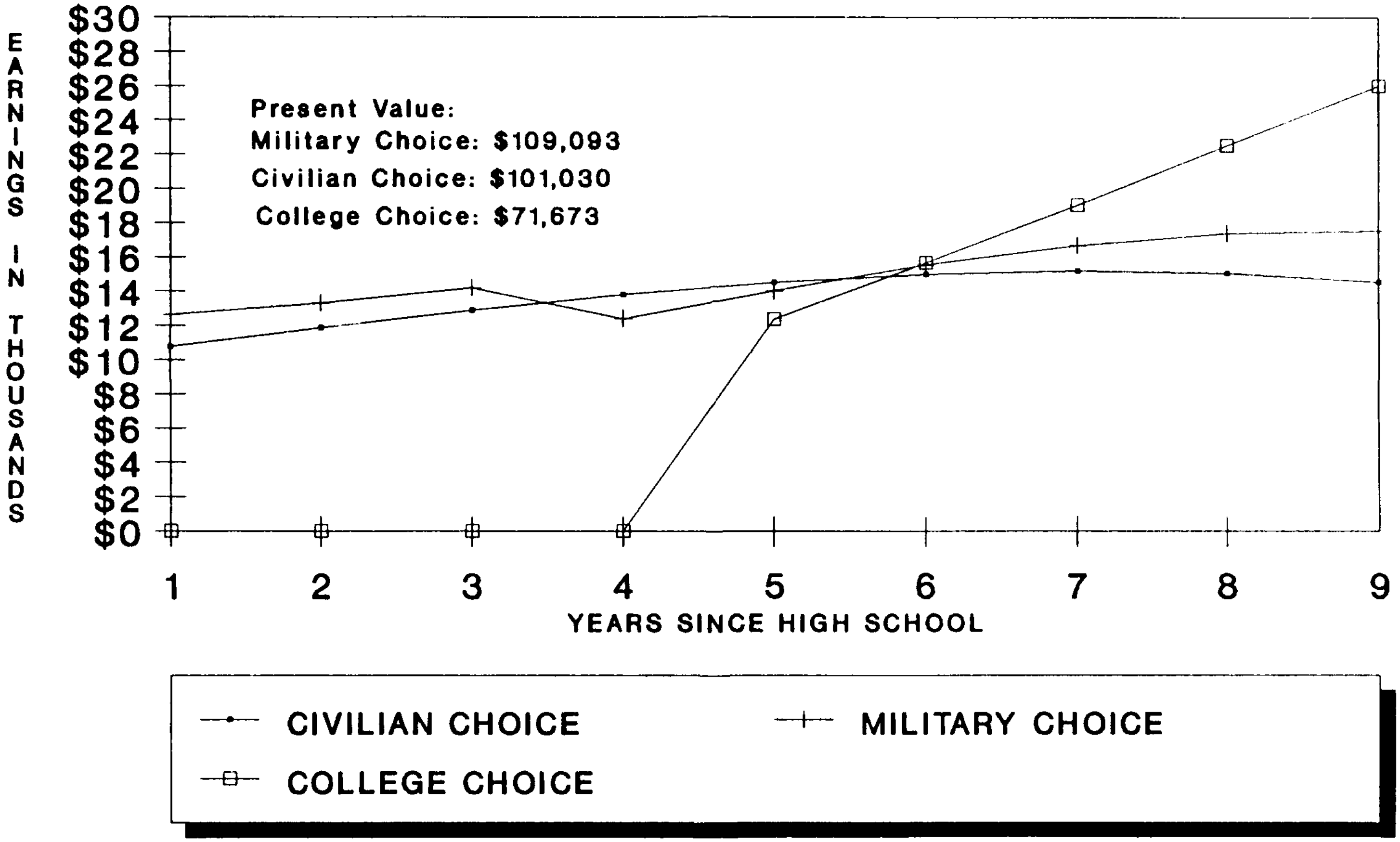
YOUNG MEN'S PROJECTED EARNINGS BY CHOICE: AVERAGE VETERANS
ADJUSTED FOR SELECTIVITY BIAS



See Tables 2A to 2F for complete results.

FIGURE 3

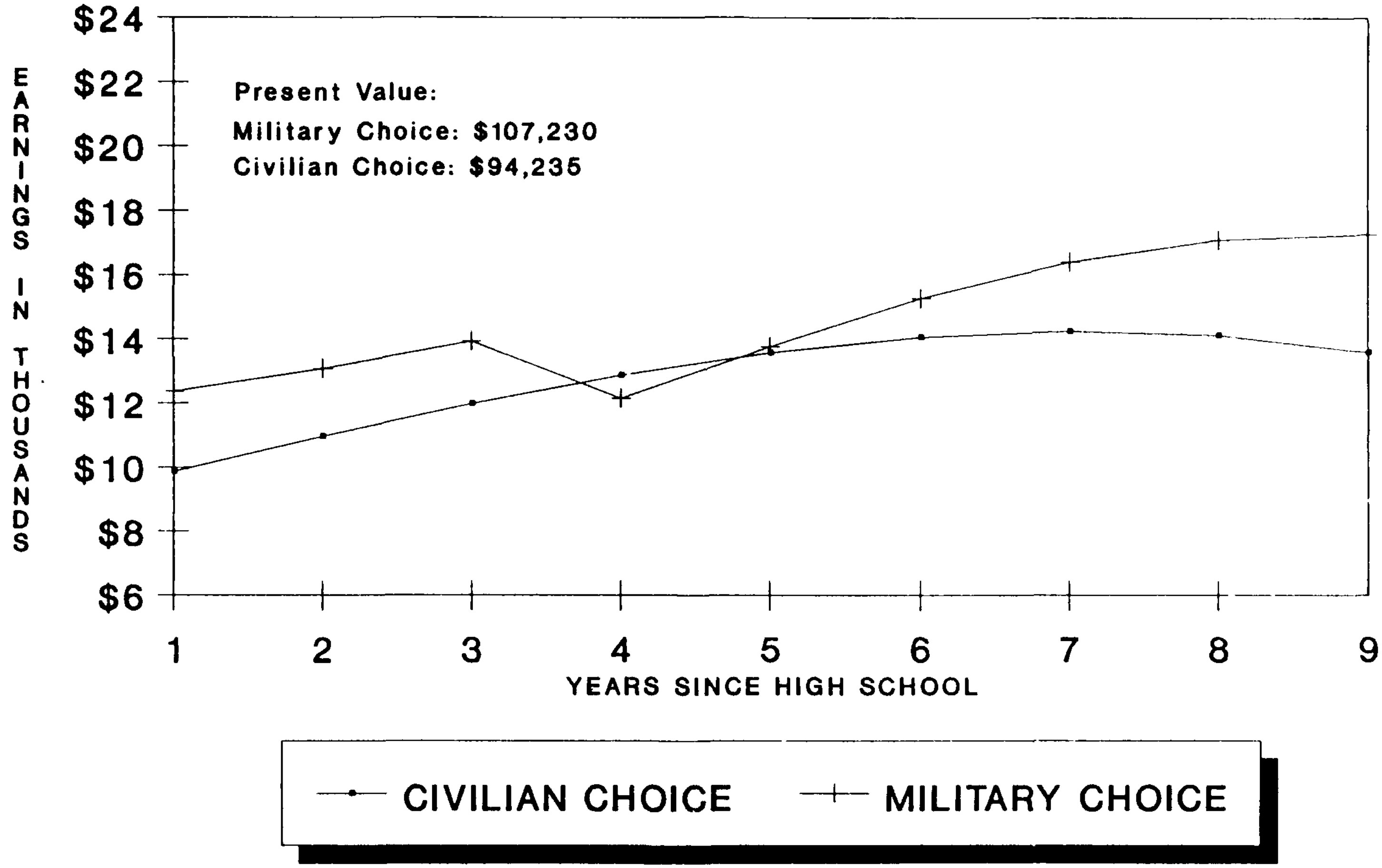
YOUNG MEN'S PROJECTED EARNINGS BY CHOICE : AVERAGE NON-COLLEGE CIVILIANS ADJUSTED FOR SELECTIVITY BIAS



See Tables 2A, 2B, 2D to 2F and 3A for complete results.

FIGURE 4

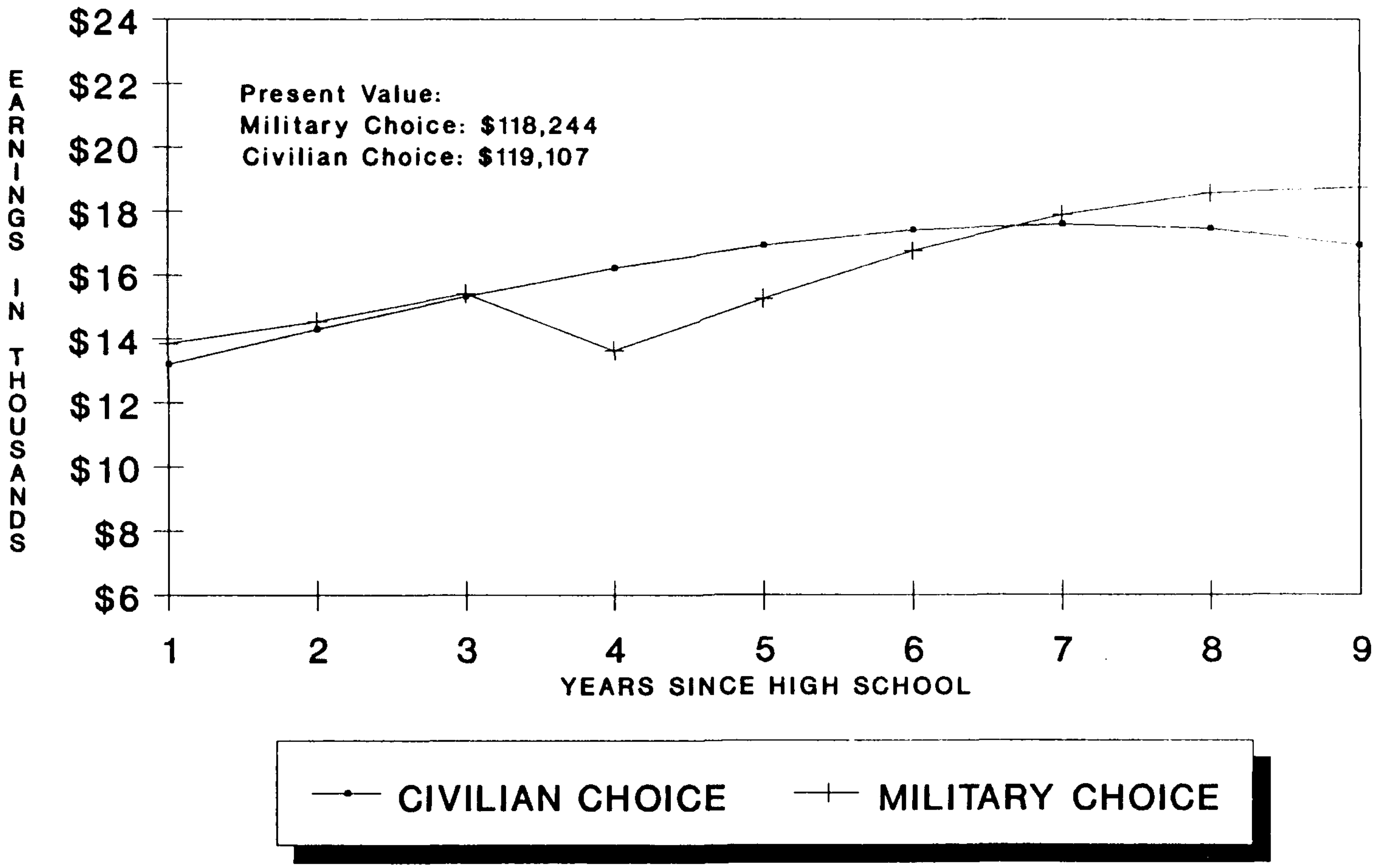
STANDARDIZED EARNINGS TRAJECTORIES : AVERAGE LOW QUALITY VETERANS ADJUSTED FOR SELECTIVITY BIAS



See Tables 2A, 2B, 2D to 2F and 4A for complete results.

FIGURE 5

YOUNG MEN'S PROJECTED EARNINGS BY CHOICE : AVERAGE HIGH QUALITY VETERANS ADJUSTED FOR SELECTIVITY BIAS

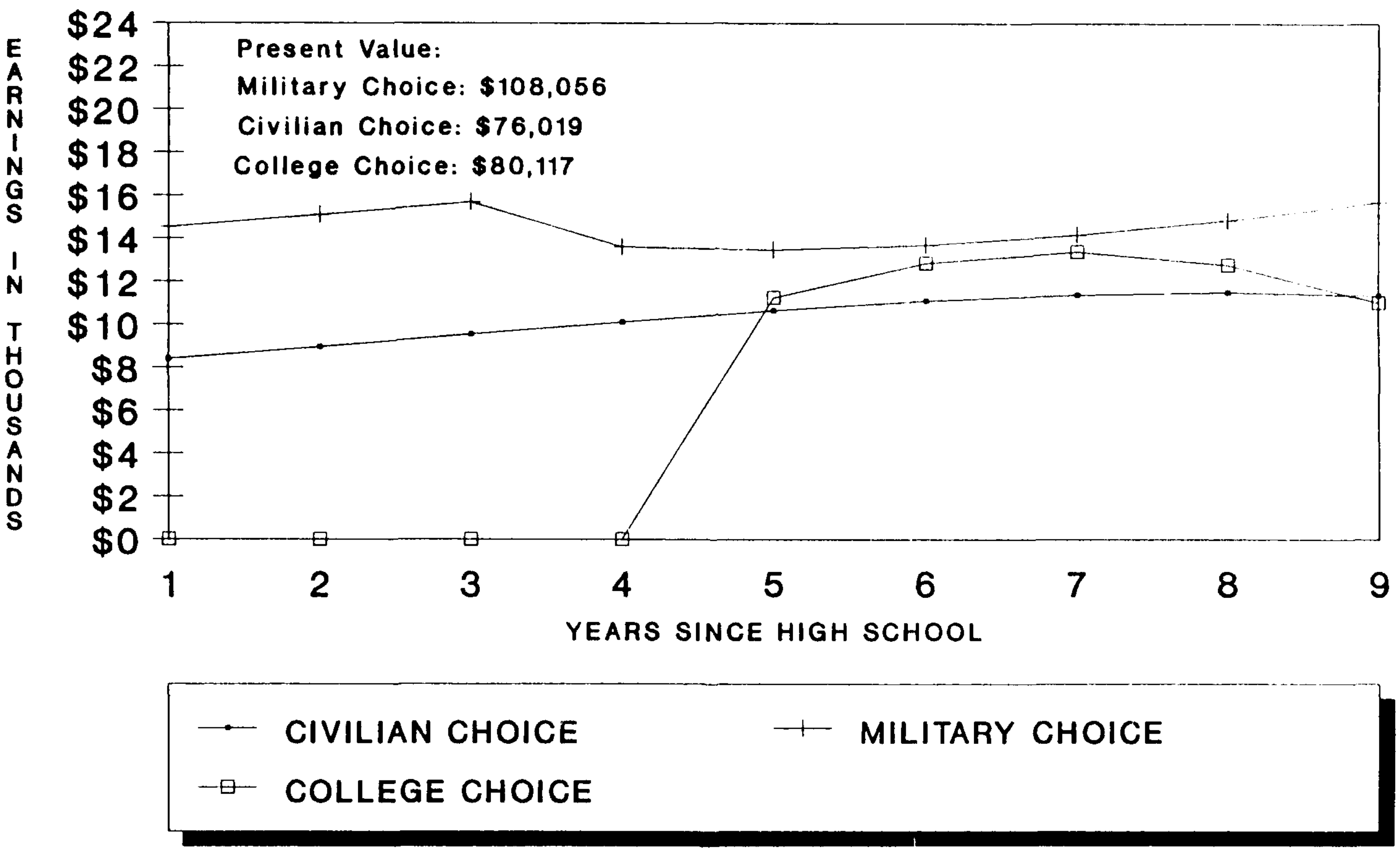


See Tables 2A, 2B, 2D to 2F and 5A for complete results.

FIGURE 6

WOMEN'S PROJECTED EARNINGS BY CHOICE : AVERAGE YOUNG WOMEN

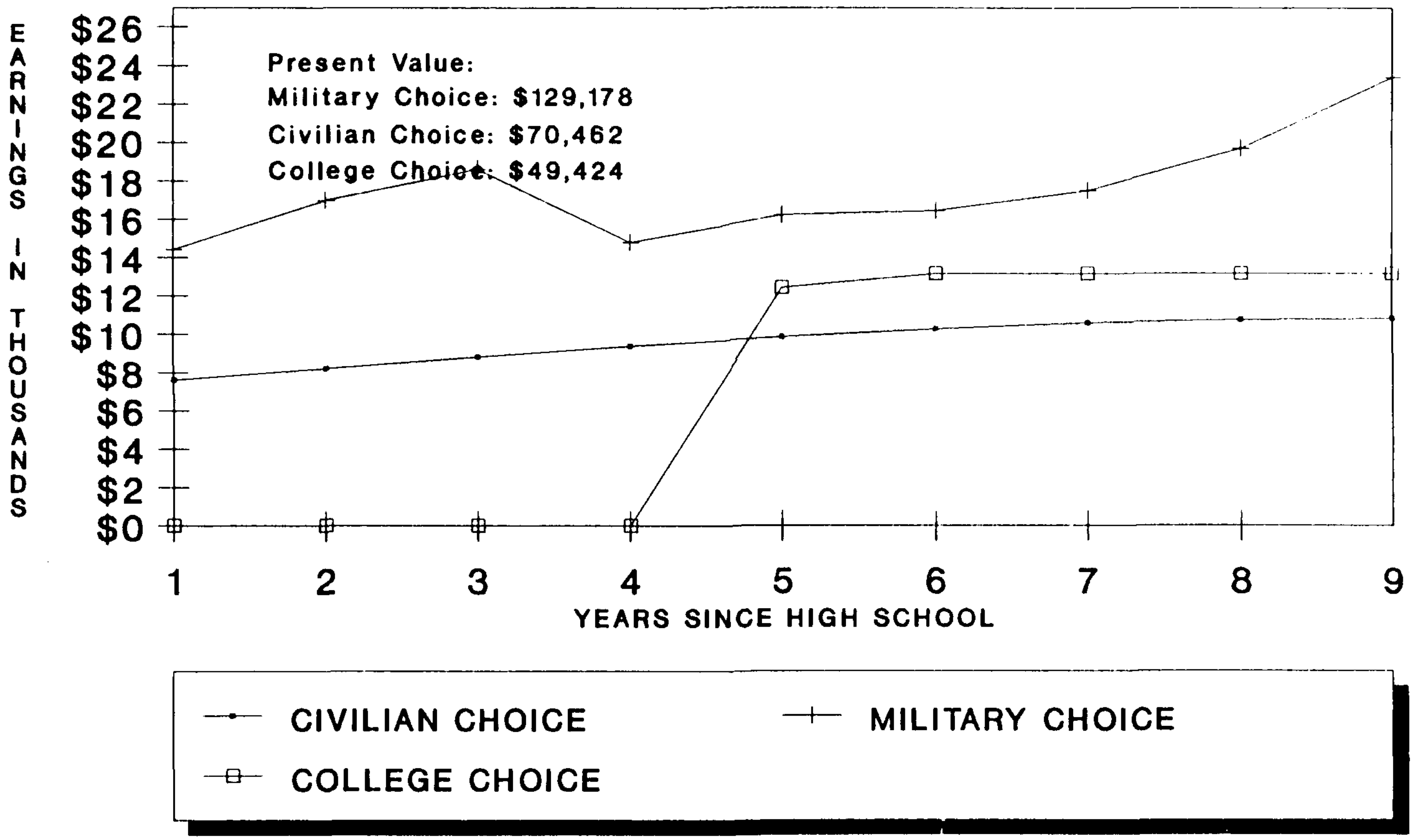
NO SELECTIVITY ADJUSTMENT



See Tables 6A and 6B for complete results.

FIGURE 7

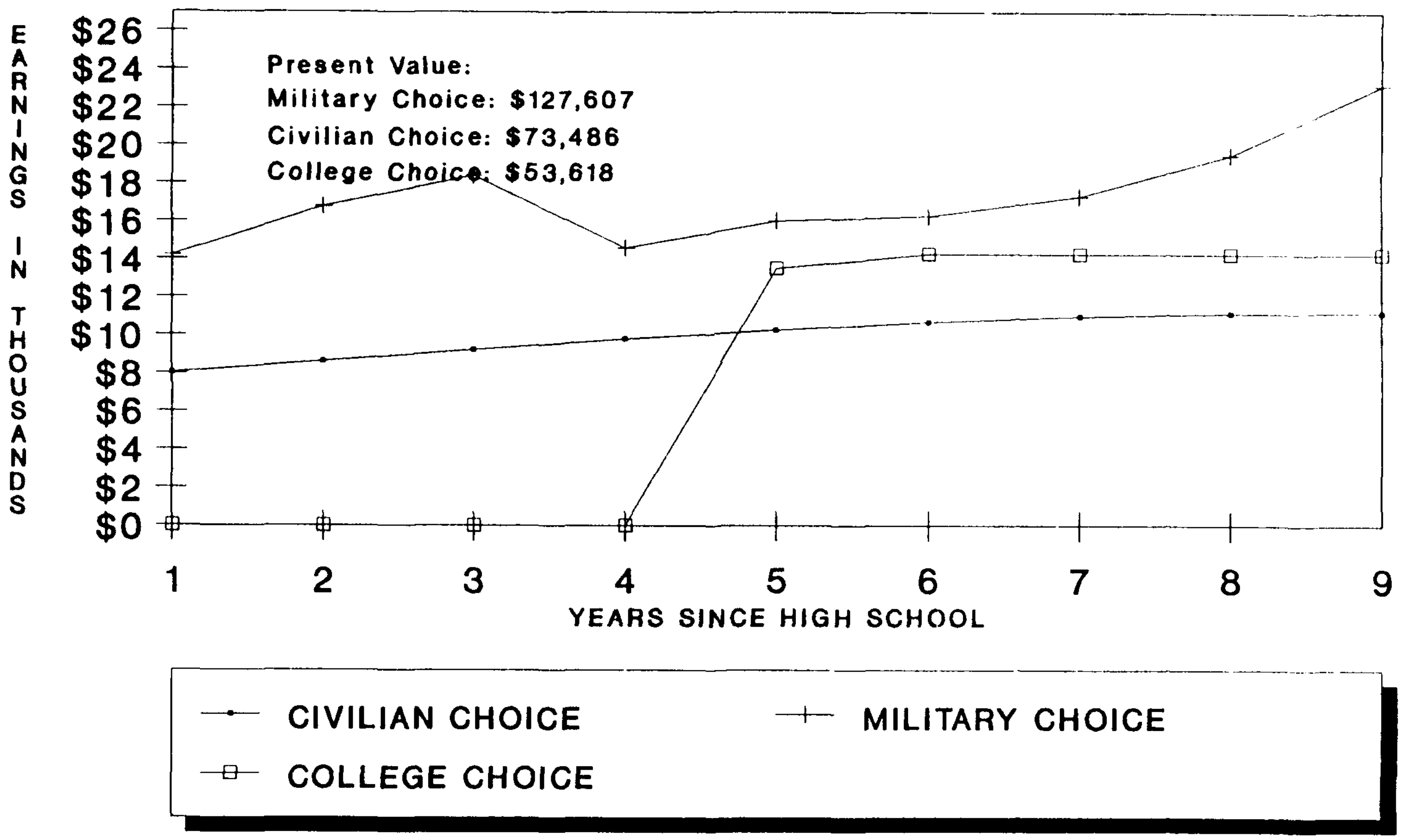
YOUNG WOMEN'S PROJECTED EARNINGS: AVERAGE VETERANS
ADJUSTED FOR SELECTIVITY BIAS



See Tables 7A to 7F for complete results.

