AD-A236 979

DTIC
ELECTE
JUN 17 1991
S C D

Reserve Accessions Among Individuals with Prior Military Service

Supply and Skill Match

M. Susan Marquis, Sheila Nataraj Kirby

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

RAND

91-02196

The research described in this report was sponsored by the Office of the Assistant Secretary of Defense (Reserve Affairs). The research was conducted in the National Defense Research Institute, RAND's federally funded research and development center supported by the Office of the Secretary of Defense and the Joint Chiefs of Staff, Contract No. MDA903-86-C-0059.

ISBN: 0-8330-1088-3

The RAND Publication Series: The Report is the principal publication documenting and transmitting RAND's major research findings and final research results. The RAND Note reports other outputs of sponsored research for general distribution. Publications of The RAND Corporation do not necessarily reflect the opinions or policies of the sponsors of RAND research.

Published by The RAND Corporation
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
R-3892-RA

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
Reserve Accessions Among Individuals with Prior Military Service: Supply and Skill Match

5. TYPE OF REPORT & PERIOD COVERED
interim

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
M. S. Marquis, S. N. Kirby

8. CONTRACT OR GRANT NUMBER(s)
MDA903-90-C-0004

9. PERFORMING ORGANIZATION NAME AND ADDRESS
RAND
1700 Main Street
Santa Monica, CA 90401

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
Office of the Assistant Secretary of Defense
(Reserve Affairs)
Washington, D. C. 20301

12. REPORT DATE
October 1989

13. NUMBER OF PAGES
60

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)
No Restrictions

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Military Reserves	Army Personnel
Recruiting	Skills
Enlisted Personnel	Military Training
National Guard	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
See reverse side

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

This report analyzes the accession behavior of enlistees who have had prior military service either on active duty or in reserve service. The report focus on the accession behavior of prior service reservists who served in the active Army or in the Army Reserve and Army National Guard. These reservists account for the largest number of separations, and these components have also traditionally had relatively greater problems in meeting their end-strength requirements. The authors endeavor to determine which policies appear to increase accessions among prior service personnel, placing special emphasis on reserve pay and affiliation bonuses. They investigate how skill match varies across different occupations, the timing of entry, years of service, and area demand.

Accession For
NTIS GRA&I ☑
DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

DTIC COPY INSPECTED 5

R-3892-RA

Reserve Accessions Among Individuals with Prior Military Service

Supply and Skill Match

M. Susan Marquis, Sheila Nataraj Kirby

October 1989

Prepared for the
Assistant Secretary of Defense (Reserve Affairs)

RAND

Approved for public release; distribution unlimited

91 6 14 051

PREFACE

This report analyzes the accession behavior of enlistees who have had prior military service either on active duty or in reserve service. The analysis was conducted for the Assistant Secretary of Defense (Reserve Affairs) by the Defense Manpower Research Center, part of RAND's National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense and the Joint Chiefs of Staff.

Most research on reserve manpower has focused on the accession and attrition of individuals with no prior service. Yet, prior service individuals constitute a little over one-half of enlisted accessions into the Selected Reserve. Thus, understanding the accession and attrition behavior of prior service reservists is extremely important in developing effective reserve manpower strategies to achieve end-strength goals. Analyzing this behavior also has important implications for the optimal mix of prior-nonprior service personnel. The mix will be influenced by how long each reservist will stay in the reserve and how each responds to incentives designed to raise accession and retention.

For two reasons, this report focuses on the accession behavior of prior service reservists who served in the Active Army or in the Army Reserve and Army National Guard. First, these reservists account for the largest number of separations; in addition, over 60 percent of prior enlisted accessions are to one of the two Selected Reserve Army components. Second, these components have also traditionally had relatively greater problems in meeting their end-strength requirements and with shortages in different skills, areas, and units. A previous RAND report, *Economic Factors in Reserve Attrition: Prior Service Individuals in the Army National Guard and Army Reserve*, R-3686-1-RA, March 1989, presents a comprehensive analysis of the attrition behavior of reservists in the Army Guard and Army Reserve. Interim findings from both the accession and attrition analyses were reported in a RAND briefing Note, *Accession and Attrition of Prior Service Reservists*, N-2946-RA, September 1989.

A primary objective of this report is to determine which policies appear to increase accessions among prior service personnel, with special emphasis on reserve pay and affiliation bonuses. As important as the rate of accession is the question of timing of entry, another focus of the analysis. A related question that has important implications for both personnel readiness and training costs is that of skill match: Is

the individual assigned at entry to a job he was previously trained to do? The report investigates how skill match varies across different occupations, the timing of entry, years of service, and area demand. In conjunction with the earlier report on attrition, these results should be useful to manpower policy planners responsible for reserve manning and for the allocation of recruiting resources to improve recruiting and retention.

SUMMARY

Individuals with prior military experience constitute a little over one-half of all enlisted accessions into all Selected Reserve components each year. Annual separations from the Active Army average about 140,000, of whom approximately half are eligible to enlist in the reserves. In addition, the Army Reserve and Army National Guard lose annually, on average, 45,000–65,000 prior service reservists. From this pool, the Army Reserve and Army National Guard enlist approximately 80,000 prior service individuals annually. Little is known, however, about who enters the reserve, the timing of their entry into the reserve and the factors influencing their accession decisions. Understanding the accession behavior of prior service individuals becomes important in light of plans to rely increasingly on reserve units for increasingly complex missions.

A primary objective of this research is to determine which policies increase accessions among prior service personnel, with particular emphasis on the compensation package. A second objective is to examine the timing of entry. The shorter the break in military service, the less we expect relevant skills to have degraded. Such information is critical in projecting the training requirements for prior service personnel. A related issue—one that has important implications for personnel readiness and training costs—is the match between an individual's occupational specialty at separation and the one to which he is assigned at entry. If a large number of prior service individuals need to be retrained upon entry because of a skill mismatch, then the reduction in training costs and the enhanced level of readiness, often thought to be concomitants of hiring prior service personnel, may not actually be realized. We address these three issues in the report.

The data for the study were obtained from the Defense Manpower Data Center and consist of cohorts of individuals with prior service who separated from the Active Army or the two Selected Reserve Army components during FY79–FY84. These are followed in time through FY85 to see if and when they enter one of the Selected Reserve components. For each individual, the records provide the date of separation, the reason for separation, demographic characteristics, and service-related variables (such as years of service, paygrade, Armed Forces Qualifying Test scores and military occupational specialty). For individuals who enlisted in the reserve, we have data from the gain record, including the date of accession and the occupational specialty

to which the individual is assigned at entry. These data were further supplemented with data characterizing the civilian economic opportunities facing the individual—the unemployment rate and the civilian wage rate in the individual's home state.

ANALYSIS OF ACCESSION BEHAVIOR

For the accession analysis, we selected 10,455 Active Army losses, a 1 in 40 sample of eligible losses from each of the study years and 13,099 losses from the Army Reserve and Army National Guard, a 1 in 50 sample of losses.

We use two survival analysis techniques to study accession behavior and the timing of entry into the reserves. The first is a descriptive technique that allows us to look at the distribution of accession times and also how variations in a given characteristic affect the timing of separation. This reveals the gross effect of that characteristic and everything else that varies with it. To estimate the net effect of a characteristic controlling for other factors, we fit a multivariate model.

We find that over a third of all losses from the Active Army eventually join the reserves. Almost two-thirds of all those who eventually enlist in the reserves do so within the first year of separation from the active force. Because of this, the average break in military service tends to be quite short, only about seven months.

Among losses from reserve service, we find that accession is lower than among individuals leaving the Active Army. Indeed, only about 13 percent of those lost from reserve service during FY79–FY84 had rejoined the reserves over this six-year period. It is important to note, however, that unlike the Active Army, accession among prior service reservists does not tail off but continues to increase over time, so that with a longer time horizon, we might find a higher cumulative rate among reserve losses. This pattern, though, means that the average break in service is longer for prior reservists than for prior active duty personnel—14 months compared to seven months.

We fit a multivariate model to estimate the net effect of economic factors and demographic characteristics on accession. The explanatory variables include measures reflecting the return from reserve service relative to that from a civilian secondary job and demographic characteristics of the individual at accession.

Increases in military pay significantly increase accession among both prior active duty personnel and those with prior reserve service. This effect is higher in the first six months after separation than in later periods. For example, a 10 percent increase in pay raises accession

rates by about 16 percent at each point in time during the first six months but only 5.1 percent thereafter among the Active Army losses. For reserve losses, the comparable numbers are 9.6 percent and 3.2 percent. The cumulative effect in the first years after leaving active duty is an 11.7 percent increase in accession resulting from a 10 percent increase in drill pay—an increase of almost 29 accessions per 1,000 separations. Among reserve losses, the cumulative effect is small—an increase of only a little more than three individuals per 1,000 reserve separations.

The affiliation bonus is associated with a large increase in the likelihood of joining the reserves, particularly in the first quarter after separation. We estimate the cumulative effect of the bonus in the first year to be an increase in accessions among eligible individuals of about 30 percent—an increase of 74 accessions per 1,000 eligible separations.

Both civilian pay and unemployment are significant and work in the expected direction during the early months after separation. Higher wage rates appear to lead to lower accession, whereas higher unemployment leads to higher accession rates. However, after the first six months, both these variables have the opposite effects. One reason may be that after the initial transition period, a stable, good economy might favor reserve participation: Employers may be more willing to accommodate reserve duties because it is more difficult to obtain labor; employees may find stable jobs that allow them to consider a part-time reserve job. These effects are small and not significant for losses among the reserves.

Individual characteristics are strongly related to accession. Among the active losses, older and more experienced individuals have considerably lower accession rates than do the younger, less experienced group. Individuals with lower educational attainment are more likely to enter the reserves, as are those with a lower aptitude score. Younger, less experienced, and less educated individuals may have an easier job finding openings in the reserve if they are at lower paygrades or in low-skill jobs. Alternatively, the differences may reflect differences in taste, propensities to use educational benefits for further education, need for extra income, or differences in civilian opportunities. Among reserve losses, we find that older, more experienced individuals are more likely to return to service. Greater vesting in the military retirement system and perhaps a greater taste for the military may help explain this trend. Individuals with less than a high school diploma have a significantly lower probability of reentering the reserve; we believe this may be related to their eligibility to reenter or to promotion possibilities.

Significant differences exist among individuals with different military skill training in the likelihood of their joining the reserves, and these differences appear to be related to demand constraints.

One interesting finding is that, controlling for all other factors, accession rates appear to have been increasing over time for both the active loss and the prior reserve service loss cohorts. We can attribute this partly to aggressive counseling and to the active and reserve components' recruiting initiatives that were triggered by the increase in reserve forces over this time period. In addition, financial incentives that we have not accounted for may have helped increase accession rates. For example, the educational benefits were substantially expanded in FY84.

ANALYSIS OF SKILL MATCH AT ACCESSION

The reasons for a skill mismatch have to do with individual choice—the individual's wish to be trained in a job that either has greater promotion possibilities or can more easily be transferred to the civilian sector—or demand constraints—the lack of an opening at the individual's level and specialty in a local unit.

We analyzed skill match for a 1 in 10 sample of individuals leaving the Active Army who joined the Army Reserve and Army National Guard (14,176 losses) and a 1 in 5 sample of individuals leaving one of the Selected Army Reserve components who returned to reserve service in one of the Army components (9,795 losses). These data were supplemented with information that allowed us to characterize the demand side of the picture.

We measured skill match by comparing the primary occupational specialty (PMOS) with the duty occupational skill (DMOS) at entry. We initially defined a five-category measure based on the degree of match. We find, however, that there is a bimodal distribution: Most individuals are assigned to a DMOS that perfectly matches the PMOS or they are not matched even in the general occupational area. Among accessions from the Active Army, about two-fifths are assigned to skills for which they were trained; the same is true for about 45 percent of prior reserve accessions. Overall, then, about 40 percent of individuals are assigned to reserve jobs for which they have not been trained at all; this poses a significant retraining burden.

The likelihood of a skill match does vary according to the skill the individual holds, with individuals trained in high-skill noncombat jobs being the least likely to be matched at entry. This may reflect demand constraints.

We fit a multivariate model to investigate which factors might be associated with the likelihood of a skill match. Among those with prior active service, the likelihood of a skill match is lower for more experienced personnel, perhaps because of demand constraints or a desire for promotion. Significant differences exist in match rates by occupational grouping. Prior active duty personnel entering the Army Reserve are significantly more likely to be assigned to their trained skill than those entering the Guard. Other studies have also observed this. Two heartening facts are that skill matches are more likely for individuals with shorter breaks in service, and use of prior training appears generally to have improved over time. We also find that demand constraints as measured by the proportion of reserve slots in the individual's home county and occupational area are important in determining the likelihood of a match although the effect is rather small.

These new results on accession of prior service individuals, along with our earlier results concerning attrition among prior service reservists (Marquis and Kirby, 1989), can inform manpower policy in a number of ways. The results on timing of entry and the need for retraining can help policymakers assess the tradeoff between recruiting prior service compared with nonprior service personnel, and between recruiting an individual leaving active service compared with one with prior reserve service. Our estimates also suggest that affiliation bonuses are an effective mechanism for increasing the enlistment rate among the junior force personnel leaving active service and for decreasing attrition, and that targeting recruiting toward certain demographic groups (e.g., those with a high school diploma or those age 31 through 35) may have more effect on accession and overall retention than changes in the basic military pay structure.

ACKNOWLEDGMENTS

We would like to thank Col. David Felt, our project sponsor at Reserve Affairs, for his interest and support. The cohort files underlying this analysis were created by the Defense Manpower Data Center. We thank William Faulkener for constructing the analytic files and Ginger Bassett and Lou Pales for helping us with the file specification. We are grateful to our reviewers Lloyd Dixon and Ron Sortor for their constructive suggestions. The report benefited greatly from their comments. David Grissmer was responsible for initiating the project and for providing overall guidance. Glenn Gotz and Susan Hosek provided helpful comments on earlier drafts and during the course of the research. We thank Luetta Pope and Barbara Thurston for their capable secretarial assistance throughout the study and Patricia Bedrosian for her stellar editing of the final report.

CONTENTS

PREFACE iii

SUMMARY v

ACKNOWLEDGMENTS xi

FIGURES xv

TABLES xvii

Section

I. INTRODUCTION 1
Background 1
Research Issues 2
Plan of the Report 3

ACCESSION

II. RESEARCH FRAMEWORK AND HYPOTHESES 4

III. DATA AND METHODS OF ANALYSIS 6
Data 6
Sample 8
Methods of Analysis 9

IV. PATTERNS OF ACCESSION 14
Accession Among Prior Active Duty Personnel 14
Return to Reserve Service Among Reserve Separations 17

V. MULTIVARIATE ANALYSIS 23
Introduction to the Multivariate Analysis 23
Results 25

SKILL MATCH

VI. RESEARCH FRAMEWORK AND HYPOTHESES 37

VII. DATA AND METHODS OF ANALYSIS 38
Data 38
Methods of Analysis 40

VIII. RESULTS 42
Patterns of Skill Match 42
Multivariate Analysis 44

IX. CONCLUDING REMARKS 51

Appendix: LOGISTIC REGRESSION MODEL OF SKILL MATCH AT ACCESSION FOR SUBSAMPLE WITH COUNTY-LEVEL DATA ON UNIT MANNING 55

BIBLIOGRAPHY 59

FIGURES

1.1. Prior service accessions constitute over half of reserve enlistments 2
4.1. Cumulative reserve accession rate for prior Active Army personnel 14
4.2. Reserve accession rate for prior Active Army personnel 16
4.3. Cumulative reserve accession rate for prior Active Army personnel, by years of service 16
4.4. Cumulative reserve accession rate for prior Active Army personnel, by education 18
4.5. Cumulative reserve accession rate for prior reservists 18
4.6. Reserve accession rate for prior reserve personnel 20
4.7. Cumulative reserve accession rate for prior reserve personnel, by years of service 20
4.8. Cumulative reserve accession rate for prior reserve personnel, by education 21

TABLES

3.1. Demographic composition of losses from the Army: Active force and reserve components, FY79–FY84 10
5.1. Parameter estimates for Cox regression on time to accession for Active Army loss cohort, FY79–FY84 26
5.2. Parameter estimates for Cox regression on time to accession for Army Reserve and National Guard loss cohorts, FY79–FY84 28
5.3. Supply and demand of reserve occupations 34
8.1. Skill match at loss and accession by type of prior service 42
8.2. Skill match at loss and accession by DoD occupational code at loss 43
8.3. Duty assignment for those in different occupation area at loss and entry 44
8.4. Skill match at accession of prior active service personnel: logistic regression parameters and net probabilities 46
8.5. Skill match at accession of prior service reservists: logistic regression parameters and net probabilities 47
8.6. Total effects of years of military service and gap in service 50
A.1. Skill match at accession of prior active service personnel: logistic regression parameters and net probabilities 56
A.2. Skill match at accession of prior service reservists: logistic regression parameters and net probabilities 57

I. INTRODUCTION

BACKGROUND

Despite dramatic growth in the size of the reserve forces in the 1980s (Marquis and Kirby, 1989), the components report shortages of junior enlisted personnel, shortages of senior personnel in some geographical areas and skills, and shortages for larger units. Furthermore, personnel shortages may become exacerbated in future years because the pool of eligible individuals from which the reserves may recruit is expected to shrink. These shortages are critical in view of Department of Defense (DoD) plans to maintain as small an active peacetime force as consistent with overall defense strategies, and to rely increasingly on reserve component units (Department of Defense, 1987). If the planned increase in reserve manpower is to be realized, therefore, policymakers must find ways to either increase the rate of accession from the eligible pool or to increase retention of reservists.

