RAND CORPORATION

Research Report

ALBERT A. ROBBERT, PATRICIA K. TONG, CHAITRA M. HARDISON

Retention of Enlisted Maintenance, Logistics, and Munitions Personnel

Analysis and Results

For more information on this publication, visit **www.rand.org/t/RRA546-1**.

About RAND

The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. To learn more about RAND, visit www.rand.org.

Research Integrity

Our mission to help improve policy and decisionmaking through research and analysis is enabled through our core values of quality and objectivity and our unwavering commitment to the highest level of integrity and ethical behavior. To help ensure our research and analysis are rigorous, objective, and nonpartisan, we subject our research publications to a robust and exacting quality-assurance process; avoid both the appearance and reality of financial and other conflicts of interest through staff training, project screening, and a policy of mandatory disclosure; and pursue transparency in our research engagements through our commitment to the open publication of our research findings and recommendations, disclosure of the source of funding of published research, and policies to ensure intellectual independence. For more information, visit www.rand.org/about/principles.

RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

Published by the RAND Corporation, Santa Monica, Calif.
© 2022 RAND Corporation
RAND® is a registered trademark.

Library of Congress Cataloging-in-Publication Data is available for this publication.

ISBN: 978-1-9774-0860-0

Cover: Air Force/Lawrence Sena.

Limited Print and Electronic Distribution Rights

This document and trademark(s) contained herein are protected by law. This representation of RAND intellectual property is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited. Permission is given to duplicate this document for personal use only, as long as it is unaltered and complete. Permission is required from RAND to reproduce, or reuse in another form, any of its research documents for commercial use. For information on reprint and linking permissions, please visit www.rand.org/pubs/permissions.

About This Report

The research reported here was commissioned by the Air Force Directorate of Logistics (AF/A4L) and conducted within the Manpower, Personnel, and Training Program of RAND Project AIR FORCE as part of a fiscal year 2020 project, "Analyzing Enlisted Maintenance Retention Challenges and Impact on Manning."

It should interest the aircraft maintenance community's leadership; U.S. Air Force and Department of Defense leaders concerned with the retention and recruitment of personnel and career field management and planning in the Air Force more broadly; and Air Force senior leaders responsible for flying operations.

RAND Project AIR FORCE

RAND Project AIR FORCE (PAF), a division of the RAND Corporation, is the Department of the Air Force's (DAF's) federally funded research and development center for studies and analyses supporting both the United States Air Force and the United States Space Force. PAF provides the DAF with independent analyses of policy alternatives affecting the development, employment, combat readiness, and support of current and future air, space, and cyber forces. Research is conducted in four programs: Strategy and Doctrine; Force Modernization and Employment; Resource Management; and Workforce, Development, and Health. The research reported here was prepared under contract FA7014-16-D-1000.

Additional information about PAF is available on our website:
www.rand.org/paf/

This report documents work originally shared with the DAF on March 18, 2020. The draft report, issued in March 2021, was reviewed by formal peer reviewers and DAF subject-matter experts.

Contents

About This Report iii
Figures v
Tables vii
Summary viii
Acknowledgments x
Abbreviations xi
1. Introduction 1
Study Approach 2
2. The Retention Environment 4
3. Regression Analysis Results 8
Regression Models 9
Impacts of Individual Characteristics and Environmental Factors on Retention Outcomes 11
Characteristics of Observations with High and Low Reenlistment Propensities 23
Munitions and Logistics Career Fields 28
4. Simulated Retention Effects of the Blended Retirement System Using the Dynamic Retention Model 29
Overview of the Blended Retirement System 29
Air Force Enlisted Maintainer Dynamic Retention Models 31
Impact of the Blended Retirement System on Accessions and Cost Holding Force Size Constant 34
Summary 38
5. Key Findings, Recommendations, and Next Steps 39
Key Findings 39
Considerations for Future Research 40
Recommendations for Improving Retention 41
Recommended Next Steps 42
Appendix A. Technical Information About the Regression Analysis Data 44
Appendix B. Enlisted Tenure Decision Points and Shaping Mechanisms 46
Appendix C. Logistic Regression Model Results 49
Appendix D. Average Marginal Effects for Years of Service 6–9 and 10–13 70
Appendix E. Dynamic Retention Model Parameter Estimates and Model Fits 79
References 88

Figures

Figure 2.1. Reenlistment Rates, Strength Changes, and Economic Factors 5
Figure 2.2. Reenlistment Rates by Gender 6
Figure 2.3. Reenlistment Rates by Race/Ethnicity 7
Figure 3.1. Marginal Retention Probabilities for Military Characteristics Variables, YOS 3–5 12
Figure 3.2. Marginal Retention Probabilities for Aptitude Variables, YOS 3–5 14
Figure 3.3. Marginal Retention Probabilities for Performance Quality Indicator Variables, YOS 3–5 15
Figure 3.4. Marginal Retention Probabilities for Demographic, Family, and Stressor Variables, YOS 3–5 18
Figure 3.5. Marginal Retention Probabilities for Geographic and Economic Factors, YOS 3–5 20
Figure 3.6. Marginal Retention Probabilities Associated with Fiscal Years 22
Figure 3.7. Marginal Retention Probabilities Associated with AFSCs 22
Figure 3.8. Average Reenlistment Rates Associated with AFSCs 23
Figure 4.1. Aerospace Maintainers 2A Changes in Retention and Accessions Under BRS ... 35
Figure 4.2. Precision Management 2P Changes in Retention and Accessions Under BRS 35
Figure 4.3. Maintenance Management 2R Changes in Retention and Accessions Under BRS 36
Figure 4.4. Munitions and Weapons 2W Changes in Retention and Accessions Under BRS 36
Figure D.1. Marginal Retention Probabilities for Military Characteristics Variables, YOS 6–9 71
Figure D.2. Marginal Retention Probabilities for Aptitude Variables, YOS 6–9 71
Figure D.3. Marginal Retention Probabilities for Performance Quality Indicator Variables, YOS 6–9 72
Figure D.4. Marginal Retention Probabilities for Demographic, Family, and Stressor Variables, YOS 6–9 73
Figure D.5. Marginal Retention Probabilities for Geographic and Economic Factor Variables, YOS 6–9 74
Figure D.6. Marginal Retention Probabilities for Military Characteristics Variables, YOS 10–13 74
Figure D.7. Marginal Retention Probabilities for Aptitude Variables, YOS 10–13 75
Figure D.8. Marginal Retention Probabilities for Performance Quality Indicator Variables, YOS 10–13 75

Figure D.9. Marginal Retention Probabilities for Demographic, Family, and Stressor Variables, YOS 10–13 76
Figure D.10. Marginal Retention Probabilities for Geographic and Economic Factor Variables, YOS 10–13 77
Figure D.11. Marginal Retention Probabilities for AFSC Variables, All YOS Bands 78
Figure E.1. Aerospace Maintainers 2A Model Fit 81
Figure E.2. Precision Management 2P Model Fit 81
Figure E.3. Maintenance Management 2R Model Fit 82
Figure E.4. Munitions and Weapons 2W Model Fit 82
Figure E.5. 2A0 Model Fit 83
Figure E.6. 2A2 Model Fit 83
Figure E.7. 2A3 Model Fit 84
Figure E.8. 2A5 Model Fit 84
Figure E.9. 2A6 Model Fit 85
Figure E.10. 2A7 Model Fit 85
Figure E.11. 2R0 Model Fit 86
Figure E.12. 2R1 Model Fit 86
Figure E.13. 2W0 Model Fit 87
Figure E.14. 2W1 Model Fit 87

Tables

Table 3.1. YOS Bands 9
Table 3.2. Reenlistment Probabilities Setting Boundaries of High- and Low-Propensity Deciles 24
Table 3.3. Characteristics of Observations with High and Low Propensity to Reenlist, YOS 3–5 24
Table 3.4. Characteristics of Observations with High and Low Propensity to Reenlist, YOS 6–9 25
Table 3.5. Characteristics of Observations with High and Low Propensity to Reenlist, YOS 10–13 26
Table 3.6. Characteristics with Little or No Differentiation Between High- and Low-Propensity Deciles 27
Table 4.1. Service Member and Agency Contributions to the TSP 30
Table 4.2. Parameter Descriptions 33
Table 4.3. Estimated Change in Cost from the BRS, Holding Force Size Constant 38
Table C.1. Model Summary for Maintenance AFSCs, YOS 3–5 49
Table C.2. Parameter Estimates for Maintenance AFSCs, YOS 3–5 49
Table C.3. Model Summary for Maintenance AFSCs, YOS 6–9 55
Table C.4. Parameter Estimates for Maintenance AFSCs, YOS 6–9 56
Table C.5. Model Summary for Maintenance AFSCs, YOS 10–13 62
Table C.6. Parameter Estimates for Maintenance AFSCs, YOS 10–13 63
Table E.1. Parameter Estimates and Standard Errors 80
Table E.2. Transformed Parameter Estimates 80

Summary

Issue

This project was intended to help policymakers understand the potential impacts of individual characteristics, economic and geographic factors, and the new Blended Retirement System (BRS) on retention. It focused on enlisted retention, primarily in aircraft maintenance career fields, with some attention to other logistics career fields as resources permitted.

Approach

Relying primarily on data available in U.S. Air Force personnel files (for logistic regressions) and the Defense Manpower Data Center's Work Experience File (for Dynamic Retention Model [DRM] estimates) but also on economic data derived from other sources, two types of analyses were conducted. First, logistic regression was used to determine how strongly a variety of individual and environmental characteristics are associated with decisions to reenlist, extend an enlistment, or separate from the Air Force. Second, RAND's DRM was used to estimate how the new BRS will affect maintenance, munitions, and logistics career fields when those in the new system reach retention decision points.

Conclusions

Viewed over a period of 15 years, from 2005 to 2019, retention has been improving in the maintenance, munitions, and logistics career fields. For much of that span, the improvement can be attributed to changes in the individual characteristics and environmental variables included in our analysis, with some unusual peaks and valleys related to extraordinary national economic shifts or to concentrated drawdowns in Air Force force size.

Key observations include the following:

- Higher grade, being selected for promotion, and higher-quality performance are positively related to retention.
- Major command and geographic region of assignment can influence retention decisions.
- Retention is not significantly related to aptitude, as measured by the Armed Forces Qualification Test.
- Retention is associated with higher performance, as indicated by a series of direct and indirect measures of performance quality.
- Marriage and family formation are positively related to retention.
- Stress, in the form of lower Air Force Specialty Code (AFSC) manning or too heavy a deployment load, tends to lower retention. But some deployment experience, up to a point, is good for retention.

- Higher national unemployment rates are associated with higher retention.
- The BRS, with appropriate application of the midcareer bonus, is not expected to adversely affect retention.

Recommendations

Much of what influences retention is beyond the Air Force's control. The Air Force cannot easily change the location of its bases, and it has no control over national economic conditions. However, we did identify areas of emphasis that could be exploited, some requiring additional research prior to implementation:

- Focus on accession of individuals on initial four-year enlistments rather than those on six-year enlistments, as the former seem to retain better. More research is needed to better inform this difference and possibly exploit it.
- Continue to use selective reenlistment bonuses to increase retention.
- Since performance and retention are positively correlated, emphasize performance-related factors, such as training, quality of leadership, and organizational climate.
- Emphasize family support services and family-friendly management practices because marriage and family formation are positively related to retention.
- Minimize stressors such as AFSC undermanning or maldistribution of deployment demands.

An underlying issue requiring more research is a general absence of insight into the ideal level of retention in the maintenance, munitions, and logistics career fields, or in the Air Force enlisted force more generally. A more experienced force, obtained through higher retention, is both more productive and more expensive. The cost/benefit trade-offs are not well understood.