FIGURE 8

YOUNG WOMEN'S PROJECTED EARNINGS: AVERAGE CIVILIANS
ADJUSTED FOR SELECTIVITY BIAS



See Tables 7A, 7B, 7D to 7F and 8A for complete results.

Table 1A Variable Descriptions

Name	Description
BLACK	1, if black; 0, otherwise.
CCITY	1, if center city residence in observation year; 0, otherwise.
DTBRTHY	Year of birth.
ED20	Years of school completed as of year of 20th birthday (up to 12 years).
ENROLL	1, if enrolled in school; 0, otherwise.
HEALTH	1, if health problem limits amount or kind of work in observation year; 0, otherwise.
HISP	1, if Hispanic; 0, otherwise.
HSD20	1, if high school diploma graduate by year of 20th birthday; 0, otherwise.
JCIV	1, if civilian labor market choice; 0, otherwise.
JCOL	1, if college choice; 0, otherwise.
JHOM	1, if home choice; 0, otherwise.
JMIL	1, if military choice; 0, otherwise.
LIT	Scale from 0 to 3 indicating the amount of reading material (e.g. books, magazines) in the home at age 14.
LMBDA100	The "lambda" term for censored earnings less than $1000 per year calculated from the logit model for censored earnings and included in the regression model to control for selection bias.
LMBDACOL	The "lambda" term for the college choice calculated from the results from the choice model and included in the regression model to control for selection bias.
LMBDACLM	The "lambda" term for the civilian labor market choice calculated from the results from the choice model and included in the regression model to control for selection bias.
LMBDAMIL	The "lambda" term for the military choice

	calculated from the results from the choice model and included in the regression model to control for selection bias.
MA1	1, if in mental aptitude category 1 (very high aptitude); 0, otherwise. Mental aptitude categories were based on AFQT scores.
MA2	1, if in mental aptitude category 2 (high aptitude); 0, otherwise. Mental aptitude categories were based on AFQT scores.
MA3A	1, if in mental aptitude category 3A (medium high aptitude); 0, otherwise. Mental aptitude categories were based on AFQT scores.
MA3B	1, if in mental aptitude category 3B (medium low aptitude); 0, otherwise. Mental aptitude categories were based on AFQT scores.
MA4	1, if in mental aptitude category 4 (low aptitude); 0, otherwise. Mental aptitude categories were based on AFQT scores.
MA5	1, if in mental aptitude category 5 (very low aptitude); 0, otherwise. Mental aptitude categories were based on AFQT scores.
MSP	1, if married spouse present in observation year; 0, otherwise.
MSP20	1, if married spouse present in year of 20th birthday; 0 otherwise.
NDEP20	Number of dependents (other than spouse) in year of 20th birthday.
NODEP	Number of dependents (other than spouse) in observation year.
NOMAN14	1, if no adult male in home at age 14; 0, otherwise.
ROTTER	Locus of control scale. A higher value indicates an internal locus of control. Often used as a measure of motivation.
SIBLING	Number of siblings at age 14.
SOUTH	1, if southern residence in observation year; 0, otherwise.

SOUTHR	1, if Southern residence at age 14; 0, otherwise.
SUBURB	1, if suburban residence in observation year; 0, otherwise.
TCDUM	1, if college choice and observation year is greater than graduation year, 0, otherwise.
TCLN	Observation year minus graduation year if college choice; 0, otherwise.
TCSQ	TCLN squared.
TMDUM	1, if military choice and observation year is later than discharge year; 0, otherwise.
TMLN	Observation year minus discharge year if military choice; 0, otherwise.
TMO	1, if military choice and observation year equals discharge year; 0, otherwise.
TMSHS	Observation year minus year left high school.
TMSHSCB	TMSHS cubed.
TMSHSQ	TMSHS squared.
TMSQ	TMLN squared.
VEAPANL	1, if respondent participated in educational benefits program while in the military and if observation year is later than discharge year; 0, otherwise.
VEAPLN	Years since military if respondent participated in educational benefits program while in the military; 0, otherwise.
WSER	Wage and Salary annual earnings. Earnings are observed for the calendar year prior to the interview year. For example, in the first interview in 1979, annual earnings were observed for calendar year 1978. Earnings were adjusted for inflation by the CPI to 1986 dollars.
YR78	1, if earnings are for 1978; 0, otherwise
YR79	1, if earnings are for 1979; 0, otherwise
YR80	1, if earnings are for 1980; 0, otherwise

YR81	1, if earnings are for 1981; 0, otherwise
YR82	1, if earnings are for 1982; 0, otherwise
YR83	1, if earnings are for 1983; 0, otherwise

TABLE 1B DESCRIPTIVE STATISTICS FOR FULL SAMPLE (FIGURE 1)

DESCRIPTIVE STATISTICS

	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIAT
INTERCEPT	11456.052	1.0000000	11456	0.00000	0.00000000
WSER	15807956.086	1379.8781715	28969421385	637936.16032	798.70905862
YR79	1315.321	0.1148145	1315	0.10379	0.32216273
YR80	1834.635	0.1601455	1835	0.13735	0.37061172
YR81	2274.424	0.1983601	2272	0.16239	0.40297362
YR82	2457.287	0.2144968	2457	0.17206	0.41480520
YR83	2654.007	0.2316686	2654	0.18178	0.42635133
MA1	236.314	0.0206279	236	0.02063	0.14363520
MA2	3381.356	0.2951589	3381	0.21245	0.46092826
MA3B	2434.781	0.2125323	2435	0.17091	0.41341727
MA4	2617.757	0.2285043	2618	0.18003	0.42430066
MA5	935.853	0.0816907	936	0.07661	0.27678375
ROTTER	133917.528	11.6896753	1631366	5.87567	2.42397816
VEAPANL	160.031	0.0139691	160	0.01407	0.11860134
VEAPLN	368.814	0.0321938	1112	0.09805	0.31312987
TMSHS	41016.677	3.5803501	182795	3.20388	1.78993987
TMSHSQ	182795.243	15.9562162	5199914	203.52946	14.26637511
TMSHSCB	932336.231	81.3837290	193816534	10513.41901	102.53496483
TMSQ	1728.065	0.1508430	21412	1.88553	1.37314443
TCSQ	3935.123	0.3434973	42937	3.70700	1.92535676
INMIL	555.198	0.0484633	555	0.04709	0.21700963
TMO	182.598	0.0159390	183	0.01602	0.12656141
TMLN	629.627	0.0549602	1728	0.15096	0.38853471
TMDUM	298.815	0.0260836	299	0.02594	0.16106617
TCLN	1506.991	0.1315454	3935	0.33312	0.57716125
TCDUM	735.850	0.0642324	736	0.06138	0.24775414
HSD2O	8398.346	0.7330925	8398	0.19982	0.44701237
HEALTH	421.210	0.0367675	421	0.03617	0.19017665
LIT	25549.301	2.2302012	66210	0.82276	0.90705968
SOUTHR	3347.769	0.2922271	3348	0.21122	0.45958621
NOMAN14	1266.455	0.1105490	1266	0.10041	0.31688244
ED2O	132036.062	11.5254419	1536708	1.33123	1.15378815
SIBLING	39844.846	3.4780609	202240	5.67460	2.38214088
HISP	653.956	0.0570839	654	0.05497	0.23445153
BLACK	1333.633	0.1164130	1334	0.10504	0.32410454
SOUTH	3653.669	0.3189292	3654	0.22182	0.47098061
CCITY	4019.406	0.3508544	4019	0.23259	0.48227449
SUBURB	3607.592	0.3149071	3608	0.22032	0.46938124
LMBDACOL	34805.131	3.0381436	130636	2.21899	1.48962729
LMBDAMIL	24098.062	2.1035224	54636	0.35164	0.59299276

TABLE 1C REGRESSION RESULTS FOR MODEL WITH NO SELECTIVITY (FIGURE 1)

MODEL: A		SSE	6164962243	F RATIO	49.95
WEIGHT: SMWGT		DFE	11182	PROB>F	0.0001
DEP VAR: WSER		MSE	551329.1	R-SQUARE	0.1385

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	383.896824	113.463250	3.3834	0.0007
YR79	1	95.776676	32.306248	2.9646	0.0030
YR80	1	2.678456	31.275276	0.0856	0.9318
YR81	1	30.859145	31.293619	0.9861	0.3241
YR82	1	-14.310991	33.082274	-0.4326	0.6653
YR83	1	-32.274372	34.933708	-0.9239	0.3556
MA1	1	117.597456	53.221050	2.2096	0.0272
MA2	1	86.782769	21.925356	3.9581	0.0001
MA3B	1	-25.085311	23.139771	-1.0841	0.2784
MA4	1	-69.220735	23.938704	-2.8916	0.0038
MA5	1	-271.346374	34.636559	-7.8341	0.0001
ROTTER	1	8.957468	3.034050	2.9523	0.0032
VEAPANL	1	-139.233189	191.110082	-0.7285	0.4663
VEAPLN	1	-4.630777	85.777633	-0.0540	0.9569
TMSHS	1	156.599245	43.911981	3.5662	0.0004
TMSHSQ	1	-12.714879	11.556392	-1.1002	0.2712
TMSHSCB	1	0.378146	0.915606	0.4130	0.6796
TMSQ	1	7.686058	31.753916	0.2421	0.8087
TCSQ	1	-8.930936	21.930353	-0.4072	0.6838
INMIL	1	179.659609	34.959704	5.1390	0.0001
TMO	1	-100.536073	56.691304	-1.7734	0.0762
TMLN	1	14.807016	158.414390	0.0935	0.9255
TMDUM	1	-11.106137	190.673288	-0.0582	0.9536
TCLN	1	244.510821	111.479813	2.1933	0.0283
TCDUM	1	-304.534753	121.004577	-2.5167	0.0119
HSD20	1	208.707326	21.831902	9.5597	0.0001
HEALTH	1	-242.347686	36.990878	-6.5516	0.0001
LIT	1	41.045171	8.908672	4.6073	0.0001

TABLE 1C REGRESSION RESULTS FOR MODEL WITH NO SELECTIVITY (FIGURE 1)

MODEL: A		SSE	6164962243	F RATIO	49.95
WEIGHT: SMWGT		DFE	11182	PROB>F	0.0001
DEP VAR: WSER		MSE	551329.1	R-SQUARE	0.1385

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
SOUTHR	1	34.409619	22.465863	1.5316	0.1256
NOMAN14	1	-66.735551	23.030484	-2.8977	0.0038
ED20	1	16.618984	8.731446	1.9033	0.0570
SIBLING	1	2.804632	3.161749	0.8871	0.3751
HISP	1	-52.948235	32.003538	-1.6544	0.0981
BLACK	1	-208.047996	25.701344	-8.0948	0.0001
SOUTH	1	15.787081	21.552447	0.7325	0.4639
CCITY	1	99.083538	18.314528	5.4101	0.0001
SUBURB	1	135.221141	18.717040	7.2245	0.0001

TABLE 2A POST HIGH SCHOOL CHOICE MODEL
(FIGURES 2 to 5)

RESPONSE: MACXY		RESPONSE LEVELS (R)=	3
WEIGHT VARIABLE: SMWGT		POPULATIONS (S)=	3305
DATA SET: ALL		TOTAL FREQUENCY (N)=	3630
		OBSERVATIONS (OBS)=	3451

ANALYSIS OF INDIVIDUAL PARAMETERS

THE ODD NUMBERED PARAMETER ASSOCIATED WITH EACH EXPLANATORY VARIABLE REFERS TO THE MILITARY - CIVILIAN CHOICE CONTRAST AND THE EVEN NUMBERED PARAMETER REFERS TO THE COLLEGE - CIVILIAN CONTRAST

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-2.23318	3.34047	0.45	0.5038
	2	-22.9475	233.702	0.01	0.9218
DTBRTHY	3	-.050417	.0534282	0.89	0.3454
	4	.0481129	.0372341	1.67	0.1963
HSD20	5	-.538817	0.243003	4.92	0.0266
	6	16.2288	233.688	0.00	0.9446
ROTTER	7	.0373463	0.032253	1.34	0.2469
	8	0.132661	0.023201	32.69	0.0001
MA1	9	.0109441	0.543391	0.00	0.9839
	10	2.31671	0.226372	104.74	0.0001
MA2	11	-.008518	0.231917	0.00	0.9707
	12	0.909587	0.149982	36.78	0.0001
MA3B	13	0.199358	0.23391	0.73	0.3941
	14	-.792017	0.213471	13.77	0.0002
MA4	15	-.421104	0.272464	2.39	0.1222
	16	-2.55595	0.433028	34.84	0.0001
MA5	17	-2.35703	0.567382	17.26	0.0001
	18	-15.7728	406.883	0.00	0.9691
LIT	19	0.433033	0.099855	18.81	0.0001
	20	0.339233	0.086856	15.25	0.0001
HEALTH	21	-0.33473	0.360513	0.86	0.3532

TABLE 2A POST HIGH SCHOOL CHOICE MODEL
(FIGURES 2 to 5)

	22	-.737135	0.3353	4.83	0.0279
SOUTHR	23	-.180019	0.163079	1.22	0.2696
	24	0.142377	0.128095	1.24	0.2664
NOMAN14	25	0.453442	0.226901	3.99	0.0457
	26	-0.18518	0.19896	0.87	0.3520
ED20	27	0.249025	0.136025	3.35	0.0671
	28	.0155482	0.11148	0.02	0.8891
SIBLING	29	.0307347	.0325768	0.89	0.3454
	30	-.135141	.0301604	20.08	0.0001
HISP	31	0.758473	0.364678	4.33	0.0375
	32	-5.0E-04	0.330892	0.00	0.9988
BLACK	33	1.54353	0.246402	39.24	0.0001
	34	0.99387	0.254172	15.29	0.0001
CCITY	35	-3.8059	0.326389	135.97	0.0001
	36	-0.03107	0.132762	0.05	0.8150
SUBURB	37	-4.50326	0.529398	72.36	0.0001
	38	-.003593	0.137266	0.00	0.9791

TABLE 2B SELECTION MODEL RESULTS FOR EARNINGS < 1000 (FIGURES 2 to 5)

LOGIT ANALYSIS

RESPONSE: WGT100	RESPONSE LEVELS (R)= 2
WEIGHT VARIABLE: SMWGT	POPULATIONS (S)= 15640
DATA SET: DATA1	TOTAL FREQUENCY (N)= 17363
	OBSERVATIONS (OBS)= 16377

ANALYSIS OF INDIVIDUAL PARAMETERS

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-1.77658	0.320224	30.78	0.0001
YR79	2	-.099019	0.103928	0.91	0.3407
YR80	3	-.069819	.0995686	0.49	0.4832
YR81	4	.0256546	.0949176	0.07	0.7869
YR82	5	0.15449	.0943998	2.68	0.1017
YR83	6	-.054229	.0970461	0.31	0.5763
VEAPANY	7	0.306908	0.140539	4.77	0.0290
JMIL	8	-1.45898	0.185181	62.07	0.0001
JCOL	9	0.106367	.0769552	1.91	0.1669
ENROLL	10	1.1226	0.06432	304.62	0.0001
ROTTER	11	-.009713	.0105984	0.84	0.3594
MA1	12	.0715919	0.13093	0.30	0.5845
MA2	13	-0.18475	.0893979	4.27	0.0388
MA3B	14	0.531015	.0924942	32.96	0.0001
MA4	15	0.565176	.0962736	34.46	0.0001
MA5	16	1.26645	0.113218	125.13	0.0001
LIT	17	-.090987	.0298802	9.27	0.0023
HSD20	18	-0.47281	.0728197	42.16	0.0001
HEALTH	19	1.02305	.0940858	118.23	0.0001
SOUTH	20	.0791652	.0269379	8.64	0.0033
NOMAN14	21	0.208365	.0711464	8.58	0.0034
ED20	22	-.012171	.0250079	0.24	0.6265

TABLE 2B SELECTION MODEL RESULTS FOR EARNINGS < 1000
(FIGURES 2 to 5)

SIBLING	23	-.042563	.0111339	14.61	0.0001
HISP	24	-.127563	0.10791	1.40	0.2372
BLACK	25	0.422903	.0744607	32.26	0.0001
CCITY	26	.0291701	.0603564	0.23	0.6289
SUBURB	27	-.210025	.0667947	9.89	0.0017

TABLE 2C DESCRIPTIVE STATISTICS FOR MILITARY SAMPLE IN REVISED MODEL (FIGURE 2)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIAN	STD DEVIATI
0INTERCEPT	1158.7170	1.00000000	1158.7	0.00000	0.00000000
0WSER	1534510.3086376.099866192528793333.9104200.53302322.80107345				
0ENROLL	122.1060	0.10538035	122.1	0.03402	0.18444529
0YR79	143.4080	0.12376447	143.4	0.03913	0.19732308
0YR80	186.5770	0.16102034	186.6	0.04875	0.22079265
0YR81	231.4250	0.19972521	231.4	0.05768	0.24016214
0YR82	241.9450	0.20880422	241.9	0.05962	0.24416317
0YR83	241.5570	0.20846937	241.6	0.05955	0.24401893
0MA1	25.8940	0.02234713	25.9	0.00788	0.08879157
0MA2	362.1980	0.31258539	362.2	0.07754	0.27845964
0MA3B	341.7600	0.29494691	341.8	0.07504	0.27393743
0MA4	236.9500	0.20449342	236.9	0.05870	0.24228699
0MA5	18.3410	0.01582871	18.3	0.00562	0.07497676
0ROTTER	13771.6327	11.88524264	170303.3	2.06293	1.43628924
0VEAPANL	227.3970	0.19624895	227.4	0.05692	0.23857943
0VEAPLN	510.9090	0.44092647	1490.8	0.39412	0.62778739
0TMSHS	4214.2340	3.63698297	19290.4	1.23429	1.11098430
0TMSHSQ	19290.3900	16.64805988	592662.2	84.55765	9.19552323
0TMSHSCB	101911.2260	87.95178288	24405271.0	4809.09280	69.34762286
0TMSQ	2118.8740	1.82863805	25716.0	6.80204	2.60807244
0INMIL	587.8130	0.50729643	587.8	0.09020	0.30032556
0TM0	198.1270	0.17098826	198.1	0.05115	0.22616845
0TMLN	780.0620	0.67321184	2118.9	0.49633	0.70450944
0HSD20	882.6990	0.76178998	882.7	0.06548	0.25589758
0HEALTH	32.3590	0.02792658	32.4	0.00980	0.09897532
0LIT	2748.1440	2.37171285	7232.4	0.22255	0.47175189
0SOUTHR	426.7430	0.36828924	426.7	0.08395	0.28974916
0ED20	13600.9090	11.73790408	160205.9	0.17433	0.41752850
0SIBLING	4088.0240	3.52806078	20197.7	1.79849	1.34107786
0HISP	54.2220	0.04679486	54.2	0.01610	0.12687054
0BLACK	242.8160	0.20955591	242.8	0.05977	0.24448604
0SOUTH	456.2840	0.39378381	456.3	0.08614	0.29350211
0CCITY	138.0930	0.11917750	138.1	0.03788	0.19463004
0SUBURB	86.9960	0.07507959	87.0	0.02506	0.15830028
0LMBDAMIL	1747.1499	1.50783139	2860.4	0.07037	0.26527432
0LMBDA100	89.1928	0.07697550	9.6	0.00084	0.02894955

TABLE 2D REGRESSION RESULTS FOR MILITARY SAMPLE IN REVISED MODEL (FIGURES 2 to 5)

MODEL:	D	SSE	290970026	F RATIO	14.01
WEIGHT:	SMWGT	DFE	3177	PROB>F	0.0001
DEP VAR:	WSER	MSE	91586.41	R-SQUARE	0.1304

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	691.378751	447.283915	1.5457	0.1223
ENROLL	1	-205.295642	57.499280	-3.5704	0.0004
LMBDAMIL	1	-46.471881	115.306936	-0.4030	0.6870
LMBDA100	1	774.138316	537.171588	1.4411	0.1496
YR79	1	20.199671	39.493077	0.5115	0.6091
YR80	1	19.072938	39.532465	0.4825	0.6295
YR81	1	100.920404	41.196040	2.4498	0.0143
YR82	1	108.520894	46.860973	2.3158	0.0206
YR83	1	57.751870	51.625149	1.1187	0.2634
MA1	1	-98.954350	74.949123	-1.3203	0.1868
MA2	1	53.676733	28.941888	1.8546	0.0637
MA3B	1	-61.513361	36.164506	-1.7009	0.0891
MA4	1	-104.217571	37.790606	-2.7578	0.0059
MA5	1	-147.172947	146.054726	-1.0077	0.3137
ROTTER	1	14.159082	3.952006	3.5828	0.0003
VEAPANL	1	-146.609456	73.007983	-2.0081	0.0447
VEAPLN	1	-4.400836	33.134618	-0.1328	0.8943
TMSHS	1	28.507182	53.444864	0.5334	0.5938
TMSHSQ	1	16.607432	13.437175	1.2359	0.2166
TMSHSCB	1	-1.342777	1.010564	-1.3287	0.1840
TMSQ	1	-10.445655	11.824518	-0.8834	0.3771
INMIL	1	287.973052	74.989125	3.8402	0.0001
TMO	1	15.317092	76.112212	0.2012	0.8405
TMLN	1	91.677833	60.158101	1.5239	0.1276
HSD20	1	135.011289	39.578378	3.4112	0.0007
HEALTH	1	-150.981366	74.176238	-2.0354	0.0419
LIT	1	10.465231	18.282873	0.5724	0.5671
SOUTHR	1	40.063582	21.237454	1.8865	0.0593
ED20	1	-1.170627	23.415665	-0.0500	0.9601
SIBLING	1	-1.580605	4.978198	-0.3175	0.7509
HISP	1	24.706745	51.777956	0.4772	0.6333

TABLE 2D REGRESSION RESULTS FOR MILITARY SAMPLE IN REVISED MODEL (FIGURES 2 to 5)

MODEL:	D	SSE	290970026	F RATIO	14.01
WEIGHT:	SMWGT	DFE	3177	PROB>F	0.0001
DEP VAR:	WSER	MSE	91586.41	R-SQUARE	0.1304

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
BLACK	1	-121.194343	62.256639	-1.9467	0.0517
SOUTH	1	20.947213	19.096582	1.0969	0.2728
CCITY	1	-128.204039	104.514323	-1.2267	0.2200
SUBURB	1	67.252172	106.027586	0.6343	0.5259

TABLE 2E REGRESSION RESULTS FOR CIVILIAN SAMPLE IN REVISED MODEL (FIGURES 2 to 5)

MODEL:	D	SSE	5950909077	F RATIO	66.07
WEIGHT:	SMWGT	DFE	9125	PROB>F	0.0001
DEP VAR:	WSER	MSE	652154.4	R-SQUARE	0.1686

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	332.049515	136.243137	2.4372	0.0148
ENROLL	1	-704.076952	45.482652	-15.4801	0.0001
LMBDACLM	1	-400.655741	71.725761	-5.5859	0.0001
LMBDA100	1	471.356597	213.263420	2.2102	0.0271
YR79	1	108.952694	33.684079	3.2345	0.0012
YR80	1	0.291616	32.938096	0.0089	0.9929
YR81	1	7.652882	32.737642	0.2338	0.8152
YR82	1	-43.446946	35.604070	-1.2203	0.2224
YR83	1	-30.874038	37.372538	-0.8261	0.4088
MA1	1	471.075200	79.210546	5.9471	0.0001
MA2	1	159.034889	28.573161	5.5659	0.0001
MA3B	1	-52.694626	30.306192	-1.7387	0.0821
MA4	1	-153.857105	33.317934	-4.6178	0.0001
MA5	1	-482.247461	69.269265	-6.9619	0.0001
ROTTER	1	17.555099	3.552081	4.9422	0.0001
TMSHS	1	111.721378	47.224854	2.3657	0.0180
TMSHSQ	1	1.298247	12.758241	0.1018	0.9190
TMSHSCB	1	-0.860044	1.033675	-0.8320	0.4054
HSD20	1	296.189417	32.408692	9.1392	0.0001
HEALTH	1	-359.413932	61.776609	-5.8180	0.0001
LIT	1	64.655447	11.132316	5.8079	0.0001
SOUTHR	1	13.552654	26.682115	0.5079	0.6115
ED20	1	14.807743	9.338920	1.5856	0.1129
SIBLING	1	3.887475	3.838131	1.0129	0.3112
HISP	1	-7.783344	34.430137	-0.2261	0.8212
BLACK	1	-221.146451	37.765093	-5.8558	0.0001
SOUTH	1	16.607114	25.606832	0.6485	0.5167
CCITY	1	50.696919	23.261157	2.1795	0.0293
SUBURB	1	68.876607	26.110904	2.6378	0.0084