Reflecting the growing importance of reserve forces in achieving national security objectives, the Sixth Quadrennial Review of Military Compensation was directed by Congress to review reserve compensation and propose reforms that would address the shortage problems. To support the review, RAND has studied reserve personnel problems that may be remedied, at least in part, by changes in compensation (Grissmer, Buddin, and Kirby, 1989). Whether proposed reforms in compensation will ultimately affect manpower levels depends on how heavily economic factors weigh in individuals' decisions about reserve service. One objective of this research is to add to knowledge about individuals' response to economic factors.

Reserve recruits are classified as nonprior service recruits—those without prior military training and experience—or as prior service recruits—individuals who have previously served in the active or reserve forces. Most previous research on recruiting and retention in the reserves has studied the accession and attrition of nonprior service personnel. However, as Fig. 1.1 shows, prior service personnel constitute over one-half of reserve enlistments.

For the Army Reserve the proportion of accessions who have prior military service has been increasing. For example, in FY80, prior service reservists constituted about 56 percent of total enlisted accessions into the Army Reserve; by FY86, this proportion had grown to 62 percent. This report presents results from a study of the accession

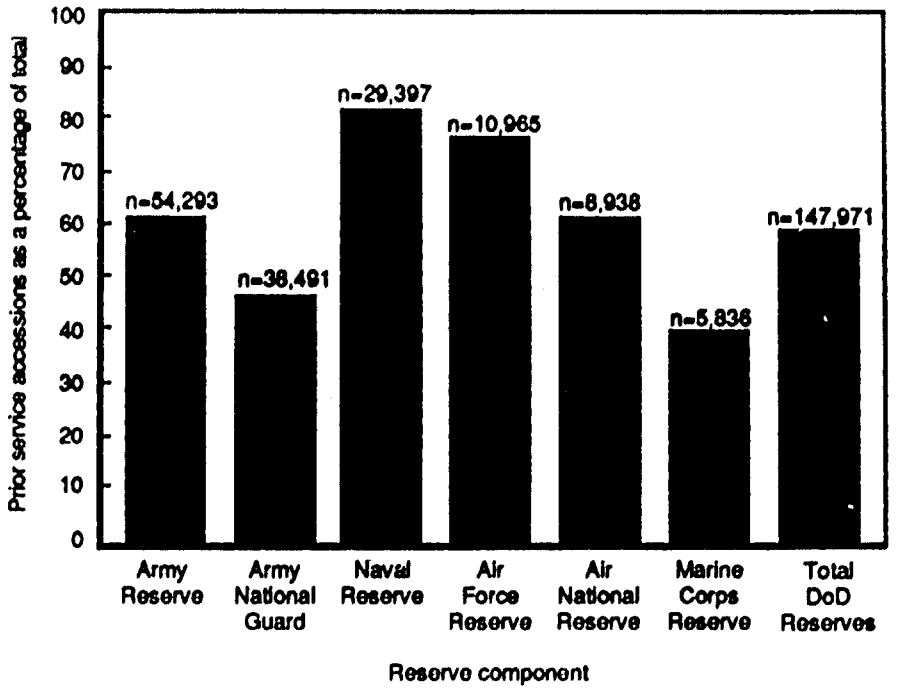

Fig. 1.1.—Prior service accessions constitute over half of reserve enlistments

decisions of these prior service individuals, who constitute such an important source of reserve manpower.[1] In our research we have focused on individuals whose prior service was in the Active Army or in one of the two Army reserve components.

RESEARCH ISSUES

A primary objective of this research is to determine which policies appear to increase accessions among prior service personnel. One policy tool available to planners is the compensation package and questions we seek to address include:

- How does an increase in reserve pay affect accession rates?
- How do affiliation bonuses affect accession?

[1]In an earlier study (Marquis and Kirby, 1989), we examined the attrition decisions of prior service individuals who do join the reserves.

We also investigate how individuals' personal characteristics affect accession rates. This information can potentially be useful in targeting recruiting resources. Furthermore, understanding the relative importance of demographic and economic factors in the accession decision will enable planners to assess the effectiveness of different recruiting policies.

As important as the rate of accession is the question of timing of entry. The shorter the break in military service, the less we expect that relevant skills will have degraded. Such information is also critical in projecting the training requirements for prior service personnel. Therefore, our analytic approach uses methods to study the time between separation from previous military service and return to military service.

Among prior service individuals who do join the reserve, we investigate whether the reserve job to which the individual is assigned uses the military skill for which the individual was previously trained. This match has important implications for personnel readiness and for training costs. A major reason for preferring prior service recruits to nonprior service enlistees is the oft-mentioned expected reduction in training costs. This may not actually be realized or may be realized only to a small degree if such individuals are assigned to occupational specialties at entry that do not match the specialties in which they were previously trained.

PLAN OF THE REPORT

Sections II and III present the results of our analyses of accession behavior, including the research framework, the available data, and our analysis methods. Section IV describes accession rates and the break in military service as a function of selected characteristics. Results from a multivariate analysis of accession are given in Sec. V. Sections VI–VIII present the research framework, the available data, and the results of an analysis of the match between occupational specialty at loss and at reserve accession. We conclude with some observations on the policy implications of our results.

II. RESEARCH FRAMEWORK AND HYPOTHESES

Reserve service constitutes a part-time or secondary job for most reservists. Consequently the decision to enlist in the reserves represents a preference for reserve service over part-time civilian jobs or leisure activity. Some factors that we expect to influence the individual's evaluation of reserve service relative to civilian alternatives are:[1]

- The relative economic rewards from military and civilian life.
- Major external circumstances of the individual's life particularly those that might conflict with the work schedule of the reserve job, such as family demands, less stability in the primary civilian job, etc.

This framework leads to a number of testable hypotheses. First, we hypothesize that, other things equal, an increase in military pay will raise the expected return from military service relative to civilian alternatives thus increasing an individual's likelihood of joining the reserves. Indeed, several studies have demonstrated that reserve accessions increase as military pay rates rise; this is found among individuals with or without prior military service (Shiells, 1986; Rostker, 1974).

Second, the military may offer special bonuses to attract personnel with specific skills or in geographic areas in which the reserves experience shortages. We expect that such bonuses will increase accessions. Affiliation bonuses to attract those leaving active duty to reserve service were authorized in FY81, within the period covered by our study. These bonuses have been found to increase accessions among Navy veterans (Asch, 1986); we will test the effect of affiliation bonuses on accessions among Army veterans.

Third, we expect that the higher the anticipated future benefit from the military retirement system, the greater the likelihood of accession. We do not have a direct measure of anticipated future benefits. However, we expect that those with more years of military service and older individuals are likely to perceive a greater return than those with fewer years of service. The more years of previous service, the closer the

[1]Grissmer and Kirby (1984, 1985, 1988) develop this framework in detail, drawing on the recent literature on labor market theory.

reservist is to being vested in the retirement system. Older individuals are closer to retirement and closer to reaping the benefits; thus the present value of retirement benefits is higher for older individuals than for younger ones.

Fourth, we expect that an increase in civilian wages will reduce the rate of accessions, by lowering the relative attractiveness of reserve service.

Fifth, changes in the unemployment rate reflect changes in civilian opportunities, which we expect will affect accession. As unemployment increases, the more difficult it will be to find an alternative in the civilian sector and the more likely that an individual will choose reserve service.

Finally, individuals' characteristics related to job, family, or geographic stability are also likely to affect the likelihood of accession. The inflexible work schedule of the reserve job, typically requiring one weekend per month and two weeks during the summer, makes the reservist unusually vulnerable to schedule conflicts between reserve obligations and the demands of family and civilian employers. Older individuals have more stability in terms of job and family responsibilities than their younger counterparts, and we expect this to make reserve service easier for them. Reservists with higher education tend to have more job stability, which we expect also to favor reserve service.

III. DATA AND METHODS OF ANALYSIS

DATA

The data for our analysis are a longitudinal history of reserve accession and reserve service for individuals who separated from Active Army service, from the Army Reserve, or from the Army National Guard during FY79 through FY84. The history file was developed by the Defense Manpower Data Center from separation records for the active and reserve forces. For each individual leaving service, the loss records provide: the date of separation; the reason for separation (separation program designator); military service data at loss including military occupation, years of service, paygrade, and Armed Forces Qualifying Test (AFQT) score; and demographic characteristics at the time of loss including age, home state, education, race, and sex.

Not all those lost from the active force are eligible to enter the reserves. To determine eligibility, we grouped the interservice separation codes into five categories. The categories and the percentage of Active Army separations designated as such are: (1) released from active duty, 50 percent; (2) performance below standards, 32 percent; (3) retirement, 6 percent; (4) medically ineligible, 7 percent; and (5) other ineligible, 5 percent. We defined the eligible pool of individuals with prior active service to include only those with a separation designator falling in category 1. Although this definition excludes some who might be eligible to enlist in the reserves or who might become eligible at a subsequent date, a later check of those who did enlist revealed that approximately 95 percent were drawn from the pool we define as eligible. Our analysis in this report is limited to active separations whom we classify in our eligible pool.

Data dictated that we adopt a different approach for individuals leaving reserve service. Separation codes were not present for losses from the National Guard and separation codes (including a designation of eligible) were available for fewer than 30 percent of losses from the Army Reserve. Consequently, we did not use the separation designator to define an eligible group among reserve separations. Our analysis includes all reserve losses except retirees, whom we define to be individuals with 30 or more years of service at loss. Had we excluded the Army Reserve losses with a separation code that indicated ineligibility, our accession rate among separations from the Army Reserve would increase by less than two percentage points. With the data at hand we cannot know whether all reserve losses absent a separation designator

are eligible. If they are not, our results on accession rates still describe returns to service among all individuals leaving reserve service but are not directly comparable with the accession rates that we estimate for the eligible pool of active separations.

Among individuals with a separation record from the Army Reserve or Army National Guard, we exclude from our study any individual who rejoined a reserve unit in the same month as his separation month; we do not consider these individuals to be losses to the reserves. We believed that such individuals most likely changed reserve units or reserve components because of a geographic move or for other reasons of convenience. Indeed, over three-quarters of these individuals either changed reserve components or had a different home state at accession than at separation. From the perspective of the military, such a change is not a loss, although it may be from the perspective of the specific unit or component. We exclude about 4 percent of all separations for this reason. If we include these individuals among the separations, our estimate of accession rates is obviously higher, since these are individuals known to "return" to service. Although we exclude these individuals from the population of losses for our primary analysis, we indicate how our results would change if we included them.

The loss records were matched, by Social Security number, to all reserve component gain files for the period FY79 through FY85. If a match was found, data from the gain record were appended to the loss record. The gain record provides the date of accession, allowing us to determine the elapsed time between separation and joining or rejoining the reserves. The gain record also indicates the occupational specialty to which the individual is assigned at entry; we use this information to compare the military occupation at separation and accession.

A key question in our research is the effect of the relative economic rewards from military and civilian life on the decision of individuals with prior military service to join the reserve. We use information about the individual's paygrade and years of military experience at the time of separation to compute the reserve pay that the individual would earn at the time of separation and at each anniversary date before accession or until the end of the study period. The computation uses the reserve pay schedules for drill pay for a single drill; the pay rates for each fiscal year are deflated to January 1979 dollars.

We have supplemented these data with information characterizing the civilian economic opportunities facing the individual—the unemployment rate and civilian wage rate in the individual's home

state.[1] We obtained the unemployment rate in the home state for the quarter in which the individual separated from active or reserve service and for all subsequent quarters representing the anniversary of separation until accession or until the end of the study period. The data come from the Bureau of Labor Statistics monthly unemployment series; this series is based on data from the Current Population Surveys. The hourly wage rate is based on hourly average earnings (excluding overtime) for production workers in manufacturing industries. These data are collected by the Bureau of Labor Statistics from a monthly survey of a sample of manufacturing establishments. Our quarterly wage measure is a simple average of the estimates for each month of the quarter and, as with the military pay measure, civilian pay is measured in January 1979 dollars.

SAMPLE

We selected a 1 in 40 sample of eligible Active Army losses from each of the study years and a 1 in 50 sample of eligible losses from the Army Reserve and from the Army National Guard. To ensure that our sample mirrored the composition of all losses, we selected the sample by stratifying losses in each year on the basis of years of prior military service, age at separation, race, sex, education, and military occupation at separation; we then selected a proportional sample from each stratum. Our procedure was to order the observations on the basis of the values of these characteristics, to group the ordered observations into clusters of 40 in the Active loss file or clusters of 50 in the two reserve loss files, and to select the *n*th observation from each group, where *n* was a randomly selected number. Our analysis sample consists of 10,455 Active Army losses, 5,368 Army Reserve losses, and 7,731 Army National Guard losses.

The demographic composition of the analysis samples is shown in Table 3.1. As we would expect, individuals entering the eligible pool of prior service individuals from the active force are younger than those separating from the reserves. Those leaving active service also have fewer years of prior service than those leaving the reserves, partly as a consequence of the younger age in the former group. Individuals leaving active duty service are more likely to have completed high school than those leaving reserve service, but the former group are less likely

[1]The home state was obtained from the loss record. This information is not updated for individuals who move during the study period, and may not accurately reflect the geographic destination of individuals who are just entering civilian life or who are separating from the reserve unit as the result of a move.

to have schooling beyond high school than the latter group. This too is partly related to the younger age of those leaving active service, and some from this group will continue with their education after leaving the military.

Differences among those entering the eligible pool of prior service individuals from the two reserve components reflect differences in the composition of the components (Marquis and Kirby, 1989). Individuals leaving the Army National Guard tend to be older and have more prior years of service than those leaving the Army Reserve. The former are also less likely to be female or black as compared with those leaving the Army Reserve. Differences in the distribution of losses by occupation reflect differences in the primary missions of the two components. Those leaving the Guard are more likely to have served in infantry or electrical and mechanical equipment repair specialties, whereas those leaving the Army Reserve are more likely to have served in administrative or support functions.

Changes in the makeup of the losses over time mirrored changes occurring in the composition of the military. The most notable trend (not shown in the following tables) is an increase in the age and years of service at the time of loss among those leaving active service and the two reserve components. This accords with the trend for longer military service.