Acknowledgments

Brig Gen Linda Hurry, the Air Force Director of Logistics (AF/A4L), provided senior leadership to set the terms of the project and guide it to completion. Our main points of contact in the maintenance community—CMSgt Dong Kim and CMSgt Brian McRory—were most helpful in keeping the project focused on the needs of their community. Within Project AIR FORCE, Larry Hanser provided timely and authoritative feedback as our dedicated project reviewer. Michael Mattock and Lisa Harrington, as our quality assurance reviewers, helped us identify weak spots in our exposition. The document also benefited from diligent editing by external editorial partner Liz Schueler.

Abbreviations

AC	active component
ACC	Air Combat Command
ADSC	active duty service commitment
AET	Air Education and Training Command
AF/A4L	Air Force Directorate of Logistics
AF/A4LM	Maintenance Division, Air Force Directorate of Logistics
AFE	U.S. Air Forces in Europe
AFI	Air Force Instruction
AFQT	Armed Forces Qualification Test
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
ALS	Airman Leadership School
AMC	Air Mobility Command
AME	average marginal effect
BPZ	below the promotion zone
BRS	Blended Retirement System
CPI	Consumer Price Index
DAFI	Department of the Air Force Instruction
DoD	Department of Defense
DRM	Dynamic Retention Model
ECI	Employment Cost Index
EPR	enlisted performance report
ETS	expiration of term of service
GAO	Government Accountability Office
HYT	high year of tenure

MOC	military occupation code
MTC	Air Material Command
NCOA	Noncommissioned Officer Academy
OTH	other
PACAF	Pacific Air Forces
PAF	Project AIR FORCE
PFE	Promotion Fitness Examination
R^2	coefficient of determination
RC	reserve component
RUCC	Rural-Urban Continuum Code
SecAF	Secretary of the Air Force
SKT	Skills Knowledge Test
SNCOA	Senior Noncommissioned Officer Academy
SOC	standard occupational classification
SPC	Air Force Space Command
SRB	selective reenlistment bonus
TSP	Thrift Savings Plan
YOS	year(s) of service

1. Introduction

This project is intended to help policymakers understand the potential impacts of individual characteristics, economic and geographic factors, and the new Blended Retirement System (BRS) on retention. It focuses primarily on aircraft maintenance career fields, with some attention to other logistics career fields as resources permitted. It provides an assessment of overall retention trends and insights into which levers the U.S. Air Force should pull to recruit, train, and retain enlisted maintenance airmen.

The Maintenance Division of the Air Force Directorate of Logistics (AF/A4LM) began a comprehensive study of enlisted maintenance retention rates as a result of a 2015 CORONA Top Tasker 8 (Retention Tools to Address Aircraft Maintenance Shortfalls). The outcome of that effort was an Enlisted Maintenance Retention Survey in November 2015, which aimed to better understand the values of airmen at that time. In 2017, AF/A4LM distributed the Aircraft Maintenance Retention Survey to all maintenance career fields with the aim of identifying the areas of greatest opportunity to improve an airman's experience in the career field and job satisfaction as well as drivers of retention.

In 2017, the regular Air Force was undermanned approximately 3,400 maintainers (in a force of about 95,600) needed to support legacy weapon systems and new F-35 bed-down requirements. Air Force maintenance career fields faced an experience shortage of airmen in the 5- and 7-skill levels. Experienced maintainers (5- and 7-skill levels) are most qualified to meet mission needs and are essential for the training and development of new 3-skill level maintainers. This experience shortage was a result of several external events that had occurred over the past ten years, including Program Budget Decision 720,[1] force management decisions, sequestration, and budgetary constraints, all of which have negatively affected overall maintenance manning as well as experienced manning levels.

Although there has been an improvement in Total Force manning since 2015, a 9-percent Total Force shortage of 5- and 7-skill level maintainers exists, whereas 3-skill level maintainers are 120 percent manned in the same time frame. This improvement was due to the Secretary of the Air Force (SecAF) approving an end-strength increase and increasing maintenance accessions by approximately 2,000 per year for two years. Additionally, resequencing of some parts of the F-35 bed-down was delayed to allow maintainers to gain an additional year of experience.

[1] Program Budget Decision 720 refers to the intentional drawdown of around 40,000 personnel across the Air Force that occurred in 2007 (Troyer, 2007). This drawdown was realized partly through force-shaping efforts that affected many Air Force Specialty Codes (AFSCs), and the effects of the force-shaping can still be seen in reduced numbers of personnel at the mid to senior grades today.

To bridge the experience shortfall, the U.S. Government Accountability Office (GAO) called for an Air Force retention strategy tailored to retain experienced maintainers. Specifically, GAO (2019) recommended that

- The SecAF should develop annual retention goals for aircraft maintainers by skill level—for both loss and reenlistment rates—in alignment with authorized levels.
- The SecAF should develop an aircraft maintainer retention strategy, including initiatives that are tailored to the specific needs and challenges of maintainers to help ensure that the Air Force can meet and retain required staffing levels.
- The SecAF agreed with the GAO to develop and implement a retention strategy to meet requirements, complete with retention goals by skill level.

Currently the AF/A4LM is pursuing both monetary and nonmonetary retention initiatives focused on four to ten years of enlisted service. The monetary initiative includes maintenance monthly pro pay,[2] whereas the nonmonetary initiatives include concerns such as additional duties, assignment priority, expanded certification access, a tool to measure scheduling effectiveness, and a master technician program. These retention strategy initiatives address known issues that are currently factors in an enlisted maintainer's decision to stay in the Air Force or leave. However, RAND was asked to explore whether factors in the personnel data (e.g., test scores, family characteristics, demographics, and deployments) and analysis of the BRS could provide additional insights into what predicts retention for this workforce.

It should be noted that the overall manning and experience shortfalls cited above were largely attributed to force structure and force management decisions rather than individuals' propensity to retain.

Study Approach

After surveying the general trend of retention in logistics career fields, we undertook two analytic approaches to examine the underlying determinants of retention. First, we constructed a set of logistic regression models to explore factors thought to influence retention. Second, we

[2] We are not aware of any current Department of Defense (DoD) definition of pro pay; however, the term has been used in the distant past to refer to proficiency pay. See, for example, House Armed Services Committee (1968, p. 7365) and Senate Appropriations Committee (1977, p. 179). Pro pay is used in those cases and in this case (with respect to incentives being pursued for maintainers) to mean additional pay offered to help attract or retain people in highly technical or high-demand career fields or to incentivize people to take on certain types of jobs or assignments. Pro pay may be offered to all members of a career field or assignment, or it may be offered only to individuals who have specialized education or technical certifications. For example, professional pay has been used to attract and retain some medical specialties, and it has been proposed for use in retaining cyber personnel (see, for example, Miller, 2020).

used RAND's Dynamic Retention Model (DRM) to examine the impact of the BRS (see Asch, Mattock, and Hosek, 2017).

Logistic regression is a commonly used approach to understanding the relationships between a binary outcome (reenlist or separate) and various factors thought to influence that outcome. We constructed models for three years-of-service (YOS) bands that generally encompass decision points at the end of the first and second terms of enlistment. The models sought to relate retention to individual characteristics available in Air Force personnel data as well as economic and geographical variables thought to have an influence.

RAND's DRM was used in the analyses that preceded adoption of the BRS. It continues to be regarded as a reliable instrument for determining the expected impact of BRS and other compensation-related policies on retention behavior.

2. The Retention Environment

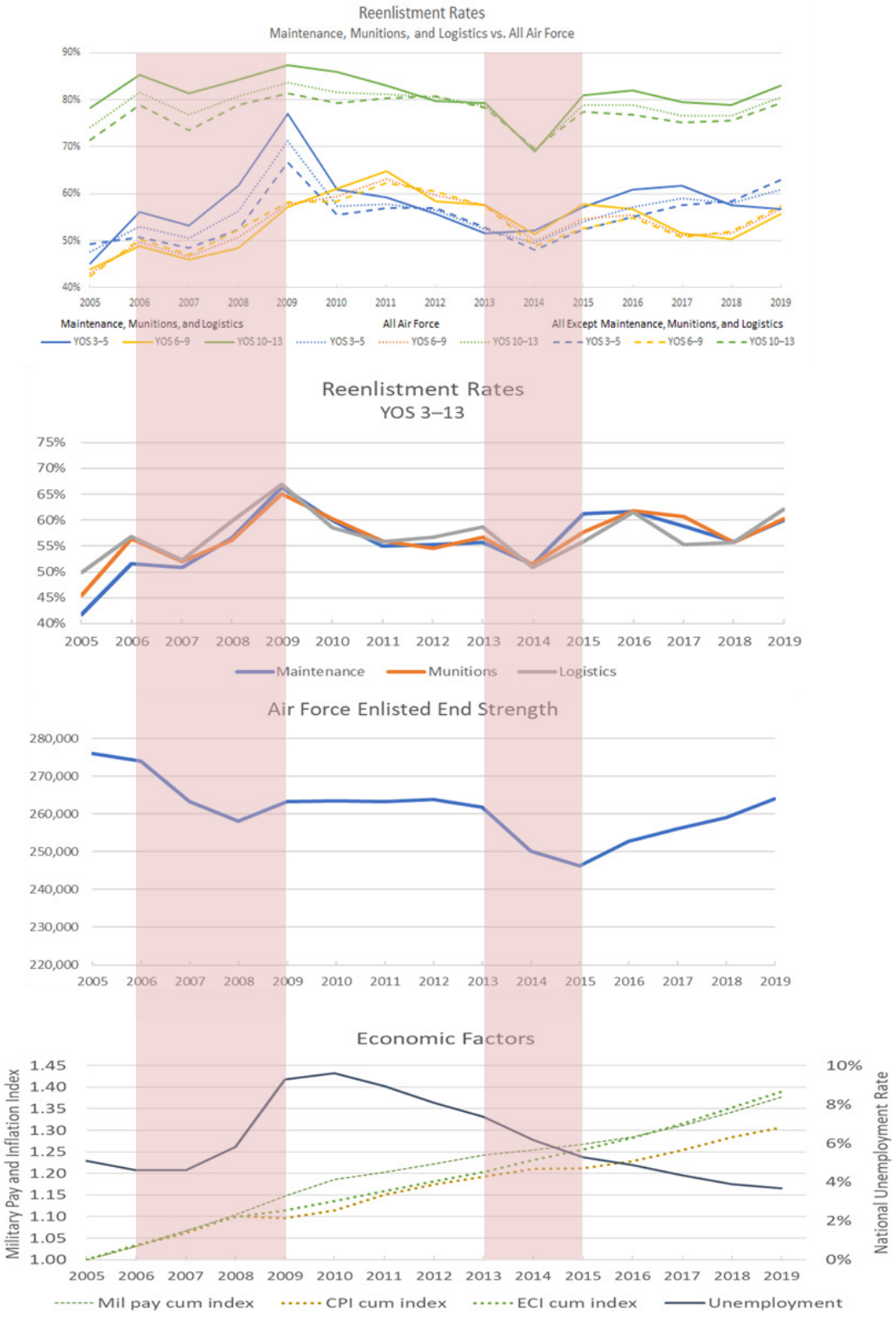
Our analysis used data from 2005 to 2019. Over that period, reenlistment rates generally improved for three broad occupational groups (aircraft maintenance, munitions, and logistics) and in three YOS bands (YOS 3–5, YOS 6–9, and YOS 10–13). We focus on these groups and bands in this chapter and throughout our analysis.[1] Viewed collectively across the three YOS bands, as indicated in the second graphic in Figure 2.1, retention in each of the three occupational groups varied in the vicinity of 50 percent in 2005–2007, 55 percent in 2009–2013, and 60 percent in 2015–2019. Between these three increasing plateaus, in the periods highlighted by red-tinted bands in Figure 2.1, we see peaks and valleys that can be associated with either changes in U.S. Air Force overall enlisted strength or trends in the U.S. economy.