TABLE 2F REGRESSION RESULTS FOR COLLEGE SAMPLE IN REVISED MODEL (FIGURES 2 to 5)

MODEL:	D	SSE	1139615740	F RATIO	48.88
WEIGHT:	SMWGT	DFE	1745	PROB>F	0.0001
DEP VAR:	WSER	MSE	653074.9	R-SQUARE	0.4566

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	19.105818	1694772517	0.0000	1.0000
ENROLL	1	-1003.15	128.711871	-7.7938	0.0001
LMBDACOL	1	214.357657	308.770906	0.6942	0.4876
LMBDA100	1	1728.171	707.785992	2.4417	0.0147
YR79	1	24.021589	71.468532	0.3361	0.7368
YR80	1	49 540357	70.811514	0.6996	0.4843
YR81	1	44.430206	72.611631	0.6119	0.5407
YR82	1	-62.069034	83.298950	-0.7451	0.4563
YR83	1	-93.711270	87.519863	-1.0707	0.2844
MA1	1	150.404725	292.310316	0.5145	0.6069
MA2	1	134.555056	134.447465	1.0008	0.3171
MA3B	1	-259.595184	149.529409	-1.7361	0.0827
MA4	1	-547.475478	352.254791	-1.5542	0.1203
ROTTER	1	12.927772	17.452091	0.7408	0.4589
TMSHS	1	-13.548882	145.608680	-0.0930	0.9259
TMSHSQ	1	38.874566	45.743280	0.8498	0.3955
TMSHSCB	1	-1.031033	4.059066	-0.2540	0.7995
TCSQ	1	-13.481621	21.196815	-0.6360	0.5248
TCLN	1	46.858207	111.639492	0.4197	0.6747
TCDUM	1	-95.741797	117.867297	-0.8123	0.4167
HSD20	1	-1589.74	1694772517	-0.0000	1.0000
HEALTH	1	-735.314688	209.085367	-3.5168	0.0004
LIT	1	102.157091	49.712874	2.0549	0.0400
SOUTHR	1	91.933954	57.816167	1.5901	0.1120
ED20	1	129.102832	34.524602	3.7394	0.0002
SIBLING	1	4.266648	21.220359	0.2011	0.8407
HISP	1	-159.265085	109.764133	-1.4510	0.1470
BLACK	1	-142.842093	155.295310	-0.9198	0.3578
SOUTH	1	-70.263339	53.429335	-1.3151	0.1887
CCITY	1	142.802455	60.610206	2.3561	0.0186
SUBURB	1	249.989100	50.942792	4.9073	0.0001

TABLE 3A DESCRIPTIVE STATISTICS FOR CIVILIAN SAMPLE IN REVISED MODEL (FIGURE 3)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIAN	STD DEVIATI
0INTERCEPT	11391.161	1.0000000	11391	0.00000	0.00000000
0WSER	14408466.171	1264.8812681	25382381980	781971.26821	884.29139327
0ENROLL	1726.735	0.1515855	1727	0.16006	0.40006923
0YR79	1475.158	0.1295002	1475	0.14030	0.37456041
0YR80	1882.765	0.1652830	1883	0.17170	0.41436776
0YR81	2347.932	0.2061188	2348	0.20365	0.45127242
0YR82	2312.758	0.2030309	2313	0.20138	0.44874962
0YR83	2384.359	0.2093166	2384	0.20597	0.45384275
0MA1	223.805	0.0196473	224	0.02397	0.15482616
0MA2	3536.349	0.3104468	3536	0.26642	0.51615451
0MA3B	2319.759	0.2036455	2320	0.20183	0.44925500
0MA4	2542.622	0.2232101	2543	0.21579	0.46452700
0MA5	948.508	0.0832670	949	0.09500	0.30821956
0ROTTER	132886.568	11.6657616	1614809	7.05626	2.65636149
0TMSHS	38375.124	3.3688510	163655	3.75557	1.93792923
0TMSHSQ	163654.804	14.3668239	4418323	225.84105	15.02800881
0TMSHSCB	809596.524	71.0723450	160025395	11196.92688	105.81553234
0HSD20	8431.134	0.7401470	8431	0.23936	0.48924355
0HEALTH	416.572	0.0365698	417	0.04385	0.20939344
0LIT	25393.789	2.2292538	65826	1.00696	1.00347306
0SOUTHR	3180.808	0.2792348	3181	0.25048	0.50047676
0ED20	131448.483	11.5395159	1531830	1.63639	1.27921491
0SIBLING	39591.714	3.4756522	200598	6.88199	2.62335416
0HISP	692.157	0.0607626	692	0.07103	0.26650678
0BLACK	1228.778	0.1078712	1229	0.11977	0.34607384
0SOUTH	3526.174	0.3095535	3526	0.26599	0.51574514
0CCITY	4363.044	0.3830201	4363	0.29410	0.54231118
0SUBURB	3862.804	0.3391054	3863	0.27891	0.52812377
0LMBDACLM	3949.482	0.3467146	2210	0.09183	0.30303919
0LMBDA100	2512.373	0.2205546	768	0.02339	0.15293935

TABLE 4A DESCRIPTIVE STATISTICS FOR LOW QUALITY MILITARY SAMPLE IN REVISED (FIGURE 4) MODEL

VARIABLE	SUM	MEAN	UNCORRECTED	VARIAN	STD DEVIATI
0INTERCEPT	708.46500	1.00000000	708.5	0.000000	0.00000000
0WSER	951994.37823	343.74228541	1466004612.0	98924.528886	314.52270011
0ENROLL	48.89100	0.06900976	48.9	0.024109	0.15526946
0INMIL	357.26300	0.50427756	357.3	0.093805	0.30627554
0LMBDMILL	999.61903	1.41096459	1749.5	0.179596	0.42378797
0LMBD100L	55.01828	0.07765843	5.4	0.000617	0.02484199
0HSD20	432.44700	0.61039995	432.4	0.089238	0.29872733
0ED20	8201.44900	11.57636439	95448.1	0.267530	0.51723312
0MA4	236.95000	0.33445548	236.9	0.083528	0.28901203
0MA5	18.34100	0.02588836	18.3	0.009463	0.09727805
0YR79	83.86300	0.11837282	83.9	0.039161	0.19789129
0YR80	111.30300	0.15710444	111.3	0.049691	0.22291501
0YR81	139.96700	0.19756375	140.0	0.059489	0.24390298
0YR82	152.26000	0.21491535	152.3	0.063314	0.25162290
0YR83	152.50500	0.21526116	152.5	0.063388	0.25176979
0ROTTER	8153.02100	11.50800816	97617.6	2.008754	1.41730505
0VEAPANL	132.96400	0.18767900	133.0	0.057208	0.23918277
0VEAPLN	317.43300	0.44805742	987.2	0.447563	0.66900143
0TMSHS	2679.77700	3.78251149	12740.9	1.379563	1.17454817
0TMSHSQ	12740.90300	17.98381430	421022.7	101.638064	10.08157053
0TMSHSCB	69821.99100	98.55390316	18636557.7	6226.338974	78.90715414
0TMSQ	1409.63900	1.98970874	18768.9	8.455557	2.90784408
0TM0	121.18900	0.17105856	121.2	0.053209	0.23067075
0TMLN	497.45500	0.70215889	1409.6	0.561624	0.74941593
0HEALTH	23.09000	0.03259159	23.1	0.011831	0.10877170
0LIT	1603.99400	2.26404127	4137.2	0.267865	0.51755689
0SIBLING	2620.01600	3.69815870	13514.7	2.026221	1.42345386
0HISP	43.55300	0.06147516	43.6	0.021650	0.14714006
0BLACK	204.38600	0.28849132	204.4	0.077025	0.27753303
0SOUTH	282.23000	0.39836830	282.2	0.089936	0.29989274
0CCITY	94.30900	0.13311737	94.3	0.043302	0.20809216
0SUBURB	43.08400	0.06081317	43.1	0.021432	0.14639728

TABLE 5A DESCRIPTIVE STATISTICS FOR HIGH QUALITY MILITARY SAMPLE IN REVISED MODEL (FIGURE 5)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIAN	STD DEVIATI
OINTERCEPT	450.25200	1.00000000	450.3	0.00000	0.00000000
OWSER	642515.93042	427.01405084	1062788721.9	110370.24301	332.22017249
OMA1	25.89400	0.05751002	25.9	0 01846	0.13586957
OMA2	287.72200	0.63902437	287.7	0.07856	0.28029139
OENROLL	73.21500	0.16260894	73.2	0.04638	0.21535173
OINMIL	230.55000	0.51204659	230.5	0.08510	0.29171316
OLMBDMILH	771.02966	1.71244027	1597.4	0.20957	0.45779174
OLMBD100H	33.66820	0.07477635	3.8	0.00096	0.03103876
OYR79	59.54500	0.13224816	59.5	0.03908	0.19769910
OYR80	75.27400	0.16718193	75.3	0.04742	0.21776187
OYR81	91.45800	0.20312625	91.5	0.05513	0.23479556
OYR82	89.68500	0.19918845	89.7	0.05433	0.23308233
OYR83	89.05200	0.19778258	89.1	0.05404	0.23246210
OROTTER	5618.61170	12.47881564	72685.7	1.94559	1.39484558
OVEAPANL	94.43300	0.20973366	94.4	0.05645	0.23759260
OVEAPLN	193.47600	0.42970603	503.6	0.31802	0.56392977
OTMSHS	1534.45700	3.40799597	6549.5	0.99854	0.99926741
OTMSHSQ	6549.48700	14.54626964	171639.5	57.76768	7.60050515
OTMSHSCB	32089.23500	71.26950019	5768713.3	2633.68345	51.31942570
OTMSQ	709.23500	1.57519567	6947.1	4.40996	2.09998975
OTMO	76.93800	0.17087764	76.9	0.04825	0.21966660
OTMLN	282.60700	0.62766406	709.2	0.40231	0.63427848
OHEALTH	9.26900	0.02058625	9.3	0.00687	0.08286742
OLIT	1144.15000	2.54113252	3095.2	0.14201	0.37684616
OSIBLING	1468.00800	3.26041417	6683.0	1.43472	1.19779611
OHISP	10.66900	0.02369562	10.7	0.00788	0.08876439
OBLACK	38.43000	0.08535220	38.4	0.02659	0.16305961
OSOUTH	174.05400	0.38657019	174.1	0.08076	0.28418995
OCCITY	43.78400	0.09724332	43.8	0.02990	0.17291288
OSUBURB	43.91200	0.09752761	43.9	0.02998	0.17313818

TABLE 6A DESCRIPTIVE STATISTICS FOR WOMEN'S SAMPLE (FIGURE 6)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIATION
INTERCEPT	9058.943	1	9058.943	0	0
WSER	9044524.1514	998.40832991	11880020574.5	328404.27767	573.06568356
YR79	1092.596	0.12060966	1092.596	0.11071887	0.33274445
YR80	1383.954	0.15277213	1383.954	0.13511459	0.36757936
YR81	1830.85	0.20210415	1830.85	0.1683369	0.4102888
YR82	1912.164	0.21108026	1912.164	0.17383544	0.41693577
YR83	2060.813	0.22748934	2060.813	0.18345241	0.42831345
MA1	216.537	0.02390312	216.537	0.02435597	0.15606399
MA2	2905.003	0.32067792	2905.003	0.22740639	0.47687146
MA3B	2013.077	0.22221986	2013.077	0.18042537	0.42476507
MA4	1902.754	0.2100415	1902.754	0.17320773	0.41618233
MA5	314.795	0.03474964	314.795	0.03501452	0.18712167
ROTTER	107072.2232	11.81950512	1317033.7285	5.93374486	2.43592793
VEAPANL	7.965	0.00087924	7.965	0.00091703	0.03028252
VEAPLN	15.392	0.00169909	38.038	0.00438025	0.06618349
TMSHS	32370.14	3.57328002	144150.254	3.28217096	1.81167628
TMSHSQ	144150.254	15.91248052	4123929.746	210.89440396	14.52220383
TMSHSCB	736242.674	81.27247009	156795870.79	11173.0364247	105.70258476
TMSQ	58.968	0.00650937	505.632	0.05822173	0.24129179
TCSQ	5420.064	0.59831086	65045.328	7.12173828	2.66865852
INMIL	50.449	0.00556897	50.449	0.00578106	0.07603329
TMO	12.797	0.00141264	12.797	0.00147257	0.03837402
TMLN	25.588	0.00282461	58.968	0.00678679	0.08238195
TMDUM	14.107	0.00155725	14.107	0.00162307	0.04028739
TCLN	2002.532	0.22105581	5420.064	0.57356449	0.75734041
TCDUM	959.565	0.10592461	959.565	0.09886189	0.3144231
HSD20	7748.557	0.85534891	7748.557	0.12915847	0.35938625
HEALTH	534.394	0.05899077	534.394	0.05794765	0.24072318
LIT	20986.787	2.31669269	55521.233	0.79526354	0.8917755
SOUTHR	2748.805	0.30343551	2748.805	0.22064069	0.46972406
NOMAN14	982.241	0.10842777	982.241	0.10091482	0.31767093
ED20	106451.72	11.75100892	1256936.448	0.69386226	0.83298395
NODEP	2198.117	0.24264608	3878.169	0.38543495	0.62083408
MSP	3369.301	0.37193092	3369.301	0.24385271	0.49381444
SIBLING	30219.004	3.33582008	140090.204	4.52696976	2.12766768
HISP	438.188	0.04837076	438.188	0.04805168	0.21920694

TABLE 6A

DESCRIPTIVE STATISTICS FOR WOMEN'S SAMPLE
(FIGURE 6)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIATION
BLACK	854.544	0.09433154	854.544	0.0891834	0.2986359
SOUTH	3006.237	0.33185295	3006.237	0.23145933	0.48110272
CCITY	3709.114	0.40944225	3709.114	0.25241359	0.50240789
SUBURB	3036.982	0.33524684	3036.982	0.23263925	0.48232691
LMBDACOL	23896.043582	2.63784015	77618.75764	1.68066541	1.2964048
LMBDAMIL	19516.200444	2.15435735	44552.07606	0.28891521	0.53750833

TABLE 6B
REGRESSION RESULTS FOR WOMEN'S MODEL WITH NO SELECTIVITY ADJUSTMENT
(FIGURE 6)

MODEL:	A	SSE	2290707953	F RATIO	55.50
WEIGHT:	SMWGT	DFE	8640	PROB>F	0.0001
DEP VAR:	WSER	MSE	265128.2	R-SQUARE	0.1962

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	666.438865	118.150925	5.6406	0.0001
YR79	1	6.339328	24.534736	0.2584	0.7961
YR80	1	38.185800	24.074452	1.5862	0.1127
YR81	1	62.926466	23.703974	2.6547	0.0080
YR82	1	78.094651	25.156947	3.1043	0.0019
YR83	1	110.530572	26.577000	4.1589	0.0001
MA1	1	258.861881	38.766359	6.6775	0.0001
MA2	1	132.324429	16.134333	8.2014	0.0001
MA3B	1	-13.606635	17.181463	-0.7919	0.4284
MA4	1	-134.956861	18.462280	-7.3099	0.0001
MA5	1	-110.819254	35.399421	-3.1305	0.0018
ROTTER	1	6.156738	2.386353	2.5800	0.0099
VEAPANL	1	104.854767	623.730717	0.1681	0.8665
VEAPLN	1	-112.150739	322.012443	-0.3483	0.7276
TMSHS	1	43.053328	33.052777	1.3026	0.1928
TMSHSQ	1	6.005068	8.548643	0.7025	0.4824
TMSHSCB	1	-0.725695	0.664570	-1.0920	0.2749
TMSQ	1	19.305514	166.563291	0.1159	0.9077
TCSQ	1	-46.815737	12.333104	-3.7959	0.0001
INMIL	1	615.319922	73.797662	8.3379	0.0001
TMO	1	348.627433	144.549663	2.4118	0.0159
TMLN	1	-77.935279	736.157387	-0.1059	0.9157
TMDUM	1	339.213392	747.761104	0.4536	0.6501
TCLN	1	257.205783	65.099911	3.9509	0.0001
TCDUM	1	-150.722248	72.654396	-2.0745	0.0381
HSD20	1	224.242942	22.796275	9.8368	0.0001
HEALTH	1	-192.242050	23.225686	-8.2771	0.0001
LIT	1	13.624513	7.150550	1.9054	0.0568

TABLE 6B

REGRESSION RESULTS FOR WOMEN'S MODEL WITH NO SELECTIVITY ADJUSTMENT (FIGURE 6)

MODEL: A		SSE	2290707953	F RATIO	55.50
WEIGHT: SMWGT		DFE	8640	PROB>F	0.0001
DEP VAR: WSER		MSE	265128.2	R-SQUARE	0.1962

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
SOUTHR	1	-0.219899	18.373095	-0.0120	0.9905
NOMAN14	1	-49.868916	18.130545	-2.7505	0.0060
ED20	1	-18.652970	10.074457	-1.8515	0.0641
NODEP	1	-70.593101	9.622745	-7.3361	0.0001
MSP	1	-115.244957	11.765536	-9.7951	0.0001
SIBLING	1	-5.642232	2.713252	-2.0795	0.0376
HISP	1	56.287624	26.554792	2.1197	0.0341
BLACK	1	23.646596	21.873345	1.0811	0.2797
SOUTH	1	-16.791566	17.722761	-0.9475	0.3434
CCITY	1	100.428726	14.194366	7.0753	0.0001
SUBURB	1	84.266403	14.788715	5.6980	0.0001

TABLE 7A POST HIGH SCHOOL CHOICE MODEL
YOUNG WOMEN
(FIGURES 7 & 8)

RESPONSE: MACXYW	RESPONSE LEVELS (R)= 4
WEIGHT VARIABLE: SMWGT	POPULATIONS (S)= 3567
DATA SET: ALL	TOTAL FREQUENCY (N)= 3727
	OBSERVATIONS (OBS)= 3716

ANALYSIS OF INDIVIDUAL PARAMETERS

THE FIRST NUMBERED PARAMETER ASSOCIATED WITH EACH EXPLANATORY VARIABLE REFERS TO THE MILITARY - CIVILIAN CHOICE CONTRAST, THE SECOND NUMBERED PARAMETER REFERS TO THE COLLEGE - CIVILIAN CONTRAST AND THE THIRD NUMBERED PARAMETER REFERS TO THE HOME CIVILIAN CONTRAST

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-22.7822	16.9137	1.81	0.1780
	2	-20.3046	249.838	0.01	0.9352
	3	4.27499	2.0217	4.47	0.0345
DTBRTHY	4	-.033459	0.173596	0.04	0.8472
	5	.0421774	.0363367	1.35	0.2457
	6	-.056001	.0333121	2.83	0.0927
HSD20	7	-1.23211	0.749985	2.70	0.1004
	8	15.965	249.736	0.00	0.9490
	9	-.891928	0.140696	40.19	0.0001
ROTTER	10	0.090841	0.105126	0.75	0.3875
	11	.0940314	.0232107	16.41	0.0001
	12	-.017405	.0202979	0.74	0.3912
MA1	13	1.19284	1.91062	0.39	0.5324
	14	2.71064	0.275401	96.88	0.0001
	15	1.36881	0.411279	11.08	0.0009
MA2	16	0.612568	0.7216	0.72	0.3959
	17	0.819	0.133413	37.69	0.0001

TABLE 7A

POST HIGH SCHOOL CHOICE MODEL
YOUNG WOMEN
(FIGURES 7 & 8)

	18	-.164471	0.176965	0.86	0.3527
MA3B	19	-.003061	0.858412	0.00	0.9972
	20	-.749318	0.189025	15.71	0.0001
	21	0.415275	0.160831	6.67	0.0098
MA4	22	0.581155	0.816573	0.51	0.4767
	23	-1.86454	0.301208	38.32	0.0001
	24	0.698645	0.157887	19.58	0.0001
MA5	25	-3.56305	6.06655	0.34	0.5570
	26	-15.345	422.604	0.00	0.9710
	27	1.32635	0.208312	40.54	0.0001
LIT	28	0.282656	0.30986	0.83	0.3617
	29	0.502593	.0918653	29.93	0.0001
	30	-.107444	.0529451	4.12	0.0424
HEALTH	31	0.323815	0.825349	0.15	0.6948
	32	-.744784	0.258491	8.30	0.0040
	33	0.387083	0.143116	7.32	0.0068
SOUTHR	34	-1.32553	0.626235	4.48	0.0343
	35	0.501412	0.116142	18.64	0.0001
	36	-.245292	0.106201	5.33	0.0209
NOMAN14	37	-0.41712	0.887609	0.22	0.6384
	38	-.239447	0.201009	1.42	0.2336
	39	.0167449	0.133228	0.02	0.9000
ED20	40	1.66713	1.20121	1.93	0.1652
	41	-.146761	0.649161	0.05	0.8211
	42	-.117575	.0535066	4.83	0.0280
SIBLING	43	0.151366	.0982772	2.37	0.1235
	44	-.127109	0.029535	18.52	0.0001
	45	.0306986	.0197408	2.42	0.1199
HISP	46	1.51338	1.05735	2.05	0.1523
	47	-.069876	0.35196	0.04	0.8426
	48	.0062224	0.184901	0.00	0.9732
BLACK	49	2.07349	0.750981	7.62	0.0058
	50	0.953896	0.217343	19.26	0.0001
	51	0.666056	0.141456	22.17	0.0001
CCITY	52	-6.65134	3.64321	3.33	0.0679

TABLE 7A

POST HIGH SCHOOL CHOICE MODEL
YOUNG WOMEN
(FIGURES 7 & 8)

	53	-.064305	0.131479	0.24	0.6248
	54	-.405306	0.114279	12.58	0.0004
SUBURB	55	-5.62408	2.85209	3.89	0.0487
	56	0.184768	0.13431	1.89	0.1689
	57	-.573757	0.124638	21.19	0.0001

TABLE 7B SELECTION MODEL RESULTS FOR EARNINGS < 1000
YOUNG WOMEN
(FIGURES 7 & 8)

LOGIT ANALYSIS

RESPONSE: WGT100
WEIGHT VARIABLE: SMWGT
DATA SET: DATA1

RESPONSE LEVELS (R) = 2
POPULATIONS (S) = 16943
TOTAL FREQUENCY (N) = 17881
OBSERVATIONS (OBS) = 17759

ANALYSIS OF INDIVIDUAL PARAMETERS

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-.316148	0.309638	1.04	0.3072
YR79	2	-.176085	.0851749	4.27	0.0387
YR80	3	-0.20314	.0816543	6.19	0.0129
YR81	4	-0.18372	.0786095	5.46	0.0194
YR82	5	-.112022	.0783538	2.04	0.1528
YR83	6	-.168953	.0788079	4.60	0.0320
VEAPANY	7	0.103913	.0975835	1.13	0.2869
JMIL	8	-.804144	0.[illegible]73057	4.65	0.0311
JCOL	9	0.301026	.0679907	19.60	0.0001
JHOM	10	2.43389	.0485819	2509.89	0.0001
ENROLL	11	0.391217	.0561771	48.50	0.0001
ROTTER	12	-.023288	.0088711	6.89	0.0087
MA1	13	-.212961	0.132162	2.60	0.1071
MA2	14	-.059562	.0655263	0.83	0.3634
MA3B	15	0.271238	.0678386	15.99	0.0001
MA4	16	0.244565	.0695493	12.37	0.0004
MA5	17	0.517846	0.100845	26.37	0.0001
LIT	18	-.095298	0.025032	14.49	0.0001
HSD20	19	-0.40677	.0705552	33.24	0.0001
HEALTH	20	1.0133	.0674255	225.85	0.0001
SOUTH	21	-.005626	.0223169	0.06	0.8010