METHODS OF ANALYSIS

A distinguishing feature of our data, and most time-to-event data, is that the event, in our case accession, may not have occurred at the time of analysis. We do not observe accession for individuals who have not returned to military service at the end of FY85, although some of them may later return. These data are "right-censored"; we know only the amount of time that elapsed between the time the individual left military service and the end of FY85 and that the individual had not returned to military service by then. Special techniques have been developed to handle censored data and we use two of these techniques in our study.

Three related functions are used in survival analysis to describe the distribution of time until the event of interest (i.e., accession) occurs: (1) the survival function, $F(t)$, is the probability that the event under study has not occurred at time t. In our analysis, $F(t)$ is the probability that the individual has not returned to military service at time t, where t is the number of months that have elapsed since the individual left previous service. This can also be viewed as the proportion of a

Table 3.1

DEMOGRAPHIC COMPOSITION OF LOSSES FROM THE ARMY: ACTIVE FORCE AND RESERVE COMPONENTS, FY79–FY84
(In percent)

Variable	Active Army Losses	Reserve Losses	
		Army Reserve	National Guard
AFQT score[a]			
Category I	4.5	6.9	5.3
Category II	25.6	25.9	26.9
Category III	58.3	55.4	58.6
Category IV	11.7	11.8	9.2
Education			
Less than high school	15.1	27.5	33.3
High school diploma	76.6	57.8	55.6
Some college or more	8.4	14.7	11.2
Occupation[b]			
Infantry	27.2	18.8	32.6
Electronic equipment repair	4.7	2.3	2.2
Communications/intelligence	11.3	5.8	6.9
Health care specialists	6.4	10.8	4.4
Other technical specialists	2.3	2.1	1.6
Functional support/administration	13.2	23.4	12.5
Electrical/mechanical equip. repair	17.7	14.0	17.4
Craftsmen	2.9	5.4	3.9
Service and supply handlers	14.3	15.4	13.7
Not occupationally qualified[c]	—	2.0	4.8
Years of service			
Less than 4	51.3	32.8	34.1
4	23.6	8.1	7.3
5–6	9.3	23.9	16.6
7–9	11.8	19.2	24.1
10 or more	4.0	16.0	17.9
Age			
Less than 22	30.4	25.3	23.7
22–23	31.4	14.9	13.6
24–25	16.1	15.8	13.1
26–30	16.8	20.8	21.8
31 or older	5.3	23.2	27.8
Race			
Black	26.8	26.6	19.8
Not black	73.2	73.4	80.2
Sex			
Female	8.3	16.2	6.6
Male	91.7	83.8	93.5
Sample size[d]	10,455	5,368	7,731

[a]Category I is a score of 93 or better, Category II, a score of 65–92, Category III, a score of 31–64, and Category IV, a score of 30 or less.

[b]DoD occupation codes—1 digit.

[c]Also includes those in undesignated occupations, students, and patients.

[d]1 in 50 sample of reserve losses; 1 in 40 sample of Active losses.

cohort with a break in military service of t months. Our estimate of the cumulative accession rate, or the proportion of a loss cohort who will return to military service within t months, is $1 - F(t)$. (2) The probability density function is given by $f(t) = -dF(t)/dt$. It gives the instantaneous rate of accession at time t for all individuals in the eligible pool of prior service individuals. (3) The hazard function, $h(t) = f(t)/F(t)$, is the instantaneous rate of accession at time t for those who have not returned by time t—those who have not returned by time t represent the eligible pool of prior service reservists with a break in service of t months. We will refer to $h(t)$ as the accession rate.

We use two survival analysis techniques to study when accession occurs. The first, called the Kaplan-Meier estimator, is a descriptive technique that allows us to look at the distribution of accession times. The Kaplan-Meier estimator, often referred to as a life-table estimator, is a nonparametric estimator that makes no assumptions about the distribution of the survival function but corrects for sample losses resulting from censored observations before time t.[2] If we let $n(j)$ be the number of prior service reservists who have not returned to military service after j months, and $d(j)$ be the number who join a reserve unit in the period, then the accession rate at time j, $h(j)$ is given by $h(j) = d(j)/n(j)$. The survival function can be estimated as:

$$F(t) = \Pi(1-h(j)),$$

where the product runs from the initial period to $t - 1$ (Kalbfleisch and Prentice, 1980; Cox and Oakes, 1984). We also use the Kaplan-Meier estimator to see how the timing of accession varies across reservists who have different demographic characteristics.

The Kaplan-Meier estimators for different subgroups allow us to see how variations in one characteristic affect the timing of accession. This reveals the gross effect of that characteristic and everything else that varies with it. For example, because years of prior experience increase with the age of the reservist, Kaplan-Meier estimators for individuals of differing age also include any effect of years of previous military service on the accession decision. To estimate the net effect of a characteristic, controlling for other characteristics, we fit a Cox proportional hazards model (Cox, 1972). This model assumes that the accession rate function for an individual with characteristics given by x is:

[2]Those included in censored observations—those who do not enter the reserves during the period over which we observe—are counted in the eligible pool (the denominator) in estimating the hazard during the period of time they are observed (e.g., t months), but the measure t is not treated as the length of time to the event (i.e., the censored observation does not enter the numerator of the hazard).

$$h(t;x) = g(x)h_0(t),$$

where $h_0(t)$ is an underlying accession rate function and $g(x)$ is a function of the characteristics.

In the Cox proportional hazards model, no assumptions are made about the underlying model for the accession rate, $h_0(t)$; it is completely arbitrary and unspecified. We adopt the Cox model precisely because it is less stringent in its assumptions than some of the alternative hazards specifications. In the multivariate analysis, we are more interested in how differences in characteristics shift the hazard function, and less interested in describing the shape of the function. In the Cox model, one assumes that the effect of an increase in a given characteristic, say x, is to multiply the accession rate by a constant factor $g(x)$, so that the accession rates for groups of individuals with different levels of x are proportional. Since the accession rate must be greater than zero, a common form for $g(x)$ is $g(x) = exp(bx)$, where b denotes the regression coefficients to be estimated. Here, the multiplicative effect on the accession rate of an increase in x is given by $exp(b)$.[3] A concrete example may help to illustrate this point. Assume we have a reference individual whom we will characterize by $x = 0$; the accession rate function for the reference individual is then the (unspecified) $h_0(t)$. A second individual is similar to the reference individual in all respects, except that the second individual differs in one characteristic; for example, he is eligible to receive an affiliation bonus if he joins the reserves ($x_1 = 1$). For the second individual, we have

$$h(t;x_1 = 1, x_2 \ldots x_n = 0) = exp(b_1)h_0(t),$$

or,

$$h(t;x_1 = 1, x_2 \ldots x_n = 0)/h_0(t) = exp(b_1).$$

[3]Then, for each individual j in the eligible pool at time t, the probability that an individual joins at time t, given that one individual in the pool joins at time t, is $exp(bx_j)/\Sigma_{j \epsilon P}(exp(bx_j))$, $x_2 \ldots x_n$, where P is the set of individuals in the eligible pool at time t. The baseline hazard (h_0) cancels because of the multiplicative assumption. Let $t_1, \ldots, t_k$ be the k distinct times and n_i be the number who join at time t_i, then the log likelihood is

$$L = \sum_{i=1}^{k} (b_j \sum_{j \epsilon t_i} x_j - n_i \ln \sum_{j \epsilon P_i} \exp(bx_j)).$$

Again, those included in censored observations enter the eligible pool but do not contribute to the numerator of the likelihood. See Cox and Oakes (1984) for a full development.

Thus, for example, if we estimate $exp(b_1) = 1.10$, this indicates that at any point in time the probability of accession among individuals who are eligible for an affiliation bonus is 10 percent higher than among those not eligible for the bonus.

IV. PATTERNS OF ACCESSION

ACCESSION AMONG PRIOR ACTIVE DUTY PERSONNEL

The Kaplan-Meier estimator of the reserve accession function for individuals who leave Active Army service is depicted in Fig. 4.1. The horizontal axis shows the length of time in months since leaving military service. The vertical axis measures the cumulative proportion of eligible individuals leaving active duty who enter the reserves within that period of time. We find that over a third of all losses from the Active Army eventually join the reserves. However, as the graph makes clear, almost two-thirds of all those who eventually enlist in the reserves do so within the first year of separation from the active

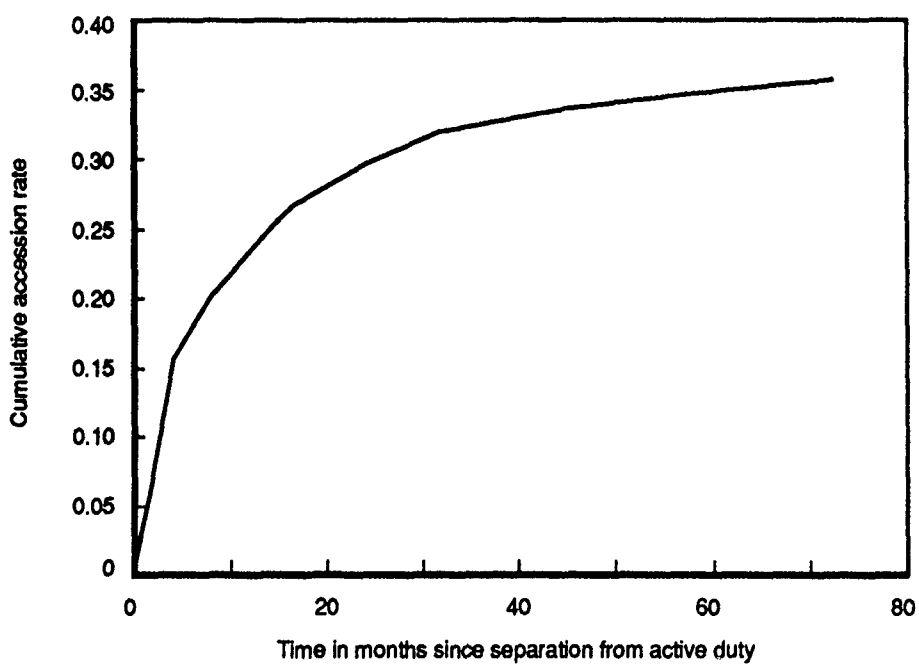

Fig. 4.1.—Cumulative reserve accession rate for prior Active Army personnel

force.[1] Because most accessions occur soon after leaving active duty, the break in military service is quite short. For individuals who join sometime within six years after leaving service, the average break is only seven months.[2]

The tendency for those who do return to do so immediately after leaving active duty is clearly seen in Fig. 4.2. The accession rate (the instantaneous probability of joining among those who have not yet done so) is highest in the early months after leaving the military and declines thereafter.[3]

We hypothesized that, for three major reasons, individuals with more years of service would be more likely to enlist in the reserves than those with fewer years. First, those with longer service are at higher pay grades and so are better compensated. Second, they have a greater investment in the military retirement system. Third, individuals with more service experience are likely to be those with a higher taste for the military.

However, as Fig. 4.3 shows, individuals with six or fewer years of service appear to be more likely to join the reserves than those with more than six years of service.[4] There are several possible explanations for this finding. One, those with greater years of experience may face demand constraints. There are limited opportunities at the high pay grades and the reserves may prefer to promote from within. Hence, those leaving active service at the high grades may have difficulty finding an opening even if they wish to join a reserve unit. A second explanation revolves around the fact that affiliation bonuses were offered during part of the study period to those who joined a reserve unit immediately upon separation from active duty. The bonus, however, was available only to those with a remaining military service obligation—only to those who had served on active duty for a shorter period of time and consequently still had time to serve. The bonus, therefore, might account for the greater propensity to join the reserves among individuals with six or fewer years of active duty

[1]The 95 percent confidence bands for some typical point estimates shown in Fig. 4.1 are: at six months, 0.159 ± 0.007; at 18 months, 0.265 ± 0.008; at 30 months, 0.312 ± 0.009.

[2]This is measured as the area under the curve shown in Fig. 4.1.

[3]The 95 percent confidence bands for some typical point estimates shown in Fig. 4.2 are: at entry, 0.043 ± 0.002; at 18 months, 0.0065 ± 0.0009; at 30 months 0.0037 ± 0.0008.

[4]The confidence bands for the subgroups are wider than those for the entire group because sample sizes are smaller (see Table 3.1 for information about subgroup sizes). Here we simply display graphically the total effect of each characteristic. We have not presented standard errors and tests of the significance of the total effect but instead focus on the statistical significance of the net or partial effects in the next section.

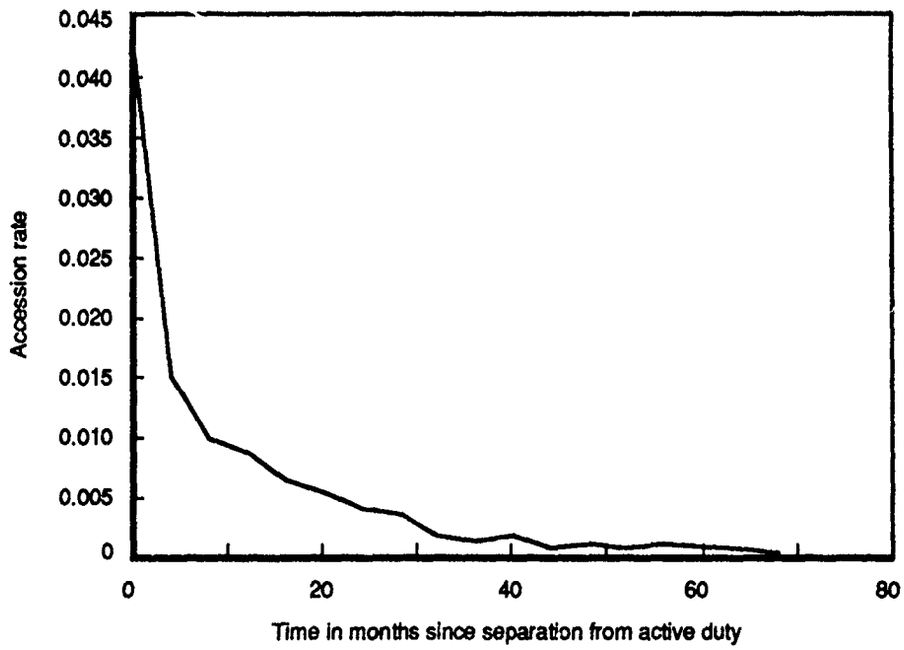

Fig. 4.2.—Reserve accession rate for prior Active Army personnel

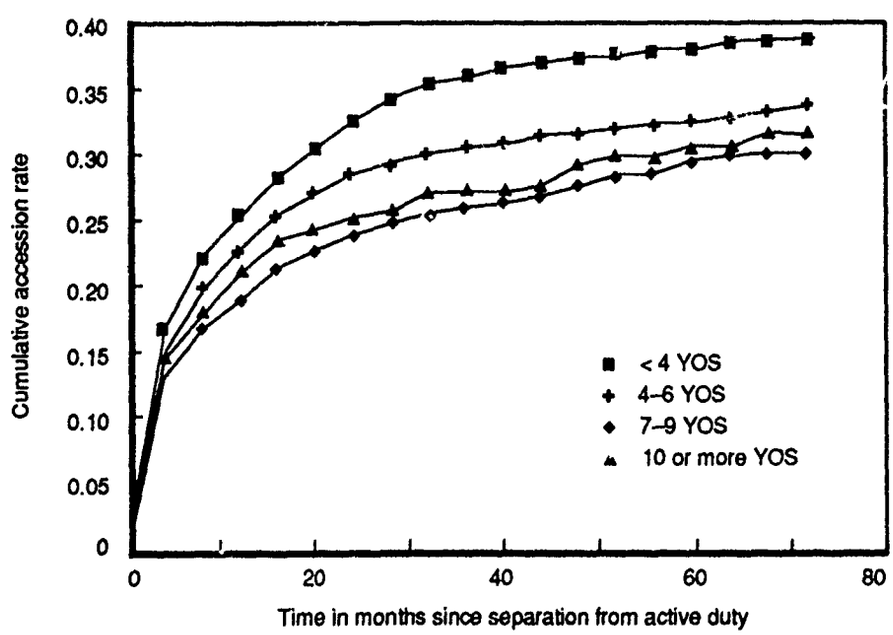

Fig. 4.3.—Cumulative reserve accession rate for prior Active Army personnel, by years of service

service. A third reason may have to do with the differences among those leaving active service at the end of the first term compared with the second term or later. If the latter differ in, say, their taste for the military, then we might see differences in their rates of accession into the reserves. Again, there may be unmeasured characteristics associated with having more years of military service that may cause this result.