In 2006, the Air Force began the two-year strength drawdown shown in the red-tinted area on the left side of the third graphic in Figure 2.1. During strength drawdowns, Air Force personnel managers are generally reluctant to reduce strength entirely through accession reductions because of the perturbations it causes in recruiting and training pipelines and downstream force management. Accordingly, separation policies are relaxed, and in some cases separations are incentivized, leading to a measured decline in retention.[2] That is evident in the dip in retention in 2007. However, 2007 also marked the beginning of a three-year surge in the U.S. unemployment rate. Rising unemployment generally results in improved retention. Also, in 2009, we see a divergence between military pay raises and the Department of Labor's ECI (a broad representation of alternative compensation levels available to separating military members) and its CPI (a measure of inflation). Both of those measures flattened out in 2009 while military pay continued to rise, making military pay relatively more attractive. As can be seen from the figure, the unemployment effect and the

[1] Throughout this document, we use the term *reenlistment rate* to indicate a calculation that, during a specified period of time, has the count of reenlistments as its numerator and the count of reenlistments plus separations as its denominator. This is equivalent to the *keep rate* published by Air Force sources. Published Air Force reenlistment rates differ from ours in that the Air Force reenlistment rate excludes from the denominator separations of those who are ineligible to reenlist. We used *keep rate* rather than a metric that excludes ineligibles from the denominator because our focus is on characteristics associated with minimizing losses from the workforce. Becoming ineligible to reenlist is a nonnegligible cause of losses. Including ineligibles in our analysis makes it sensitive to characteristics that reduce retention by contributing to ineligibility. Additionally, consistent with the way the Air Force calculates reenlistment and keep rates, we treated extensions of enlistment of more than two years as though they were reenlistments.

[2] We considered excluding induced losses from our analyses but did not do so for two reasons. First, they are not reliably identifiable in the data. Second, many drawdown-induced losses are actually just time-shifted losses—many would occur in a later period if not for the drawdown. If excluded in the period when they were lost, we would need to estimate the proportion that would have left in a later period and/or in a different YOS band. Failing to impute the losses in later periods or different YOS bands would distort overall retention propensities. Lacking good analytic approaches to either identifying the induced losses or imputing when they would otherwise occur, we determined it would be best to rely on the fiscal year variable in our regression analyses to account for such loss shifting.

Figure 2.1. Reenlistment Rates, Strength Changes, and Economic Factors



NOTES: Mil = military, CPI = Consumer Price Index, ECI = Employment Cost Index, Cum = cumulative. The military pay index is based on an annual across-the-board increase in basic pay. ECI data are for all civilian workers and are seasonally adjusted. Red-tinted bands indicate periods of retention perturbation described in the main text.

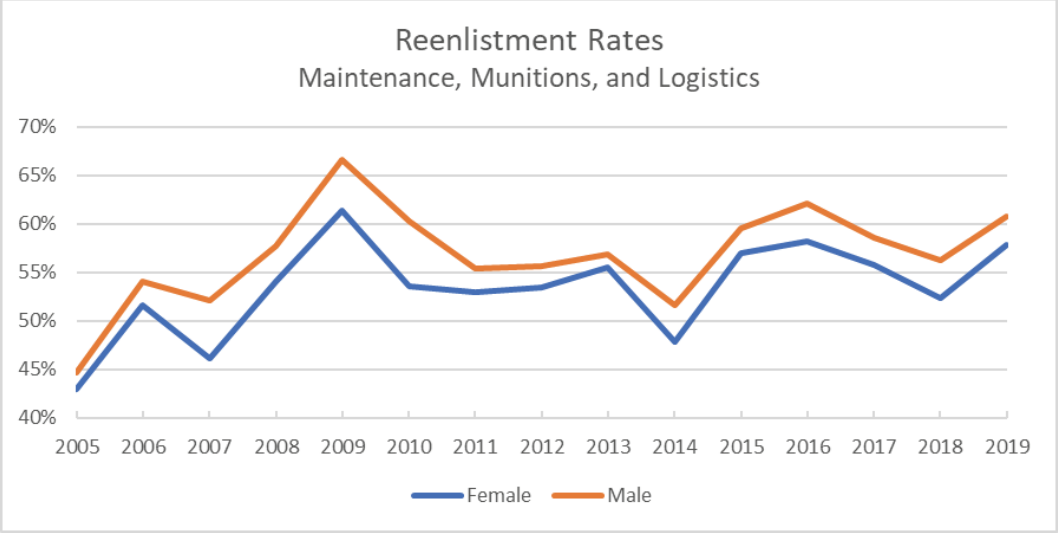
relative improvement in military pay overwhelmed the force-reduction effect, resulting in a spike in retention in 2009.

In 2013, we see the beginning of another two-year drawdown in Air Force strength. In this period, however, there are no offsetting economic influences. The result is the drop in retention in 2014. The retention recovery in 2015 seems incongruous because strength continued to decline in that year, but the apparent recovery is likely due to the phenomenon of "borrowed" losses during and after a strength drawdown. Under relaxed or induced separation policies, individuals who would otherwise have separated in 2015 may have had their separations accelerated to 2014, artificially reducing the number of separations experienced in 2015 and therefore artificially elevating retention rates in 2015. A slight widening of the difference between military pay and inflation indexes beginning in 2015 was also a likely factor.

The aforementioned three plateaus, at 50 percent, 55 percent, and 60 percent for YOS 3–13 collectively, indicate that the long-run trends for maintenance, munitions, and logistics enlisted communities are favorable. The dotted lines in the first graphic of Figure 2.1 show the overall Air Force rates for the three YOS bands. As can be seen, maintenance, munitions, and logistics retention closely follows the pattern of overall Air Force retention and is generally slightly better than overall Air Force retention.

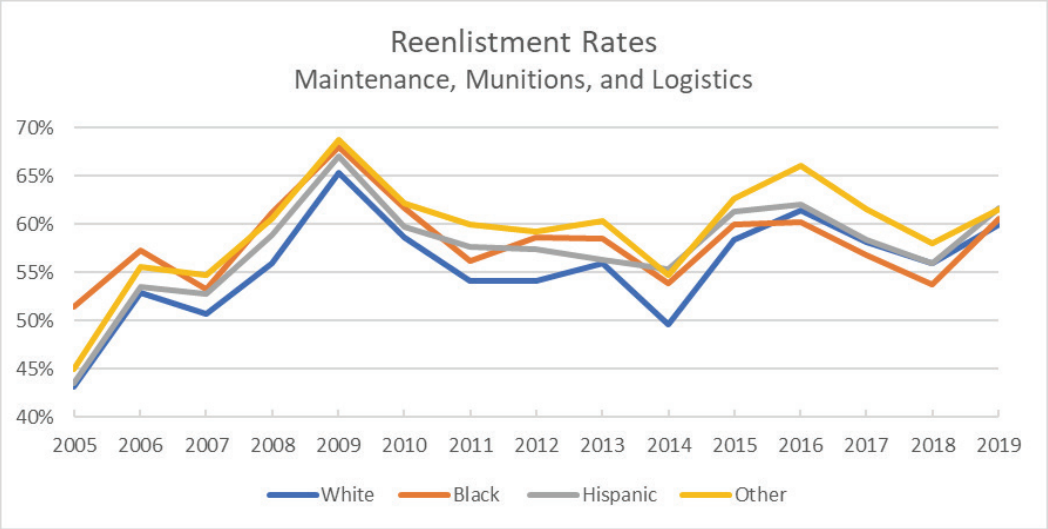
While time-series differences in retention are interesting, cross-sectional (demographic) dimensions are also of interest. For example, retention has been found to differ by gender and race/ethnicity. As Figure 2.2 indicates, gender differences have persisted, with males retaining at between 2 and 6 percentage points better than females. Figure 2.3 shows minority retention exceeding White retention in 2015 and earlier, with rates converging after that.

Figure 2.2. Reenlistment Rates by Gender



NOTE: Data include aircraft maintenance, munitions, and logistics career fields and the three YOS bands included in our analysis.

Figure 2.3. Reenlistment Rates by Race/Ethnicity



NOTE: Data include aircraft maintenance, munitions, and logistics career fields and the three YOS bands included in our analysis.

In the remainder of this report, we will explore a lengthier list of individual characteristics and environmental factors that might relate to retention behaviors in the career fields and YOS bands presented in this chapter. Our analysis will use the same historical data but will do so in a way that analytically isolates the effects of various factors. For example, while the data in Figure 2.3 indicate a gap of up to 5 percentage points between Black and White retention over much of our time frame, our subsequent analysis will demonstrate that differences in retention attributable solely to race/ethnicity, after controlling for other factors, are smaller than the apparent differences depicted here (see Figures 3.4, D.4, and D.9).

3. Regression Analysis Results

The goal of our regression analysis was to explore whether decisions by members of the U.S. Air Force enlisted maintenance workforce to stay or leave the Air Force are related to key information available in individual personnel records, including a range of demographics and personnel experiences and factors over the course of a career. We also sought to understand whether geographic and local or national economic factors could explain their decisions.

The dependent variable in our regression analyses (the outcome we were predicting) was therefore whether someone chose to stay (or retain) or leave (or separate from) the Air Force, at each point when they made such a decision. These retention and separation decision points are reflected in one of three distinct transactions in the personnel data:

- **Separations from the Air Force.** This includes voluntary and involuntary separations at the end of one's term of service, at the beginning of one's term of service, and at the point of retirement.
- **Reenlistments for an additional term of service.**
- **Extensions of enlistment.** Extensions can be short (e.g., a delay of a month, which might occur to allow someone to adjust their separation date or delay their separation decision) or long (e.g., two years, as could occur to obtain retainability for a permanent change of station).

Because of their temporizing effect on tenure—neither a full commitment to stay nor a full commitment to leave—we treated extensions selectively. The Air Force constructively considers extensions of more than two YOS as reenlistments in its computation of reenlistment and keep rates. We followed the same convention. Our analysis treats the decision to leave as a single binary variable (reenlist or extend for more than two years = 1; separate = 0). Our analysis covered decision transactions that occurred from 2005 through 2019.[1]

For many individuals there can be a series of these transactions over the course of their time in the Air Force. This means that in our data there are often multiple transaction records for a single individual, one for each point at which a transaction occurred. For example, one individual could decide to reenlist after the first term of service, reenlist after the second term of service, extend their service commitment for two years before completing a permanent change of station, and then decide to separate after that extension is complete. In this example, the individual would be represented in three separate observations in the transaction file. In this way, our regression analysis sample sizes reflect numbers of transactions, not numbers of individuals. The average number of transactions per individual in our data was 1.65.

[1] For more on how we identified these transactions and the corresponding data sets, see Appendix A.

The primary goal of this study was to explore predictors for the aircraft maintenance career fields (2A and 2R). Full results for those career fields are presented in this and the next chapter and in the appendixes. However, our sponsor also asked that we explore two additional groups of career fields that were not within our initial project scope: the munitions (2W) and logistics (2F, 2G, 2P, 2S, and 2T) career fields. We therefore present only limited results for these two additional groups.[2]

Regression Models

We explored three regression models, each intended to approximate one of three reenlistment zones defined by the Air Force for management of selective reenlistment bonuses (SRBs) (Air Force Instruction [AFI] 36-2606, 2021, p. 34). The three zones are shown in Table 3.1 along with the terminology used in our analyses.

Table 3.1. YOS Bands

Zone	SRB Zone Definition	Corresponding YOS Band Used in This Report
A	>=17 months to <= 6 years	YOS 3–5
B	>= 6 years and 1 day to <=10 years	YOS 6–9
C	>10 years and 1 day to <=14 years	YOS 10–13

Although reenlistment zone A starts at 17 months, we include in our analysis only transactions that occurred at or after three YOS because Air Force policy (AFI 36-2606, Table 5.1) precludes reenlistments before 36 months of service, and any transaction occurring before that would involve either extensions of enlistment or separation for cause, an early discharge based on humanitarian considerations, or other such circumstances not reflecting actual retention propensity. Because the data in YOS 1 and 2 would not represent typical retention behavior, we elected to include only those transactions that occur for individuals who are in their third, fourth, or fifth YOS. Zone A includes reenlistments with exactly six YOS (i.e., the first day of someone's sixth YOS), but we chose to define our YOS bands by whole YOS, and thus those enlisting on the first day of their sixth YOS (i.e., exactly six YOS) are not included in our *YOS 3–5* band. Because initial terms of service are either four or six years, almost all decisions made in this zone are during or at the end of someone's first term of service.