TABLE 7B SELECTION MODEL RESULTS FOR EARNINGS < 1000
YOUNG WOMEN
(FIGURES 7 & 8)

NOMAN14	22	.0148736	.0630134	0.06	0.8134
ED20	23	-.064842	.0270711	5.74	0.0166
SIBLING	24	.0574714	.0092178	38.87	0.0001
HISP	25	-.048722	.0882543	0.30	0.5809
BLACK	26	0.006657	.0682046	0.01	0.9222
CCITY	27	-.193855	0.050768	14.58	0.0001
SUBURB	28	-.266284	.0536094	24.67	0.0001

TABLE 7C DESCRIPTIVE STATISTICS FOR WOMEN'S MILITARY SAMPLE (SELECTIVITY MODEL)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIATION
INTERCEPT	77.353	1	77.353	0	0
WSER	107666.69201	1391.8877356	167942543.83	14547.5427951	120.61319495
YR79	9.34	0.12074516	9.34	0.00660679	0.08128216
YR80	16.482	0.21307512	16.482	0.01043451	0.10214945
YR81	17.058	0.22052151	17.058	0.01069698	0.1034262
YR82	15.217	0.19672152	15.217	0.00983386	0.09916582
YR83	12.861	0.16626375	12.861	0.00862645	0.0928787
MA1	1.221	0.01578478	1.221	0.0009668	0.03109334
MA2	31.657	0.40925368	31.657	0.01504526	0.12265911
MA3B	12.064	0.15596034	12.064	0.00819187	0.09050895
MA4	20.407	0.26381653	20.407	0.01208632	0.1099378
MA5	0.14	0.00180988	0.14	0.00011243	0.01060315
ROTTER	938.5312	12.13309374	11808.87244	0.33916767	0.58238103
VEAPANL	7.965	0.1029695	7.965	0.00574807	0.07581601
VEAPLN	15.392	0.19898388	38.038	0.02813776	0.16774315
TMSHS	243.473	3.1475573	979.277	0.17130473	0.41388976
TMSHSQ	979.277	12.65984513	24409.373	9.66361854	3.10863612
TMSHSCB	4627.985	59.82941838	846903.677	458.57926482	21.41446392
TMSQ	58.968	0.76232337	505.632	0.37061892	0.60878479
TCSQ	0	0	0	0	0
INMIL	50.449	0.6521919	50.449	0.01411631	0.11881207
TMO	12.797	0.16543638	12.797	0.00859204	0.09269328
TMLN	25.588	0.33079519	58.968	0.04063042	0.20156989
TMDUM	14.107	0.18237172	14.107	0.00927939	0.09632959
TCLN	0	0	0	0	0
TCDUM	0	0	0	0	0
HSD20	67.952	0.87846625	67.952	0.00664398	0.08151058
HEALTH	4.806	0.06213075	4.806	0.00362623	0.06021816
LIT	188.395	2.43552286	507.499	0.03914615	0.19785387
ED20	925.116	11.95966543	11070.032	0.00479015	0.06921091
NODEP	22.218	0.28722868	42.048	0.02869377	0.16939235
MSP	32.779	0.42375861	32.779	0.01519599	0.12327202
SIBLING	315.946	4.0844699	1756.91	0.37525187	0.61257805
HISP	4.384	0.05667524	4.384	0.00332706	0.05768067
BLACK	16.313	0.21089033	16.313	0.01035619	0.10176537

TABLE 7C DESCRIPTIVE STATISTICS FOR WOMEN'S MILITARY SAMPLE (SELECTIVITY MODEL)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIATION
SOUTH	37.349	0.48283842	37.349	0.0155394	0.12465711
CCITY	4.587	0.05929957	4.587	0.00347143	0.05891888
SUBURB	2.689	0.03476271	2.689	0.00208811	0.04569586
LMBDFMIL	184.06684288	2.37956954	473.46084062	0.02852855	0.16890397
LMBDF100	7.35722106	0.09511229	1.14552249	0.00035862	0.01893717

TABLE 7D
REGRESSION RESULTS FOR WOMEN'S MILITARY SAMPLE (SELECTIVITY MODEL)
(FIGURES 7 & 8)

MODEL: B	SSE 12763453	F RATIO	14.82
WEIGHT: SMWGT	DFE 1209	PROB>F	0.0001
DEP VAR: WSER	MSE 10557.03	R-SQUARE	0.2942

VARIABLE		DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT		1	1021.517	876.928007		
LMBDFMIL		1	-140.921457	63.032662	-2.2357	0.0256
LMBDF100		1	785.413098	306.522826	2.5623	0.0105
YR79		1	-63.702843	54.349815	-1.1721	0.2414
YR80		1	-80.297733	58.729331	-1.3673	0.1718
YR81		1	9.034080	64.171554	0.1408	0.8881
YR82		1	155.839385	69.450304	2.2439	0.0250
YR83		1	124.084343	76.604011	1.6198	0.1055
MA1		1	272.169912	98.809876	2.7545	0.0060
MA2		1	58.058782	37.664813	1.5415	0.1235
MA3B		1	30.811583	44.456051	0.6931	0.4884
MA4		1	130.997573	48.715556	2.6890	0.0073
MA5		1	154.085723	300.910991	0.5121	0.6087
ROTTER		1	-0.628872	5.982179	-0.1051	0.9163
VEAPANL		1	63.865997	126.424802	0.5052	0.6135
VEAPLN		1	-44.114136	65.197630	-0.6766	0.4988
TMSHS		1	464.554342	80.609549	5.7630	0.0001
TMSHSQ		1	-83.192071	22.505787	-3.6965	0.0002
TMSHSCB		1	5.895274	1.850477	3.1858	0.0015
TMSQ		1	16.946984	33.829534	0.5010	0.6165
TCSQ	*	0	0	0		
INMIL		1	317.682337	152.911152		
TMO		1	-161.720809	153.815232		
TMLN		1	-112.378461	148.950322	-0.7545	0.4507
TMDUM	*	0	0	0		
TCLN	*	0	0	0		
TCDUM	*	0	0	0		
HSD20		1	141.041266	65.960350	2.1383	0.0327

TABLE 7D

REGRESSION RESULTS FOR WOMEN'S MILITARY SAMPLE (SELECTIVITY MODEL)
(FIGURES 7 & 8)

MODEL: B		SSE	12763453	F RATIO	14.82
WEIGHT: SMWGT		DFE	1209	PROB>F	0.0001
DEP VAR: WSER		MSE	10557.03	R-SQUARE	0.2942

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
HEALTH	1	-237.423379	61.236041	-3.8772	0.0001
LIT	1	30.284043	18.412366	1.6448	0.1003
ED20	1	-36.022829	62.794550	-0.5737	0.5663
MSP	1	47.349672	26.995817	1.7540	0.0797
NODEP	1	13.428335	19.781888	0.6788	0.4974
SIBLING	1	-29.386045	6.766212	-4.3431	0.0001
HISP	1	-41.034387	68.894866	-0.5956	0.5515
BLACK	1	-56.204730	46.432121	-1.2105	0.2263
SOUTH	1	-16.327190	27.295929	-0.5982	0.5498
CCITY	1	-69.144978	131.978347	-0.5239	0.6004
SUBURB	1	-88.267339	121.479674	-0.7266	0.4676

TABLE 7E
REGRESSION RESULTS FOR WOMEN'S CIVILIAN SAMPLE (SELECTIVITY MODEL)
(FIGURES 7 & 8)

MODEL: B		SSE	1837221380	F RATIO	44.67
WEIGHT: SMWGT		DFE	6542	PROB>F	0.0001
DEP VAR: WSER		MSE	280834.8	R-SQUARE	0.1605

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	680.243000	148.595251	4.5778	0.0001
LMBDFCLM	1	8.827171	53.158147	0.1661	0.8681
LMBDF100	1	61.841816	99.985727	0.6185	0.5363
YR79	1	-4.788992	26.074483	-0.1837	0.8543
YR80	1	37.618971	32.132995	1.1707	0.2418
YR81	1	60.255989	31.793234	1.8952	0.0581
YR82	1	64.176196	32.839562	1.9542	0.0507
YR83	1	100.829405	34.349595	2.9354	0.0033
MA1	1	187.772419	80.665799	2.3278	0.0200
MA2	1	137.655265	20.201323	6.8142	0.0001
MA3B	1	-23.198023	18.429354	-1.2588	0.2082
MA4	1	-143.707617	19.478587	-7.3777	0.0001
MA5	1	-125.775463	41.046358	-3.0642	0.0022
ROTTER	1	3.324211	2.695196	1.2334	0.2175
VEAPANL	* 0	0	0		
VEAPLN	* 0	0	0		
TMSHS	1	62.262515	34.595542	1.7997	0.0719
TMSHSQ	1	0.729929	8.946792	0.0816	0.9350
TMSHSCB	1	-0.325951	0.695255	-0.4688	0.6392
TMSQ	* 0	0	0		
TCSQ	* 0	0	0		
INMIL	* 0	0	0		
TM0	* 0	0	0		
TMLN	* 0	0	0		
TMDUM	* 0	0	0		
TCLN	* 0	0	0		
TCDUM	* 0	0	0		
HSD20	1	241.451564	24.040298	10.0436	0.0001

TABLE 7E
REGRESSION RESULTS FOR WOMEN'S CIVILIAN SAMPLE (SELECTIVITY MODEL)
(FIGURES 7 & 8)

MODEL: B		SSE	1837221380	F RATIO	44.67
WEIGHT: SMWGT		DFE	6542	PROB>F	0.0001
DEP VAR: WSER		MSE	280834.8	R-SQUARE	0.1605

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
HEALTH	1	-179.217800	29.978622	-5.9782	0.0001
LIT	1	14.705656	7.737015	1.9007	0.0574
ED20	1	-19.535627	11.310915	-1.7271	0.0842
MSP	1	-124.132115	12.855044	-9.6563	0.0001
NODEP	1	-65.631946	10.132167	-6.4776	0.0001
SIBLING	1	-5.450756	3.015590	-1.8075	0.0707
HISP	1	47.356384	28.247446	1.6765	0.0937
BLACK	1	5.305555	26.061360	0.2036	0.8387
SOUTH	1	-25.778197	13.665526	-1.8864	0.0593
CCITY	1	97.077383	16.294457	5.9577	0.0001
SUBURB	1	77.132699	16.920640	4.5585	0.0001

TABLE 7F
REGRESSION RESULTS FOR WOMEN'S COLLEGE SAMPLE (SELECTIVITY MODEL)
(FIGURES 7 & 8)

MODEL: B		SSE	393917601	F RATIO	7.20
WEIGHT: SMWGT		DFE	833	PROB>F	0.0001
DEP VAR: WSER		MSE	472890.3	R-SQUARE	0.2059

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-1741.93	2884297788	-0.0000	1.0000
LMBDFCOL	1	216.724030	298.123716	0.7270	0.4675
LMBDF100	1	-527.775227	391.101003	-1.3495	0.1776
YR79	1	-23.586968	238.124155	-0.0991	0.9211
YR80	1	-22.279654	223.178033	-0.0998	0.9205
YR81	1	14.491182	222.039900	0.0653	0.9480
YR82	1	82.998263	225.990293	0.3673	0.7135
YR83	1	74.984542	225.773534	0.3321	0.7399
MA1	1	650.553147	300.593024	2.1642	0.0307
MA2	1	304.483171	128.963462	2.3610	0.0185
MA3B	1	121.168254	149.873192	0.8085	0.4190
MA4	1	-220.784824	310.185583	-0.7118	0.4768
MA5	* 0	0	0		
ROTTER	1	35.334865	16.459565	2.1468	0.0321
VEAPANL	* 0	0	0		
VEAPLN	* 0	0	0		
TMSHS	1	-81.483069	445.655964	-0.1828	0.8550
TMSHSQ	1	80.868636	101.807828	0.7943	0.4272
TMSHSCB	1	-7.580085	7.478844	-1.0135	0.3111
TMSQ	* 0	0	0		
TCSQ	1	-11.205009	22.810899	-0.4912	0.6234
INMIL	* 0	0	0		
TMO	* 0	0	0		
TMLN	* 0	0	0		
TMDUM	* 0	0	0		
TCLN	1	-11.241017	131.810150	-0.0853	0.9321
TCDUM	1	445.821596	259.514245	1.7179	0.0862

TABLE 7F
REGRESSION RESULTS FOR WOMEN'S COLLEGE SAMPLE (SELECTIVITY MODEL)
(FIGURES 7 & 8)

MODEL: B		SSE	393917601	F RATIO	7.20
WEIGHT: SMWGT		DFE	833	PROB>F	0.0001
DEP VAR: WSER		MSE	472890.3	R-SQUARE	0.2059

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
HSD20	1	-3339.83	2884297788	-0.0000	1.0000
HEALTH	1	-514.923384	169.046946	-3.0460	0.0024
LIT	1	118.583314	75.663786	1.5672	0.1174
ED20	1	346.948974	441.416035	0.7860	0.4321
MSP	1	-86.993133	52.339569	-1.6621	0.0969
NODEP	1	-284.540770	79.784047	-3.5664	0.0004
SIBLING	1	-29.260422	21.427364	-1.3656	0.1724
HISP	1	146.933253	173.566944	0.8466	0.3975
BLACK	1	207.818946	158.821169	1.3085	0.1911
SOUTH	1	84.122827	70.005049	1.2017	0.2298
CCITY	1	167.075946	66.855261	2.4991	0.0126
SUBURB	1	214.514250	76.214313	2.8146	0.0050

TABLE 8A DESCRIPTIVE STATISTICS FOR WOMEN'S CIVILIAN SAMPLE (SELECTIVITY MODEL) (FIGURE 8)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIATION
INTERCEPT	7976.424	1	7976.424	0	0
WSER	7589263.5749	951.46190509	9409361760.7	333099.9363	577.14810603
YR79	1047.345	0.13130508	1047.345	0.13848147	0.37213099
YR80	1274.951	0.15983992	1274.951	0.1630385	0.40378026
YR81	1636.692	0.2051912	1636.692	0.19799957	0.44497143
YR82	1630.824	0.20445553	1630.824	0.1974723	0.44437856
YR83	1639.576	0.20555276	1639.576	0.19825824	0.44526199
MA1	71.731	0.00899288	71.731	0.01081978	0.10401815
MA2	2234.272	0.28010948	2234.272	0.24481449	0.49478732
MA3B	1938.266	0.24299937	1938.266	0.22332855	0.4725765
MA4	1862.988	0.23356181	1862.988	0.21733107	0.46618781
MA5	314.655	0.03944813	314.655	0.04600342	0.21448407
ROTTER	93217.4667	11.68662382	1134671.7315	6.89106011	2.62508288
VEAPANL	0	0	0	0	0
VEAPLN	0	0	0	0	0
TMSHS	27322.612	3.42542122	118589.87	3.80493382	1.95062396
TMSHSQ	118589.87	14.86754842	3352907.51	241.97364935	15.55550222
TMSHSCB	599048.296	75.10236367	129692646.23	12892.3444826	113.54446038
TMSQ	0	0	0	0	0
TCSQ	0	0	0	0	0
INMIL	0	0	0	0	0
TM0	0	0	0	0	0
TMLN	0	0	0	0	0
TMDUM	0	0	0	0	0
TCLN	0	0	0	0	0
TCDUM	0	0	0	0	0
HSD20	6675.439	0.83689621	6675.439	0.16572137	0.4070889
HEALTH	492.923	0.06179749	492.923	0.07038989	0.26531094
LIT	18017.169	2.25880282	47036.737	0.96491703	0.98230191
ED20	93465.97	11.71777854	1101152.388	0.90393458	0.95075474
NODEP	2108.969	0.26440031	3748.343	0.48565159	0.69688707
MSP	3063.969	0.38412815	3063.969	0.28721648	0.53592581
SIBLING	27240.07	3.41507297	128144.398	5.34514022	2.31195593
HISP	415.922	0.05214392	415.922	0.06000521	0.2449596

TABLE 8A DESCRIPTIVE STATISTICS FOR WOMEN'S CIVILIAN SAMPLE (SELECTIVITY MODEL) (FIGURE 8)

VARIABLE	SUM	MEAN	UNCORRECTED	VARIANCE	STD DEVIATION
BLACK	779.841	0.09776825	779.841	0.10709244	0.32724981
SOUTH	2600.809	0.32606203	2600.809	0.26678599	0.5165133
CCITY	3243.633	0.40665253	3243.633	0.29293781	0.5412373
SUBURB	2652.042	0.33248508	2652.042	0.26944864	0.51908443
LMBDFCLM	4414.2003073	0.55340593	2776.1175329	0.05072647	0.22522538
LMBDF100	1135.8069725	0.14239551	270.86730444	0.01661088	0.12888321

TABLE 9A POST HIGH SCHOOL CHOICE MODEL (LOW QUALITY YOUNG MEN)

RESPONSE: MACXY		RESPONSE LEVELS (R)=	3
WEIGHT VARIABLE: SMWGT		POPULATIONS (S)=	1959
DATA SET: LOQ		TOTAL FREQUENCY (N)=	1764
		OBSERVATIONS (OBS)=	1977

ANALYSIS OF INDIVIDUAL PARAMETERS

THE ODD NUMBERED PARAMETER ASSOCIATED WITH EACH EXPLANATORY VARIABLE REFERS TO THE MILITARY - CIVILIAN CHOICE CONTRAST AND THE EVEN NUMBERED PARAMETER REFERS TO THE COLLEGE - CIVILIAN CONTRAST

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-1.01571	4.68432	0.05	0.8283
	2	-78.4127	3431.44	0.00	0.9818
DTBRTHY	3	-.092568	.0784096	1.39	0.2378
	4	.0181406	.0998549	0.03	0.8558
HSD20	5	-.240616	0.342518	0.49	0.4824
	6	15.6922	662.412	0.00	0.9811
ROTTER	7	.0577786	.0482379	1.43	0.2310
	8	0.180001	.0628157	8.21	0.0042
MA1	9	-19.9532	8715.16	0.00	0.9982
	10	.	.	.	.
MA2	11	0.931263	0.492126	3.58	0.0584
	12	-2.51254	1965.89	0.00	0.9990
MA3B	13	0.484823	0.4149	1.37	0.2426
	14	-1.74314	1404.66	0.00	0.9990
MA4	15	-.341543	0.288911	1.40	0.2371
	16	-2.92331	0.484682	36.38	0.0001
MA5	17	-2.19271	0.588062	13.90	0.0002
	18	-18.4301	1066.35	0.00	0.9862
LIT	19	0.374175	0.13114	8.14	0.0043
	20	0.703165	0.214937	10.70	0.0011
HEALTH	21	-.188584	0.472529	0.16	0.6898
	22	-17.5313	1716.73	0.00	0.9919

TABLE 9A POST HIGH SCHOOL CHOICE MODEL (LOW QUALITY YOUNG MEN)

SOUTHR	23	-.128154	0.229594	0.31	0.5767
	24	-.238389	0.339106	0.49	0.4821
NOMAN14	25	0.543531	0.305048	3.17	0.0748
	26	0.804795	0.399128	4.07	0.0438
ED20	27	0.338814	0.153834	4.85	0.0276
	28	4.74958	280.884	0.00	0.9865
SIBLING	29	.0101347	.0466297	0.05	0.8279
	30	-.070827	.0729489	0.94	0.3316
HISP	31	0.823793	0.475358	3.00	0.0831
	32	-2.00966	1.71008	1.38	0.2399
BLACK	33	1.37194	0.31402	19.09	0.0001
	34	1.87007	0.450764	17.21	0.0001
CCITY	35	-3.95957	0.465229	72.44	0.0001
	36	-1.37429	0.352706	15.18	0.0001
SUBURB	37	-4.46044	0.671651	44.10	0.0001
	38	-.940821	0.330148	8.12	0.0044

TABLE 9B POST HIGH SCHOOL CHOICE MODEL (HIGH QUALITY YOUNG MEN)

RESPONSE: MACXY		RESPONSE LEVELS (R)=	3
WEIGHT VARIABLE: SMWGT		POPULATIONS (S)=	1345
DATA SET: HIQ		TOTAL FREQUENCY (N)=	1866
		OBSERVATIONS (OBS)=	1474

ANALYSIS OF INDIVIDUAL PARAMETERS

THE ODD NUMBERED PARAMETER ASSOCIATED WITH EACH EXPLANATORY VARIABLE REFERS TO THE MILITARY - CIVILIAN CHOICE CONTRAST AND THE EVEN NUMBERED PARAMETER REFERS TO THE COLLEGE - CIVILIAN CONTRAST

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	.0293252	4.47545	0.00	0.9948
	2	-7.3661	2.48562	8.78	0.0030
DTBRTHY	3	-.050139	.0760301	0.43	0.5096
	4	.0530638	0.040567	1.71	0.1909
ROTLER	5	.0393437	.0451175	0.76	0.3832
	6	0.121533	.0252973	23.08	0.0001
MA1	7	.0741037	0.530398	0.02	0.8889
	8	3.10184	0.251344	152.30	0.0001
MA2	9	-.334297	0.230104	2.11	0.1463
	10	1.67394	0.181543	85.02	0.0001
LIT	11	0.520683	0.160633	10.51	0.0012
	12	0.264414	.0974886	7.36	0.0067
HEALTH	13	-.723105	0.605351	1.43	0.2323
	14	-.539942	0.348351	2.40	0.1211
SOUTHR	15	-.294667	0.242215	1.48	0.2238
	16	0.204349	0.141215	2.09	0.1479
NOMAN14	17	0.496517	0.361855	1.88	0.1700
	18	-.449931	0.230298	3.82	0.0507
SIBLING	19	0.064415	.0472576	1.86	0.1729
	20	-.150699	.0337969	19.88	0.0001
HI[illegible]	21	0.67828	0.59526	1.30	0.2545
	22	0.212763	0.356987	0.36	0.5512

TABLE 9B POST HIGH SCHOOL CHOICE MODEL (HIGH QUALITY YOUNG MEN)

BLACK	23	1.90059	0.41907	20.57	0.0001
	24	0.546729	0.335239	2.66	0.1029
CCITY	25	-3.71065	0.463226	64.17	0.0001
	26	0.205055	0.145751	1.98	0.1595
SUBURB	27	-4.72948	0.8691	29.61	0.0001
	28	0.192147	0.152186	1.59	0.2067

TABLE 9C SELECTION MODEL RESULTS FOR EARNINGS < 1000
LOW QUALITY (WORK BOUND) YOUNG MEN

LOGIT ANALYSIS

RESPONSE: WGT100		RESPONSE LEVELS (R)=	2
WEIGHT VARIABLE: SMWGT		POPULATIONS (S)=	9095
DATA SET: LOQ		TOTAL FREQUENCY (N)=	8376
		OBSERVATIONS (OBS)=	9233

ANALYSIS OF INDIVIDUAL PARAMETERS

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-1.39017	0.37494	13.75	0.0002
YR79	2	-.134772	0.143542	0.88	0.3478
YR80	3	-.173506	0.137405	1.59	0.2067
YR81	4	-.017488	0.130257	0.02	0.8932
YR82	5	0.113632	0.129149	0.77	0.3789
YR83	6	-.091337	0.13168	0.48	0.4879
VEAPANY	7	0.10459	0.249861	0.18	0.6755
JMIL	8	-1.72981	0.28071	37.97	0.0001
JCOL	9	0.300632	0.169784	3.14	0.0766
ENROLL	10	1.05622	.0995262	112.62	0.0001
ROTTER	11	-.043874	.0143348	9.37	0.0022
MA1	12	2.93211	0.524032	31.31	0.0001
MA2	13	-.086816	0.210715	0.17	0.6803
MA3B	14	0.589435	0.14608	16.28	0.0001
MA4	15	0.602093	0.104736	33.05	0.0001
MA5	16	1.29959	0.125535	107.17	0.0001
LIT	17	-.003502	.0364082	0.01	0.9234
HSD20	18	-.416024	.0926772	20.15	0.0001
HEALTH	19	1.23111	0.118261	108.37	0.0001
SOUTH	20	0.125576	.0363961	11.90	0.0006
NOMAN14	21	0.222947	0.086187	6.69	0.0097
ED20	22	-.028414	0.028489	0.99	0.3186