Accession is somewhat more likely among those leaving the Active Army with less than a high school diploma than among those who have completed high school or have some college (Fig. 4.4). This may reflect differences in the civilian economic opportunities facing these groups, differences in the need for extra income, differences in their propensities to use educational benefits after leaving the service to pursue further education, and the problems associated with managing both civilian jobs and schooling. An alternative explanation might be that individuals with lower educational attainment might be at lower paygrades or in low-skill jobs, for which there exist relatively more openings in the reserve components. We examine the effect of relative economic rewards on accession more directly in the multivariate analysis presented the next section.

RETURN TO RESERVE SERVICE AMONG RESERVE SEPARATIONS

Turning to losses from the reserve forces who subsequently reentered the reserves, we find that accession is lower than among individuals leaving the Active Army (Fig. 4.5). Indeed, only about 13 percent of those lost from the reserves during FY80–FY84 (as compared to 35 percent of the Active Army losses) had rejoined the reserves over this six-year period.[5]

However, several factors may alter this conclusion. First, as we noted above, separation designators were unavailable for the Army National Guard losses and were coded for only a small fraction of Army Reserve losses, and so we did not use these data in defining the eligible pool. If we exclude everyone with a separation code in the ineligible range, our estimate of cumulative accession over the period increases by fewer than two percentage points over the rate shown. But we have no way of knowing whether all individuals with no

[5]The 95 percent confidence bands for some selected point estimates shown in Fig. 4.5 are: at six months, 0.019 ± 0.004; at 18 months, 0.054 ± 0.006; at 30 months, 0.071 ± 0.007, for the Army Reserve. For the Army National Guard, these are 0.017 ± 0.003, 0.049 ± 0.005, 0.071 ± 0.006, respectively.

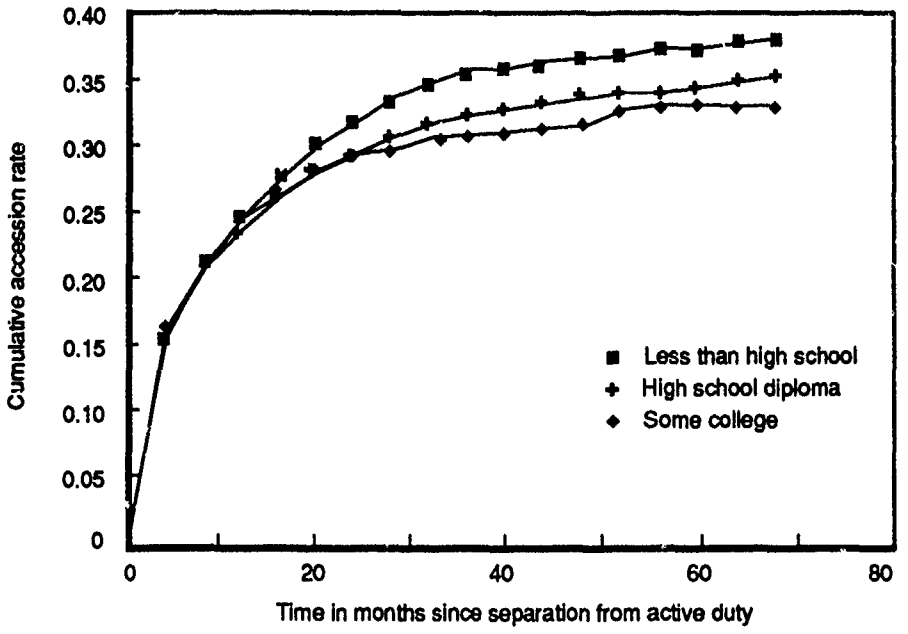

Fig. 4.4.—Cumulative reserve accession rate for prior Active Army personnel, by education

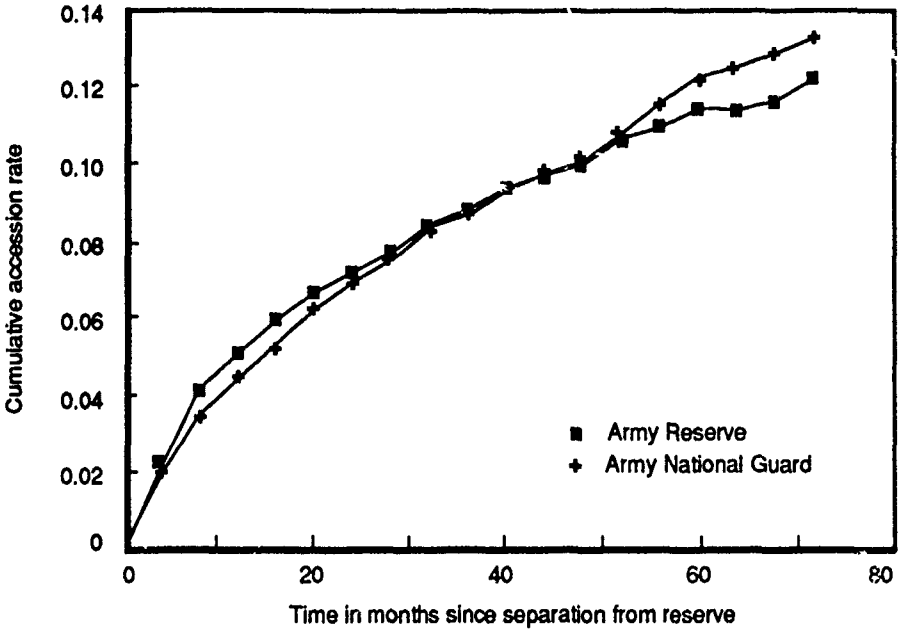

Fig. 4.5.—Cumulative reserve accession rate for prior reservists

separation program designator should be classed as eligible to return to reserve service.

Second, individuals joining a reserve unit in the same month as they separate from previous service were excluded from our analysis of reserve losses, although, of course, individuals joining a reserve unit immediately upon leaving active service are included in that analysis. We excluded reservists with a break in service of less than a month because the evidence supported the hypothesis that these individuals were simply transferring to another reserve unit in another geographic area or to another reserve component; from the perspective of the military they are not separations. If we do count these individuals as losses to the reserves, then also as subsequent accessions, our estimate of the cumulative accession over the study period would rise to about 15 percent of losses—about two percentage points higher than the rate shown

Finally, unlike the Active Army losses, accession among prior reservists appears not to tail off but to increase over time, so with a longer time horizon we might find a higher cumulative rate among reserve losses. This also can be seen by contrasting the accession rates for separations from the two reserve components in Fig. 4.6 with that given in Fig. 4.2 for Active Army losses. In the latter case, the accession rate fell dramatically in the first six months and approached zero for the remainder of the follow-up period. In the former case, accession rates do fall after six months, but the fall-off is not as dramatic as with the Active Army losses. Thereafter, among prior reservists, accession rates remain at a fairly constant level throughout the six year follow-up period.[6] The finding also means that the break in service is typically longer for a prior reservist who rejoins the reserves than for a prior active military individual. The break in service averages 14 months for a prior reservist in contrast to the seven months for a prior active service individual.[7]

When we examine the accession rate of reserve losses among reservists with different amounts of prior military service, we find the expected result (Fig. 4.7). Here, persons with more years of service are more likely to rejoin the reserves than those with fewer years of service. The highest rates of reentry are among those with 10 or more

[6]The 95 percent confidence bands for some selected point estimates shown in Fig. 4.6 are: at entry, 0.0047 ± 0.0009; at 18 months, 0.0018 ± 0.0006; at 30 months, 0.0017 ± 0.0007 for the Army Reserve. For the Army National Guard, these are 0.0043 ± 0.0007, 0.0024 ± 0.0006 and 0.0020 ± 0.0006, respectively.

[7]If we include reservists with a recorded separation who return to service in the same month, the average break in service falls to 11 months but is still longer than that for accessions among prior active duty personnel.

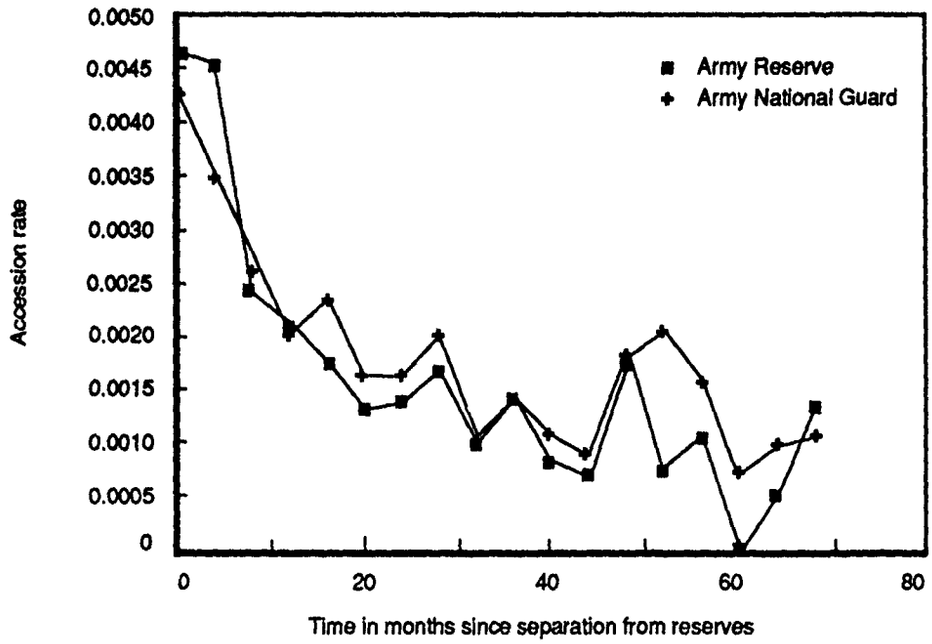

Fig. 4.6.—Reserve accession rate for prior reserve personnel

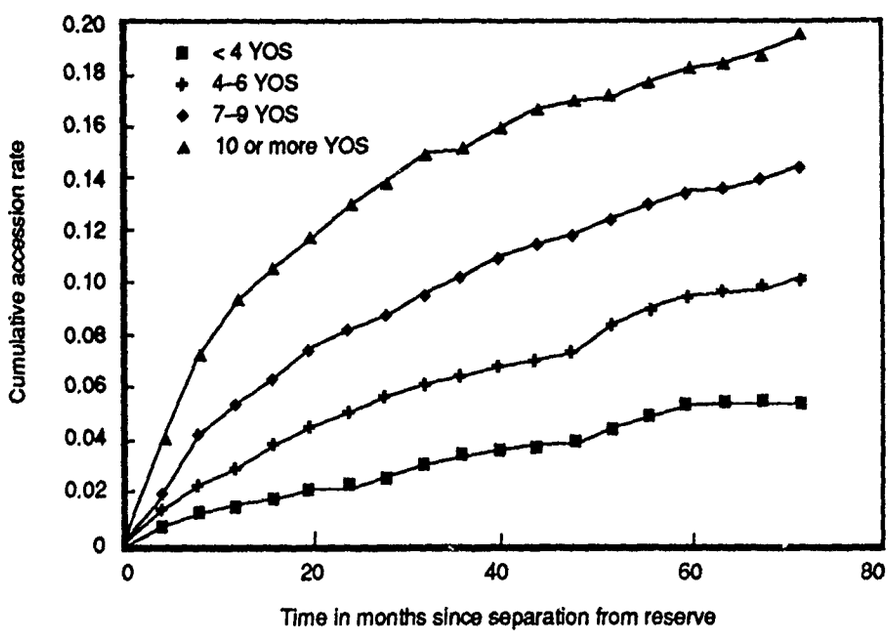

Fig. 4.7.—Cumulative reserve accession rate for prior reserve personnel, by years of service

years of service. We hypothesize that demand constraints among those with more years of service are less important for individuals with prior reserve service than for those coming straight from the active force, since the former are more familiar with reserve service and reserve units. In addition, the affiliation bonus that might explain the high propensity to join the reserves among active losses with fewer years of service was not offered to prior reserve service personnel. Yet a third reason may be that younger individuals leaving the reserves may separate for very different reasons than older individuals and these reasons may cause them to be less likely to rejoin.

Education, too, evidences a different relationship with accession among prior reservists than we found for prior active duty personnel. Figure 4.8 shows that prior reservists with high educational attainment are more likely to return to reserve service than those with lower educational attainment. This may be due to a variety of reasons. We have not been able to sort out among these data who are eligible to

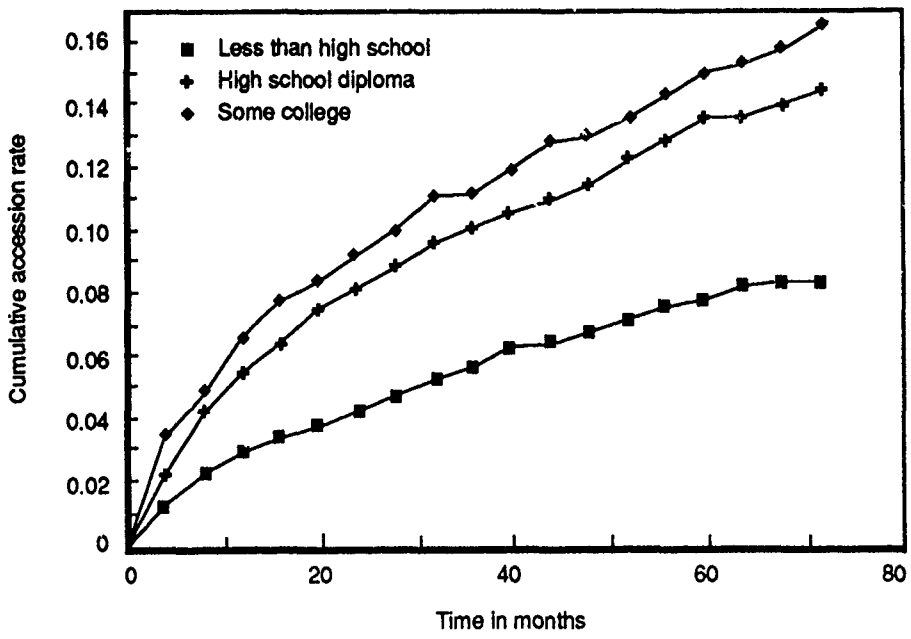

Fig. 4.8.—Cumulative reserve accession rate for prior reserve personnel, by education

reenlist in the reserves. If a higher proportion of those with lower educational attainment are ineligible to reenlist, then our accession rate measurements are in error and we do not know whether these patterns would hold. Another possibility is that individuals with lower educational attainment may face poorer promotion possibilities and so choose not to reenter or are discouraged from doing so by the reserve components. Alternatively, they may face more severe employer conflicts in carrying out their reserve duties than those in better civilian jobs.

V. MULTIVARIATE ANALYSIS

INTRODUCTION TO THE MULTIVARIATE ANALYSIS

The figures given in the previous section show the total effect of a characteristic and all other characteristics correlated with it on accessions among individuals with prior military service. To estimate the joint effect of the characteristics on accession, we fit a Cox proportional hazards model, described in Sec. III. The model has two types of explanatory variables: (1) baseline characteristics of the individual at the time of separation from military service include the individual's age, years of previous military service, prior military training, and education; (2) measures influencing the return to reserve service rather than a civilian secondary job include reserve drill pay, affiliation bonuses, the civilian wage rate, and the civilian unemployment rate. The relative returns from the alternative choices may change over time, and we assume that these influence the reservist's decision about whether to return to military service.