[2] We used the first two digits of the individual's control AFSC to determine their career field. Individuals with maintenance backgrounds but assigned to special duties such as recruiter or military training instructor have their control AFSC changed to the appropriate special duty identifier during that assignment and are thus not included in our data if they reenlist during that assignment.

Second, nearly everyone will have made at least one reenlistment/extension/separation decision in this YOS band. This is true even for those with a six-year service commitment; most would have had at least one reenlistment/extension/separation decision before their first day of their sixth YOS.

The second regression model focuses on transitions that occur during reenlistment zone B, which occurs from one day after six YOS to exactly ten YOS. Again, we include transactions occurring at exactly six YOS and exclude transactions at exactly ten YOS for this model, which spans our *YOS 6–9* band. These data include mostly transactions that occur when people are in their second term of enlistment, although there are some transactions by people who were still in their first term (after extending their first term of enlistment). In addition, some transactions reflect decisions made by people who were already in a third term of enlistment.

The third regression model focuses on zone C, which ranges from one day past 10 YOS up to exactly 14 YOS. We again used a slightly modified range that focused on whole years (10 YOS exactly through one day before 14 YOS), resulting in what we refer to as our *YOS 10–13* band. This YOS band includes mostly people who are in their third term of service or longer.

The data used in our regression analyses were derived in part from a transaction file that records reenlistments, separations, and extensions of enlistment. This file contains some information from contemporaneous personnel records at the time of the transaction, but not enough for the analysis called for in our study. Accordingly, we linked observations from the transaction file with contemporaneous personnel files to obtain a richer data set. Appendix A provides more detail on this and other aspects of our data sources.

Logistic regression results for the three YOS bands represented in our analyses are shown in Appendix C. These include summary statistics for each model and coefficients, standard errors, levels of statistical significance, and 95-percent confidence intervals for each variable and interaction included in the models. Because of our very large number of observations, ranging from 26,396 in the YOS 10–13 band to 51,627 in the YOS 6–9 band, coefficients for a large proportion of the variables had very high levels of statistical significance. In addition, the pseudo R^2 values for our models overall were large (see Appendix C).[3]

Logistic regression results are important for understanding statistical significance; however, they do not lend themselves to ready interpretation when trying to understand the practical significance of a predictor variable or when comparing the magnitude of the impacts on the outcome of interest across different variables in the analysis. The average marginal effect (AME), which can be calculated from the regression results, is commonly used instead. The AME illustrates the expected impact of a single variable on reenlistment probability when all

[3] The pseudo R^2 statistic is a measure of how much of the variance in the dependent variable (reenlist or separate) is explained by the other variables in the model.

other variables are held at their observed levels. Appendix D provides more information on AMEs and how they are calculated.

AMEs for YOS 3–5 are shown graphically in the remainder of this chapter. By scanning the graphics, readers can quickly sense how strongly the individual variables affect reenlistment propensities. AME figures for YOS 6–9 and 10–13 are presented in Appendix D.

Impacts of Individual Characteristics and Environmental Factors on Retention Outcomes

For lay readers, an example can clarify how AMEs are used to indicate the relative impact of individual characteristics and other factors on retention. The upper-left frame of Figure 3.1 shows the marginal effects for grade. It indicates that the predicted promotion probability associated with grade E-3, based on our data, is about 36 percent. The interpretation is that the reenlistment probability for all observations in the YOS 3–5 band would average 36 percent if they retained all their other characteristics (YOS, initial term of enlistment, major command, etc.) but were all in grade E-3. The differences between E-3, E-4, and E-5 in this frame can be attributed solely to grade and not to other characteristics.

In the figures presented in this chapter and in Appendix D, categorical variables are shown using bar graphs, and continuous variables are shown using line graphs. Confidence intervals are shown using whisker bars in the bar graphs, and dotted lines in the line graphs.[4] To allow easy comparison among variables, we generally adhered to a common range of values on the vertical axis for graphs within a YOS band. Where necessary to depict a margin outside of these common ranges, a nonconforming value is indicated by a red tint. Additionally, the graphics are grouped into five broad categories:

- military characteristics
- aptitude
- performance quality indicators
- demographic, family, and stressor variables
- geographic and economic factors.

Military Characteristics

Figure 3.1 shows seven variables that characterize various aspects of an individual's military status. *Grade* and *years of service* are the person's grade and YOS as of the date of the

[4] The confidence intervals are based on the standard error of the estimated margin derived from the logistic regression. Our confidence intervals indicate that there is a 95-percent probability that the true margin associated with a variable lies within the interval indicated by the whisker bars. The values represented by any two bars are considered to have statistically significant differences if there is no overlap in the intervals represented by their whisker bars.

Figure 3.1. Marginal Retention Probabilities for Military Characteristics Variables, YOS 3–5

NOTES: ACC = Air Combat Command, AET = Air Education and Training Command, AFE = U.S. Air Forces in Europe, AMC = Air Mobility Command, MTC = Air Material Command, PACAF = Pacific Air Forces, AFSOC = Air Force Special Operations Command, SPC = Air Force Space Command, OTH = other. The range of vertical axis values for YOS 3–5 is 30–60 percent except where indicated by a red tint over the value. Dotted lines and whisker bars indicate 95-percent confidence intervals.

reenlistment or separation transaction. *Initial enlistment* indicates the term of members on their first enlistment.[5] For members in the YOS 3–5 band, this would also be their current enlistment at the time of the reenlistment or separation transaction included in the data set. *Major command* is the one to which they are assigned at the time of the transaction. *Promotion selection* indicates that they have been selected for and are pending promotion at the time of the transaction. *Under ADSC* (active duty service commitment) indicates that they were required to have or obtain (by reenlisting or extending their enlistment) defined periods of retainability in order to attend a training or education course, make a permanent change-of-station move, or undertake other similar activity and that the ADSC extends to some point beyond the reenlistment or separation transaction date. The *SRB multiple*, used in computing selective reenlistment bonus amounts, is the multiple authorized for the individual's AFSC and SRB zone at the time of the transaction.

These data indicate that reenlistment propensity is higher at higher grades and among those selected for promotion. The lower propensity among those in YOS 4 and on six-year enlistments was unexpected but could be a function of some complex interaction between the term of

[5] Individuals have the option of enlisting for four or six years on their first enlistment. An initial six-year enlistment provides some accelerated promotions and could signal a different retention propensity than a four-year enlistment.

enlistment, YOS, and eligibility for reenlistment. Alternatively, because a six-year enlistment confers some accelerated promotions, its lower propensity could be emerging because of a correlation between the initial term of enlistment and some of the performance quality indicators discussed below. A fuller discussion of this phenomenon appears below in the "Performance Quality Indicators" section.

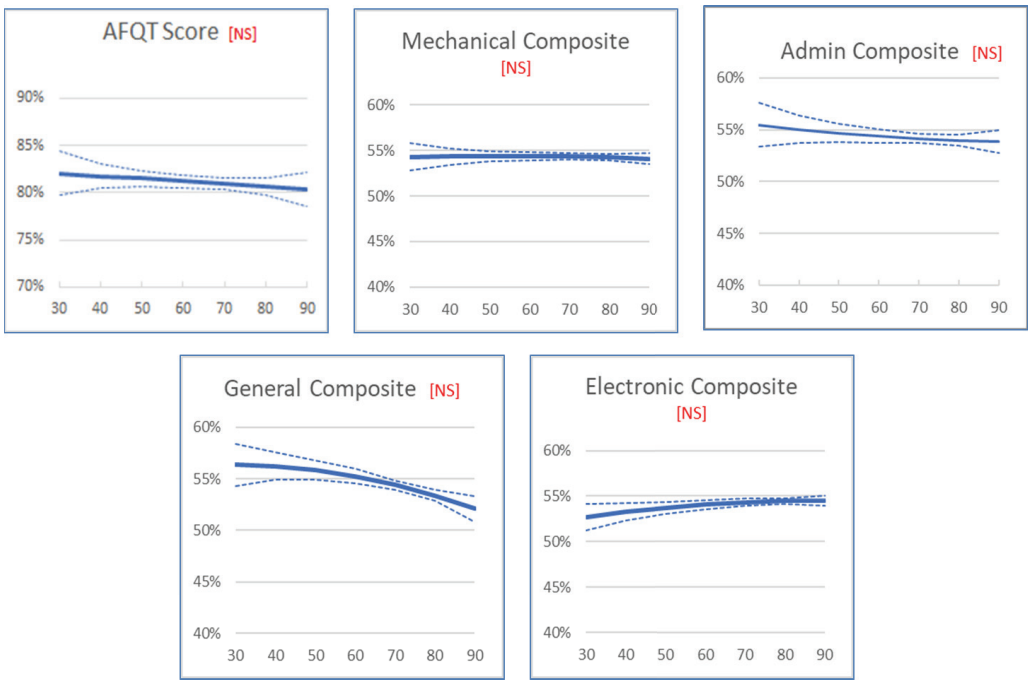
The SRB multiple appears to be serving its purpose here—inducing higher reenlistment propensities at higher multiple levels. But note that causality may also potentially operate in the opposite direction. Since SRB multiples are intended to offset retention propensities that are considered too low, it is possible that higher multiples could be associated with lower retention (i.e., lower retention leads to offering higher SRBs). This may explain why in the other two YOS bands we see no relationship between SRB multiple and retention (see Figures D.1 and D.6 in Appendix D). This *endogeneity* of the SRB multiple (i.e., it is an independent variable but it can also influence the dependent variable) was addressed in Joffrion and Wozny (2015). Using an approach that exploited within-career-field variation in bonus multipliers, they found that retention differences can still in part be explained by the SRB program, even after statistically accounting for the fact that AFSCs with low retention are more likely to have a higher SRB.

Aptitude

Our aptitude variables, shown in Figure 3.2, consist of the individual's best scores on the Armed Forces Qualification Test (*AFQT*) and its four composites (*Mechanical*, *Administrative*, *General*, and *Electronic*) used by the Air Force. Aptitude measures the potential for human capital development, and clearly the Air Force would prefer to have retention positively correlated with aptitude. Unfortunately, as shown in Figure 3.2, that is generally not the case. We see no significant relationship between aptitude and retention in this or the other two YOS bands. Among military personnel of all services, Asch, Romley, and Totten (2005) found similar results regarding the AFQT score—no retention effects at the end of the first term and "slightly no" effects at later career points—while Hosek and Mattock (2003) examining all-service data at the level of the one-digit DoD occupational code, found a negative correlation between AFQT score and reenlistment. In a nonmilitary context, Griffeth, Hom, and Gaertner (2000) conducted a meta-analysis of predictor-turnover studies in the decade prior to their publication, finding no relationship between aptitude and employee retention (sample size weighted average $r = –0.01$). Similar results of no relationship for "abilities and skills" (sample size weighted average $r = 0.06$) were also reported in a more recent meta-analysis by Rubenstein et al. (2018) that updated the Griffeth, Hom, and Gaertner results.