TABLE 9C SELECTION MODEL RESULTS FOR EARNINGS < 1000
LOW QUALITY (WORK BOUND) YOUNG MEN

SIBLING	23	-.056296	.0137912	16.66	0.0001
HISP	24	-.132409	0.133235	0.99	0.3203
BLACK	25	0.591119	.0870865	46.07	0.0001
CCITY	26	-.007295	.0818324	0.01	0.9290
SUBURB	27	-.213682	.0907461	5.54	0.0185

TABLE 9D SELECTION MODEL RESULTS FOR EARNINGS < 1000
HIGH QUALITY (COLLEGE BOUND) YOUNG MEN

LOGIT ANALYSIS

RESPONSE: WGT100		RESPONSE LEVELS (R)=	2
WEIGHT VARIABLE: SMWGT		POPULATIONS (S)=	6545
DATA SET: HIQ		TOTAL FREQUENCY (N)=	8987
		OBSERVATIONS (OBS)=	7144

ANALYSIS OF INDIVIDUAL PARAMETERS

EFFECT	PARAMETER	ESTIMATE	STANDARD ERROR	CHI-SQUARE	PROB
INTERCEPT	1	-1.19762	0.811024	2.18	0.1398
YR79	2	-.051054	0.152388	0.11	0.7376
YR80	3	0.063473	0.145989	0.19	0.6637
YR81	4	.0764515	0.140516	0.30	0.5864
YR82	5	0.205894	0.140316	2.15	0.1423
YR83	6	-.017803	0.146127	0.01	0.9030
VEAPANY	7	0.244925	0.202224	1.47	0.2258
JMIL	8	-.948887	0.257903	13.54	0.0002
JCOL	9	.0833975	.0885047	0.89	0.3460
ENROLL	10	1.23872	.0881226	197.59	0.0001
ROTTER	11	.0288532	.0161704	3.18	0.0744
MA1	12	-.636688	0.14151	20.24	0.0001
MA2	13	-.744179	.0914185	66.27	0.0001
MA3B	14	.	.	.	.
MA4	15	.	.	.	.
MA5	16	.	.	.	.
LIT	17	-.298341	.0525455	32.24	0.0001
HSD20	18	.	.	.	.
HEALTH	19	0.690284	0.168767	16.73	0.0001
SOUTH	20	.0039651	0.0409	0.01	0.9228
NOMAN14	21	0.157077	0.133544	1.38	0.2395
ED20	22	-.062232	.0633179	0.97	0.3257

TABLE 9D SELECTION MODEL RESULTS FOR EARNINGS < 1000
HIGH QUALITY (COLLEGE BOUND) YOUNG MEN

SIBLING	23	-.013573	.0191311	0.50	0.4780
HISP	24	-.027304	0.186306	0.02	0.8835
BLACK	25	-.083439	0.17359	0.23	0.6308
CCITY	26	.0690103	.0916281	0.57	0.4514
SUBURB	27	-.198298	0.100582	3.89	0.0487

TABLE 9E DESCRIPTIVE STATISTICS FOR BRANCH & MILITARY OCCUPATION EFFECTS MODEL (LOW QUALITY)

VARIABLE	SUM	MEAN	UNCORRECTED SS	VARIANCE	STD DEVIATION
WSER	246602.7335	1279.763425	410268374.6	180677.8924	425.0622218
MA2	26.707	0.138598	26.7	0.0439	0.2095318
MA3B	88.518	0.459371	88.5	0.0913	0.3022038
MA4	66.535	0.345288	66.5	0.0831	0.2883264
MA5	3.452	0.017914	3.5	0.0065	0.0804[illegible]49
ENROLL	31.004	0.160898	31	0.0496	0.2228182
LMBDAMIL	384.7988	1.996943	901	0.2529	0.502931
LMBDA100	14.6321	0.075934	1.4	0.0006	0.0237269
YR79	8.156	0.042326	8.2	0.0149	0.1220905
YR80	17.548	0.091067	17.5	0.0304	0.1744674
YR81	37.333	0.193742	37.3	0.0574	0.2396722
YR82	54.144	0.280984	54.1	0.0743	0.2725704
YR83	74.351	0.38585	74.4	0.0871	0.295199
ROTTER	2297.278	11.921897	28409.6	1.9499	1.3963752
TMSHS	1010.786	5.24555	5712.6	0.7834	0.8850708
TMSHSCB	34378.364	178.409105	10089472.9	7549.7323	86.8891955
TMSQ	1290.983	6.699653	17966.5	17.7813	4.2167832
TMLN	437.889	2.272458	1291	0.5647	0.75146
HEALTH	1.772	0.009196	1.8	0.0034	0.0578842
LIT	441.772	2.292609	1149.5	0.2608	0.5106364
SIBLING	715.567	3.713489	3851.1	2.2783	1.5094037
HISP	15.096	0.078342	15.1	0.0266	0.1629485
BLACK	38.261	0.198558	38.3	0.0585	0.241907
SOUTH	66.157	0.343327	66.2	0.0829	0.2879366
CCITY	76.318	0.396058	76.3	0.088	0.2965825
SUBURB	36.696	0.190437	36.7	0.0567	0.2381053
MARIN	37.186	0.19298	37.2	0.0573	0.239313
NAVY	35.923	0.186425	35.9	0.0558	0.2361671
AIRF	13.044	0.067693	13	0.0232	0.1523419
TECH	56.116	0.291218	56.1	0.0759	0.2755079
OCC_OTHR	65.567	0.340265	65.6	0.0826	0.2873173
INTERCEP	192.694	1	192.7	0	0

TABLE 9F DESCRIPTIVE STATISTICS FOR BRANCH & MILITARY OCCUPATION EFFECTS MODEL (HIGH QUALITY)

VARIABLE	SUM	MEAN	UNCORRECTED SS	VARIANCE	STD DEVIATION
WSER	149425.5009	1292.630503	270592882.7	204870.1649	452.6258553
MA1	12.089	0.104578	12.1	0.0286	0.1692245
MA2	77.308	0.668766	77.3	0.0677	0.2602758
ENROLL	38.856	0.33613	38.9	0.0682	0.2612309
LMBDAMIL	298.205	2.579672	855.4	0.228	0.4777457
LMBDA100	11.9452	0.103334	1.8	0.0015	0.0386745
YR79	2.77	0.023962	2.8	0.0072	0.0815721
YR80	13.337	0.115374	13.3	0.0312	0.1766701
YR81	24.31	0.210298	24.3	0.0508	0.2253607
YR82	32.929	0.284858	32.9	0.0623	0.2495971
ROTTER	1448.9308	12.53422	18689	1.3962	1.1815901
TMSHS	583.126	5.04443	3100	0.4192	0.6474325
TMSHSCB	17232.238	149.070382	3617326.1	2773.8355	52.6672143
TMSQ	621.424	5.375733	6372.5	8.0209	2.8321129
TMLN	238.76	2.065434	621.4	0.3394	0.5825529
HEALTH	1.856	0.016056	1.9	0.0048	0.069507
LIT	299.54	2.591221	820.3	0.1166	0.3415091
SIBLING	366.716	3.172339	1703.5	1.4289	1.1953621
HISP	0.989	0.008556	1	0.0026	0.0509315
BLACK	8.094	0.070019	8.1	0.0199	0.1411149
SOUTH	37.795	0.326952	37.8	0.0673	0.2594145
CCITY	37.859	0.327506	37.9	0.0674	0.2595273
SUBURB	38.55	0.333483	38.5	0.068	0.2607185
MARIN	22.433	0.19406	22.4	0.0478	0.2187001
NAVY	28.457	0.246172	28.5	0.0568	0.2382236
AIRF	27.261	0.235826	27.3	0.0551	0.2347584
TECH	64.651	0.559274	64.7	0.0754	0.2745528
OCC_OTHR	35.046	0.303171	35	0.0646	0.254177
INTERCEP	115.598	1	115.6	0	0

TABLE 9G REGRESSION RESULTS FOR BRANCH AND MILITARY OCCUPATION EFFECTS (LOW QUALITY)

MODEL: D
DEP VARIABLE: WSER

ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	30	20125489.23	670849.64	4.445	0.0001
ERROR	494	74549726.40	150910.38		
C TOTAL	524	94675215.63			

ROOT MSE	388.4718	R-SQUARE	0.2126
DEP MEAN	1279.763	ADJ R-SQ	0.1648
C.V.	30.35497		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	898.77462	889.89565	1.010	0.3130
TECH	1	111.54201	90.36312437	1.234	0.2176
OCC_OTHR	1	57.22224799	82.85782690	0.691	0.4901
MARIN	1	149.66315	86.26535769	1.735	0.0834
NAVY	1	55.12134684	92.60632175	0.595	0.5520
AIRF	1	127.45834	136.01281	0.937	0.3492
MA2	1	-186.54954	197.40546	-0.945	0.3451
MA3B	1	54.92375832	184.58966	0.298	0.7662
MA4	1	47.62940163	211.92843	0.225	0.8223
MA5	1	-110.52330	497.92636	-0.222	0.8244
ENROLL	1	-500.56389	178.87276	-2.798	0.0053
LMBDAMIL	1	-216.30357	332.95224	-0.650	0.5162
LMBDA100	1	3479.55345	2195.72089	1.585	0.1137
YR79	1	420.18187	400.93105	1.048	0.2951
YR80	1	-322.64274	391.38593	-0.824	0.4101
YR81	1	-121.62950	388.70288	-0.313	0.7545

TABLE 9G REGRESSION RESULTS FOR BRANCH AND MILITARY OCCUPATION EFFECTS (LOW QUALITY)

YR82	1	-249.81868	394.56731	-0.633	0.5269
YR83	1	-483.17704	397.78850	-1.215	0.2251
ROTTER	1	-7.61991292	18.22536674	-0.418	0.6761
TMSHS	1	-25.34848753	77.93404126	-0.325	0.7451
TMSHSCB	1	0.85496910	0.69597533	1.228	0.2199
TMSQ	1	-4.29105222	18.60894594	-0.231	0.8177
TMLN	1	203.99478	107.97559	1.889	0.0594
HEALTH	1	-398.27726	361.52599	-1.102	0.2711
LIT	1	125.48999	72.32909912	1.735	0.0834
SIBLING	1	9.45912933	13.09176379	0.723	0.4703
HISP	1	73.17175595	202.67961	0.361	0.7182
BLACK	1	-407.89103	204.07114	-1.999	0.0462
SOUTH	1	162.38115	68.81140222	2.360	0.0187
CCITY	1	157.07743	459.35326	0.342	0.7325
SUBURB	1	430.88277	572.48501	0.753	0.4520

TABLE 9H REGRESSION RESULTS FOR BRANCH AND MILITARY OCCUPATION EFFECTS (HIGH QUALITY)

MODEL: D
DEP VARIABLE: WSER

ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	27	22487472.42	832869.35	5.320	0.0001
ERROR	351	54953449.90	156562.54		
C TOTAL	378	77440922.32			

ROOT MSE	395.6798	R-SQUARE	0.2904
DEP MEAN	1292.631	ADJ R-SQ	0.2358
C.V.	30.61044		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	-163.86219	859.46085	-0.191	0.8489
TECH	1	-121.87091	123.80189	-0.984	0.3256
OCC_OTHR	1	-317.22918	138.83148	-2.285	0.0229
MARIN	1	74.75457570	124.14250	0.602	0.5475
NAVY	1	175.91967	121.87638	1.443	0.1498
AIRF	1	296.38240	124.24217	2.386	0.0176
MA1	1	199.16820	192.36383	1.035	0.3012
MA2	1	30.88894959	96.81225106	0.319	0.7499
ENROLL	1	-753.32837	311.99593	-2.415	0.0163
LMBDAMIL	1	286.10636	285.12127	1.003	0.3163
LMBDA100	1	2550.56010	2276.26296	1.121	0.2633
YR79	1	-95.37854370	340.90764	-0.280	0.7798
YR80	1	-43.51698495	172.59901	-0.252	0.8011
YR81	1	-12.78499697	128.55045	-0.099	0.9208
YR82	1	-109.93562	117.93780	-0.932	0.3519
ROTTER	1	32.77763261	19.67716969	1.666	0.0967

TABLE 9H REGRESSION RESULTS FOR BRANCH AND MILITARY OCCUPATION EFFECTS
(HIGH QUALITY)

TMSHS	1	-47.40470355	171.71360	-0.276	0.7827
TMSHSCB	1	2.02946886	2.03745271	0.996	0.3199
TMSQ	1	-119.39938	39.13336287	-3.051	0.0025
TMLN	1	560.76693	195.59220	2.867	0.0044
HEALTH	1	-978.14414	435.92923	-2.244	0.0255
LIT	1	-29.63811897	72.54391154	-0.409	0.6831
SIBLING	1	12.73871124	28.59168823	0.446	0.6562
HISP	1	80.35108755	414.42240	0.194	0.8464
BLACK	1	87.52964088	264.04647	0.331	0.7405
SOUTH	1	-299.09973	88.16364819	-3.393	0.0008
CCITY	1	-262.97726	548.84706	-0.479	0.6321
SUBURB	1	-50.62012417	498.03624	-0.102	0.9191

APPENDIX B:

LITERATURE REVIEW

LITERATURE REVIEW

Introduction.

The question of military service as a "bridge" to civilian opportunities most likely goes back to the beginning of armies. Service in the Roman Legions could sometimes lead to lucrative civilian opportunities. During the Feudal Period, it was possible for serfs to improve their post-battle lot through excellent service such as uncommon bravery or outstanding leadership and organizational skills. Even modern day leaders point to stints of military service to make themselves more attractive to the electorate. However, our focus is on the degree that service in the armed forces can enhance the human capital of the average individual who may have only a relatively short enlistment period.

Interest in the question of the contribution of military service to the development of human capital of the average individual rose sharply toward the close of WW II, with the impending demobilization of millions of soldiers and sailors. Our earliest reference to the applicability of armed forces experience and its possible advantages in civilian life came from the classic work *The American Soldier* by Stouffer *et al.* in which they refer to the expectations of soldiers leaving the Army at the close of WW II.

> In considering the psychological climate in which the soldier viewed his personal future, one must remember that, except for those seriously disabled, the Army experience was not necessarily a handicap to a future career and could be conceived as advantageous ... in terms of intrinsic values of Army experience in teaching something which might be useful in civilian life. (v II, p. 609)

With respect to such expectations, the authors commented that "...there is little available data adding up the pro's and con's of Army experience." (Vol. II, p. 609) However, the authors went on to add that, "There can be no doubt that many men learned new skills in the Army or acquired useful experience in leadership." (Vol. II, p. 610)

The research group did extensive surveys of soldiers in various units at both oversea and U. S. locations. After analyzing the data, they concluded,

> What the average soldiers wanted in their Army jobs is first analyzed inferentially from a study of branch preferences....(1) desire for status in the Army--informal as well as formal; (2) desire to maximize experience which would be useful in civilian life after the war; (3) desire to minimize the chances of death and injury; and (4) desire to minimize deprivations from civilian comforts. (VI, p. 361)

The question continued to obtain even after the demobilization period due to the requirement to sustain large standing military forces. The force structure was and is such that there is no way that the armed forces can retain as careerists all those who sign up for an initial enlistment. There was at least some concern during the period after the close of WW II to the advent of the all-volunteer force that enlistments could be induced to the extent that service was seen as a bridge either to civilian employment opportunity or to career status as a soldier, sailor, or airman. Even though there was a draft, there was still the endeavor to induce the maximum number to join through recruiting programs in order to have to draft only the minimum number. Further, for those drafted, there was concern that they gain something from service -- either some usable skill in the private sector, or an opportunity to improve their human capital array by attending some post-service training program or attending college, both partially funded by the G.I. Bill.

With the advent of the decision to shift to an all-voluntary armed force, the question again became salient as the probability of recruiting the required numbers depended upon the perceived benefits of not only the wage rate but also in part to the application of skills learned in the service to the private sector. However, the decision to adopt a voluntary force versus maintaining a mixed force of volunteers and conscripts, discounted the impact, if any, of the utility of skill training provided within the armed forces. Instead, the Gates Commission relied upon a higher wage rate, sufficient to attract the required number of volunteers regardless of perceived usefulness of service-provided training.

Finally, the question was asked again as the services experienced difficulty in attracting the required number and quality of volunteers. The issue arose from the controversy of the possibility of the armed forces making false advertising claims concerning the applicability of armed forces skill training to the labor market (see the *Wall Street Journal* (1985) article for example.) Among the varying reasons for joining the Army, the top two categories, similar for both men and women, were money for college and skill training (Benedict, 1987). Thus, the existence of a veterans' premium and the applicability of Army-furnished skill training to civilian occupations are two critical issues with highly important policy implications.

Approach.

We conducted an exhaustive literature search in four academic disciplines -- economics/econometrics, psychology, sociology, and organization behavior/management. Over 5000 books, journals, and other publications were searched for articles on the areas of interest.

Appendix IA contains a listing of the journals by by the four disciplines listed above.

There are over 200 references with varying degrees of relevance. Our preliminary review resulted in the identification of several issues relevant to the research project. Findings from other research efforts depended upon several considerations.

• The time period under review. It is quite possible that different era veterans had different results.

• The data base used for the analysis. Certain data bases were highly limiting. Others allowed for a life-cycle approach.

• The methodology employed in the analysis. Some studies used a cross-sectional approach. Others used a comparison at two points in time. Still others used a longitudinal approach for a specific number of years. Also with respect to methodology, issues were raised concerning the following:

•• Selectivity Bias -- does the decision to join constitute a self-selection process that cannot be accounted by normal analytical techniques?

•• Screening Effect -- does service in the armed forces with its concomitant requirements for initial entry testing (both physical and mental) plus its standards for the continuation of service through the first term constitute a special selection effect?

•• Screening Effect, Perceived -- do employers perceive a screening effect and are thus more likely to hire veterans?

•• Earnings distribution truncation, especially with respect to women.

•• Cohort bias -- a suggestion that older cohorts earn less.

•• Determinants of earnings over the life cycle -- the relevant variables to be included in any analysis.

• Dependent Variable Selection -- should we use hourly rates of pay at a point in time, wages and salaries for a selected time period, measures of job congruence between training and employment, or more than one, or some other dependent variable.

• The variables used for control purposes in the analysis. Some used only age and education. Others used a wide array to include a surrogate IQ measure.

• Classification of Training -- general or specific.

• Type of General Training (e.g., Electronic Repairman) Received in the Service.

• The sub-population of veterans studied. Differing conclusions were made depending upon the following:

•• One termers

•• Retirees

•• Males

•• Females

•• Minorities

•• High School Graduates

•• Non-high School Graduates

•• College Oriented

•• Work Oriented

•• Married

•• Unmarried

•• Healthy

•• Unhealthy

For clarity of understanding, we divided the issues into four basic categories as follows.

1. Veterans' premium/penalty. This is the primary question that involves a comparison of those who served with comparable others who did not, and the resulting differences if any in income/wage rate/etc.

2. Skill Transfer. Do skills provided by the Army transfer to jobs in the labor market? This question involves less of a comparison and focuses more on the issue of direct transfer.

3. General considerations and concerns on research about

   a. Females.

   b. Minorities.

   c. Use of the NLS data.

4. Methodological considerations.

Appendix IB contains a consolidated listing of references.

The next section contains an overview/summary of each issue. The last issue, methodological considerations, leads us to consider the special methodological techniques needed to advance the knowledge beyond what we now know.

Issues.

Veterans' Premium/Penalty

The key notion of the existence of a veterans' premium is couched in the context of Becker's (1964) general theory of investment in human capital. It is interesting to note that Becker used the military as an example of an individual acquiring human capital. We will use Becker's definition of general and specific training and provide extracts of his discussion with respect to the military.

> General Training. General training is useful in many firms besides those providing it; for example, a machinist trained in the army finds his skills of value in steel and aircraft firms, and a doctor trained (interned) at one hospital finds his skills useful at other hospitals. (p. 12) Completely general training increases the marginal productivity of trainees by exactly the same amount in the firms providing the training as in other firms. (p. 18)

With respect to general training, Becker examined the military during the decade of the 1950's and used it as an example of an organization that both pays for training costs and does not pay market wages after training. As a result it has an easy access to "students" and a difficult time keeping its "graduates."

> Indeed, its graduates make up the predominant part of the supply in several civilian occupations. For example, well over 90 per cent of United States commercial airline pilots received much of their training in the armed forces. (p. 17)

Becker's definition of specific training is described as follows:

> Training that increases productivity more in firms providing it will be called specific training. Completely specific training can be defined as training that has no effect on the productivity of trainees that would be useful in other firms. Much on-the-job training is neither completely specific nor completely general but increases productivity more in the firms providing it and falls within the definition of specific training. The rest increases productivity by at least as much in other firms and falls within a definition of general training. (p. 18) The

military offers some forms of training that are extremely useful in the civilian sector, as already noted, and others that are only of minor use to civilians, i.e., astronauts, fighter pilots, and missile men. Such training falls within the scope of specific training because productivity is raised in the military but not (much) elsewhere. (p. 19)

Based upon the theory of general investment in human capital, one would expect that some service members receive both general and specific training. The varying ratios of both would depend upon the specific skill in which they are trained. Further, when compared to some similar other, whether or not there was a veteran premium would depend upon whether the similar other received an amount of general training equal to, more than, or less than the service member. Thus, the question is not whether or not the armed forces provides general training. Clearly, it can do so. Rather the question is for whom, to what degree, and what are the advantages, if any, of Army-provided general training.

As indicated above, the earliest concern we can find for the notion that the Army provides useful civilian skill training was related to demobilization toward the end of WW II, in which the researchers speculated as to the possibility of Army experience would facilitate (or, using a term that would be developed later, act as a "bridge" to) civilian employment (Stouffer, *et.al.*, V. II, 1949).

Broom and Smith (1963) introduced the notion of a "bridging occupation" after studying various ideas concerning social and occupational mobility, primarily in Great Britain. In their review of the literature, they concluded that a great deal was known about vertical movement between generations and the changing statuses of individuals during their work lives; however, they suggested very little was known about the significance of horizontal movement between occupational clusters, e.g., manufacturing, public administration, transport, arts and entertainment. They defined a bridging occupation as one which provides through work experience, the conditions and opportunities for movement from one occupation to another. Further, they listed five attributes of the ideal case -- resocialization (change perspective, communicate new values, change life style, suggest alternative career lines), independency (cutting the ties and commitments that would restrict mobility), health, access to information (or individuals that may be of help), and financial competence (included would be such things a guaranteed personal loans for business or even for college or other improvement programs). Broom and Smith go to illustrate two bridging occupations -- domestic service and military service. However, they qualify the latter as depending upon two factors -- the place given to military activities in the social order, and the relation between military and civilian skills. Finally, they suggest that in modern societies, the bridge between military service and the civilian labor market has been strengthened because of four major trends, (1) interrelations between war-making technology and industrial technology, (2) growing similarity between military and civil administration, (3) increasing demand for high-level manpower, and (4) the recognition that ex-servicemen should be assisted to find meaningful employment after service.

Lopreato and Poston (1977) in examining the U. S. armed forces, provide an explanation of the "bridging environment" or occupation whereby an individual may obtain higher status. In essence, a bridging occupation is one that provides skills and advantages that facilitate entrance into better paid and higher prestige endeavors. They went on to suggest three broad categories whereby military service might enhance opportunities for veterans in the civilian labor market. First, there may be acquisition of additional education and/or general vocational training. Second, forced and integrated living with diverse others may have a positive effect on an individuals aspirations, especially for those who may come from a segregated or disadvantaged background. Third, the military provides experiences for individuals in coping with bureaucratic structures similar to those they may encounter in the civilian labor market.