A model in which the covariates change over time implies, in principle, a three-dimensional data set with measurements on the time-varying covariates for each individual at each point in time.[1] The amount of data to be processed, and hence the cost of estimating the model parameters, increases with the number of individuals in the sample and with the number of points at which measurements on the time-varying covariates are taken. Because of the expense of fitting the proportional hazards model with time-varying covariates, we have estimated the model using data on a 25 percent random subsample[2] of our full analysis sample, constituting 2,558 individuals who separated from Active Army service and 3,223 individuals who left reserve service over the time period.[3] We have also limited our measurement of the time-varying covariates to each anniversary date.

We checked the estimates that we obtained from the subsample by fitting a model on the full analysis sample using measures of the pay

[1]With time-varying covariates, the accession rate function is given by $h(t;x_t) = h_0(t)exp(bx_t)$, where x_t denotes the characteristics of the individual at time t.

[2]This is a straight 25 percent random subsample, not a 25 percent subsample of each stratified cell.

[3]We exclude from the multivariate analysis individuals who do not reside in one of the 50 states or on whom we are missing information about the home residence, because we are unable to attribute measures characterizing the civilian economic opportunities to these individuals. This reduces our analysis samples by 3 percent.

and unemployment variables taken only at the time of separation. This procedure measures with error the returns from the alternative options that the individual faces at each decision point. If we assume that the error in measurement is random, our estimate of the effect of the pay and unemployment measures will understate the true effect. We present both the full-sample and subsample estimates in the tables that follow.

The military pay at each anniversary is calculated based on reserve pay schedules and the personnel system data about paygrade and years of experience at each anniversary. The civilian wage rate and unemployment rate are those for the individual's home state during the quarter in which the anniversary occurs. In the model for accessions among those with prior active duty service, we use an indicator variable for whether the individual is eligible for an affiliation bonus. In the full-sample estimate, the indicator variable takes on the value 1 for any individual who separated from active service in FY81 or later (after the authorization of affiliation bonuses) who had a remaining military service obligation at the time of separation. This variable, however, is also time dependent because the bonus is available only to those who join the reserves at the time of separation from active duty. In the model with time-varying covariates, then, the affiliation bonus indicator takes the value 1 for eligible individuals during the first three months after leaving service and is 0 for all ineligible individuals and for any decision point later than three months after separation.

In the proportional hazards model, we assume that the effect of a change in any covariate is a shift in the accession rate that is constant over time. However, we hypothesized that individuals leaving active service might respond to incentives to join the reserve services in a different way after they had made a successful transition to civilian life than they would during the transition. Consequently, in the model with time-varying covariates we interact the measures of military pay, civilian pay, and unemployment with an indicator variable for whether the decision point is or is not within six months of separation from service. We also include the interaction between time and the economic factors in fitting the model for decisions of prior reservists as well as those with previous active service, because inclusion of the interactions provides a test of the proportional hazards assumption for the key economic variables.

We interpret our results as supply responses. Over this time period, reserve units were not fully manned and as such, demand should not be a constraining factor. However some of our results are consistent with the hypothesis that certain groups may have faced demand constraints at certain times, although there is no overwhelming evidence to

support this. If this is true, then we have not correctly identified a supply response and our estimates of price elasticity of supply may be biased.

RESULTS

The estimation results for the Active Army separations are given in Table 5.1; Table 5.2 contains the estimates for individuals leaving reserve service. In addition to the coefficient estimates and their t-values, we present the multiplicative factor defined as $exp(\beta)$, where β is the estimated coefficient. For the measures of reserve pay, civilian pay, and unemployment rate, the multiplicative factor gives the proportional shift in the accession rate associated with a one dollar increase in pay or with a one percentage point increase in the unemployment rate. For the other characteristics, the multiplicative factor shows the shift in the accession rate for an individual with the particular characteristic (e.g., with less than four years of military service at separation) relative to that for an otherwise similar individual with the reference or omitted value for that characteristic (e.g., exactly four years of service at separation).

Effects of Military Compensation

Policymakers can affect reserve manpower levels either by changing the basic pay rate or by offering bonuses. Increases in the reserve pay rate appear to significantly increase accession among both prior active duty personnel and those with prior reserve service. The multiplicative factor for the baseline reserve pay in the model for active duty personnel (Table 5.1) shows that a one dollar increase in pay increases the accession rate at any point in time by about 9 percent; at the mean drill pay rate of $18.50, this is an elasticity of supply with respect to reserve pay of 1.6. For prior reservists (Table 5.2), the effect of an increase in reserve pay on accession is smaller, though still significantly different from zero. Using the baseline pay rate, a one dollar increase in pay increases accession by about 2 percent; at the mean drill pay rate of $18.50, this is a supply elasticity of 0.36.[4]

Among losses from both the active force and the reserve force, higher rates of pay appear to influence the decision to join or return to

[4]These results exclude reserve losses who return to reserve service in the same month as they separate from previous service. Similar results concerning the effect of economic and demographic characteristics on the accession rate are obtained if these losses are included in the analysis. For example, the supply elasticity is estimated to be 0.54 if losses who immediately return are included in the results.

Table 5.1

PARAMETER ESTIMATES FOR COX REGRESSION ON TIME TO ACCESSION FOR ACTIVE ARMY LOSS COHORT, FY79–FY84

Variable	Full Analysis Sample, Baseline Characteristics				25 Percent Subsample, Time-Varying Economic Factors			
	β Coef.	Multiplicative Factor exp(β)	t-Stat.	Chi-Square	β Coef.	Multiplicative Factor exp(β)	t-Stat.	Chi-Square
Reserve pay rate								
Baseline pay	0.085	1.089	5.656					
Pay if within 6 months of loss					0.082	1.085	2.526	
Pay if 6 months after loss					0.028	1.028	0.816	
Civilian wage rate								
Baseline wage	0.087	1.091	3.939					
Wage if within 6 months of loss					−0.055	0.946	−0.964	
Wage if 6 months after loss					0.114	1.120	1.615	
Unemployment rate								
Baseline rate	−0.032	0.968	−3.309					
Rate if within 6 months of loss					0.004	1.003	0.155	
Rate if 6 months after loss					−0.050	0.950	−1.835	
Affiliation bonus eligible	0.365	1.441	4.366		0.493	1.637	3.493	
Age at separation				10.22*				0.66
22–23	−0.079	0.925	−1.737		0.010	1.010	0.110	
24–25	−0.103	0.903	−1.717		−0.076	0.926	−0.617	
26–30	−0.156	0.856	−2.277		−0.069	0.933	−0.478	
31 or older	−0.316	0.729	−2.805		−0.103	0.901	−0.430	
Years of military service				24.62*				3.58
Under 4	0.199	1.220	3.924		0.143	1.153	1.390	
5–6	−0.136	0.873	−1.660		−0.159	0.852	−1.006	
7–9	−0.210	0.811	−2.042		−0.204	0.815	−1.040	
10 or more	−0.315	0.730	−1.933		−0.344	0.708	−1.095	

Education				6.85*				0.18
Less than high school	0.073	1.076	1.474		0.005	1.004	0.042	
Some college	0.162	1.176	2.255		−0.016	0.984	−0.105	
AFQT category				26.32*				11.05*
Category I	−0.049	0.952	−0.517		0.111	1.117	0.653	
Category II	−0.167	0.846	−3.523		−0.236	0.789	−2.447	
Category IV	0.170	1.186	3.196		0.166	1.181	1.507	
Male	0.021	1.021	0.319		−0.049	0.951	−0.371	
Black	0.477	1.611	11.690		0.424	1.528	4.994	
Active force occupation				31.35*				4.05
Electronic equipment repair	−0.366	0.693	−3.577		−0.257	0.773	−1.241	
Communications/intelligence	−0.000	0.999	−0.005		−0.036	0.964	−0.282	
Health care specialists	0.144	1.154	1.886		0.124	1.131	0.791	
Other technical specialists	−0.077	0.926	−0.612		0.003	1.003	0.011	
Support/administration	0.122	1.130	2.071		0.075	1.077	0.617	
Electrical/mechanical repair	−0.062	0.940	−1.168		−0.031	0.969	−0.283	
Craftsmen	−0.040	0.961	−0.359		−0.047	0.954	−0.207	
Service/supply handlers	0.075	1.078	1.339		0.012	1.011	0.099	
Loss cohort				36.23*				17.71*
FY80	0.248	1.282	4.038		0.235	1.264	1.924	
FY81	0.079	1.082	0.815		0.071	1.073	0.494	
FY82	0.224	1.251	2.241		0.372	1.450	2.586	
FY83	0.315	1.371	3.131		0.279	1.323	1.941	
FY84	0.387	1.473	4.077		0.441	1.554	3.100	
Number of cases in sample		10,189				2,558		

NOTES: The omitted categories are: age less than 22 years, four years of prior service, Category III, high school graduate, occupation infantry, FY79 cohort. Reserve pay is measured in $ per drill, civilian wage in $ per hour, unemployment rate as a percentage. The chi-square statistic tests the joint effect of all coefficients associated with a particular characteristic. A chi-square that is significant at $p = 0.05$ is denoted by *.

Table 5.2

PARAMETER ESTIMATES FOR COX REGRESSION ON TIME TO ACCESSION FOR ARMY RESERVE AND NATIONAL GUARD LOSS COHORTS, FY79–FY84

	Full Analysis Sample, Baseline Characteristics				25 Percent Subsample, Time-Varying Economic Factors			
Variable	β Coef.	Multiplicative Factor exp(β)	t-Stat.	Chi-Square	β Coef.	Multiplicative Factor exp(β)	t-Stat.	Chi-Square
Reserve pay rate								
Baseline pay	0.022	1.021	2.507		0.052	1.053	2.289	
Pay if within 6 months of loss					0.018	1.018	0.939	
Pay if 6 months after loss								
Civilian wage rate								
Baseline wage	0.009	1.009	0.240		−0.026	0.974	−0.212	
Wage if within 6 months of loss					0.046	1.046	0.498	
Wage if 6 months after loss								
Unemployment rate								
Baseline rate	−0.008	0.991	−0.531		0.040	1.041	0.893	
Rate if within 6 months of loss					−0.029	0.971	−0.925	
Rate if 6 months after loss					0.373	1.452	2.891	
Prior Guard service	0.077	1.080	1.191	5.78				5.27
Age at separation								
22–23	−0.130	0.877	−0.860		−0.112	0.894	−0.359	
24–25	0.083	1.086	0.548		0.253	1.287	0.834	
26–30	0.155	1.167	1.031		0.444	1.559	1.487	
31 or older	0.027	1.026	0.165	44.23*	0.491	1.634	1.550	2.22
Years of military service								
Under 4	−0.471	0.624	−3.064		−0.288	0.750	−0.985	
5–6	−0.018	0.981	−0.126		−0.040	0.960	−0.145	
7–9	0.348	1.416	2.256		0.110	1.116	0.375	
10 or more	0.645	1.905	3.627		0.188	1.206	0.549	

Education				11.28*				9.12*
Less than high school	−0.285	0.752	−3.266		−0.499	0.607	−2.787	
Some college	−0.068	0.934	−0.761		0.118	1.124	0.716	
AFQT category				6.09				4.61
Category I	−0.132	0.876	−1.053		0.036	1.036	0.162	
Category II	−0.169	0.844	−2.306		−0.261	0.770	−1.781	
Category IV	0.042	1.042	0.364		0.144	1.154	0.631	
Male	−0.257	0.773	−2.174		−0.056	0.945	−0.231	
Black	−0.014	0.986	−0.177		−0.078	0.925	−0.490	
Military occupation[a]				7.68[a]				7.74
Electronic equipment repair	0.047	1.048	0.240		−0.138	0.870	−0.369	
Communications/intelligence	−0.052	0.949	−0.385		−0.348	0.706	−1.272	
Health care specialists	−0.104	0.901	−0.755		−0.341	0.711	−1.238	
Other technical specialists	−0.053	0.948	−0.235		−0.011	0.988	−0.028	
Support/administration	0.099	1.103	1.047		−0.059	0.943	−0.323	
Electrical/mechanical repair	0.046	1.047	0.489		−0.031	0.969	−0.173	
Craftsmen	−0.257	0.773	−1.471		−1.004	0.366	−1.956	
Service/supply handlers	−0.105	0.900	−1.040		−0.062	0.940	−0.327	
Not occupationally qualified	−0.631	0.531	−3.049		−1.753	0.173	−2.927	
Loss cohort				67.73*				6.98
FY80	0.365	1.439	3.222		0.072	1.074	0.343	
FY81	0.475	1.607	4.027		0.368	1.445	1.749	
FY82	0.599	1.821	4.663		0.291	1.337	1.296	
FY83	0.849	2.336	6.310		0.397	1.487	1.758	
FY84	0.972	2.642	7.716		0.425	1.529	1.779	
Number of cases in sample		13,828				3,233		

NOTE: The omitted categories are: age less than 22 years, four years of prior service, Category III, high school graduate, occupation infantry, FY79 cohort. Reserve pay is measured in $ per drill, civilian wage in $ per hour, unemployment rate as a percentage. The chi-square statistic tests the joint effect of all coefficients associated with a particular characteristic. A chi-square that is significant at $p = 0.05$ is denoted by *

[a]The chi-square test for occupation does not include the nonoccupationally qualified group.

reserve service more among those who have recently left military service than among those who have been out of service for more than six months. This may be because those who have just left service have more information about military pay levels than do those whose contacts with the military are more distant. Among active separations, the supply elasticity with respect to military pay using the time-varying results is estimated to be 1.55 in the first six months after leaving service, and falls to 0.51 thereafter. For reserve losses, the time-varying results yield an estimate of 0.96 for the supply elasticity in the first six months and 0.32 thereafter.

These supply responses and the multiplicative factors give the effect of a pay increase on the accession rate at any point in time, not the cumulative effect over time. Using the Kaplan-Meier nonparametric estimate of the hazard function described in the previous section as the baseline or reference function, we can use the Cox regression results given in Tables 5.1 and 5.2 to estimate the cumulative effect of a change in compensation over a specified period of time. We consider how a 10 percent increase in drill pay (from $18 to $19.80) would affect the expected number of accessions from a loss cohort over the first year based on the estimates from the model with time-varying covariates. Among active duty separations, a 10 percent wage increase would raise the proportion joining sometime within the year by 11.7 percent—an increase of almost 29 accessions per 1,000 separations. For losses from the reserves, that wage increase would increase accessions 7.6 percent within a year—an increase of only a little more than three individuals per 1,000 reserve separations.

The affiliation bonus for prior active duty personnel is associated with a large increase in the likelihood of joining the reserves.[5] We estimate that the bonus offer in the full sample analysis would increase accessions at any point by over 40 percent. In the full sample analysis we assume that the bonus offer has a proportional effect on the accession decision at any point in time. However, since the bonus is available only to those who join the reserves immediately upon leaving active service, we expect the effect of the bonus to apply only in the early months after separation and hence the full sample analysis would lead us to understate the effect in the early period. Indeed, when we

[5]A member serving on active duty with fewer than 180 days of active duty obligation remaining, but who has a military service obligation upon release from active service, may receive a bonus equal to $50 multiplied by the number of months of remaining service obligation, provided he is qualified in a designated military specialty and there is a vacancy at his grade level. If the individual has 18 months (or fewer) of obligation remaining, the bonus may be paid in a lump sum. Otherwise, half the bonus is paid at the time of enlistment, and the remainder on the fifth anniversary of his original enlistment or call to active duty.

limit the bonus offer only to the first quarter, the estimated effect is higher; the bonus offer increases accessions at any point in the first quarter after separation by over 60 percent. Using the time-varying results to estimate the cumulative effect of offering a bonus over one year, we estimate that the bonus would increase accessions among eligible individuals by about 30 percent—an increase of 74 individuals per 1,000 eligible separations.[6]

Because our study is observational and not an experimental test of pay variation, our ability to generalize our estimates of the effects of changes in military compensation on accession to predict what would actually occur if policy was changed is limited. The sources of variation in pay in our data are cohort, years of military service, and paygrade. Our results control for the former two effects, so the effect that we attribute to changes in military pay is due primarily to differences among individuals in paygrade. Controlling for other characteristics such as education, length of service, and so forth, individuals at higher paygrades have had a more successful military promotion history than otherwise similar individuals who are at lower paygrades. The former might reasonably expect a more successful military future than the latter and differences in expectations may be the real factor influencing the accession decision. That is, the unmeasured characteristic "expected future military opportunities" is related to both paygrade and accession and we attribute the effect of this characteristic on accession to an effect due to military pay.