It is worth noting that AFQT is used for screening purposes for entry into these career fields. That means that our data can only explore whether a relationship exists above the screening cut point. It is, however, possible that below that cut point we would find a relationship if people were invited into the career field without any screening. Such a relationship might occur, for example, if people of low aptitude (below the cut point) perform so poorly on the job that the

Figure 3.2. Marginal Retention Probabilities for Aptitude Variables, YOS 3–5



NOTE: "NS" in red type indicates that the marginal effects are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

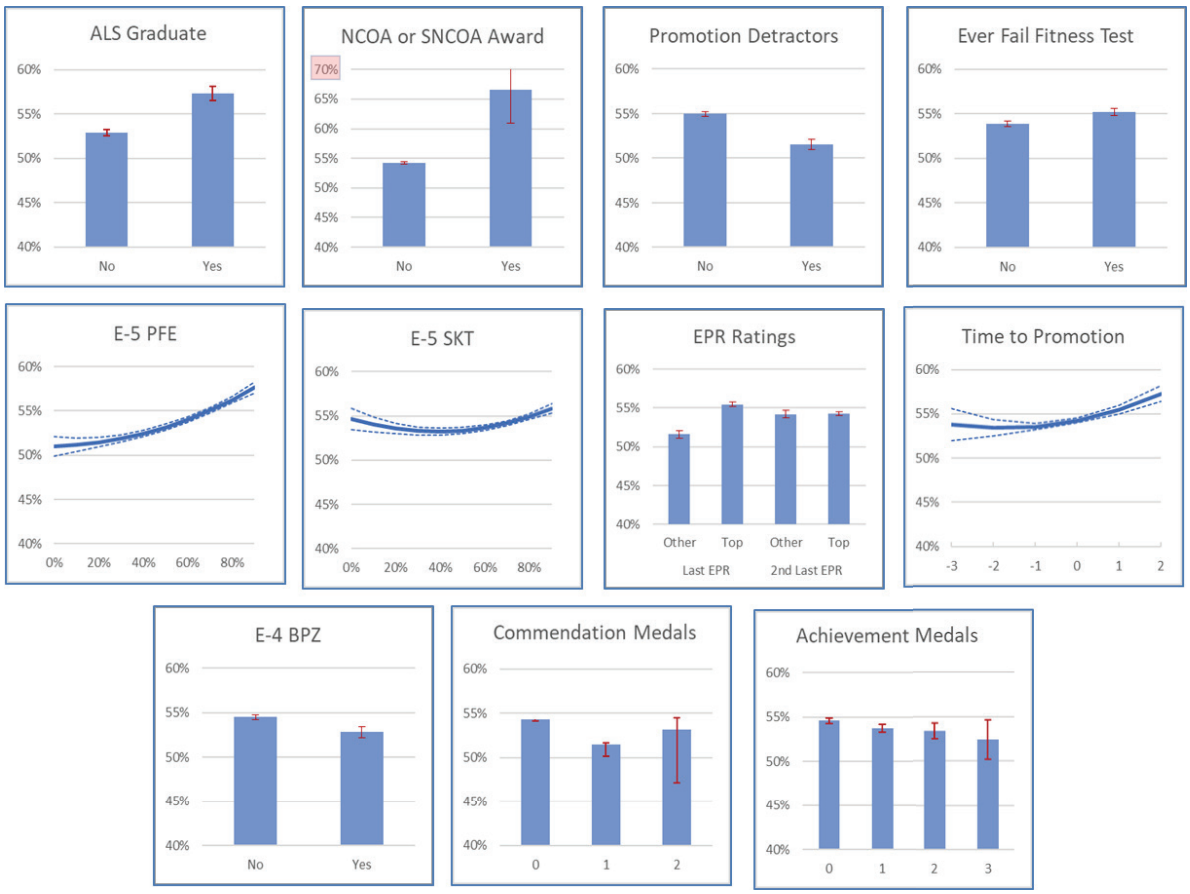
Air Force repeatedly fails to promote them, removes them from the career field, or finds other ways to intentionally encourage them to leave. Thus, these results should not be used to suggest that the AFQT is not a useful screening tool as it is currently being used.

Performance Quality Indicators

As with aptitude, the Air Force would prefer to see better retention among better performers. Except for enlisted performance report (*EPR*) ratings, military personnel data files contain no direct measures of performance. The available metric—overall rating on each EPR—provides limited differentiation. To obtain a more nuanced assessment of performance, we tapped into the variety of surrogate measures shown in Figure 3.3: completing Airman Leadership School (*ALS graduate*), receiving a graduation award after completing the Noncommissioned Officer Academy (NCOA) or Senior Noncommissioned Officer Academy (SNCOA) (*NCOA or SNCOA award*), scoring well on the E-5 Promotion Fitness Examination (*PFE score*) or Skills Knowledge Test (*SKT score*),[6] being promoted to current grade faster than peers for their most recent promotion

[6] We used the best E-5 PFE and SKT scores for this variable in order to avoid a measure that uses tests from different grades, which would not be comparable. For individuals lacking an E-5 PFE or SKT score, we substituted the average of the available scores.

Figure 3.3. Marginal Retention Probabilities for Performance Quality Indicator Variables, YOS 3–5



NOTES: The range of vertical axis values for YOS 3–5 is 30–60 percent except where indicated by a red tint over the value. Dotted lines and whisker bars indicate 95-percent confidence intervals.

(*time to promotion*),[7] having had an accelerated promotion to E-4 (*E-4 BPZ* [below the promotion zone]), and having a higher count of *achievement medals* or *commendation medals*. Our performance quality indicator variables also include two indicators of negative performance: presence of a *promotion detractor* (demotion, nonjudicial punishment, court-martial, and a range of lesser negative indicators that can detract from promotability) and failure of a fitness test at any time during their military service (*ever fail fitness test*).

Past research has explored the relationship between these types of quality indicators and retention in both military and nonmilitary contexts, and the results suggest that higher quality is

[7] The *time-to-promotion* variable is a standardized score (standardized within fiscal year, YOS, and grade) with mean equal to 0 and standard deviation equal to 1. A negative score indicates that the individual was promoted faster than peers (i.e., had a shorter time in grade), while a positive score indicates a slower path to promotion (i.e., a longer time in grade).

typically associated with higher retention. For example, Hosek and Mattock (2003), using all-service data and time to promotion to E-4 and E-5 as a basis for estimating quality, found that quality is correlated with higher retention. These results confirmed earlier findings by Ward and Tan (1985), who used a similar promotion-based estimation of quality to demonstrate that enlisted personnel who tended to retain also tended to exhibit higher quality. Griffeth, Hom, and Gaertner (2000), in their meta-analysis of 1990s retention studies in nonmilitary organizations, also found a negative correlation (sample size weighted average $r = –0.14$) on average between performance and turnover across 72 estimates. On average, the relationship was near zero (sample size weighted average $r = –0.07$) across a total of 86 estimates in the more recent meta-analysis by Rubenstein et al. (2018), but again negative (sample size weighted average $r = 0.17$) if one particularly influential study was excluded. Given this past research showing generally negative relationships with turnover overall, we therefore expected we might find similarly positive relationships between performance quality and retention (the opposite of turnover) in our data.

As shown in the figures, we found that many but not all of our performance indicator variables are related to retention propensity in this expected direction (i.e., where better quality is related to higher retention). The exceptions are fitness test failure (small statistically significant relationship, but not in the expected direction), a top rating on the second-to-last EPR (no relationship), time to promotion (slower promotion is related to higher retention propensity), and the number of achievement and commendation medals (a higher number of medals is related to lower retention propensity). Figures D.3 and D.8 in Appendix D indicate that these same relationships generally hold for the YOS 6–9 and 10–13 bands, except that the SKT and PFE variables cease to be statistically significant in the YOS 10–13 band.

Although, as indicated above, the direction of several of the performance quality indicator results is opposite of what we want, this may be occurring because many of these performance quality variables are correlated with each other. Examining our raw data, we find that all of our quality indicators are statistically significantly associated with higher retention, and many show practically significant relationships (e.g., many show raw correlations with absolute values between 0.10 and 0.33 across all three YOS bands). Moreover, all of the raw relationships are in the direction we want (e.g., higher quality is associated with higher retention). For example, in our YOS 3–5 data, time to promotion was positively correlated with detractors and ever failing a fitness test (0.27 and 0.13, respectively), meaning that as the time to the most recent promotion goes up, the likelihood of having a detractor or failing a fitness test also goes up. Similarly, time to promotion was negatively correlated with other key performance quality indicators like ALS (–0.14), number of medals (–0.10 and –0.13), E-5 SKTs (–0.12), EPRs (–0.16 and –0.18) and E-4 BPZ (–0.33). In other words, those who were promoted faster were also more likely to have medals, better EPRs, and an E-4 BPZ and to have performed better on SKTs. These relationships (both the positive ones and the negative ones) are in the same direction and even slightly higher for the 6–9 YOS group and the 10–13 YOS group.

That these relationships exist is especially important to keep in mind when interpreting the results of any single performance quality coefficient. That is, when variables have relationships with multiple other variables in a regression model, the result of the regression has to be interpreted in that context. Continuing with the time-to-promotion example, the parts of time to promotion that overlap with the other variables likely do lead to a relationship in the direction one might hope, but that relationship is already captured in the model by the estimated coefficients for those other variables. The parts that are *not* already accounted for by these other variables in the model are the parts that are showing the opposite relationship.

In our military characteristics variables, we saw that higher grades and pending promotions are associated with better retention. Favorable promotion outcomes are generally related to better performance, so it is no surprise that promotion outcome, performance, and retention are all positively correlated. Note, however, that *aptitude* is generally not significantly correlated with retention behavior. While there is a relationship between aptitude and performance, there is enough independence between aptitude and performance to produce the effects we observe: Better performance is related to higher retention propensity, but higher aptitude is not. This suggests that, at any aptitude level, higher performers are more likely to be retained.

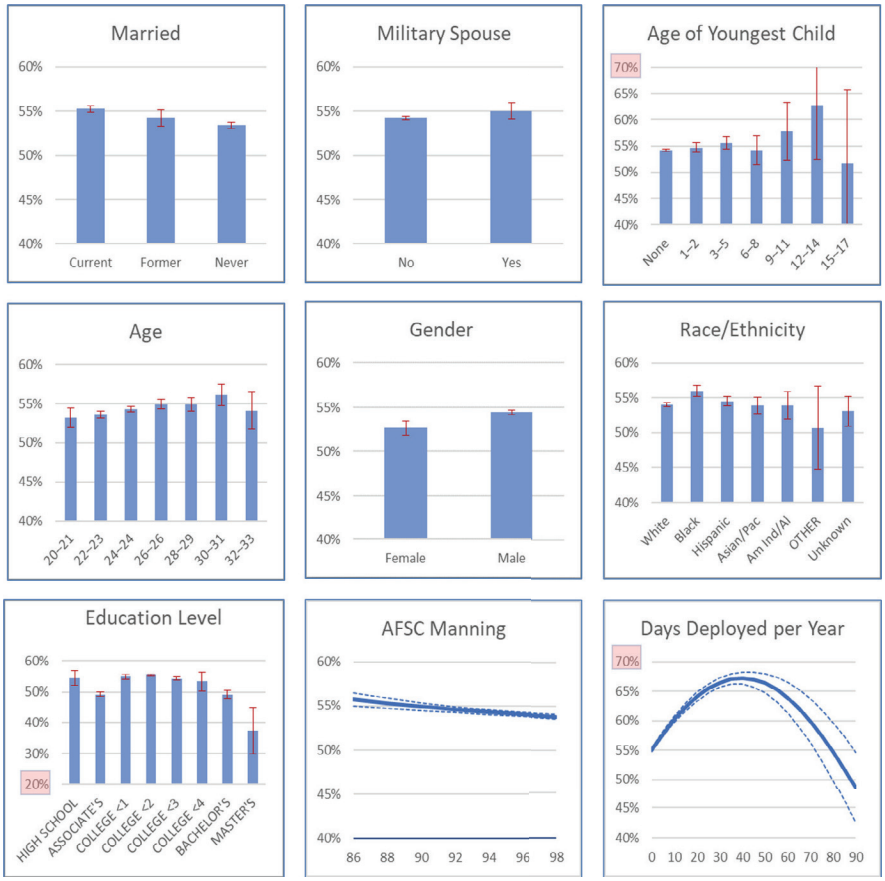
Demographics, Family, and Stressors

Demographic and family characteristics, shown in Figure 3.4, revealed some interesting findings. Notwithstanding the challenges of simultaneously meeting the demands of military service and family life, *married* members tend to retain better than nonmarried members, and members with children in the household (*age of youngest child*) tend to retain better than those without children (the effect tends to increase with the age of the youngest child). This is also consistent with what has been observed outside of the military. Rubenstein et al. (2018) report an average relationship of 0.10 with married personnel being more likely to stay than unmarried personnel. They also observed that as the number of children goes up, people are more likely to stay (sample size weighted average $r = 0.19$). *Gender* and *race/ethnicity* have effects, with males retaining slightly better than females, and Black airmen retaining slightly better than White airmen and other minorities. This finding is not consistent with meta-analytic findings from the broader literature regarding retention, which show no relationship on average with gender or race (Rubenstein et al., 2018); however, the results for gender are generally consistent with findings in military settings where female retention is consistently lower than that of males (GAO, 2020).