Browning *et al.* (1973), based upon 1960 census data, suggested a definite economic advantage to veterans in general and for both blacks and Mexican Americans in particular.

Further, they found that the advantages were greatest in those occupations where one would hypothesize the bridging functions would be most influential.

The Era Prior to Vietnam.

Fredland and Little (1985) examined the socioeconomic status of WW II veterans through use of NLS data, in order to conduct an empirical test of the bridging hypothesis. As indicated above, such benefits could come from both general and specific training -- an increase in one's ability to cope with new challenges by being on one's own in the midst of diversity and a demanding organizational structure, and, by receiving training that may either be a "stepping stone" to a civilian job or training that is directly related to some civilian occupation. The data base was the NLS "older male cohort" that included men aged 45 to 59 years in 1966. Thus, most veterans in their sample would have been discharged for about 20 years. Dependent variables included both wages and the Duncan Index of socioeconomic status (a weighted index of the subject's education and earnings for his/her occupation on a scale of 1-100.) Their conclusions were that there appeared to be advantages for WW II veterans; however, they suggested the bridging hypothesis was overly broad. The service effect was different, depending upon race. Although both groups benefited, black veterans benefited less, but gained an advantage from employment in government which the authors indicate may be associated with veterans' preference in governmental hiring. Whereas both black and white veterans are more likely to be employed by the government, such employment makes no difference for whites, but adds 25% to earnings and approximately 6 points to the Duncan Index for blacks.

Nelson and Armington (1970) found a positive differential in earnings for veterans between the ages of 25-34 years. Their findings were based upon 1960 census data. Further, they found that the differential ranged from two to over ten percent, but decreased with age.

Interestingly, the differentials were the greatest for those with less human capital (high school drop-outs and men in low skill occupations.)

In contrast to Nelson and Armington (1970), Mason (1970) concluded there was no "veterans' premium." However, Mason (1970) used the results from a 1968 Department of Defense survey taken at the ten month after discharge point. In fact, one could argue (as do Daymont and Andrisani, 1986, discussed later) that frictional unemployment after discharge may well depress the initial earnings of veterans.

Also writing in the early seventies were several researchers examining the feasibility and desirability of eliminating the draft. A fairly significant consensus emerged around the theme that military service and therefore the draft policy, constituted a "tax" on those drafted because of not only the lower wages paid by the military, but also because of the negative effect of service on subsequent civilian earnings (Bailey and Cargill, 1969; Davis and Palomba, 1968; Hanson and Weisbrod, 1967; Miller and Tollison, 1971; Oi, 1967; Sjaastad and Hanson, 1970). Miller and Tollison's research was fairly typical of the "tax" approach and yielded results reasonably commensurate with the other findings. Specifically, Miller and Tollison found that the "conscription tax" varied by amount of human capital -- zero for those with only an elementary school education to over $9000 (in 1970 dollars) for those with a college education. Kassing (1970) writing for the President's Commission of the All Volunteer Force did no go as far as others, but did unequivocally conclude that military service did not increase the earnings of veterans relative to what their respective incomes would have been if they had remained in civilian life. Kassing goes on to suggest if there is any veterans' effect on wages, it is negative.

Cutright (1974) compared civilian earnings in 1964, using Social Security data files, of former draftees who were given Selective Service exams in the early 1950s and found no support for the bridging hypothesis for white or minority men. Cutright has been criticized for focusing on a single cohort with small subgroup samples with small differences (Poston, 1979).

Little and Fredland (1979) used the mature men's cohort of the NLS, which allowed for the selection of a broader set of variables than was heretofore possible, to investigate the bridging hypothesis notion. They concluded that service in the armed forces appears to be a significant training variable in the human capital sense. They contrast their findings with earlier findings that did not show a veterans' premium and suggested earlier studies did not have the advantage of panel data and therefore could not control for critical variables such as job tenure, and important consideration when comparing earnings, especially for the more recent veterans. Veteran status was shown to result in a 5-10% earnings advantage for whites and a 13 -15% advantage for blacks.

De Tray (1980) also used the NLS data set, the young mens' cohort (men aged 14 -24 in 1966.) He had access to the data collected from 1966 to 1975. His findings indicate that when controls for such characteristics as age and education are applied, the veterans' premium may be as high as 10%. De Tray further provides insight into why other researchers might not find a veterans' premium by suggesting that sample composition effects can hide true veteran/nonveteran income differences. De Tray cautions that the observed veterans' premium may not unequivocally be as a result of service provided experience but instead, could be due to other factors, such as the filtering effect of service selection or the certification effect of a completed service tour of duty.

De Tray (1982) followed up his earlier research to more thoroughly examine the possible explanations for his earlier findings. He arranged the several possible explanations under one of two headings (1) human capital investments, and (2) screening effects. He basically concluded that the picture which emerged from his analysis was that veteran status emerged as a valuable screening device.

Findings Including the Vietnam Era.

Villemez and Kasarda (1976) used 1970 Census data and determined there was an earnings advantage for male veterans in general, but that it varied depending upon the time period in which service occurred. That is, WW II veterans had the greatest positive differential; Korean veterans had a smaller, but positive advantage; and, Vietnam veterans had a negative differential.

Lopreato and Poston (1977) also used the 1970 Census data and found that black veterans were better able than black nonveterans to convert their educational attainment into earnings. Further, black veterans have an earnings advantage when compared to their nonveteran counterparts, adding further support to the bridging hypothesis.

Kohen and Shields (1977) used the younger men's cohort of the NLS data set to conduct separate investigations for white and black men on the impact of service during the Vietnam era on subsequent earnings. Earnings was used as the dependent variable with a host of control variables including region of residence, urbanicity, and ability. Their results were ambiguous, although they did suggest that there may have been a sightly greater payoff to black veterans than to their white counterparts.

Martindale and Poston (1979) investigated the impact of different eras on veterans, with particular attention to the hypothesis that black Vietnam veterans are especially disadvantaged when compared with their nonveteran counterparts. They used Public Use Samples from the 1970 Census. Contrary to Villemez and Kasarda's (1976) results, Martindale and Poston's results indicated that minority veterans had adjusted earnings differentials over nonveterans. Further the differentials held across wartime eras; however, the effect for the Vietnam era was less pronounced. On the other hand, results for white veterans were similar to those of Villemez and Kasarda (1976) -- a positive differential for WW II and Korean War veterans, but a negative differential for Vietnam War veterans.

Stinson (1979) reported that the overall employment situation of Vietnam veterans had much improved by 1978; however, they still had higher unemployment rates than their nonveteran counterparts.

Poston (1979) investigated military service as a lifecycle contingency variable with respect to earnings, for blacks, Mexican Americans, and Anglos, using Public Use Samples of the 1970 Census, and focusing on men in the Southwestern United States. Their comparisons showed that minority men obtain more for their characteristics than comparably defined nonveterans; but, the opposite was true for whites. They suggested that their research did support the notion of the armed forces as a bridging environment, but only for minorities.

Schwartz (1986) used population survey data for the years 1967 and 1976 in order to compare the earnings of Vietnam veterans to those of Korean veterans, relative to nonveterans at similar points in their work history -- 12 and 16 years after separation. For both years, unadjusted average annual earnings for veterans and nonveterans were similar. However, after controlling for such factors as education, age, race, and marital status, Vietnam veterans were worse off in that their rate of return per year of education was significantly lower. Korean veterans were indistinguishable from nonveterans.

Berger and Hirsch (1983 and 1985) examined the civilian earnings of Vietnam veterans and the role of veteran status as a screening device during the Vietnam era. With respect to earnings, they found that Vietnam-era veterans exhibited longitudinal profiles that were initially lower but later became steeper than those of nonveterans. They further found that only those with less than a high school education consistently realized a veterans' premium. They also found little evidence supporting the idea of veteran status as a positive screen.

The most comprehensive look at the veterans' premium issue came from the research of Daymont and Andrisani (1986). They used data from two cohorts of the NLS to examine the relative differences in earnings for male veterans and nonveterans. The first cohort was comprised of over 4000 young men between the ages of 22 and 26 in 1984 who were interviewed annually since 1979. The second was comprised of over 5000 prime age men ages 29 to 39 in 1981 and who were interviewed annually or biennially, 12 times since 1966. Some of the key findings included the following:

- There was a significant earnings advantage for young men while in the military relative to their civilian counterparts, mainly due to the valuation of "room and board" benefits while in the service.

- The earnings of servicemen drop substantially at the time of separation, especially for whites.

- The earnings of former servicemen rise rapidly and overtake the earnings of their civilian counterparts within one to four years after separation. The "catch-up" is much more rapid for minorities.

- Once earnings of veterans overtake the earnings of those who never served, the higher earnings of veterans persisted until the end of the period covered by the study, approximately 19 years after high school.

- The economic returns to military service are greater for minorities than for whites.

- Only small differences existed among those who held combat arms, technical, and other types of military jobs in terms of their subsequent civilian earnings.

<u>Veterans' Penalty Argument.</u>

Until 1989, with the exception of studies of Vietnam era veterans which focused on the short run, the literature produced hardly any evidence of a veterans' penalty. Moreover, the Vietnam era studies for the most part could be explained on the basis of the short period of time after leaving the military when earnings of veterans and nonveterans were compared.

With the publication of research by Angrist (1989 and 1990), all previous research was turned upside-down. Angrist not only announced that there was no veteran's premium, but that there was, in fact, a veterans' penalty even for WW II veterans! This new and completely different development in the field threatens to discredit the entire body of research on the subject that was done over the last forty years.

According to Angrist, armed forces service tends to relegate an individual to lower income levels for long periods of time after leaving the service. Further, Angrist suggested that all previous work was methodologically flawed, even the work that employed special procedures for the correction of possible selectivity bias. The methodological flaw, according to Angrist, was why his findings differed so dramatically from other findings over the years, even for WW II veterans.

While the results obtained by Angrist may be suspect, his logic and methodology appear on the surface to be impeccable. His studies already have and will continue to carry great weight in the economics profession. His findings have quickly spread via both the general media and the scientific publication outlets. He has already gained acceptance of his article in one of the most prestigious economic journals in the nation -- *The American Economic Review (AER),* in which it has just been published.

His use of lottery data from WW II and Vietnam allowed him to have what appears to be a "natural random experiment" study which is generally viewed on "a priori" theoretical grounds as superior to field survey approaches -- which were performed in virtually every research study cited in the literature.[1] Thus, his results could possibly be considered the "true situation" and military advertising slogans could be viewed as constituting a false promise, including the slogan used by the joint advertising program "a great place to start."

[1]James Heckman (1990) disagrees on practical grounds with the "a priori" theoretical generalization about the superiority of experiments in the social sciences. He argues that for many reasons there can be no such thing as a "natural random experiment" in the social sciences. In his words (p.302): "Ideal experiments produce ideal data. Actual experiments do not and are likely to be of limited value in evaluating many important social programs."

The main conclusion of the Angrist (1989 and 1990) studies is that there is a veterans' penalty rather than premium, even for WW II veterans. This penalty, even for the Vietnam era, is not observable when conventional techniques such as in our original study are employed, or even after conventional corrections for selectivity such as Heckman's are employed. Rather, only after the data are adjusted for selectivity using draft lottery data is a veterans' penalty observed.[2]

The key concern is whether the random assignment of draft lottery numbers was in fact tantamount to randomly assigning men to the veteran and nonveteran groups. If so, the natural random experimental design which the lottery presumably makes available to Angrist argues persuasively for the validity of his study. However, even Angrist's own data show clearly that many at high risk of induction avoided the draft altogether while many at low risk of being drafted enlisted.[3]

However, despite the obvious randomness of lottery data, they may not in fact have provided a natural random experiment in any real sense as a practical matter. Thus while Angrist's approach indeed has a theoretical and conceptual advantage to every other study ever done on the subject, its conclusions may very well be wrong. There are a number of reasons supporting such a conclusion:

(1) After replicating his NLS findings on the Vietnam era, we found his results to be highly sensitive to some unusual and questionable cases in his NLS sample.[4] If just a single

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[2]Angrist's research shows that NLS data for the Vietnam era cohort show results that are: (1) equivalent to ours before adjusting for sample selections bias, (2) even more favorable to veterans after adjusting for sample selection bias using conventional approaches, but (3) extremely unfavorable to veterans after adjusting for sample selection bias using draft lottery data.

[3]Many at risk of the draft avoided or were rejected for mental, physical, or religious reasons, while many who it later turned out were not at risk, volunteered or enlisted because they mistakenly thought their draft number would cause them to be drafted.

[4]We are extremely grateful to Joshua Angrist for his kind and generous assistance in making many of his computer programs available to us to assist in our replication.

individual from his NLS sample is removed -- a nonveteran who earned an extremely questionable $270/hour -- his veterans' "penalty" drops substantially. Other questionable cases of low earning veterans with only a month's time on active duty and unbelievably high earning nonveterans also have been observed in his data. Eliminating just 6 cases from his NLS sample eliminates his Vietnam era veterans' "penalty" entirely.

(2) Angrist's data are not at all generalizable to "true volunteers" but only to draftees and draft-induced enlistments. Hence they are not of relevance to the AVF era but only to WW II and Vietnam. That is, veterans during that era who were not at risk of the draft but who nonetheless volunteered are not considered in his models.[5] Yet it is precisely the true volunteers during the lottery era who provide the most useful evidence of whether military service is helpful or hurtful to subsequent career earnings and have the greatest relevance to the AVF era.[6]

(3) The military "treatment" may not have taken as well with reluctant draftees of an unpopular war as with true volunteers. The implications for current AVF era enlistees most certainly depends more on the findings for Vietnam volunteers than draftees, if these historical data are of any relevance today at all. Thus, if the returns to volunteers and draftees could be separated, the focus should definitely be on the former rather than the latter. Yet Angrist clearly focused on the latter.

(4) As Angrist clearly acknowledges, there were "behavioral responses to the draft." However, notwithstanding his assertions to the contrary, his model fails to consider adequately either the consequences of "draft avoidance behavior" that may have either temporarily or

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[5]The applicability of Angrist's work to the AVF era is virtually nonexistent. He states that the effect of veterans' status for true volunteers is not identified and will become part of the regression error. That is, his model explicitly factors out the effect that we are trying to measure in the AVF era -- the effect of volunteering to serve in the military.

[6]Another issue is whether results based on lottery data even on true volunteers during wartime would be generalizable to peacetime, aside from the issues of cohort and period effects.

irreparably harmed the short term earnings of "draft avoiders" or the consequences of "rejection by the draft" for mental, physical, or religious reasons. He dismisses their relevance because of one or two simple statistical tests which suggest that his findings are unaffected by draft avoidance behavior.

That is, Angrist's findings are that those "at risk" of being drafted -- many of whom were never veterans because of avoidance or rejection by the military -- earned less later than those "not at risk" of being drafted -- many of whom were either true volunteers or enlistees whose birthdates made them concerned enough about being drafted to volunteer. Since these two groups were randomly assigned on the basis of birthdates, earnings differences between them, in essence, are attributed to the military since any other differences between the groups are purportedly random.

However, draft avoiders ("at risk" nonveterans) of the Vietnam era may not have improved their lifetime earnings, relative to those "not at risk,' by remaining in school to beat the draft, as Angrist contends.[7] Rather, they may in fact have "harmed" their human capital stock by investing in worthless schooling (choices of inferior colleges and major fields of study that would otherwise be ill-advised), migration strategies, etc., which lowered their lifetime or early career earnings relative to nonveterans with equal years of schooling. Thus it may not be the military which caused them to be low earners today but rather, their choices with respect to ways to avoid or postpone the draft.

Rumsberger (1987) and Verdugo and Verdugo (1989) show clearly that "surplus" education leads consistently to lower rather than higher earnings relative to "their adequately educated and undereducated counterparts" (p.629). Freeman's (1976) book on the

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[7]Others, aside from draft avoiders, who were at risk for the draft but did not serve include a goodly percentage of youths ineligible due to physical, mental, or religious reasons. They too are unlikely to be high earners in the civilian sector, on average.

"overeducated American" made the same point. And worthless education, as opposed to more education, may in a career earnings sense be worse yet.

Thus, the lower early career earnings of Angrist's 29-31 year old men who were at risk of the draft during Vietnam may not at all reflect military service.[8] Rather, they may reflect the adverse effects of "draft rejection" and "draft avoidance" behavior on subsequent earnings, the short time horizon over which vets could return to school and catchup, and employer discrimination against and societal rejection of Vietnam vets as noted in previous sections of this report.

In sum, his studies do not deal with veterans and nonveterans, but with those "at risk of the draft" and those "not at risk." However, there are really 6 combinations of choice and risk behaviors: (1) "at risk" veterans,[9] (2) "draft avoiders," (3) "draft ineligibles,"[10] (4) "true volunteers"[11] (5) "not at risk" nonveterans, and (6) volunteers whose birthdates were close enough to the draft cutoff dateline, which was not announced in advance, that they thought they would be drafted and thus enlisted to secure a choice of branch and/or military assignment. His results may clearly be influenced by the failure to estimate differences among each of the logical behaviors rather than between those at risk and those not at risk.

(5) His veterans' penalty is only observed for whites. In fact, his findings for blacks often show a statistically significant veterans' premium about which Angrist is conspicuously silent.

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[8]In his *AER* study, his sample was 31-34 years of age, but only 29-31 in his NLS study.

[9]Draftees in the Angrist studies may not have served in the year when called, but may have delayed entry into the military for years (if not altogether) by virtue of deferments which may have hindered rather than enhanced their career earnings.

[10]Angrist reports that a large fraction of "at risk" youths during the Vietnam war failed either the AFQT, the pre-induction physical, or both.

[11]Since it was not clear what the cutoff point would be for the draft in any given year until far into the year, many of these may have volunteered only because they expected they would have been drafted anyway.

(6) The penalty is generally not statistically significant at conventional levels (5%, 2 tails) with NLS data, but rather only at the 10% (2 tails) level. In his *AER* study, his observed shortfall to those at risk of the draft is about 3%, and often not statistically significant.[12] Thus since a one tail test is clearly inappropriate unless a veterans' premium is hypothesized, Angrist's veterans' penalty both in his NLS study and *AER* study often appear to be much ado about statistically insignificant findings.

(7) His model fails to measure the indirect effects of military service through increased human capital accumulation. Education, training, and location, for example, are measured at the same time as earnings rather than at the time of induction. Thus, if military service inspires veterans to pursue further education and training or to migrate, none of these returns to military service are captured.[13] This is even more worrisome in the models which control for occupation and industry, where the effects of military service on subsequent access to better paying jobs are statistically controlled for and not credited to military service.

(8) Even worse, his model compares veterans (who returned to school) and nonveterans who are college graduates as though they both completed college right after high school. While veterans ultimately may reap the same returns to college as their nonveteran counterparts who went straight to college, the vets will have a shorter time horizon over which the returns to schooling can be observed in the Angrist model.[14]

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[12]These 3% shortfalls are then projected up to a 15% veterans' penalty by using Wald estimators -- i.e., by using the estimates that 30% of those at risk actually served while only 20% of those not at risk actually served in the military.

[13]In the case of education, the Wall Street Journal (1988) recently reported that 2.2 million veterans of WW II returned to college on the GI Bill after the war, producing 162% more college degrees in 1950 than in 1939, and a record number that stood until 1962. Clearly at least some of the returns to the $14.5 billion dollar federal investment in the education and job training of WW II veterans should be attributed to having served in the military, contrary to Dr. Angrist's model specification.

[14]This is more worrisome for the younger Vietnam era veterans of course than for the older WW II veterans.

(9) More than one-third of the NLS sample were "missing" in 1981, the single year Angrist studied. There was no data whatsoever for any of them that year. The representativeness of the NLS data he used is certainly in doubt in that single year which he chose to study.

(10) Angrist studied a single point in time, 1981, for his NLS Vietnam era vets. Daymont and Andrisani (1986) show clearly that the veteran's premium/penalty is definitely not constant over the life cycle but varies from a penalty shortly after discharge to an advantage later on.

(11) Angrist's 1989 study argues that veteran's status is not exogenous, but endogenous, essentially because "V hat" -- or predicted probability of being a veteran based on the lottery instrument -- is statistically significant even after actual veterans' status is controlled for in the model.[15] But "V hat" may be significant precisely because it adds explanatory power to the model (in addition to veterans' status) by explaining earnings variance within both the veterans and nonveterans groups. Consider the following:

(a) Within the veterans group the lottery data logically may be showing earnings differences between "draftees" and "true volunteers," with the latter outperforming the former -- i.e., those with "low risk of draft" birthdates earning more than those with "high risk of draft" birthdates.

(b) In addition, within the nonveterans group the lottery data logically may also be showing earnings differences between "draft avoiders" and "true nonveterans" -- i.e., and again, with those with "low risk of draft" birthdates (true nonveterans) earning more than those with "high risk of draft" birthdates (draft avoiders).

(c) Conversely, holding lottery data constant a veterans' premium may not be due to endogeneity at all but to the fact that veterans status and lottery data, although correlated,

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[15]This is basically the Hausman test for exogeneity.

are representing logically distinct concepts. Within the "high risk" group, for instance, draftees logically may outperform draft avoiders, while in the "low risk" group true volunteers may have outperformed nonveterans.

(12) Angrist's earnings model with NLS data contains few control variables, as though they were unmeasurable. Yet many were measurable but ignored. This places tremendous pressures on his statistical techniques. In his *AER* study, no control variables other than age and race are considered.

(13) His NLS point estimates for the veterans' penalty are logically not plausible. They suggest that the average Vietnam draft induced veteran would earn 50-60% more if he resisted serving. If true, the observable economic scars of the Vietnam War on its veterans would be obvious to all without this or any other study.

(14) Angrist's *AER* study (1990) reports more plausible results than his NLS (1989) study -- a veterans' penalty in the 15% range. But the data are quite limited in that they lack the richness of the NLS (which were not exploited effectively anyway), they lack any control variables other than age and race, the earnings measures are censored, and it was necessary to combine data from a combination of sources.

(15) Even if the lottery were a true experiment -- with everyone at risk serving and those not at risk excluded from serving -- there is no pre-treatment vs. post-treatment comparison between veterans and nonveterans as would be performed in a true experiment. However, this could have been accomplished if the longitudinal richness of the NLS data had been properly exploited.

Despite these criticisms, it is likely that many will not only believe a veterans' penalty for WW II and Vietnam, but also believe that an experiment during the AVF era would likewise demonstrate a penalty. This may occur for many reasons -- e.g., Angrist's ingenious use of draft lottery data to simulate a "natural random experiment" and the general belief in the superiority of experiments.

Summary.

As can be seen from the above review, the findings as to the existence of a veterans' premium are diverse, frequently contradictory, perhaps era dependent, contingent upon certain subgroups, and definitely driven by the selected data set(s) and the methodology of the researcher. Those researchers using panel data consistently found for the existence of a veterans' premium; those using a comparison technique of a given point in time usually found none.

Skill Transfer

There are basically two ways that the armed forces can affect the possibility of skill transfer. One is through the general training (Becker, 1964) and the other is through the provision of some sort of post-service educational benefit that could be turned into general training for a specific skill. In the present section, we will focus on the transferability of military-provided training.