Similar problems arise in the estimate of the affiliation bonus. Here, the estimated effect is due to differences in the accession rates of individuals in different cohorts—those entering before the bonus was offered and those entering after. Although we include cohort indicators, it is possible that we attributed confounding factors changing over time to the bonus effect. For example, the bonus authorization signals an increased effort by the military to attract those leaving active service to continue their military service in the reserves. If this effort also affected recruiting emphasis and efforts, a part of the estimated bonus effect may be attributable to other nonfinancial efforts to recruit prior active personnel. Without controlled experiments, it is difficult to accurately estimate the effects of changes in bonuses and other forms of compensation.

---

[6]This is an estimate of the increase for individuals who separate with a remaining service obligation and so are eligible to receive an affiliation bonus if they do join the reserves. The increase in the accessions among a full loss cohort would be smaller because some of the individuals are not eligible for the bonus.

Effects of Civilian Economic Conditions

Using the baseline measures of civilian opportunities, we obtain estimates of the effects of these characteristics on accessions among active duty separations that are opposite in sign to our hypotheses: Higher wage rates are estimated to be related to *higher* accession rates and higher unemployment to be related to *lower* accession rates. The results with the time-varying covariates, however, suggest an explanation for this finding. In the months just after leaving active service while the individual is making the transition into the civilian economic environment, the opportunities facing the individual do seem to work in the hypothesized direction in affecting the decision about reserve service. The effect of an increase in the civilian wage is to lower the likelihood of joining the reserves; an increase in unemployment raises the likelihood of joining the reserves. These effects, however, are small and not statistically different from zero.

It is only after the transition to civilian economic life is accomplished (as represented by a six-month period of separation), that the civilian economic conditions appear to have a perverse effect. We conjecture that in the post-transition period, a high wage and low unemployment are proxies for a "sellers" market for labor. In good economic times, there is increased competition among employers for labor. In these circumstances, workers may find that employers are more accommodating in allowing employees to carry out their reserve service obligations if they do join the reserves. That is, higher civilian wages and low unemployment are acting as proxies for employer attitudes toward reserve service. The importance of these attitudes in decisions that individuals make about continuing reserve service is documented in Grissmer, Buddin, and Kirby (1989).

However, the civilian wage and unemployment rate that we use measure with error the civilian opportunities facing any particular individual because the variables do not take into account the individual's skills and training. It would be preferable to use wage and unemployment measures that adjust for education or occupation as well as home residence, but such data series are not available. The measurement error will bias the coefficient estimates on the civilian pay and unemployment variables. Unfortunately, the usual econometric errors-in-variables result that the coefficient will be attenuated may not hold here. This is because the errors in measuring the civilian opportunities facing the individual cannot be assumed to be random, but are likely to be correlated with other covariates in the model such as education. As a result, the direction of bias in the coefficients on the measures of civilian economic conditions is uncertain.[7]

[7]For a discussion of the effects of measurement error on coefficients in multivariate regression under a variety of assumptions regarding the nature of measurement error, see Marquis et al. (1981).

Among losses from the reserves, the civilian economic measures also obtain different signs in the time period just after separation and in the later period. However, the estimated effects are small and not significantly different from zero. Surveys of reservists' attitudes toward reserve service have indicated that serving the country, pride in accomplishment, and retirement benefits are mentioned more often than current economic motivations as reasons for continuing reserve service (Grissmer, Buddin, and Kirby, 1989); presumably these factors also weigh heavily in prior reservists' decisions to return to service.

Effects of Individual Characteristics

Among active force separations, increasing age and years of active service decrease the likelihood of joining the reserves. The relationship holds for both the full-sample estimates and the 25 percent subsample but the effects are statistically significant only in the former.[8] We hypothesized in Sec. II that these characteristics would be related to increases in accession because the perceived value of military retirement benefits increases with age and military experience. However, in the descriptive analysis we offered some explanations for the finding: (1) Demand constraints make it difficult for older individuals and those at higher paygrades to find openings. (2) The separation decision by an individual who did reenlist in active service after finishing one term but who does not continue until retirement may signal his perception that promotional opportunities are limited or a dissatisfaction with military service that makes reserve service unlikely.

In the full-sample analysis, those with a high school diploma appear to be less likely than those without a degree or those with advanced education to join the reserves, though this result is not obtained in the subsample. Surprisingly, however, decreasing aptitude test scores are associated with increasing likelihood of joining the reserves among Active Army separations. It may be that these individuals tend to be in the low-skill jobs for which there is a high demand in the reserves. Again, this may be a selection effect. We are examining accession among individuals who were classed as eligible active separations. Those with lower aptitude scores who perform successfully in the military, and so are released with satisfactory performance designation, may be successful because they have a strong taste for military service.

[8]The chi-square statistics represent the effect of deleting the explanatory variable from the model. Those presented for the subsample come from fitting the proportional hazards model using the baseline values of the pay and unemployment variables rather than allowing these characteristics to vary over time. This was done because of the high cost of estimating the model with time-varying characteristics.

Another explanation for this finding is that education and aptitude are correlated with the individual's specific opportunities in the civilian market that we cannot capture with our aggregate unemployment and wage measure; those with less education and lower aptitude have fewer civilian opportunities and so are more likely to join the reserves.

Significant differences exist among individuals with different military skill training in the likelihood of joining the reserves. These may reflect differences in the relative opportunities in the civilian and military sectors available to individuals in the different specialties. Alternatively, they may reflect demand constraints. For example, Table 5.3 contrasts the distribution of skills among the loss cohorts with the distribution of positions in the reserves based on the unit data on personnel for the period FY79–FY85 described in Sec. III. The likelihood of joining the reserves is lowest among active separations with skill training in electronic equipment repair (Table 5.1), precisely the skill class where the supply of skills, relative to the number of reserve positions, is highest. By contrast, accession is most likely among individuals trained as health care specialists or in support and administration skills where the number of reserve positions, relative to the supply of active separations trained in the skills, is high.

It is possible to examine how likely is the hypothesis of demand constraint by contrasting the sign of the coefficient for a given occupation in the accession analysis (which measures the likelihood of accession

Table 5.3

SUPPLY AND DEMAND OF RESERVE OCCUPATIONS

DoD Occupation Group One-Digit Grouping	Percent of Active Army Loss Cohorts	Percent of Reserve Positions	Ratio Supply to Demand
Infantry, gun crew	27.2	26.7	1.02
Electronic equipment repair	4.7	2.4	1.96
Communications/intelligence	11.3	6.7	1.69
Health care specialists	6.4	7.1	0.90
Other technical specialists	2.3	2.2	1.04
Support/administration	13.2	18.2	0.73
Electrical/mechnical repair	17.7	17.2	1.03
Craftsmen	2.9	4.7	0.62
Service/supply handlers	14.3	14.8	0.96

relative to infantry) and the difference between the supply and demand ratio shown in Table 5.3 as contrasted with the ratio for infantry. If the two signs are different, as they are for seven of eight occupations for the Active Army cohort accession model, this suggests evidence of demand constraints. However, for the reserve accession model, only three of eight signs are consistent with such a hypothesis. The evidence is thus mixed and suggests that what we are measuring may not be supply.

Among reserve separations (Table 5.2), increasing years of military service are associated with an increase in the likelihood of returning to reserve service. This accords with our hypothesis concerning the perceived value of military retirement benefits, and as we noted in Sec. III, demand constraints are less a factor among prior reservists who are familiar with the system and have contacts within the reserve system; these individuals can find an opening if they wish to return.

Prior reservists with less than a high school diploma are less likely to return to reserve service than those with more education. Other research has shown that lower education is also associated with a higher rate of early attrition among first-term enlistments in the reserve (Grissmer and Kirby, 1985, 1988) so the pool of prior reservists with low educational attainment may include a higher fraction of individuals who found military service not to their liking than other education groups or who were encouraged to leave early because performance was inadequate. Recall that our prior reservist pool is not restricted on the basis of separation status as is the case for the prior active pool that we study.

By contrast, there appears to be a tendency for decreases in aptitude scores to be associated with an increase in prior reservists' likelihood of returning to service, although the effect is not statistically significant. Again, this may represent individual specific civilian opportunities. Military occupation is not a factor in return to service among prior reservists, except that those who are not occupationally qualified are much less likely than others to return to the reserves.

Among both prior active duty and prior reserve personnel, the rate of accession increases over time; accession rates among the most recent loss cohorts are significantly higher than among the earlier cohorts. For the prior reservists, accession increases in each loss cohort; for active duty personnel, there is not a strictly monotonic relationship between loss cohort and accession, although accession rates have steadily increased since the 1982 cohort. Several factors may have played a role in causing this trend. First, as we pointed out above, there was a dramatic growth in both authorized and operating strength of the reserves during this period. Indeed, the Army Reserve grew by

almost 50 percent from FY80 through FY86 and the Army National Guard grew about 22 percent over this same time period. The Selected Reserve as a whole increased by a third. Increased demand may have resulted in aggressive recruiting and counseling by the active and reserve components targeted toward those reaching the time of separation. Second, although we have controlled for some financial factors and incentives, other incentives were introduced over this period that may be in part a factor in the trend toward greater accession. For example, the educational assistance benefit was substantially expanded in FY84. Third, other minor factors such as a change in the overall attitude toward military service, need for additional income, etc., may have contributed toward this increase in accession rates. If expanded benefits and aggressive recruiting are partially responsible for the increase in accession propensities among different cohorts, then this suggests that these would be useful policy tools for manpower planners.

VI. RESEARCH FRAMEWORK AND HYPOTHESES

Whether a prior service individual is assigned a reserve job that matches his prior military skill training has important implications for training costs and for personnel readiness. If, as we pointed out above, a large number of prior service reservists need to be retrained upon entry, because their occupational specialty on entry does not match their specialty at separation, then the reduction in training costs that is frequently thought to be a major benefit of hiring prior service reservists may not actually come to pass. Further, given that a necessary condition for unit readiness is that the individual reservists be qualified to perform the occupation to which they are assigned, then if prior service individuals enter an occupation for which they are not trained, they detract from unit readiness and require retraining.

Such mismatches may occur for several reasons, the most important being either a deliberate choice on the part of the individual or lack of demand. A mismatch between reserve occupation and previous training may be an individual choice—the individual may wish to learn a new skill that will be more valuable in civilian life or may want to change skills to enhance promotion opportunities. Or mismatches may result from demand conditions—a local unit may not have an opening in that particular skill.

Enhancing promotion opportunities is likely to be more important for more senior personnel than for junior personnel, thus we might expect a greater likelihood of mismatch among those with intermediate and longer terms of service. On the other hand, acquisition of new skills to use in civilian life may be relatively more important for younger, junior reservists. Thus, the effect of years of service on the likelihood of a skill match is a priori ambiguous.

If individual choice is a primary reason for the mismatch, then individual characteristics, including years of service, aptitude test scores, and sex, are likely to have a greater influence on the likelihood of a match than demand variables. If demand factors predominate, we expect a greater likelihood of match if the individual has a skill that is in high demand by the reserves, or in relatively high demand where the individual lives.

VII. DATA AND METHODS OF ANALYSIS

DATA

The second phase of our analysis addresses the question of whether individuals with prior military service enter the reserves in the military occupation for which they were previously trained. The data for this analysis are a subset of the data described above; we selected losses from the Active Army or the two reserve components who subsequently joined the Army Reserve or Army National Guard during our study period.[1] Since our focus in this analysis is on skill match, we necessarily exclude from the database any individual on whom information is missing about the skill at separation from previous service or at entry. This excluded less than 1 percent of individuals with previous active service and about 5 percent of those with previous reserve service.

We also selected a sample of all cases to carry out the occupational match analysis. We selected a 1 in 10 sample of individuals leaving the Active Army who joined the Army Reserve or Army National Guard and a 1 in 5 sample of individuals leaving one of the Army reserve components who returned to reserve service. Our samples were selected to ensure demographic representation of the population using the same stratification techniques described above for the selection of the accession analysis samples. Our analysis sample consists of 14,176 prior active duty personnel who joined one of the Army reserve components, and 9,795 reserve losses returning to reserve service during the study period.[2]

We supplemented information from the matched military separation and reserve gain files with measures intended to characterize the demand side of the picture. These measures were developed using data on units from a variety of sources. The Defense Manpower Data Center constructed a unit file from the Reserve Components Common Personnel Data System (RCCPDS) records that provided a count of the number of personnel serving in particular military occupational

[1]Our accession rates include all accessions into any reserve component. We restrict our analysis here to those entering one of the Army reserve components because of differences in the military occupational skill codes across services.

[2]As in the accession analysis, we excluded reservists who rejoined a reserve unit in the same month that they separated. We also report how our analysis of skill match is changed if these individuals are included in the sample; including these individuals, our analysis sample of reserve losses returning to reserve service is 13,101 individuals.

specialties in that unit. These data span FY79–FY85. A second file contained unit location information which, when matched by the Unit Identification Code (UIC), gave us the state, county, and zip code of the units. A third file, obtained from FORSCOM, contained data on authorizations and actual strength completed during annual training. Although these data cover 1979–1984, the coverage of units is sadly incomplete. Using these files, we aggregate the unit data for all Army Reserve and National Guard units in each county, and link the constructed measures to the records for the individual reservists using the county in which the individual we study resides (derived from information about the home zip code in the gain record).

One constructed measure is based on the distribution of reserve personnel by occupational specialty using data for 1979–1984 on the actual number of personnel in each military occupational specialty. We computed the average number of personnel in service in the county in each occupational specialty over the period, and from these counts calculated the average share of all reserve positions in the county that are associated with each occupational specialty (measured at the one-digit DoD occupation code level). To each individual's record, we link information about the share of reserve slots in the county associated with the individual's occupational specialty at the time of separation from previous service. If there were no reserve units for any of the years 1979–1984 in the county in which an individual reservist lived, we matched the constructed measure for closest county (based on geographic coordinates) with that individual's record; a match based on a nearby county was necessary for about 2 percent of individuals. This measure allows us to test the hypothesis that the likelihood of skill match will be greater for individuals in areas where the demand for their particular skill, as measured by the share of reserve positions in the occupational specialty group, is higher than for individuals in other areas.

A second measure is derived from the FORSCOM data. Using records for 1979–1980, the years in which we appear to have the least amount of missing data, we compute the average number of actual personnel and the average number of authorizations in each unit for the period and then calculate the average fill rate for the county as the ratio of the aggregate of actual personnel for all units in the county to authorized personnel. Recording of these forms, however, is quite incomplete and we do not have data for all units. We use whatever data we have to construct a measure for the county. Even so, we obtain measures of fill rates in the county that can be directly matched to the county of residence for only 20 percent of the individuals. Because the coverage in this unit file is so incomplete, we believed that

using information on a nearby county would introduce too much error. Therefore, we analyze the relationship between the measure of fill rate and skill match for the restricted sample of individuals where a match was possible.