With respect to stressors, *AFSC manning* (total inventory in an AFSC divided by total requirements) has a weak effect in the expected direction—better manning is associated with better retention. Relationships with stress that have been reported in the research literature tend to be stronger (sample size weighted average $r = 0.20$) where stress/exhaustion is related to an increased likelihood of leaving (Rubenstein et al., 2018).

Days deployment per year has the same effect on retention as observed in other studies—some deployment is good, but more is bad. In a qualitative study involving officers and enlisted

Figure 3.4. Marginal Retention Probabilities for Demographic, Family, and Stressor Variables, YOS 3–5



NOTE: Dotted lines and whisker bars indicate 95-percent confidence intervals.

personnel from all services, Hosek, Kavanagh, and Miller (2006) found that service members identified both positive and negative aspects of deployment. In a quantitative analysis of how Army and Marine Corps deployments to hostile-fire areas affect first- and second-term reenlistments, Hosek and Martorell (2009) found positive effects for those with fewer than 12 cumulative months deployed and negative effects for greater accumulations.

While the YOS 6–9 and 10–13 bands generally show the same patterns, some notable differences are apparent in Figures D.4 and D.9 in Appendix D. The gender gap grows larger. In the YOS 10–13 band, marital status ceases to show statistically significant differences.

Geographic and Economic Factors

It is generally understood that some base locations are more desirable than others. It is therefore possible that being stationed at an undesirable base may in part drive some people's decisions to stay or leave the service. Military personnel cite a variety of factors that make a base

less desirable, including lack of spousal employment options or impacts on spouse's career, quality of the local schools, poverty levels in the surrounding community, lack of recreation and entertainment options, cost of living, weather, and so on. It may even relate to the general location in the country (e.g., northern tier bases). We therefore included a series of geographic and economic factors, including local socioeconomic conditions, and other potential quality-of-life factors (e.g., rural vs. urban lifestyle) to help capture some of these potential desirability differences.

In addition, potential job alternatives available in the external job market (which can be related to local, national, industry, and occupational unemployment rates and other economic factors) have been shown to be relevant when predicting turnover (see, for example, Rubenstein et al., 2018; Speer et al., 2019; Wong et al., 2017), and it is well understood that the national economy (including unemployment rates) can drive stay/leave rates in the military as well (Warner, 2012). We therefore included two national-level variables in our regressions to account for annual variability in the attractiveness of potential job options.

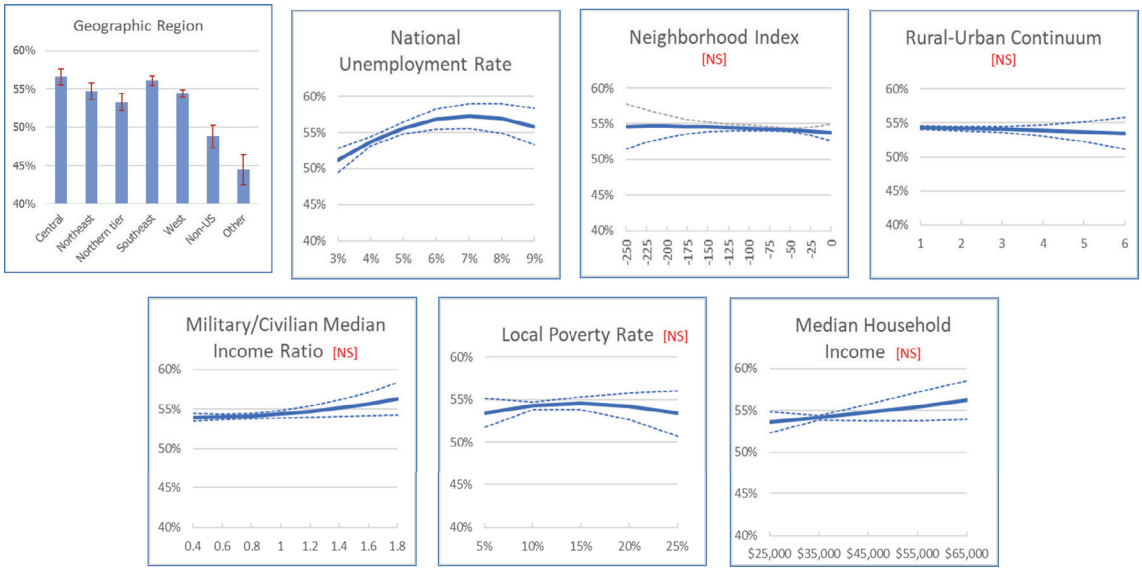
Factors shown in Figure 3.5 were drawn from sources other than Air Force personnel data. Five of the factors are related to the geographic location of the installation to which the member was assigned at the time of the reenlistment or separation transaction:

- *Geographic region* was included to account for the fact that some base locations are known to be more desirable than other locations (e.g., northern tier bases), and this is believed to affect people's willingness to stay in the military. Geographic region is the authors' construct.
- *Neighborhood index* is drawn from previous research (Meadows et al., 2013) identifying 22 social and economic factors thought to be associated with health and well-being, with neighborhood being defined as the zip code of an Army or Air Force installation and the zip codes contiguous to it.[8]
- *Rural-Urban Continuum Code* (RUCC) is a construct developed by the Department of Agriculture that distinguishes metropolitan counties by the population size of their metro area and nonmetropolitan counties by degree of urbanization and adjacency to a metro area (U.S. Department of Agriculture, undated).[9]
- *Local poverty rate* and *median household income* were obtained from the U.S. Census Bureau's Small Area Income and Poverty Estimates Program by a separate ongoing RAND study focused on military retention. Both of these metrics pertain to the larger civilian population surrounding an installation rather than to the military population of the installation itself.

[8] The index was developed only for installations within the 50 United States. For non-U.S. installations we substituted the average value (–51.9) for transactions occurring at U.S. installations.

[9] The code is available only for zip codes in the United States and its territories. As with the neighborhood index, for non-U.S. installations we substituted the average value (2.44) for transactions occurring at U.S. installations.

Figure 3.5. Marginal Retention Probabilities for Geographic and Economic Factors, YOS 3–5



NOTE: "NS" in red type indicates that the marginal effects for the continuous variables are not statistically significant.

Two of the factors are not related to a specific geographic location:

- *National unemployment rate* was obtained from the Bureau of Labor Statistics Current Population Survey (U.S. Bureau of Labor Statistics, 2021) and linked to the year and month of the reenlistment or separation transaction.
- The *military/civilian median income ratio* was developed by the aforementioned RAND project on retention behavior (Meadows et al., 2013) to capture the difference in pay that someone could expect to earn in the civilian marketplace if they left military service to pursue work in a highly similar field. More specifically, this relative income measure is calculated as a ratio between regular military compensation (which is grade specific) and median civilian income, where the latter is computed for civilian occupations corresponding to similar military occupation classification (MOC) codes.[10] These data were linked to reenlistment or separation transactions by fiscal year, grade, YOS, and five-digit AFSC.[11]

[10] The MOC is a DoD construct that provides a common crosswalk between the classification codes of the military services. This variable assumes that maintainers are only considering the income-potential options that are associated with jobs in the private sector that are closely aligned with their current AFSCs (e.g., aircraft maintenance jobs). It, in turn, can be linked to standard occupational classification (SOC) codes via a crosswalk in the Department of Labor's O*Net system (see O*Net Resource Center, 2021b). Regular military compensation is taken from the DoD's Compensation Greenbooks (DoD, undated b). SOC-level income data are derived from the U.S. Census American Community Survey data set (U.S. Census Bureau, undated). SOCs were mapped to MOCs using a Defense Manpower Data Center crosswalk (see O*Net Resource Center, 2021a). In this crosswalk, MOCs are aggregated by the first three, and SOCs are aggregated by the first five digits. This was done both to reduce the number of MOCs without SOC matches and to pool data from closely related SOCs. MOCs without an SOC match were assigned annual unemployment rates by education level. National averages of high school graduates are used for enlisted AFSCs.

[11] In some cases, exact matches could not be obtained. Data were matched by successively broader aggregations: three-digit AFSC, grade and YOS, and grade alone.

Geographically, we saw that U.S. regions had better retention than non-U.S. locations, with central, northeast, and southeast locations favored over northern tier, western, and non-U.S. locations.[12] The national unemployment rate was the only economic variable that showed a relationship to retention. It was in the expected direction—higher unemployment associated with higher retention—but was not statistically significant in the YOS 6–9 band.

This finding of no relationship for some of the other variables was interesting but perhaps not unexpected given the lack of specificity of some of the indicators. For example, it is important to note that the *military/civilian median income ratio* variable assumes that military members' retention decisions are influenced by prevailing compensation rates in civilian occupations related to their military occupations. However, the assumption that separating military members tend to pursue civilian employment that is directly related to their military occupations may not hold for maintainers. In fact, members of the maintainer community are believed to regularly move into a wide range of jobs in other industries (construction, industrial work, etc.), and pay potential in those industries may differ.

Fiscal Year and Air Force Specialty Code Effects

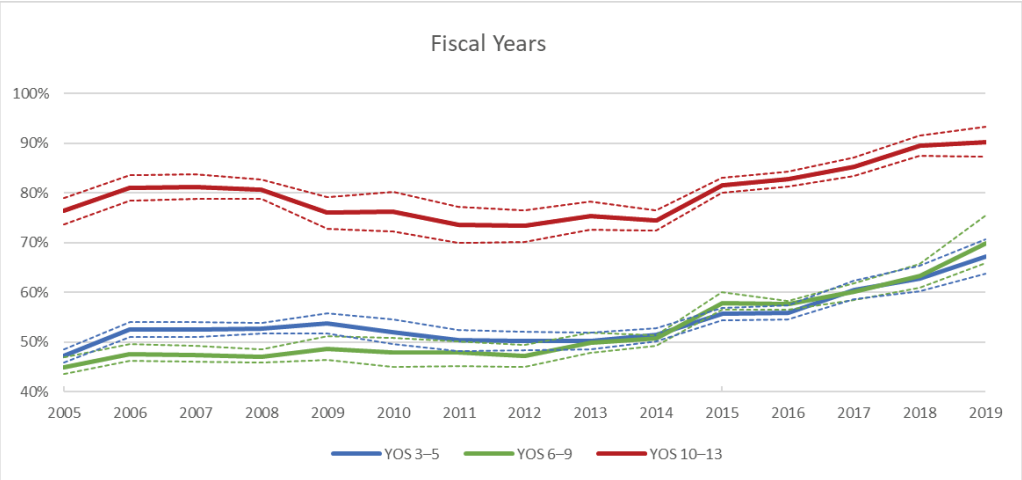
Two of the variables used in our analysis—fiscal year and AFSC—capture variation in reenlistment probabilities not accounted for by the individual characteristics and environmental factors described above. Many of the differences in retention probabilities across fiscal years are large enough to be both statistically and practically significant, whereas the remaining differences among AFSCs are relatively small.

The marginal effects associated with the fiscal-year variable, shown for all three YOS bands in Figure 3.6, suggest that something was changing systematically across the period examined in our analysis, particularly after 2014, and that the change was favorable to retention. Since these effects are observed after controlling for the other variables in our analysis, our data are unable to explain these trends. We sought to include all data in Air Force personnel files that might have a bearing on retention as well as environmental data from other sources. Thus, further exploration of these trends will require tapping into new sources of information, such as survey data or more fine-grained analysis of economic data.