In terms of the major theoretical considerations, human capital theory (Becker, 1964) and the bridging hypothesis (Broom and Smith, 1963), there are strong reasons to expect the armed forces to be instrumental in providing for skill transfer. As indicated in the discussion of the first issue, veterans' premium, Becker (1964) used the military as an example of an organization aiding in the formation of human capital of a general training nature. But, certain specific aspects of military training might also assist in the transition from a military to a civilian job. Broom and Smith (1963) also cited the military as an example of a bridging environment, and emphasized the greater the convergence between military and civilian technology, the greater the bridging effect. They also emphasized the ancillary aspects of military training such as the integration into different groups, coping requirements with established bureaucracies, and the influence on attitudes toward work. Further, Levine (1984) provides an overview of a survey on employer needs that included sixty-four attributes grouped into ten clusters. each representing a broad attitude, skill, or behavior. The clusters were as follows:

- Striving to do work well
- Priority setting; working under pressure
- Problem solving; decision making
- Working well with others
- Communicating
- Learning
- Physical and safety demands
- Number skills
- Office skills
- Mechanical and lab skills

Each of the attitude clusters were rated by the sample population -- individuals from large companies, small businesses, and postsecondary institutions. The results were quite interesting in that employers placed more importance for initial entry on positive attitudes toward work and generic cognitive skills than on job-related skills. Both large and small companies ranked Striving To Do Work Well as their number one factor. With respect to advancement, again the results held across all categories of analysis, with the key factors being the ability to learn and higher order thinking skills. We suggest such attitudes and abilities can emerge from both the military's selection as well as the training process. Therefore, theoretically, the armed forces should provide an ample amount of job transfer to the civilian labor market. The question is, however, as to the availability of empirical evidence.

As indicated in the first section, De Tray (1982) linked the job opportunities of veterans, in part, to the screening device or signaling effect of military service to employers. This notion is certainly commensurate with the employer survey, discussed above. However, Berger and Hirsch (1985) suggested that it is unlikely that in all cases veteran status acts as a positive signal. They suggest that military service during the Vietnam era provided a different set of signals to employers. That is, during WW II, there existed almost universal service and support for the war effort was widespread. Further, returning veterans were welcomed back as individuals who had sacrificed for the greater good of the nation. In contrast, the Vietnam conflict experienced extensive opposition and the rate of participation of the population was far less. Berger and Hirsch assert that a great deal of time and money was spent in avoiding service. Thus, being a veteran from WW II gave a different signal than being a veteran from the Vietnam War.

Berger and Hirsch (1985) further suggest that the degree that veteran status acts as a positive screen will vary across population groups. They advance reasons that veteran status may be more valuable for individuals in lower schooling and nonwhite groups.

- The AFQT tends to screen out more in such groups.
- Service in the military is more likely to act as a substitute for formal schooling.
- In lower schooling groups, a greater proportion of those with higher underlying abilities tend to be accepted by the military than in the higher schooling groups.

Berger and Hirsch (1985) selected a sample of men born between 1942 and 1952, from the 1969 to 1978 March CPS tapes. They concluded that their results provided limited evidence that veteran status acted as a positive screen for whites in the lower education grouping (less than a high school education) and for nonwhites with up to 12 years of education. However, for the large group of white high school graduates, the authors concluded service during the Vietnam era gave a negative signal to the civilian labor market. Finally, they close with the observation that the evidence through the late seventies illustrates that veteran differentials have varied systematically by age, schooling, and race, and have not been consistently positive as in the past.

Biderman and Sharp (1968) produced a classic article examining the military structure and the transfer of military skills and credentials to the civilian labor market. Although they were primarily concerned with the civilian employment of military retirees, suggestions of convergent structures between the military and civilian society have applicability to short term veterans. Specifically, Biderman and Sharp suggested there was evidence of convergence through (1) structural similarities -- ways in which occupations are organized, (2) dynamic similarities -- being subject to the operation of similar forces and manifesting similar principles of change, and (3) interpenetrability of the structures -- the ease of movement of persons from a role in one of these structures to a role in another.

Fredland and Little (1980) examined the effects of vocational training gained through service experience. Their sample was a set of mid-career workers who received military vocational training, drawn from the NLS mens' sample, white men who were aged 45-49 in 1966. (Note: they wanted to keep their sample as homogeneous as possible) It should be noted that the sample consisted of men who had general training (Becker, 1964), that is, vocational training that had a civilian counterpart, e.g., welder. Individuals in the sample took the vocational training 15 - 20 years prior to the observation of their income. The results of their analysis provided support for the proposition that those who take and subsequently use vocational training receive long-term earnings premiums; and, military training taken but not used in subsequent civilian employment appears to yield no premium.

Goldberg and Warner (1987) suggested that more military experience increased subsequent civilian earnings, but the relative impact of military and civilian experience varied by type of military training received. Goldberg and Warner made comparisons among veterans who separated after military service of different lengths. Their data set was the Social Security reported earnings for the years 1972-1977 of a cohort of enlisted personnel who left the service in FY 71. They created categories of military training by use of the One-Digit DOD Occupation Group. The groups examined were as follows:

- Infantry/Combat
- Electronic Equipment Repair
- Communications/Intelligence
- Medical
- Other Technical
- Administrative/Clerical
- Electrical/Mechanical Equipment Repair
- Craftsmen
- Service/Supply

They found that for all nine military occupation categories, military experience increased potential civilian earnings. In four of the nine categories (Medical, Electrical/Mechanical Equipment Repair, Other Technical, and Electronics Equipment Repair) military experience and civilian experience have approximately equal impact on potential civilian earnings. They further note that the four categories correspond the Becker's (1964) notion of general training, which should have the greatest transferability. In the remaining five categories, although military experience increases civilian earnings, but not at the same rate as years of experience gained in the civilian labor market.

Perhaps the most extensive review of the issue of military skill transferability has been the effort by Stephen Mangum using the NLS youth cohort as his primary data set for analysis. He has published either singly or with David Ball on the subject over a five year period. Mangum and Ball (1984) discovered a 30 percent direct occupational overlap between military specialty and post-military civilian employment. He further found that the relative labor market performances of veterans varied according to the length of time after discharge that the comparisons were made. Further, as in the findings of Fredland and Little (1980), veterans with post-military occupational matches did better than those who did not locate such a match. Finally, it appeared that an additional week of civilian work experience had a greater impact on civilian earnings for veterans than for nonveterans, suggesting a "gap-closing" function with increasing time after discharge.

Mangum and Ball (1987) again use the NLS Youth Cohort with updated files and again document significant amounts of skill transfer between military training and civilian employment, but with gender differences. Males had the greatest transfer in the occupational categories of service, craft, and equipment repair. Females had the greatest transfer in the traditional occupational categories of administrative/functional support. The researchers were quite adamant in their conclusion that, "Analysis of this data set leaves little reason to doubt the viability of the military as a training provider offering linkage to the civilian work world." (p. 439)

Finally, Mangum and Ball (1989) with further data from the NLS Youth Cohort and additional analysis found that the transfer of skills from the armed forces to the civilian labor market of young men and women who enlisted during the "all-volunteer" era, was as high for military provided training as for civilian provided training, i. e., between 45-50 percent. (They were comparing military training to civilian training that was not employer provided.) Also, their results indicated that within two years of the veterans discharge, those who received military training had higher earnings than those who received training in the civilian sector. The latter results are in contrast to the findings concerning Vietnam veterans (Villemez and Kasarda, 1976; Martindale and Poston, 1979; Schwartz, 1986), but commensurate with results for WW II and Korean veterans (Villemez and Kasarda, 1976; Martindale and Poston, 1979;

Fredland and Little, 1985; Nelson and Armington, 1970; Little and Fredland, 1979; De Tray, 1980; Daymont and Andrisani, 1986).

General Considerations and Concerns on Females, Minorities, and Use of NLS Data

Research on Female Labor Supply.

In general, most of this research has focused on (1) identifying or testing hypotheses about the most important determinants of labor supply; (2) modeling the interdependencies among the processes determining fertility, wages, and labor supply; and (3) describing and explaining life cycle patterns and temporal changes in labor supply.

Wages and other determinants of labor supply. Much research has been conducted using the NLS to identify and estimate the effects of the important determinants of the labor supply of women. Some of these studies examine a range of explanatory factors jointly, while others focus on a particular factor or issue. Because of the multidimensional nature of patterns of labor supply, researchers have examined the determinants of different aspects of labor supply including labor force participation at the time of the survey (e.g., Stephan and Schroeder, 1980), measures of individual labor supply aggregated over (substantial portions of) the life cycle (Maret, 1982), part-week work (e.g., Jones and Long, 1979; 1981; Long and Jones, 1981), and patterns of intermittency (Shaw, 1982). As more studies are completed using different statistical models, and different arrays of explanatory variables, certain factors continually emerge as important determinants of labor supply.

Virtually all studies that examine the issue find that, as suggested by economic theories of labor supply, the ability of a woman to command a high wage in the market increases the likelihood that she will work. While most researchers have used a gross wage rate, Leuthold (1978a; 1978b) used a disposable wage rate calculated for each respondent on the basis of her imputed wage rate and her marginal (income plus social security) tax rate. The wife was assumed to be the secondary worker in the household, and the marginal income tax rate was computed as the highest bracket rate applying to the husband's last dollar of taxable income. The results indicate that the lower disposable income produced by higher marginal tax rates reduces labor force participation rates and hours worked by married women. In another study, Leuthold (1979) studied the impact of marginal tax rates on work decisions in two-earner families. Interestingly, she found negative cross-wage effects for both white wives and husbands, implying that an increase in the spouse's wage rate causes a decrease in hours of work for both wives and husbands. The results also suggest that an increase in the marginal tax rate will lead to a greater sex-based division of labor within the family with the wife decreasing her time spent in market work while the husband increases his.

While many studies have found the effect of wages on labor supply to be significant, an analysis by Cogan (1981) suggests that these effects may be upwardly biased due to a failure to model the fixed costs associated with entry into the labor market. To model the effects of these costs, Cogan developed and estimated a model that allowed reservation hours (the minimum number of hours a woman is willing to work) to be positive and differ among women. The results indicated that there are substantial fixed costs to labor force participation and that when these are taken into account, the estimated effects of wages on labor supply are reduced. In concluding, however, Cogan points out that his findings might also result from minimum hours of work constraints imposed by employers (possibly due to their fixed costs) rather than the fixed costs of work on the supply side as the model assumed.

Studies of labor supply consistently find that, in addition to wages, family responsibilities in general, and child rearing responsibilities in particular, are major determinants of labor supply. Women with children, especially preschool age children, are less likely to work, controlling for other factors. In addition, the husband's earnings have a negative effect on the wife's labor supply. And, although the relatively low earnings of black males help explain some of the greater labor supply of their spouses, these models show that black women work more even after controlling for this factor. Not surprisingly, health problems inhibit the labor supply of women, as it does for men (Waldron, 1982; Maret, 1982; Shaw, 1982). Furthermore, the greater incidence of health problems among black women, coupled with a larger effect on their labor supply, means that health problems are especially important in limiting the labor supply of black women (Maret, 1982).

The results of analyses of the effect of education on labor supply depend upon whether the woman's wage rate is included in the analytic model. When the wage rate is not included and education serves as a proxy for wage, it has a positive impact on labor supply (e.g., Stephan and Schroeder, 1980). When education is included along with the wage rate, its effect tends to be insignificant or negative. A common interpretation of this result is that it reflects a tendency for more educated mothers to spend more time in child care than less educated mothers (e.g., Long and Jones, 1981). Of course, this interpretation implies that the effect of education on labor supply will be lower when children are present. Waite (1980) finds such a pattern in her analysis.

Most studies of female labor supply that use the NLS utilize an economic theory perspective, and many other studies that are not couched within a purely economic framework are consistent with or expand upon this framework (e.g., Waite, 1980). (Studies focusing more on the role of social psychological factors are discussed in section 6). In contrast to these, D'Amico (forthcoming) takes a more distinctly sociological approach. His paper tests two opposing hypotheses about the effect of the relative earnings capacities of the husband and wife on the wife's labor force participation (and marital dissolution). The first hypothesis derives from Parsons' status competition model and states that, the higher a wife's potential wage relative to her husband's, the lower and more peripheral will be her labor force participation. Opposing this hypothesis is Oppenheimer's status maintenance model which argues that a significant labor market attachment will enhance the family's status most when she has an earnings capacity close to that of her husband rather than lower. This leads to an hypothesis that a wife's labor force participation will be greater the more congruent her earnings capacity is with that of her husband. In general, the results support the Oppenheimer model. Although Oppenheimer and economists use different conceptual frameworks, they come to very similar hypotheses about the relationship between the earnings of wives and her labor force participation (except when the wife has a higher earnings capacity than her husband).

Patterns and changes in labor supply. A major goal of much of the female labor supply research has been to better understand life cycle patterns of labor supply. These patterns were the subject of debate in an exchange between Heckman and Willis (1977; 1979) and Mincer and Ofek (1979). Cross-sectional data indicate that in recent years about half of married women participate in the labor force at any point in time. At issue in the debate was the degree to which this means that (1) most women work about half of their married years, or (2) about half of married women work most of their married years, while about half work very little or none at all. In an earlier paper, Heckman and Willis (1977) used longitudinal data from the Michigan Panel Study of Income Dynamics (PSID) to construct a distribution of years worked by married women over a 5-year period (1967-71). The distribution was decidedly U-shaped, leading the authors to conclude that most married women have participation near 0 or 1. Mincer and Ofek (1979) show that if distributions of labor force participation over the lifetime are calculated, the distributions suggest that the truth lies somewhere between these extremes. In their rebuttal, Heckman and Willis (1979) show that the shapes of the distributions vary, depending upon the definition of labor force participation and whether or not premarital work experience is included. In addition, their distributions suggest substantially more heterogeneity among older women than among younger women. In general though, the distributions of

Heckman and Willis also suggest that neither extreme assumption is warranted: a substantial number of women work little or not at all while married, some work intermittently, and a few work almost continuously.

School to work transition. In an exploratory study, Stephenson (1982) used a multinomial logit model to express the probability of being in each of six states defined in terms of school enrollment and labor force status as a function of time, age, family size, region, city type, local unemployment rate, family SES, and the school enrollment-labor force status in the previous year for a sample of single male youth. The results indicated that many of the explanatory variables influence school enrollment-labor force status in significant and predictable ways. More generally, however, the results underscored the pronounced mobility among these six school enrollment-labor force states exhibited by most single male youth. On the other hand, a significant minority of youth remained unemployed or out of the labor force from one year to the next. For example, among whites who were not enrolled in school and out of the labor force in 1 year, an estimated 31% were neither enrolled in school nor working in the following year. For blacks, it was 49%.

Other studies (e.g., Shields, 1980; Kim et al., 1980; Kim, 1982a, 1982b; Fredland and Little, 1982) have examined military service as an alternative activity during the school to work transition period. These studies typically have used economic theories of labor supply and occupational choice as bases for models of enlistment (or reenlistment, attrition, or intentions to serve) versus alternative activities such as civilian work or school. In general, the results of these studies indicated that young men do respond to factors suggested by economic theory. In particular, young men are more likely to enlist if they have low potential wages in civilian employment or live in areas or times of high unemployment. In addition, the results of Kim (1982) suggest that the opportunity to obtain occupational or on-the-job training in the military that may be transferable to a civilian job increases the likelihood of enlistment. The perception that the military provides useful training seems well founded: although the pay of male veterans was below that of their civilian counterparts at the time of separation, parity in wage rates with comparable civilians was attained after less than 1 year of civilian labor force experience. The effect of occupational training on the likelihood of enlistment, combined with the generally lower level of opportunity for skill training transferable to the civilian sector in the Army and the Marine Corps, helps explain the difficulty of these two branches of the service, relative to the Air Force and the Navy, in attracting highly qualified recruits.

Female veterans. Two fairly recent societal trends, the increasing number of women entering the work force and the increasing number of women entering military service, have converged to make the issue of military service experience for women an important concern for national policy makers. Just as the question has been posed for men, a similar question arises as to whether or not military service is a good investment for young women.

A better understanding of the relationship between military experience and later career earnings for young women is important for several reasons. For instance, as the male youths cohort continues to shrink, the services are increasing their recruiting efforts directed at women, and also increasing the ceiling on the number of women who may join. College and civilian employers who compete with the military for youths are altering their recruiting strategy as well. In addition, given the realities of the feminization of poverty and risks of marital instability, rational career planning is especially important for young females.

There are, of course, varying reasons for an individual to join one of the military services -- money for college, skill training, better pay, challenge, family tradition, and an opportunity to serve the nation. Based upon a survey of new recruits entering the Army, the distribution of primary reasons for joining looked similar for women and men. Money for college and skill training were the top two categories for both (Benedict, 1987). Based upon the survey results, it appears that young women as well as young men are viewing military service, at least to a degree, as an investment in human capital.

As previously noted, many studies have examined the issue of economic returns to military service in the civilian labor market. However, most have dealt exclusively with men. Our search of the literature yielded very little on the subject of the impact of military service on post service earnings of women, especially during the AVG era. Perhaps one reason for a lack of literature on female veterans is a lack of data.

In one of the few studies on the subject, Mangum and Ball (1987) controlled for type of skill/experience obtained in the service for veterans and examined whether or not they were able to find civilian employment in a related skill. They found significant amounts of skill transfer for both male and female veterans.

For male veterans, the probability of skill transfer was lower than for civilians trained in apprenticeship and employer-provided training programs, but about the same as those trained in vocational/technical institutes, proprietary business colleges, etc. For female veterans, transfer percentages were greatest in the traditional skills of administrative/functional support. When compared to specific training for civilian females such as nursing, apprenticeship, or beauty programs, or to training programs provided by employers, female veterans had a lower rate of transfer.

They went on to suggest that the key to explaining such gender differences may be the presence of internal labor-market mechanisms which facilitate the transition from training to work in certain institutional settings.

If the early career reduction in veterans' earnings upon leaving the service results from a "veterans' penalty" (Angrist, 1989 and 1990) -- i.e., a lack of transferability of service-gained skills and experience -- rather than frictional unemployment and returning to school, one would expect to see the reduction in earnings persist over a longer period of one's career. Yet this is not what Daymont and Andrisani (1986) show with their data on male veterans and one of the key issues this study takes up for both young men and women during AVF era.

Daymont and Andrisani (1986) showed the earnings reduction rapidly dissipating after discharge from the service. This suggests frictional unemployment which typically accompanies entry and reentry into the civilian labor market, the returning of vets to school or training (learning instead of earning), the greater availability of unemployment insurance benefits for veterans than nonveterans, and employer discrimination early in careers against veterans.

Accordingly, we hypothesize that a substantial portion of the decline is temporary and that the earnings of former servicewomen will rise more quickly than the earnings of civilians of comparable ages and education, just as was observed by Daymont and Andrisani (1986) in the case of men.

Labor Market Differentials and Inequalities.

Racial Inequality in the Labor Market. Several NLS-based research studies have examined, either directly or indirectly, the reasons for the reduction in the black-white earnings gap over the last 15 years. Daymont (1981) used a set of pooled cross sections from the young men data to assess changes in the relative earnings and employment opportunities of black and white males (temporal changes in the earnings and unemployment for blacks relative to the changes for whites not accounted for by relative changes in indicators of human capital). The results for earnings indicated substantial increases in the relative earnings opportunities of blacks between 1966 and 1976. No support was found for the "vintage" effect hypothesis proposed by Smith and Welch (1977; 1978) that this apparent improvement could be largely explained by changes in the relative quality of schools attended by blacks and whites. In addition, no support was found for Lazear's (1979) contention that the relative improvement in earnings opportunities of blacks measured in young samples is illusory due to a deterioration in the on-the-job training opportunities for young blacks.

Daymont (1981) also tested several potential explanations for the paradox of improving earnings opportunities for young blacks but no improvement in employment opportunities. The results suggested that this paradox could not be explained by the declining labor market conditions of the period, differences across levels of education in the degree of change in relative black opportunities, or the movement of young men across regions, into urban areas, or out of farming. The results were inconclusive with regards to the hypothesis that the lack of improvement in measured employment opportunities was due to blacks becoming less willing to accept low-paying jobs (as measured by changes in the relative reservation wages of blacks and whites-i.e., the wage below which an individual would not accept a job offer). As other research with the NLS (e.g., Daymont, 1981) and other data indicate, this paradox seems to exist only for younger men; for older men, the relative opportunities of blacks improved in terms of employment as well as in terms of earnings. Still other research suggests that the improvement in relative black opportunities among young men does not appear to be restricted to earnings. Using a status attainment model approach, Lyon and Abell (1979) found a trend toward decreasing racial discrimination in the labor market in terms of both occupational prestige and income.

Another version of Welch's vintage hypothesis has also been tested with NLS data. In an earlier study, Link, Ratledge, and Lewis (1976) used the measure of school quality available in the NLS data for young men and found the returns to school quality to be similar for young black and white men. They interpreted this as supporting Welch's hypothesis that the recent rise in the returns to schooling for blacks relative to whites, can be attributed to a more rapid increase in the quality of education for blacks. Akin and Garfinkel (1980) took issue with this conclusion on the basis of an analysis using data from the Michigan Panel Study of Income

Dynamics (PSID). In a reply, Link, Ratledge, and Lewis (1976) analyze data from both the NLS and PSID and reaffirmed their support for Welch's hypothesis that a relative upgrading of educational quality for blacks has been a major factor in causing a trend toward convergence in black-white differences in returns to schooling.

While most studies of racial discrimination have examined data on men, Lyon and Rector-Owen (1981) investigated racial differences in status attainment models for occupational prestige and income for young women and concluded that racial inequalities. These studies are reviewed in the sections on labor market segmentation and unionization respectively.

Methodological Research Using the NLS Data.

Improved statistical and methodological techniques constitute a major intellectual payoff to the NLS. The richness and longitudinal nature of the data have facilitated the development of more sophisticated statistical methods to deal with a variety of issues that arise in quantitative analyses, most notably sample heterogeneity and sample selection bias.

Bielby *et al.* (1977) observed that the NLS had been used by several researchers in their efforts to test and develop techniques popularized by Heckman (1974;1976) and others (e.g., Gronau, 1973, 1974) for modeling sample selectivity bias. Originally used by economists in models of female labor supply, generalizations and elaborations of this approach are now being used in a wide variety of situations where it is reasonable to assume that the observation of an endogenous variable is contingent upon an unobserved variable, which is expressed as a function of other variables, exceeding a threshold. [See Maddala (1978) for a partial list of situations in which this approach has been used. This list includes such research topics as estimating the returns to schooling, the effects of unions on wages, the effects of migration, and the effects of training programs.] Researchers have continued to use the NLS in studies that have further tested and developed sample selection models.

The next section focuses on the specific problems of modeling this type data with the issues of training efficacy.

Methodological Considerations: Self-selection Bias in Veterans' Studies

This section addresses the methodological issues that must be confronted in estimating a veterans' premium/penalty. The primary methodological problem is that of "self-selection".[16] The first section provides an overview of this problem in labor market studies. The second section demonstrates that when veteran status is determined non-randomly, standard procedures for estimating the veterans' premium/penalty yield biased estimates. We develop several models of the process that generates veteran status and the observed earnings data. In the more complicated models the direction of the bias is, unfortunately, ambiguous. Econometric procedures for dealing with the bias and the data required to implement these procedures are discussed.

Overview.

The problem of self-selection in the analysis of earnings data has its origins in the work of Gronau (1974). Gronau considered the problem of estimating the return to female education. Standard procedure at the time was to delete from the analysis observations on women who did not work and for whom, therefore, no earnings data were observed, and simply estimate a regression of earnings on education. Because who chooses to work and who chooses to stay home is not random, Gronau reasoned that such a regression will give a biased estimate of the relationship between education and earnings. Women work only if their market wage opportunity exceeds their value of home time, so that the women who work will tend to be those who, for unobservable reasons, have abnormally good market wage opportunities. The mean of observed wages will overstate the mean that would have been observed if all

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[16]For an excellent review of the econometrics of this issue, see: Manski (1989).

women had worked. The overstatement of mean market wage opportunities declines as the proportion of women who work increases. And since the proportion who work rises with education level, the overstatement is most severe at the lowest education levels. Consequently, a regression of earnings on education level will tend to understate the effect of education on earnings.[17]

Other problems of self-selection pervade the estimation of the returns to education and government training programs. Consider the problem of estimation of the return to a college education. Standard procedure is to collect a sample of data containing observations on individuals who enter the labor market after high school and others who go on to complete a college degree. In a regression for earnings that includes a dummy for completion of a college degree, the coefficient on this dummy is interpreted as the earnings effect of the college degree. However, if more able individuals go to college and less able individuals terminate their educations after high school, part of the estimated effect of the college degree will actually measure the effects of (unobservable) ability. The bias again arises from the fact that individuals are not randomly selected to receive college educations but choose their education levels non-randomly on the basis of factors that cannot be observed. If ability is unidimensional and the more able go to college, standard procedures will overstate the return to a college degree.[18]

Estimation of the return to government training programs such as MDTA and CETA is also plagued by the problem of self-selection. Here the bias is clear: individuals who choose to participate in such programs are likely to be individuals who have very poor job prospects. If

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[17]Subsequent analyses have shown that the bias could run in either direction. See Smith (1980) for a compendium of studies of female earnings.