METHODS OF ANALYSIS

We measure the skill match by comparing the PMOS—the skill for which the individual is trained or the most significant skill held by the individual—at the time of separation from the military with the DMOS—the skill that the individual is actually working in—at entry into the reserve. To assess the degree of congruence between individuals' skill and their reserve assignment, we developed the following hierarchical measure:

1. A perfect match is assigned if the PMOS and the DMOS agree.
2. A second-order match is assigned if the PMOS and the DMOS differ, but both belong to the same DoD occupational subgroup (three-digit grouping). For example, an individual with skill training as a SATCOM microwave communications chief (PMOS 29T) serving as an automatic test equipment operator/maintainer (DMOS 39B) would be classed as a second-order match, since both skills are included in the DoD occupation group of Radio Code (201).
3. A third-order match is assigned if the PMOS and DMOS are classified in the DoD occupational group (two-digit grouping) but the DoD subgroups differ. For example, if our individual trained in PMOS 29T is assigned in reserve service to perform as a multichannel communications equipment operator (DMOS 31M, DoD occupation group 202 Non-Code Radio); both of these occupations are DoD occupations of Radio and Radio Code (20).
4. A fourth-order match applies when the PMOS and DMOS agree only at DoD occupational area (one-digit grouping). This level match would apply if the individual trained in PMOS 29T is assigned to duty as a communications systems supervisor (DMOS 31Y, DoD occupation 260). The PMOS and DMOS agree at the one-digit DoD classification of communications and intelligence.
5. A nonmatch occurs if the PMOS and DMOS do not agree even at the DoD occupational area.

We present a descriptive analysis of skill match based on this measure in Sec. VIII. We show that for most recruits the duty occupation at reserve entry either matches the previous skill training at the MOS classification level, or there is not a match even at the occupational area level. Second-, third-, and fourth-order matches occur infrequently. For our multivariate analysis of factors related to the likelihood of a match, therefore, we study a dichotomous match classification that assumes the value 1 if the PMOS and DMOS agree and 0 otherwise.

We use logistic regression to analyze patterns of match. The model specification is:

$$\ln\{PR(match = 1)/PR(match = 0)\} = X\beta,$$

where X are characteristics of the recruit and the demand environment facing the recruit, and β are the coefficients to be estimated. We present our estimate of the net effect of a characteristic, that is, the effect of that characteristic holding all other variables constant, by comparing the probability of assignment at accession to the military occupational skill for which training was previously received for two recruits who differ on the characteristic under study but otherwise have the same values for all other characteristics.

Net effects are useful for informing about characteristics that seem most influential in the likelihood of a match. The net effect, however, does not give the complete picture as to how skill match differs between groups if there are other characteristics that are correlated both with the particular characteristic of interest and with the likelihood of a match. To see the total effects of characteristics of interest taking into account the effects of correlated variables, we estimate the probability of skill match for each individual in the sample based on his characteristics and the fitted model. The total effect is seen by comparing the average probability for all persons in subgroups defined by the differing values of the characteristic under study.

VIII. RESULTS

PATTERNS OF SKILL MATCH

Ideally, individuals with prior military service who join the reserves would be assigned to a job that uses the military skill for which they were previously trained. Failure to make this match has important implications for training costs and for personnel readiness. The degree to which this ideal is achieved is shown in Table 8.1. Only slightly more than 40 percent of prior service individuals join or rejoin the reserves in the military skill in which they were trained; the match is somewhat higher for those previously in reserve service than those coming from the active forces but the patterns are similar.[1] Surprisingly, less than 20 percent of accessions are assigned to a skill closely related to the one in which they were trained to serve as measured by a match at the DoD occupational area or better but not an exact skill match. As a result, almost 40 percent of individuals are assigned to a reserve job that is not even in the same occupational area for which they received prior training. This poses a significant retraining burden. Most prior service individuals are retrained on the job, which takes considerable time. Other RAND research has estimated

Table 8.1

SKILL MATCH AT LOSS AND ACCESSION BY TYPE OF PRIOR SERVICE
(In percent)

	Reserve Losses		
Match Level	Army Reserve	National Guard	Active Army Losses
MOS match	45.0	43.7	40.1
DoD occupational subgroup (3 digit)	6.2	4.8	5.1
DoD ocuupational group (2 digit)	2.9	2.5	3.1
DoD occupational area (1 digit)	8.8	7.8	9.0
No match	37.1	41.2	42.7
Sample size	3,961	5,782	14,176

[1]The reported results exclude prior reservists who rejoin a reserve unit in the same month that they separated. The distribution of the match variable is quite similar if these individuals are included.

that retraining times for prior service individuals average about 10 months.

The likelihood of a skill match at accession varies according to the skill that the individual holds (Table 8.2). Fewer than a third of individuals trained in combat skills in the active forces are assigned to the same skill when they enter the reserves—a lower rate of match than average. In contrast, the likelihood of match is slightly higher than average among prior reservists trained in combat skills. Except for health care specialists (area 3), individuals trained in high-skill noncombat jobs are less likely to be assigned to that skill in the reserves than are individuals in low-skill noncombat jobs. This may represent demand constraints or relatively greater increases in number of authorized positions in certain skills over time; since only about 11 percent of reserve positions are in DoD occupational areas 1, 2, and 4 (see Table 5.3), the likelihood that the individual will find a local unit that uses his or her skill may be low. In addition, a specific skill in a high-skill area may not substitute for a related skill. Assignment to a

Table 8.2

SKILL MATCH AT LOSS AND ACCESSION BY DOD OCCUPATIONAL CODE AT LOSS

	Combat	High-Skill Noncombat				Low-Skill Noncombat			
Match Level	Area 0	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8
Active losses									
MOS match	30.6	30.4	31.1	60 6	40.8	52.6	35.5	35.2	52.7
3-digit DoD code	4.1	4.9	5.2	11.9	3.2	6.1	8.0	4.0	0.1
2-digit DoD code	0.4	2.3	1.6	3.2	1.1	6.0	8.9	0.6	0.7
1-digit DoD code	15.1	5.1	5.2	5.0	1.7	12.0	7.0	2.0	4.3
No match	49.8	57.3	56.9	19.3	53.3	23.3	40.6	58.2	42.3
(N)	4,029	487	1,604	960	289	2,014	2,431	349	2,013
Reserve losses									
MOS match	49.5	30.0	39.1	48.1	39.4	38.8	37.0	41.3	52.3
3-digit DoD code	5.9	5.3	5.5	13.9	6.9	6.5	4.5	3.4	0.6
2-digit DoD code	0.1	1.0	0.8	2.9	2.3	5.4	7.5	3.2	0.3
1-digit DoD code	8.4	4.3	5.7	5.6	1.4	16.7	7.6	3.7	3.5
No match	36.1	59.4	49.0	29.6	50.0	32.6	43.4	48.4	43.3
(N)	2,760	209	671	631	217	1,798	1,530	413	1,566

NOTE: Area 1—Electronic Equipment Repairmen; Area 2—Communications/Intelligence Specialists; Area 3—Health Care Specialists; Area 4—Other Technical Specialists; Area 5—Functional Support and Administration; Area 6—Electrical/Mechanical Equipment Repairmen; Area 7—Craftsmen; Area 8—Service and Supply Handlers.

closely related area among those who are not matched to the same MOS is less likely in the high-skill jobs than in at least some of the lower-skill occupational areas.

The reserve assignments of individuals who are not matched even in the same occupational area for which they received previous training is shown in Table 8.3. Most of these individuals enter a low-skill noncombat job, as we would expect, because these jobs account for about half of the reserve positions. In addition, mismatches between prior skill may be an individual choice—the individual may wish to learn a new skill that will be more valuable in civilian life or may want to change skills to enhance promotion opportunities. Assignment to combat and high-skill noncombat jobs are also in line with the number of reserve positions in these areas.

MULTIVARIATE ANALYSIS

Mismatches between separation and entry assignment skills may thus be the result of individual choice or demand conditions. To investigate which factors do predict skill match, we fit a logistic regression to explain the likelihood of a match. Because most matches that do occur are matches in the same MOS, the dependent variable in this analysis is the dichotomous classification that takes the value 1 if the

Table 8.3

DUTY ASSIGNMENT FOR THOSE IN DIFFERENT OCCUPATION AREA AT LOSS AND ENTRY

	Exit Skill Level		
Accession Duty Assignment	Combat	High-Skill Noncombat	Low-Skill Noncombat
Prior active service individuals			
Combat	0.0	23.2	30.5
High-skill noncombat	23.4	18.5	21.0
Low-skill noncombat	76.6	58.3	48.5
Total	100.0	100.0	100.0
Prior reserve service individuals			
Combat	0.0	22.2	29.0
High-skill noncombat	26.6	18.8	24.0
Low-skill noncombat	73.4	59.0	47.0
Total	100.0	100.0	100.0

individual is assigned to a reserve position in the same MOS for which prior training was obtained, a 0 otherwise. That is, assignment to a related area is treated as a nonmatch in this analysis.[2]

Net Effects of Characteristics on Skill Match

The skill match results for individuals with prior active duty service are given in Table 8.4; for those with prior reserve service the results are given in Table 8.5. In addition to the regression coefficient and tests of the statistical significance of the coefficients, the final column in each table shows how the predicted probability of a skill match varies according to the characteristic under study. The predictions are for a reference individual in all characteristics except the particular characteristic under study. The reference individual has four years of military service, an AFQT category score of III, is male, not black, in loss cohort FY79, trained in a combat skill, lives in an area where 22 percent of the reserve positions are in his or her trained skill area, and joins the reserve within six months of separation from prior service. In the active model, the reference individual joins the Army Reserve. In the reserve model the reserve component variable is prior component rather than the component subsequently joined because most individuals return to the same component; the reference individual previously served in the Army Reserve. By comparing the predicted probabilities for two individuals who take on the reference characteristics on all variables save one, we can see the net effect of the characteristic under study controlling for all other characteristics.

Among those with prior active service, skill matches appear to be lower for those with seven or more years of service than for individuals with fewer years of military service. The more years of service the higher the paygrade, and as we noted above there are few reserve slots at these high levels. Thus demand constraints on finding a position in the trained skill may be particularly binding for these individuals. Because on-the-job training costs increase with paygrade, the higher on-the-job training needs among those with greater military tenure at the higher paygrades compared with those with fewer years of previous service is particularly costly to the military. For prior reservists we also see that skill match is related to length of prior service; in this case those with fewer than four years of service are the most likely to

[2]We also fit models (not shown) in which a match was considered to have been achieved if the individual was assigned to any job in the same occupational area (DoD one-digit code). Though the level of match is obviously higher in this latter case, the relationship between the likelihood of a match and the characteristics used to explain the match was essentially the same.

Table 8.4

SKILL MATCH AT ACCESSION OF PRIOR ACTIVE SERVICE PERSONNEL: LOGISTIC REGRESSION PARAMETERS AND NET PROBABILITIES

Variable	Regression Coefficient	t-Stat.	Chi-Square	Predicted Match Rate
Years of military service				
Under 4	−0.067	−1.43	7.4	0.341
4	Reference			0.356
5–6	−0.064	−0.84		0.342
7–9	−0.148	−2.06		0.323
10 or more	−0.229	−2.16		0.305
AFQT category				
Category I	0.171	1.65	3.4	0.396
Category II	0.046	0.94		0.367
Category III	Reference			0.356
Category IV	0.033	0.60		0.364
Sex				
Male	Reference			0.356
Female	0.017	0.25		0.360
Race				
Not black	Reference			0.356
Black	0.124	3.03		0.385
Loss cohort				
FY79	Reference		22.4*	0.356
FY80	0.033	0.53		0.364
FY81	0.109	1.64		0.382
FY82	0.267	4.02		0.420
FY83	0.153	2.44		0.392
FY84	0.200	3.03		0.404
Military occupation at separation			596.0*	
Infantry, gun crew	Reference			0.356
Electronic equipment repair	0.369	3.27		0.445
Communications/intelligence	0.265	3.69		0.419
Health care specialists	1.388	16.86		0.689
Other technical specialists	0.803	6.03		0.553
Support/administration	0.936	15.19		0.585
Electrical/mechanical repair	0.379	6.49		0.447
Craftsmen	0.507	4.16		0.479
Service/supply handlers	1.096	17.87		0.624
Accession component				
Army Reserve	Reference			0.356
Army National Guard	−0.726	−17.05		0.211
Gap in service			223.4*	
6 months or less	Reference			0.356
7–12 months	−0.550	−10.04		0.242
13–24 months	−0.609	−11.07		0.231
25 months or more	−0.577	−8.56		0.237
Demand variable:				
Proportion county reserve slots in PMOS	1.586	12.01		
Predicted match at mean (0.22)				0.356
Prediction at 10% increase (0.242)				0.364
Intercept	−0.938	−12.00		

NOTES: The chi-square statistic tests the joint effect of all coefficients associated with a particular characteristic. A chi-square that is significant at $p = 0.05$ is denoted by *. The predicted match rate is for an individual with reference values for all characteristics except for the particular characteristic under study. The predicted match is for a demand variable value of 0.22.

Table 8.5

SKILL MATCH AT ACCESSION OF PRIOR SERVICE RESERVISTS: LOGISTIC REGRESSION PARAMETERS AND NET PROBABILITIES

Variable	Regression Coefficient	t-Stat.	Chi-Square	Predicted Match Rate
Years of military service			19.6*	
Under 4	0.249	2.45		0.569
4	Reference			0.507
5–6	−0.061	−0.62		0.492
7–9	0.071	0.75		0.525
10 or more	0.126	1.32		0.539
AFQT category			0.4	
Category I	−0.066	−0.70		0.490
Category II	−0.011	−0.22		0.504
Category III	Reference			0.507
Category IV	0.001	0.02		0.507
Sex				
Male	Reference			0.507
Female	0.149	1.76		0.544
Race				
Not black	Reference			0.507
Black	0.0043	0.09		0.508
Loss cohort			14.8*	
FY79	Reference			0.507
FY80	−0.011	−0.15		0.504
FY81	0.183	2.29		0.553
FY82	0.217	2.73		0.561
FY83	0.072	0.91		0.525
FY84	0.068	0.84		0.524
Military occupation at separation			130.8*	
Infantry, gun crew	Reference			0.507
Electronic equipment repair	−0.312	−1.90		0.429
Communications/intelligence	−0.057	−0.61		0.493
Health care specialists	0.183	1.87		0.553
Other technical specialists	0.078	0.52		0.527
Support/administration	−0.361	−5.18		0.417
Electrical/mechanical repair	−0.277	−3.97		0.438
Craftsmen	−0.038	−0.33		0.497
Service/supply handlers	0.368	5.32		0.598
Prior service				
Army Reserve	Reference			0.507
Army National Guard	−0.038	−0.83		0.497
Gap in service			217.4*	
6 months or less	Reference			0.507
7–12 months	−0.204	−3.32		0.456
13–24 months	−0.548	−9.05		0.373
25 months or more	−0.857	−13.90		0.304
Demand variable:				
Proportion county reserve slots in PMOS	2.092	16.18		
Predicted match at mean (0.22)				0.507
Prediction at 10% increase (0.242)				0.519
Intercept	−0.043	−3.43		

NOTES: The chi-square statistic tests the joint effect of all coefficients associated with a particular characteristic. A chi-square that is significant at $p = 0.05$ is denoted by *. The predicted match rate is for an individual with reference values for all characteristics except for the particular characteristic under study. The predicted match is for a demand variable value of 0.22.

rejoin in the same skill. In the case of prior reservists, the relationship is not monotonic and at the highest length of tenure the likelihood of a match begins to increase relative to those with intermediate years of service.

The reserves use of individuals' prior training appears to have improved over time. The rates of skill match were higher for active loss cohorts from FY81 and later than for the earlier cohorts. Among prior reservists, match rates for the FY81 and FY82 loss cohorts were significantly better than for the earler years, but match rates have declined somewhat for the more recent cohorts.