The marginal effects associated with AFSCs, shown in Figure 3.7, are like those for fiscal years. They show systematic differences among AFSCs that are not explained by the other variables in our analysis. The figure is arrayed in order of decreasing levels of the YOS 3–5

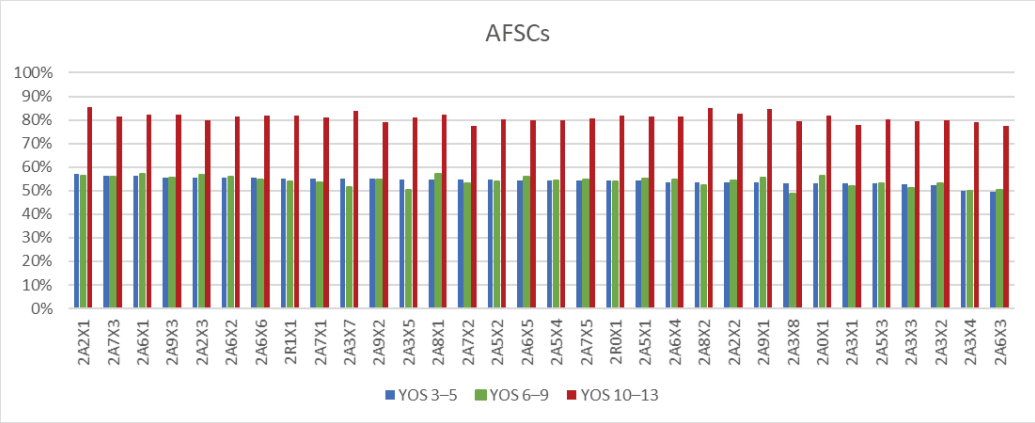
[12] Retention rates in non-U.S. locations may be affected by retainability requirements associated with assignments to and from overseas. Before an overseas assignment, individuals must obtain retainability for the overseas tour length. Upon completion of the overseas tour, they must have retainability for a continental United States (CONUS) assignment (12 months or more, depending on the assignment) (AFI 36-2110, Table 5.2). Otherwise, their date of separation is involuntarily extended to match the completion date of their overseas tour (AFI 36-2110, para 6.6.1). It would appear from our data that this combination of policies tends to yield a lower retention rate for the YOS 3–6 band but not the other two bands.

Figure 3.6. Marginal Retention Probabilities Associated with Fiscal Years



NOTE: Dotted lines indicate 95-percent confidence intervals.

Figure 3.7. Marginal Retention Probabilities Associated with AFSCs



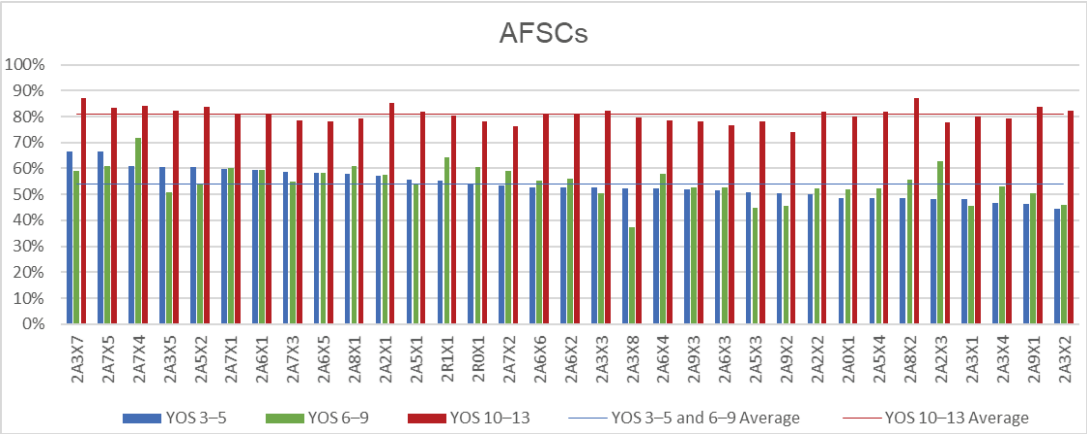
NOTE: To avoid overloading the figure, whisker bars showing 95-percent confidence intervals were not included. These confidence intervals can be seen in Figure D.11 in Appendix D.

predicted reenlistment probabilities. The difference between the largest and smallest effects in each of the YOS bands is about 8 percentage points. Like the fiscal year marginal differences, these differences cannot be explained by our available data. Further analysis would require tapping into additional data sources.

To put these unexplained differences in perspective, Figure 3.8 shows the differences in the raw reenlistment rates among AFSCs averaged over the period covered by our data.[13]

[13] Reenlistment rate in this context is defined as reenlistments divided by reenlistments plus separations. It is comparable to the *keep rate* published by Air Force sources and to the reenlistment probabilities shown in our marginal effects.

Figure 3.8. Average Reenlistment Rates Associated with AFSCs



NOTE: Averages for YOS 3–5 and 6–9 coincide; thus, only one line is shown.

YOS 3–5 reenlistment rates shown in this figure range from 45 percent to 67 percent. The YOS 6–9 range is even wider: 37–71 percent. This indicates that many of the differences in retention that appear to be associated with AFSCs are attributable to other variables included in our analysis.

Characteristics of Observations with High and Low Reenlistment Propensities

Using the marginal results from our logistic regressions, we identified the variables with notable differences (both statistically and practically significant) between observations with high reenlistment propensities and those with low reenlistment propensities. For each of the three YOS bands, we rank-ordered the observations on the basis of their predicted reenlistment probabilities, then examined the top and bottom deciles in this rank ordering. Table 3.2 provides the reenlistment probabilities that set the lower end of the high-propensity deciles (e.g., observations in the high-propensity decile in the YOS 3–5 band all had a reenlistment probability of 99.8 percent or more) and the upper end of the low-propensity deciles. For observations in the high- and low-propensity deciles, Tables 3.3–3.5 provide the variable values in which there were notable differences in each of our YOS bands. Collectively, these tables provide a sense of the typical characteristics of those who are either very likely or very unlikely to reenlist.

Variables not listed in Tables 3.3–3.5 either were not statistically significant or were represented at similar levels among both high- and low-propensity deciles. Since the absence of a notable retention effect is also of interest, these variables are listed in Table 3.6.

Table 3.2. Reenlistment Probabilities Setting Boundaries of High- and Low-Propensity Deciles

YOS Range	Lower Bound of High-Propensity Decile (percentage)	Upper Bound of Low-Propensity Decile (percentage)
3–5	99.8	0.9
6–9	99.5	4.4
10–13	99.8	25.4

Table 3.3. Characteristics of Observations with High and Low Propensity to Reenlist, YOS 3–5

	Average Value or Proportion with Characteristic	
Characteristic	**High PTR**	**Low PTR**
Military characteristics		
In grade E-4 or E-5	100%	35%
Average YOS	4.6	3.8
Selected for promotion	15%	4%
In an AFSC with an SRB multiple of 1 or more	39%	8%
Under ADSC	100%	2%
Aptitude (no practical differences)		
Performance quality indicators		
ALS grad	80%	4%
NCOA or SNCOA awardee	11%	0%
E-4 BPZ	19%	8%
Detractor in record	10%	77%
Ever failed a fitness test	25%	34%
E-5 PFE average	70	53
E-5 SKT average	71	58
Top rating on last EPR	90%	46%
Time-to-promotion average standard score	–0.35	0.02
One or more commendation medals	5%	1%
One or more achievement medals	46%	16%
Demographic, family, and stressor variables		
Married	64%	34%
Military spouse	9%	5%
Female	5%	9%
Child in household	33%	7%
At least three years of college credit	37%	16%
Average days per year deployed	17.4	0.7
Geographic and economic factors		
Based in southeast region of United States	37%	23%
Based overseas	6%	16%
Military/civilian median income ratio	0.93	0.83

NOTE: PTR = propensity to reenlist.

Table 3.4. Characteristics of Observations with High and Low Propensity to Reenlist, YOS 6–9

	Average Value or Proportion with Characteristic	
Characteristic	**High PTR**	**Low PTR**
Military characteristics		
In grade E-5 or E-6	99%	25%
Average YOS	8.2	6.4
Selected for promotion	20%	1%
Under ADSC	100%	1%
In an AFSC with an SRB multiple of 1 or more	99%	25%
Aptitude (no practical differences)		
Performance quality indicators		
ALS grad	99%	47%
NCOA or SNCOA award	4%	0%
E-4 BPZ	16%	12%
Detractor in record	21%	57%
Ever failed a fitness test	37%	47%
E-5 PFE average	67	48
E-5 SKT average	69	50
Top rating on last EPR	90%	46%
Time-to-promotion average standard score	0.06	0.15
One or more commendation medals	42%	8%
One or more achievement medals	77%	33%
Demographic, family, and stressor variables		
Married	76%	43%
Military spouse	10%	5%
Female	4%	8%
Child in household	37%	10%
Average age	28.1	25.1
Racial/ethnic minority	32%	24%
At least three years of college credit	47%	24%
Average days per year deployed	7.4	0.3
Geographic and economic factors		
Based in southeast region of United States	32%	24%
Based in western region of United States	29%	40%
Military/civilian median income ratio	0.98	0.91

Table 3.5. Characteristics of Observations with High and Low Propensity to Reenlist, YOS 10–13

	Average Value or Proportion with Characteristic	
Characteristic	**High PTR**	**Low PTR**
Military characteristics		
In grade E-6 or E-7	81%	13%
Average YOS	11.5	10.9
Selected for promotion	28%	1%
Under ADSC	100%	1%
Aptitude (no practical differences)		
Performance quality indicators		
Detractor in record	23%	64%
Ever failed a fitness test	38%	67%
Top rating on last EPR	96%	40%
Time-to-promotion average standard score	–0.09	0.14
One or more commendation medals	76%	41%
One or more achievement medals	75%	59%
Demographic, family, and stressor variables		
Married	82%	68%
Military spouse	10%	5%
Female	2%	8%
Child in household	59%	45%
Racial/ethnic minority	32%	23%
AFSC manning level	100%	97%
Average days per year deployed	8.6	0.2
Geographic and economic factors		
Based in southeast region of United States	30%	24%
Based in western region of United States	31%	40%
Based overseas	22%	12%
Military/civilian median income ratio	1.38	1.14
Median household income in base vicinity	$52,976	$46,562

Table 3.6. Characteristics with Little or No Differentiation Between High- and Low-Propensity Deciles

Characteristic	Models in Which Indicated Characteristics Show Little or No Differentiation		
	YOS 3–5	YOS 6–9	YOS 10–13
Military characteristics			
Length of initial enlistment	X	X	X
Major command	X	X	X
Aptitude			
AFQT	X	X	X
Mechanical composite	X	X	X
Administrative composite	X	X	X
General composite	X	X	X
Electronic composite	X	X	X
Performance quality indicators			
ALS grad			X
NCOA or SNCOA awardee			X
E-5 PFE average			X
E-5 SKT average			X
Top rating on second-to-last EPR rating	X	X	X
E-4 BPZ			X
Demographic, family, and stressor variables			
Average age		X	
Racial/ethnic minority	X		
Education level			X
AFSC manning	X	X	
Geographic and economic factors			
National unemployment rate		X	X
Neighborhood index	X	X	X
RUCC	X	X	X
Local poverty rate	X	X	X
Median household income in base vicinity	X	X	

Munitions and Logistics Career Fields

We developed the same regression models for munitions and logistics career fields as were developed for aircraft maintenance career fields. We compared the coefficients obtained from these models with the coefficients obtained in the aircraft maintenance models.[14] The direction and magnitude of effects in the munitions and logistics regressions are generally comparable to effects in the maintenance regressions, but there are differences that might prove to be notable if examined using marginal analysis. However, resources in the project underlying this report were insufficient for deeper analysis of the munitions and logistics results.

[14] Coefficients and other results from these models are not provided in this document but are available from the authors.