[18]However, Willis and Rosen (1979) suggest that ability is not unidimensional. In their approach, people sort themselves by educational level on the basis of their comparative advantage at doing the things required of people at different education levels. Consistent with this approach, their empirical results suggest that standard procedures understate the return to a college education.

the choice to participate in the training program is non-random, comparison of the earnings of participants with a control group of observationally equivalent non-participants will give a biased estimate of the effect of the program. In this case the analysis will be biased against finding a positive effect of the training even if an effect exists. O'Neill (1977) recognized this to be a problem for estimating the return to vocational and technical training uses of the GI Bill.) For further discussion of the problem of evaluating government training programs, see Moffitt (1986) and Barnow (1986).

Previous studies of the veterans' premium/penalty may be evaluated in light of this discussion. Fredland and Little (1980), for instance, find a sizeable positive veterans' premium for World War II veterans. The majority of young males served in World War II. Those who did not are likely to have been individuals who were unable to meet the military's mental, moral, or physical screens. If the inability to meet these screens carries over to performance in the labor market, then a comparison of their earnings with earnings of veterans, who satisfied the screens, is likely to give an upward biased measure of the veterans' premium. As Berger and Hirsch (1983, p.461) note, those who were successful in dodging the Vietnam era draft may have been individuals who had better than average civilian opportunities; draftees and draft-motivated volunteers were those who had worse than average civilian opportunities (given their education level and other observable attributes). In such a case a comparison of veteran and non-veteran earnings will understate the true veterans' premium.

Berger and Hirsch clearly recognized the selection bias problem but did not deal with it econometrically. We now develop several models of the process that generates the observed earnings data and the econometric procedures that are implied.

Standard Procedure.

Consider a sample of data that includes observations on veterans and non-veterans. Our goal is to estimate whether there is any earnings effect attributable to military service. One approach is to specify separate earnings equations for non-veterans (n) and for veterans (v):

$$Y_n = \beta_{on} + \beta'_n X_n + \varepsilon_n \qquad (1a)$$

$$Y_v = \beta_{ov} + \beta'_v X_v + \varepsilon_v \qquad (1b)$$

where Y denotes earnings, X denotes a vector of observable determinants of earnings and ε denotes unobservable random error. Assume that ε_v and ε_n are normally distributed with zero means and standard deviations σ_v and σ_n, respectively. Typically included in X are variables for education, experience, race, mental group, geographic region, and any other observable, theoretically plausible determinant of earnings available in the data set at hand.[19] Standard procedure is to estimate these equations by OLS, use the fitted equations to predict earnings (Y_v and Y_n) for various values of the observable regressors and then estimate the veterans' premium/penalty by the predicted difference $Y_v - Y_n$.

Assuming the regressor vectors X_v and X_n are the same, that $\beta = \beta_n = \beta_v$, and $\sigma_n = \sigma_v$, an alternative approach is to pool (1a) and (1b) into a single equation:

$$Y = \beta_{on} + \beta'X + \alpha D + \varepsilon \qquad (2a)$$

where D = 1 if the observation is on a veteran and 0 if the observation is on a non-veteran. The parameter α is the veterans' premium/penalty and is equal to $\beta_{ov} - \beta_{on}$. To relax the assumption that the slope vector β is the same for veterans and non-veterans, veteran status can be interacted with X:

$$Y = \beta_{on} + \beta'X + \alpha D + \delta'(D^*X) + \varepsilon \qquad (2b)$$

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[19]Data sets like the National Longitudinal Survey (NLS) contain an inherently richer set of observables than data sets like the Current Population Survey (CPS). For instance, in addition to military mental group category the NLS contains detailed family background data not available in the CPS.

where $\delta = \beta_v - \beta_n$. OLS estimation of (2b) will yield the same results as estimation of (1a) - (1b).

A question that has received much attention in the econometrics literature is the conditions under which estimation of (1a) - (1b) or (2b) will yield an unbiased estimate of the veterans' premium/penalty. The answer is that the properties of the OLS estimator of (2b) depend upon the way the data are generated. If people are randomly plucked from civilian life, given the military "treatment", and then returned to civilian life (as in a completely random draft), OLS estimation (2b) will yield unbiased estimates of the veterans' premium/penalty. The reason is that random selection of people to receive the military treatment guarantees that the random error ε will be unrelated to the regressors included in the model, which is one of the assumptions required for OLS to yield unbiased parameter estimates.

Even if the selection is non-random, OLS may still be unbiased. Suppose in a draft environment the military only takes high school graduates or people with AFQT scores above 35 and these are the only factors that determine whether one is drafted. Then as long as these factors are included in the earnings equation the random error ε will still be uncorrelated with the included regressors and OLS remain unbiased.

Models with Self-Selection.

It is unlikely, however, that these conditions will ever be met, especially in an All Volunteer Force (AVF) environment. In this environment individuals are not randomly selected to received the "treatment"; rather they must want to join and the military must want to take them. In this environment the data on veterans and non-veterans are the outcome of a process of self-selection. The fact that the data are generated non-randomly may lead to biased estimation of the veterans' premium/penalty by standard procedures and dictates the necessity for more appropriate econometric procedures. The self-selection problem and procedures for dealing with it are now more rigorously discussed.

Self-Selection at Entry Based on Earnings Maximization.

The simplest model one can construct is based on the assumption that individuals make the decision to join the military according to the choice that maximizes earnings. The more general case of choice based on utility maximization is developed below. To get started, we make two additional (unrealistic) assumptions that are relaxed below. One is that enlistees are unaware at enlistment of what a period of military service will do to their future civilian earnings capacities. Second, we assume that all enlistees will leave the military after one term of service. The latter assumption permits development of a choice model based on one time period; the former assumption obviates dealing with the self-selection that might arise at the first-term reenlistment point.

For simplicity, let M be the military wage. Assume that it is known with certainty and is independent of observable or unobservable characteristics. Civilian earnings are defined by equation (1a). In this case the individual choses to join if $M > Y_n$. He therefore joins if $M - \beta_{on} - \beta_n X > \varepsilon_n$. If ε_n is distributed normally with mean zero and standard deviation σ_n, the probability of enlistment is $Pr((M - \beta_{on} - \beta'_n X)/\sigma_n > \varepsilon_n/\sigma_n) = \Phi(z)$ where $z = (M - \beta_{on} - \beta'_n X)/\sigma_n$ and $\Phi(z)$ denotes the standard normal distribution function evaluated at z.[20]

Given this decision process for determining who enlists and who does not, we may derive the expected earnings of non-veterans and veterans. The expected earnings of non-veterans (i.e., expected value of either (1a) or (2b) conditional on not having enlisted is

$E(Y_n \mid \text{don't enlist}) = \beta_{on} + \beta'_n X + E(\varepsilon_n \mid \text{don't enlist})$ (3)

It may be shown that

$E(\varepsilon_n \mid \text{don't enlist}) = \sigma_n \phi(z)/(1 - \Phi(z))$ (4)

[20]Notice that the probability of enlistment can be expressed as $Pr(\text{enlist}) = Pr(\Theta_o + \Theta_1 M + \Theta_2 X > \varepsilon_n/\sigma_n)$ where $\Theta_o = -\beta_{on}/\sigma_n$, $\Theta_1 = 1/\sigma_n$, and $\Theta_2 = -\beta_n/\sigma_n$.

where $z = (M - \beta_{on} - \beta'_n X)/\sigma_n$, $\Phi(z)$ denotes the standard normal density function, and $1 - \Phi(z)$ is the probability of not enlisting. Since all terms in (4) are positive, ε_n therefore has a positive expectation. Consequently, conditional on the observed personal attribute vector X, the expected earnings of those who did not enlist, equation (3), will be an upward biased measure of the earnings that would have been expected had no-one served. The expectation (3) is also the expectation of (2b) conditional on D = 0.

Consider now the expected earnings of veterans. If (1b) describes their earnings, their expected earnings are

$$E(Y_v \mid enlist) = \beta_{ov} + \beta'_v X + E(\varepsilon_v \mid enlist) \qquad (5)$$

where

$$E(\varepsilon_v \mid enlist) = -\rho\sigma_v\phi(z)/\Phi(z) \qquad (6)$$

where ρ is the correlation between ε_v and ε_n. The expectation (5) is also the expectation of (2b) conditional upon enlistment (D = 1), where $\beta_{ov} = \beta_{on} + \alpha$ and $\beta_v = \beta_n + \delta$. Since (6) is negative, the expected earnings of those who served in the military provide a downward biased measure the earnings that would be expected had all served. Consequently, in a sample of veterans and non-veterans sorted on the basis of earnings maximization, the mean earnings of non-veterans provides an upward-biased estimate of the mean earnings that would be observed had all individuals remained non-veterans while the mean earnings of veterans provides a downward-biased estimate of the mean earnings that would be observed if all were veterans. Econometrically, OLS estimation with such a sample will lead to a downward biased estimate of the veterans' premium/penalty α as well as biased estimates of other parameters.

<u>Self-Selection at Entry based on Utility Maximization.</u>

It is unlikely that enlistment decisions are based on simple earnings maximization. Individuals' preferences for the non-pecuniary aspects of military versus civilian life certainly play a major role in military enlistment decisions. Suppose an individual's utility from civilian life can be expressed as $U_n - Y_n + \gamma_n$ where γ_n is the monetary value the individual places on all the non-pecuniary aspects of civilian life. Likewise, the utility of a military enlistment is $U_m = M + \kappa'Z + \gamma_m$ where γ_m is the value the individual places on the non-pecuniary aspects of military life and Z is a vector of observable variables other than military pay that influence the utility of a military enlistment. Included in the vector Z might be the civilian unemployment rate at the time of enlistment and other factors that influence the propensity to enlist such as educational benefits, recruiters, and advertising expenditures.

The individual is assumed to join the military if $U_m > U_n$ or $M + \kappa'Z + \gamma_m > Y_n + \gamma_n$. The individual joins if $M + \kappa'Z - \beta_{on} - \beta'_nX > \varepsilon_n + \gamma_n - \gamma_m$. Let $\gamma = \gamma_n - \gamma_m$ (the individual's net preference for the non-pecuniary aspects of civilian life) be distributed with mean μ_γ and variance σ^2_γ. The mean of the error $\varepsilon_n + \gamma$ is thus μ_γ. The probability of enlistment is thus

$Pr(M + \kappa'Z - \beta_{on} - \beta'_nX > \varepsilon_n + \gamma) =$

$Pr(M + \kappa'Z + \beta_{on} - \mu_\gamma - \beta'_nX > \varepsilon_n + \gamma - \mu_\gamma) =$

$Pr((M + \kappa'Z - \beta_{on} - \mu_\gamma - \beta'_nX)/\sigma > (\varepsilon_n + \gamma - \mu_\gamma)/\sigma) =$

$Pr((M + \kappa'Z - \beta_{on} - \mu_\gamma - \beta'_nX)/\sigma > u)$

where $\sigma^2 = \sigma^2_{\varepsilon n} + \sigma^2_\gamma + 2COV(\varepsilon_n, \gamma)$ is the variance of $\varepsilon_n + \gamma$ and $u = (\varepsilon_n + \gamma - \mu_\gamma)/\sigma$. Using the notation above, the probability of enlistment is $\Phi(z)$ where $z = (M + \kappa'Z - \beta_{on} - \mu_\gamma - \beta'_nX)/\sigma$. The key point here is that the probability of enlistment is affected by the net non-pecuniary preference for civilian life as well as earnings opportunities in the two sectors. A rise in the mean net non-pecuniary preference for civilian life, μ_γ, reduces the probability of enlistment.[21]

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[21] As in the previous model the probability of enlistment can be expressed as Pr (enlist) = Pr $(\Theta_o + \Theta_1 M + \Theta_2 X + \Theta_3 Z > u)$. Now, however, $\Theta_o = -(\beta_{on} + \mu_\gamma)/\sigma$. That is, the intercept of the equation for enlistment, Θ_o, absorbs the intercept of the non-veteran earnings equation plus the mean net preference for civilian life.

How does introduction of non-pecuniary preferences affect the expected earnings of veterans and non-veterans? It may be shown that the random error ε_n in the earnings equation for non-veterans now has expectation

$$E(\varepsilon_n \mid \text{don't enlist}) = \sigma_{\varepsilon n,u}\, \phi(z)/(1 - \Phi(z)) \qquad (7)$$

where $\sigma_{\varepsilon n,u}$ is the covariance between ε_n and u . As in the case above of choice based on earnings maximization, the expectation of the random error ε_n will be positive if this covariance is positive. In this case the mean earnings of non-veterans will again overstate the mean earnings that would be observed if no-one had served. Such will clearly be the case if ε_n and γ are positively correlated, i.e., those who have abnormally good civilian wage opportunities also have high net preferences for civilian life. The covariance $\sigma_{\varepsilon n,u}$ could be negative, however, if those who have unusually high civilian opportunities (i.e., large positive values of ε_n) also have strong net preferences for military life (i.e., negative values of γ). If this covariance is negative, the mean earnings of non-veterans will understate the mean earnings that would have been observed had no-one served.

The earnings of veterans may be analyzed analogously. The expected value of the random error in the veteran wage equation is

$$E(\varepsilon_v \mid \text{enlist}) = -\sigma_{\varepsilon v,u}(\phi(z)/\Phi(z) \qquad (8)$$

where $\sigma_{\varepsilon v,u}$ is the covariance between ε_v and u. If the covariance $\sigma_{\varepsilon v,u}$ is positive the error ε_v will have a negative expectation and the earnings of veterans will, as in the previous case, provide a downward biased estimate of mean earnings that would be observed if everyone was a veteran. Conversely, earnings are upward biased if $\sigma_{\varepsilon v,u}$ is negative.

A Two-Period Utility Maximization Model of the Enlistment Choice.

An assumption made above was that potential enlistees are ignorant of the civilian sector value of the skills received in the military. This section shows that this assumption may be relaxed without altering the basic results. The assumption that all enlistees must leave after one enlistment is maintained, however. Suppose that individuals discount future earnings at rate d. Suppose further that civilian earnings grow at rate g for each period of civilian sector experience. Individuals are now assumed to enlist if the present value of utility from an enlistment exceeds the present value of not enlisting.

The present value of utility from one period in the military and one period in the civilian sector is

$U_m = M + \kappa'Z + \gamma_m + dY_v + d\gamma_n = M + \kappa'Z + \gamma_m + d\gamma_n + d\beta_{vo} + d\beta'_v X + d\varepsilon_v.$

The present value at the enlistment decision point of two periods spent in the civilian sector is

$U_n = Y_n + d(1+g)\, Y_n + \gamma_n + d\gamma_n =$

$\beta_{on} + \beta_n X + d(1+g)\beta_{on} + d(1+g)\beta_n X + \varepsilon_n + d(1+g)\varepsilon_n + \gamma_n + d\gamma_n.$

The choice is therefore to enlist if

$M + \kappa'Z - \beta_{on} + d(\beta_{ov} - \beta_{on}) - dg\beta_{on} - dg + (d\beta'_v - \beta'_n - d(1+g)\, \beta'_n)X$

$> (1+d+dg)\, \varepsilon_n + \gamma - d\varepsilon_v.$

The probability of enlistment may again be written as $\Pr(z > u) = \Phi(z)$ where

$z = (M + \kappa'Z - \beta_{on} + d(\beta_{ov} - \beta_{on}) - dg\beta_{on} - dg - \mu_\gamma + (d\beta'_v - \beta'_n - d(1+g)\beta'_n)X)/\sigma$, u is the composite error $(1+d+dg)\varepsilon_n + \gamma - d\varepsilon_v - \mu_\gamma$ and σ is the standard deviation of u.[22]

Notice from this statement for the probability of enlistment that the veterans' premium/penalty $\alpha = \beta_{OV} - \beta_{On}$ enters positively in the enlistment decision. That is, the more likely military service is to raise one's future civilian earnings opportunities, the more likely an individual will be to enlist.[23] However, civilian wage growth enters negatively: the faster is

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[22]Again the probability of enlistment can be written in the form Pr (enlist) = Pr ($\Theta_0 + \Theta_1 M + \Theta_2 X + \Theta_3 Z > u$). Now, however, $\Theta_0 = (\beta_{ov} + d(\beta_{ov} - \beta_{on}) - dg\beta_{on} - dg - \mu_\gamma)/\sigma$ and $\Theta_2 = (d\beta'_v - \beta'_n - d\,(1+g)\beta'_n)\,/\sigma$. The intercept Θ_0 and the slope coefficient Θ_2 absorb the parameters from the structural equations of the model, but it would be impossible to identify these parameters from estimation of the Θ's.

[23]It is apparent that potential enlistees do consider the impact of military service on future civilian opportunities. The services must frequently resort to paying enlistment bonuses or offering other incentives (e.g., enhanced educational benefits) to attract recruits into skills

civilian earnings growth with respect to civilian experience, the less likely one will be to enlist. Introduction of a second time period leaves unaffected the expectations of the random errors in the post-service earnings equations, which are still defined by equations (7) and (8).

Correction for Self-Selection.

As is evident from the above discussion, OLS estimation of the separate earnings equations (1) and (2) or the pooled equation (2b) yields biased estimates of the veterans' premium/penalty when individuals are not randomly assigned to receive the military treatment. Unless individuals base enlistment decisions on earnings maximization, it is not possible to determine a priori whether OLS estimates of the premium/penalty are upward or downward biased. Methodologies for dealing with self-selection are now well developed and are reviewed in detail by Maddala (1983). As can be seen from the expectations in (4) and (6) or (7) and (8), the expected values of the errors in the earnings equations for veterans and non-veterans, respectively, contain expressions involving the probability of enlistment $\Phi(z)$. Given a random sample of potential enlistees on whom actual enlistment decisions and later civilian earnings are observed, one procedure, first proposed by Heckman (1976,1979), is to estimate a probit equation for the probability of enlistment. Variables in this equation are military pay at the time of enlistment (M), other factors that influence the propensity to enlist (Z), and the personal attribute vector (X). From this probit one can estimate z, $\phi(z)$, and $\Phi(z)$ for each observation in the sample. In a second stage the variable $\phi(z)/(1-\Phi(z))$ is constructed and included in the equation for non-veterans while the variable $\phi(z)/\Phi(z)$ is included in the equation for veterans. These two variables account for the non-zero expectation of the random errors in the respective earnings equations. The parameter estimate on the variable $\phi(z)/(1-\Phi(z))$ in the non-veteran equation is an estimate of the covariance $\sigma_{\varepsilon n,u}$ (see equation (7)) while

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that do not provide transferable training. Recruiting is generally much easier into skills that do provide transferable training.

the parameter estimate on the variable $\phi(z)/\Phi(z)$ in the veteran equation is an estimate of $-\sigma_{\varepsilon v,u}$ (see equation (8)).

An alternative approach makes use of the pooled equation (2b). Define the unconditional expectation of earnings in (2b) as

$$E(Y) = (1 - \Phi(z))\, E(Y_n \mid D=0) + \Phi(z)E(Y_v \mid D=1)$$

$$=(1 - \Phi(z))\, (\beta'X + \sigma_{\varepsilon n,u}\, \phi(z)/(1 - \Phi(z))) + \Phi(z)\, (\beta'X + \delta DX + \alpha D - \sigma_{\varepsilon v,u}\, \phi(z)/\Phi(z))$$

$$= \beta'X + \delta(\Phi(z)DX) + \alpha\Phi(z)D + (\sigma_{\varepsilon n,u} - \sigma_{\varepsilon v,u})\phi(z) \qquad (9)$$

The steps here are to estimate a probit equation for enlistment and, for each observation in the sample, use the estimated probit equation to predict the probability of enlistment $\Phi(z)$ and the quantity $\phi(z)$. Then create $\Phi(z)DX$ and $\Phi(z)D$. Then regress Y on X, $\Phi(z)DX$, $\Phi(z)D$, and $\phi(z)$ to estimate β, δ,α, and the covariance difference $\sigma_{\varepsilon n,u} - \sigma_{\varepsilon v,u}$. In estimating the earnings equation (2b) this procedure simply involves the extra step of weighting the interaction variables DX and the dummy D for veteran status by the probability of enlistment $\Phi(z)$.

Other Complications.

Other complications arise from the above discussion. The first is relatively east to deal with. The enlistment model assumes that an individual is observed to enlist if $U_m>U_n$. In fact, to actually enlist in a volunteer environment the individual must both want to enlist and the military must want to take him/her. This suggests that the enlistment decision should be modeled as a bivariate process (rather than a univariate process) with four outcomes (desire to enlist and military willing to accept, desire to enlist but the military rejects, etc.). It is unlikely that available data will support such a model since all we can observe with public use data is whether or not the individual enlists. But since the military's selection process is based mostly on observables such as education and mental group that will be included in the probit for enlistment, inclusion of these variables should adequately control for military selection as well as individual self-selection in the enlistment process.

The second consideration is more vexing. Not only is there a self-selection at the initial entry point, but there is self-selection at the reenlistment point as well. Since about one-third of entrants reenlist after their initial term of service, the assumption that all individuals leave after their first enlistment is clearly invalid. Models of the reenlistment decision patterned after the utility maximization approach of sections 3b and 3c above are already available in the literature (e.g., Warner and Goldberg (1984)).

The biases that arise from self-selection at the first-term point can be sketched out verbally. If those who leave at the first-term point tend to be those who have abnormally good civilian alternatives, the mean earnings of those who leave after an initial enlistment will overstate the mean earnings of all who have served. The bias could be negative, however, if those who have abnormally good civilian opportunities are also ones who have such sufficiently strong net preferences for military service that they reenlist at a higher rate than those with worse civilian opportunities.

The military selection process again plays a role here. People with the worst civilian opportunities may also be failures in the military and therefore denied eligibility for reenlistment. Again, it is probably impossible to sign the bias in observed veteran earnings that is likely to arise from the self-selection at reenlistment. For our purpose in this study, since our goal is to estimate the economic returns to military serv -- as opposed to only the civilian returns -- we have chosen to treat reenlistment earnings the same as civilian earnings and not model selection bias at reenlistment.[24]

Maddala (1983, pp. 278-283) discusses the estimation of models with multiple criteria for selectivity. The method is utilized in Fishe, Trost and Lurie (1981) and Sorenson (1989). If we observe veterans' earnings only for those who choose to enlist but not to reenlist, we must first estimate a (sequential) bivariate probit model for enlistment/reenlistment. The results

[24]This was suggested to us by Wendell Wilson.

of the bivariate probit analysis are used to construct two selectivity correction variables that are then included in the estimation of the earnings equation for veterans. Details of this procedure are found in Maddala (1983).

In the case of analysis of female earnings, the additional problem discussed above of nonparticipation arises. The problem is handled by estimation of a probit for labor force participation, construction of a selectivity variable similar to those discussed above and inclusion of this variable in the earnings equation for those for whom we observe earnings. Successful application of the method requires that we observe some variables that affect participation that do not also affect the enlistment (or reenlistment) choice. Such variables should be readily available: marital status, number of children, husband's earnings, etc., and this is the strategy we in fact employed.

Two final problems to which thought needs to be given is how to deal with attriters and those who return to college after service. Daymont and Andrisani (1986) deleted attriters from their sample. First-term attrition is a serious problem, however: in the AVF period the fraction of entrants failing to complete their initial enlistments runs between 30 and 40 percent. The potential biases that might arise from deleting these individuals from the data are not apparent. Additionally, those who return to college upon leaving the military may represent a sizeable percentage of veterans. They, too, should not be ignored. More thought needs to be given to how to deal with these groups.