Significant differences exist in match rates by occupational grouping as we discussed above. Contrary to expectation, prior active duty personnel entering the Army Reserve are significantly more likely to be assigned to their trained skill than those entering the Army National Guard. Other RAND researchers also observed this but found that retraining times in the National Guard were shorter than in the Army Reserve. They conjecture that the National Guard may be more likely to match individuals to a closely related skill than the Army Reserve. However, if we fit the model to an alternative definition of a match—namely, one in which all assignments to the same occupational area (one-digit DoD code) are considered as a match—we estimate a similar difference in the likelihood of a match between the components. We do not find differences in subsequent skill match for reservists who previously served in the Army Reserve (most of whom return to the Army Reserve) relative to those who previously served in the National Guard (most of whom return to the National Guard).

An important result is that skill matches are more likely among individuals who return to military service with only a short break than those with a longer break in service. Among prior active duty personnel, skill match rates are about 10 percentage points higher for those who join within six months of separating from active service than for others. Among prior reserve personnel, a similar difference is noted. The shorter the break in service, the less we expect military skills to degrade and so the fewer refresher training courses we would expect to be needed assuming that skills are matched. Therefore, a failure to match skills for those returning after a short break would be especially costly to the military, in terms of benefit forgone.

We hypothesized above that a skill match would be more likely for individuals in areas where the demand for their skill, as measured by the share of reserve positions in the county in the individual's occupational area, was higher than for other individuals.[3] This measure may

[3]We also tried a formulation using the number of positions available in each skill in the county. Similar results were obtained.

also serve as a proxy for search costs to the individual, since the cost of finding a unit with an opening in the skill would be expected to fall if there are relatively more positions locally in that skill. Indeed, this variable is significant in explaining the likelihood of a match, but the absolute size of the effect on predicted probabilities is small relative to changes in break in service and in skill group.

The other demand measure that we described in Sec. III is the fill rate in the county. Because we were unable to measure all counties' fill rates, we do not include this demand measure in the results shown in Tables 8.4 and 8.5 for the full sample. Instead, we included this measure in a logistic regression model fit using only individuals residing in counties where we were able to measure fill rate; the full logistic regression results for this subsample are shown in Appendix A. A priori it is difficult to predict whether individuals in areas where the fill rate is high would be more or less likely to join a unit in their trained skill. When fill rates are high, the individual is less able to find a unit with an opening in his skill and so may join a unit that assigns him to an occupation for which he is not trained. On the other hand, if the measure really reflects demand constraints, areas in which fill rates are high are likely to be more selective in taking in personnel and will only accept individuals trained in the skills for which they have openings. In the logistic regression model for both prior active duty and prior reserve personnel, the coefficient on the fill rate measure was positive, supporting the demand constraint hypothesis. However, in both models the coefficient is very small and did not differ significantly from zero.

Total Effects of Characteristics on Skill Match

The net effects indicate which factors are most influential in determining skill match, but to know whether subgroups of individuals differ in the likelihood of a reserve assignment in their trained skill, we need to estimate the *total* effects of a factor taking into account the effects of correlated variables. We have calculated the total effects of the length of time to accession and of years of military service on the skill match because these effects are particularly important in assessing retraining cost to the military. The longer the break in service the greater are expected costs of retraining in the prior skill and so the less the incremental cost from assignment to a different skill. The more years of military service, the higher the paygrade and so consequently the greater the cost of on-the-job training.

The total effects are calculated by estimating the probability that each individual in our sample is assigned in the trained skill using the logistic regression model and the individual's personal characteristics. We calculate the probability for each subgroup as the average of the individual predicted probabilities for members of the subgroup. The total effects are shown in Table 8.6 where we report the average predicted probability for the subgroup, the standard error, and a t-test for a contrast with a reference subgroup. The reference subgroup for tests of total effect of years of service is the group with four to six years; for the break in service the reference subgroup includes individuals who return to military service within six months.

The total effects produce similar patterns to the net effects. Among prior active duty personnel, there is a decreasing relationship between the likelihood of skill match and the number of years of military service and those with seven or more years of service are significantly (at 10 percent two-tailed test) less likely to be assigned to a reserve job in their trained skill. Among prior reservists, those who have completed a single term of service (four to six years) are significantly less likely to be assigned in their prior skill when they return to the reserves than are those with fewer or more years of service. For individuals with either prior active duty or prior reserve experience, the likelihood of a skill match at the time of accession is about 15 percentage points higher for individuals who return within six months than for those who have a break in service of a year or more.

Table 8.6

TOTAL EFFECTS OF YEARS OF MILITARY SERVICE AND GAP IN SERVICE

	Prior Active Duty Personnel			Prior Reserve Personnel		
Group	Pred. Prob.	Std. Error	t-Stat. vs Ref.	Pred. Prob.	Std. Error	t-Stat. vs Ref.
Years of service						
Less than 4	0.401	0.007	0.39	0.461	0.013	3.55
4–6	0.398	0.005	—	0.404	0.010	—
7 or more	0.373	0.011	−1.87	0.454	0.006	4.43
Gap in service						
6 months or less	0.454	0.005	—	0.538	0.009	—
7 to 12 months	0.329	0.010	−10.96	0.484	0.012	−3.71
More than 1 year	0.303	0.007	−16.66	0.366	0.007	−15.42

IX. CONCLUDING REMARKS

Our new results on accession of prior service individuals, along with our earlier results concerning attrition among prior service reservists (Marquis and Kirby, 1989), can inform manpower policy in a number of ways. First, the effective use of recruiting resources requires that policymakers assess the tradeoff between recruiting prior service or nonprior service personnel, and between recruiting an individual leaving active service or one with prior reserve service. We estimate that the time between leaving military service and returning to the reserves is shorter for active losses than for reserve losses. Among the former, the average break in service is about seven months, whereas for the latter it exceeds one year. Hence, the on-the-job training needs and retraining needs and the associated costs should be lower for prior active duty personnel than for prior reservists, at least when the job assignment uses the skill training. However, we have shown that reservists frequently are *not* assigned to a job that matches their previous skill. If retraining is required, then the length of the average break in service becomes a moot point. In addition there may be another tradeoff to be considered here: Prior reservists have institutional knowledge and a demonstrated preference for serving in the reserves as compared to those entering the reserve from active duty. Our earlier work had also shown that attrition rates tend to be higher among reservists whose prior military experience was active duty than among those who served in the reserve, at least for the Army National Guard.

Perhaps the most important policy question we have addressed here is that of the match between occupational skill at loss and entry; this has implications for readiness and retraining costs and for the tradeoff between recruiting prior service or nonprior service personnel. If the reserves do not use the previous military skill the reduction in training cost thought to be a concomitant of hiring prior service rather than nonprior service personnel may not be realized. We have shown that fewer than half of recruits with prior military service are assigned to a job in the same skill for which they were previously trained. The match rate is not substantially higher if we include assignment to job in the same occupational area but does increase to about 60 percent. It is encouraging, however, that skill matches are more likely among individuals who return to military service with only a short break than among those with a longer gap in service. The shorter the gap in service the less we expect military skills to degrade and so a failure to

match skills for this group would be especially costly, in terms of opportunity costs. Both individual and demand characteristics affect the likelihood of match, suggesting at least in part that a failure to match may result from the individual's choice to receive training in a different skill, either because of better promotion possibilities or the more desirable nature of the new skill. It is also possible that high search costs may cause individuals to settle for something less than ideal. The evidence in Grissmer, Buddin, and Kirby (1989) that reservists frequently change skills, especially when changing units, supports both these hypotheses. If individual choice is a factor in the match, then restructuring the compensation system in ways that would provide incentives to reservists to stay in the same skill rather than change skill may help increase the likelihood of match and MOS qualification rates (Grissmer, Buddin, and Kirby, 1989). If high search costs are an issue, then centralizing data on units and positions in such a way as to be freely accessible to recruiters would help. Another policy that might be considered is to allow the individual to affiliate long-distance with units in his given skill. Although the reservist may not be available for all drills, he would, however, be able to exercise the skill for which he was trained.

Second, our results can also help planners project the manpower costs associated with recruiting prior service personnel. The seniority of these individuals has implications for budgetary costs for both basic pay and retirement outlays. We find that active losses with short terms of prior experience are most likely to affiliate, even after controlling for financial incentives offered to encourage junior personnel to affiliate. This finding is reassuring given that the present experience-mix of the reserve force finds unusually large cohorts in the 10–20 year of service groups and that current 15-year projections show strong increases in the number of reservists with greater than 15 years of service. There is a real need to keep enlistment and retention rates high among the more junior force personnel.

Third, our estimates suggest that affiliation bonuses are an effective mechanism for increasing the enlistment rate among the junior personnel leaving active service. We estimate that an additional 74 reservists are recruited per 1,000 active duty separations when those separations are offered an affiliation bonus. We also found from our previous work that the affiliation bonus was effective in decreasing attrition among those who received a bonus, at least for the Army Reserve.

Fourth, our results suggest that targeted recruiting may have more effect on accession and retention than changes in the basic military pay structure. Increases in military pay were associated with increases in accession among both prior active duty personnel and among prior

reserve personnel. Among the former, we estimate that a 10 percent increase in pay would add 29 accessions per 1,000 active force separations within the first year after leaving active service; an additional three accessions per 1,000 reserve separations would be expected. These are statistically significant results, but demographic factors have a larger absolute impact on accessions. Our analysis of attrition (Marquis and Kirby, 1989) among prior service personnel reached similar conclusions. For example, recruiting 100 prior service individuals with high school diplomas into the Army Reserve increases the expected years of service by more than 50 over a six-year period, as compared with 100 recruits who have not completed high school (an 18 percent increase); similarly, recruiting somewhat older individuals (age 31–35 rather than 26–30) can be expected to provide 40 more years of service. The effects are smaller in the Guard but still quite substantial. The combined results suggest that appropriate targeting of recruiting resources toward groups such as these may increase both the rate of accession and the length of service.

Appendix

LOGISTIC REGRESSION MODEL OF SKILL MATCH AT ACCESSION FOR SUBSAMPLE WITH COUNTY-LEVEL DATA ON UNIT MANNING

This appendix presents the results from the logistic regression to explain skill match at accession for the subsample of cases for whom we had county-level data concerning the ratio of actual reserve personnel to authorized personnel. There were 2,932 sample cases in fitting the prior active personnel model and 1,979 in fitting the prior reservist model.

Table A.1

SKILL MATCH AT ACCESSION OF PRIOR ACTIVE SERVICE PERSONNEL: LOGISTIC REGRESSION PARAMETERS AND NET PROBABILITIES

Variable	Regression Coefficient	t-Stat.
Years of military service		
Under 4	0.037	0.37
4	Reference	
5–6	−0.013	−0.08
7–9	−0.254	−1.65
10 or more	−0.305	−1.38
AFQT category		
Category I	0.296	1.37
Category II	0.057	0.56
Category III	Reference	
Category IV	0.272	1.35
Sex		
Male	Reference	
Female	−0.297	−1.96
Race		
Not black	Reference	
Black	0.059	0.66
Loss cohort		
FY79	Reference	
FY80	−0.005	−0.03
FY81	0.078	0.53
FY82	0.210	1.43
FY83	0.231	1.65
FY84	0.202	1.35
Military occupation at separation		
Infantry, gun crew	Reference	
Electronic equipment repair	0.392	1.50
Communications/intelligence	0.296	1.80
Health care specialists	1.450	8.37
Other technical specialists	1.2247	4.33
Support/administration	1.097	8.19
Electrical/mechanical repair	0.518	4.15
Craftsmen	1.161	4.01
Service/supply handlers	1.088	8.03
Accession component		
Army Reserve	Reference	
Army National Guard	−0.770	−8.13
Break in service		
6 months or less	Reference	
7–12 months	−0.534	−4.42
13–24 months	−0.563	−4.70
25 months or more	−0.717	−4.74
Demand variables:		
Proportion county reserve slots in PMOS	1.837	5.62
Fill rate (actual/authorized)	0.001	0.82
Intercept	−1.108	−5.18

Table A.2

SKILL MATCH AT ACCESSION OF PRIOR SERVICE RESERVISTS: LOGISTIC REGRESSION PARAMETERS AND NET PROBABILITIES

Variable	Regression Coefficient	t-Stat.
Years of military service		
Under 4	0.333	1.44
4	Reference	
5–6	−0.059	−0.27
7–9	0.343	1.57
10 or more	0.328	1.49
AFQT category		
Category I	−0.502	−2.33
Category II	−0.139	−1.22
Category III	Reference	
Category IV	−0.013	−0.67
Sex		
Male	Reference	
Female	0.209	1.16
Race		
Not black	Reference	
Black	−0.045	0.39
Loss cohort		
FY79	Reference	
FY80	0.119	0.68
FY81	0.169	0.98
FY82	0.188	1.11
FY83	0.128	0.74
FY84	0.070	0.39
Military occupation at separation		
Infantry, gun crew	Reference	
Electronic equipment repair	0.140	0.41
Communications/intelligence	−0.087	−0.41
Health care specialists	0.099	0.45
Other technical specialists	0.216	0.56
Support/administration	−0.124	−0.80
Electrical/mechanical repair	−0.404	−2.64
Craftsmen	−0.453	−1.69
Service/supply handlers	0.172	1.14
Accession component		
Army Reserve	Reference	
Army National Guard	−0.082	−0.79
Break in service		
6 months or less	Reference	
7–12 months	0.053	-0.40
13–24 months	−0.508	−3.72
25 months or more	−0.541	−4.10
Demand variables:		
Proportion county reserve slots in PMOS	2.137	7.29
Fill rate (actual/authorized)	0.001	1.03
Intercept	−0.742	−2.53

BIBLIOGRAPHY

Asch, Beth J., *A Technique for Estimating the Effect of Pay on Selected Reserve Supply,* Center for Naval Analyses, CRM 86-42, Alexandria, Virginia, March 1986.

Cox, D. R., "Regression Models and Life Tables (with Discussion)," *J. R. Stat. Soc. B,* No. 34, 1972, pp. 187–220.

Cox, D. R., and D. Oakes, *Analysis of Survival Data,* Chapman and Hall, London and New York, 1984.

Department of Defense, *Manpower Requirements Report, FY 1988,* February 1987.

Grissmer, David W., and Sheila Nataraj Kirby, *Attrition During Training in the Army Reserve and Army National Guard,* The RAND Corporation, N-2079-RA, August 1984.

Grissmer, David W., and Sheila Nataraj Kirby, *Attrition of Nonprior Service Reservists in the Army National Guard and Army Reserve,* The RAND Corporation, R-3267-RA, April 1985.

Grissmer, David W., and Sheila Nataraj Kirby, with Priscilla M. Schlegel, *Changing Patterns of Nonprior Service Attrition in the Army National Guard and Army Reserve,* The RAND Corporation, R-3626-RA, July 1988.

Grissmer, David W., Richard Buddin, and Sheila Nataraj Kirby, *Improving Reserve Compensation: A Review of Current Compensation and Related Personnel and Training-Readiness Issues,* The RAND Corporation, R-3707-FMP/RA, September 1989.

Kalbfleisch, J. D., and R. L. Prentice, *The Statistical Analysis of Failure Time Data,* John Wiley and Sons, New York, 1980.

Marquis, K. H., N. Duan, M. S. Marquis, and J. M. Polich, *Response Errors in Sensitive Topic Surveys: Estimates, Effects, and Correction Options,* The RAND Corporation, R-2710/2-HHS, April 1981.

Marquis, M. S., and Sheila Nataraj Kirby, *Economic Factors in Reserve Attrition: Prior Service Individuals in the Army National Guard and Army Reserve,* The RAND Corporation, R-3686-1-RA, March 1989.

Marquis, M. S., and Sheila Nataraj Kirby, *Accession and Attrition of Prior Service Reservists,* The RAND Corporation, N-2946-RA, September 1989.

Rostker, Bernard, *Air Reserve Personnel Study, Vol. III: Total Force Planning, Personnel Costs, and the Supply of New Reservists,* The RAND Corporation, R-1430-PR, October 1974.

Shiells, Martha E., *Affiliation of Navy Veterans with the Selected Reserve,* The Center for Naval Analysis, CRM 86-249, Alexandria, Virginia, December 1986.