4. Simulated Retention Effects of the Blended Retirement System Using the Dynamic Retention Model

For this study, we extend the RAND DRM to create U.S. Air Force enlisted maintainer specific DRMs at the two-digit AFSC level. These models enable us to simulate the retention and cost effects of the BRS on these occupational groups. We note that this exercise is a first step in using the DRM to model Air Force maintenance retention, and accordingly there are limitations to our results. We recommend several steps to extend the analysis at the end of this chapter.

In this chapter, we first provide an overview of the BRS. Next, we describe the Air Force–enlisted DRMs. Finally, we use the DRMs to estimate how much accessions and costs would change under the BRS if we hold force size constant.

Overview of the Blended Retirement System

The BRS was enacted as part of the Fiscal Year 2016 National Defense Authorization Act. The BRS includes aspects of the legacy retirement system and more common retirement benefits found in the civilian sector—namely, a defined contribution plan. Compared with the legacy retirement system, the BRS provides a lower retirement annuity but gives service members who leave the armed services with fewer than 20 YOS retirement benefits through its defined contribution plan. In contrast, the legacy retirement system only includes a defined benefit plan that provides a retirement annuity to service members who retire with at least 20 YOS.

Effective January 1, 2018, new accessions into the uniformed services are covered by the BRS. Service members with fewer than 12 years of total service as of December 31, 2017, were eligible to opt into the BRS during calendar year 2018. Among Air Force service members eligible to opt in, 29.1 percent chose to do so, while the rest remain under the legacy retirement system (Philpott, 2019). Service members with more than 12 YOS as of December 31, 2017, are also covered by the legacy retirement system.

The BRS consists of three components: a defined benefit plan, a defined contribution plan, and continuation pay. The defined benefit plan provides a retirement annuity calculated as 2 percent multiplied by YOS and the average of the highest three years of basic pay. Service members are vested after 20 YOS (i.e., those who leave the armed forces before 20 YOS do not receive a retirement annuity). At the time of retirement, service members have the option to choose a lump-sum payout with a reduced annuity or the full annuity. Service members can choose a lump sum equal to 25 or 50 percent of the discounted present value of future retirement benefits up to age 67, at which point individuals receive the full retirement annuity again. The BRS provides a lower retirement annuity compared with the legacy retirement system, with the latter providing an annuity equal to 2.5 percent multiplied by YOS and the average of the highest three years of basic pay.

The second component of the BRS is the defined contribution plan, also known as the Thrift Savings Plan (TSP). BRS participants are automatically enrolled in the TSP at 60 days of service; however, participants can choose to disenroll or change their employee contributions to the TSP. Additionally, automatic agency contributions to a participant's TSP account of 1 percent of basic pay begin after 60 days of service. Contributions to the TSP are deposited into an age-appropriate life-cycle fund, unless the participant chooses a different fund allocation. Before January 1, 2021, BRS participants were automatically enrolled to contribute 3 percent of basic pay. On January 1, 2021, BRS participants were automatically enrolled to contribute 5 percent of basic pay. Those who reduce their TSP contributions to zero are automatically reenrolled in the TSP at the beginning of each calendar year. After two YOS, BRS participants receive agency matching contributions that increase with the service member's contribution as summarized in Table 4.1 up to a maximum of 4 percent. Automatic agency contributions and agency matching contributions end after 26 YOS. Service members have full access to TSP funds at age 59.5 (similar to retirement contribution plans offered in the private sector), and there are required minimum distributions beginning at age 72.

Table 4.1. Service Member and Agency Contributions to the TSP

Service Member Contribution (percentage)	Automatic Agency Contribution (percentage)	Agency Matching Contribution (percentage)	Total Contribution (percentage)
0	1	0	1
1	1	1	3
2	1	2	5
3	1	3	7
4	1	3.5	8.5
5	1	4	10
More than 5	1	4	Service member contribution + 5

SOURCE: DoD, undated a.

The third component of the BRS is continuation pay, which provides a retention incentive for midcareer service members and is meant to offset reduced retention incentives from decreasing the retirement annuity. Continuation pay is calculated as a multiplier times monthly basic pay and is tied to a service agreement. The multipliers are set each calendar year by each service and can range from 2.5 to 13 for those in the active component (AC) and 0.5 to 6 for those in the reserve component (RC). Each service can also choose the length of the service obligation tied to continuation pay as long as it is at or above the imposed minimum length of three years. Service members can receive continuation pay between the completion of 8 YOS and before the completion of 12 YOS. For calendar year 2020, the Air Force AC continuation pay multiplier was set equal to 2.5, and the RC pay multiplier was set equal to 0.5. Moreover, the continuation

pay service obligation was 4 YOS in 2020 and paid out at 12 YOS among Air Force service members covered by the BRS.

Air Force Enlisted Maintainer Dynamic Retention Models

In this section, we describe the Air Force–enlisted DRMs and provide a broad overview of the DRM, describe the data used for the DRM, and describe the model fits. Our broad overview of the DRM summarizes the description of the DRM (Tong, Mattock, and Asch, 2021). Additional technical details can be found in this reference and in Asch, Hosek, and Mattock (2013).

Overview

The DRM is a mathematical model of individual member-retention decisions over their active and reserve careers where members' retention decisions change as the value of staying or leaving the military changes. These decisions are modeled as a dynamic program in which service members in the model make annual decisions on whether to stay or leave based on the career path that yields the highest value. The DRM is characterized by a set of parameters that are estimated with longitudinal administrative data that follow service member retention in the AC and RC. These parameters can then be used to estimate the impact of different policies on retention, including those that do not have a historical analog (such as the BRS).

The DRM has been estimated for various military communities including Air Force pilots, military mental health care providers, and Air Force career-enlisted aviators (Hosek et al., 2017; Mattock et al., 2016; Tong, Mattock, and Asch, 2021). Moreover, the DRM has been used to estimate the retention effects from the BRS across the services (Asch, Mattock, and Hosek, 2017) and the retention effects from changes in special and incentive pays for different occupations (Tong, Mattock, and Asch, 2021).

In the DRM, service members begin their careers in the AC and decide to stay or leave each year. Members who leave the AC cannot rejoin the AC. Instead, they take a civilian job and simultaneously choose whether to participate in the RC. A reservist can choose to remain in the RC or not, and a civilian can choose to participate in the RC or not.

The model assumes that individuals are forward-looking, meaning they anticipate being able to revisit their decisions to stay or leave the military each year. Individuals are also assumed to have different preferences for serving in the AC and RC that are unobserved and do not change over time.[1] The trajectory of pay over military and civilian careers and the trajectory of income

[1] We acknowledge that this assumption may not hold if forward-looking individuals update their preferences each year as they make their annual decisions to stay or leave the military. However, to the extent that preferences update as a result of future shocks, such as having a good assignment or serving on a dangerous mission, these future shock effects will be incorporated into the model through the estimated scale parameters of the distribution of these shocks as described in the main text.

in retirement are known to the individual.[2] Each year, there are random shocks that affect the value of each career choice (e.g., whether to stay or leave the AC, whether to stay or leave the RC). These shocks could reflect a good assignment; a dangerous mission; an excellent leader; inadequate training or equipment for the tasks at hand; a strong or weak civilian job market; an opportunity for on-the-job training or promotion; the choice of location; a change in marital status, dependency status, or health status; the prospect of deployment or deployment itself; or a change in school tuition rates. These shocks affect the value of being in the AC, RC, and/or in the civilian sector. While the individual is assumed to know the distributions that generate the shocks, the distribution of future shocks is unknown, meaning that individuals are not able to perfectly predict the types of shocks listed above. As a result, an individual uses the information that is realized in the current period to choose whether to stay or leave military service. The individual receives the pay associated with his or her decision. For example, an individual who decides to stay in the AC receives the pay from serving in the AC. In addition, the individual receives the monetary equivalent of the preference for serving in an AC or RC.

In the current period, when future shock realizations are unknown, the individual chooses the option that provides the expected value of the best choice in the next period—that is, the expected value of the maximum. Logically, this will also be true in each subsequent period, so the model is forward-looking and rationally handles future uncertainty. The model assumes that the individual can reoptimize in each future period, depending on the individual's career choice and shocks realized in that period, meaning that today's decision takes into account the possibility of future career changes and assumes that future decisions will also be optimizing.

The model includes two switching costs. These are not costs paid by the individual but the implicit cost of making certain career transitions that assist with fitting the model to the observed data. The first switching cost is the cost of leaving active duty before completing the first-term service obligation. The observed retention profiles for Air Force enlisted maintainers show large drops in personnel at four YOS. Consequently, the DRM assumes that the first term is four years. The second switching cost is the cost of moving from a purely civilian state to participating in the RC.

Table 4.2 describes the parameters estimated by the DRM. Additionally, we assume that the personal discount factor is 0.88,[3] which was the personal discount factor estimated in the Air Force–enlisted DRM published in Asch, Hosek, and Mattock (2014), and the personal discount

[2] We acknowledge that this assumption may not hold if service members do not fully comprehend military and civilian pay structures or understand how to forecast their military retirement benefits. This is certainly a possibility, as many individuals likely have not calculated the totals for each alternative and therefore may make incorrect assumptions about the relative value of each. However, it is likely that over time, an approximate awareness of the relative value of both options will become generally understood within the workforce.

[3] The personal discount factor equals $1/(1 + r)$, where r is the personal discount rate. A personal discount factor of 0.88 corresponds to a discount rate r of 13.6 percent.

Table 4.2. Parameter Descriptions

Parameter	Description
τ	Scale parameter of the distribution of the shock for leaving active duty
λ	Scale parameter of the distribution of the reserve and civilian shock parameters
μ_a	Mean active taste
μ_r	Mean reserve taste
σ_a	Standard deviation of active taste
σ_r	Standard deviation of reserve taste
ρ	Correlation between active and reserve tastes
Switch cost 1	Switch cost for leaving active before 4 YOS
Switch cost 2	Switch cost for moving from civilian to reserve

factor used for enlisted personnel in prior DRM modeling work (Asch, Mattock, and Hosek, 2017; Tong, Mattock, and Asch, 2021). These estimated parameters are used to simulate the retention responses to the BRS.

Data

The data used for the DRM come from the Defense Manpower Data Center Work Experience File, which contains longitudinal information about military careers at the individual service member level. For this project, we use data on Air Force–enlisted service members who entered into the AC in years 1990–1993 and have a two-digit AFSC equal to 2A, 2P, 2R, or 2W recorded on their personnel record during their military tenure. We track active and reserve service for each Air Force enlisted maintainer from his or her year of entry through 2012. A key assumption of the DRM is that service members choose whether to stay or leave the AC. As a result, we exclude data from years 2013 and beyond in order to omit years when force-shaping by the Air Force resulted in involuntary exits from the AC.

Because of the limited scope of the project, models were estimated at the two-digit AFSC level as opposed to the three-digit level or higher. Creating the models at the two-digit level has a couple of advantages. First, this approach allows us to avoid small sample sizes that could occur at lower levels of aggregation. Second, modeling at the two-digit level allows us to avoid issues related to AFSCs changing over time at the three-digit level or finer. The main disadvantage to modeling at the two-digit AFSC level is that service member retention and retention responses to the BRS could vary across service members within a three-digit AFSC. To demonstrate that we are confident in the two-digit model's ability to fit observed retention, we apply the two-digit model to each of the three-digit AFSCs in Appendix E and show that the models fit the data well at the three-digit level. However, we cannot conclude that the findings from the BRS simulation described in the next chapter are representative of what the results would be for subspecialties at the three-digit level.

In the DRM, service members make annual decisions to stay or leave military service based in part on AC pay, RC pay, and civilian pay as described above. In the model, these pay streams are set equal to averages based on the individual's years of AC, RC, and total experience, respectively. For AC and RC pay, we use data on regular military compensation (RMC) and basic pay from the *Selected Military Compensation Tables (Greenbook)* (Office of the Under Secretary of Defense for Personnel and Readiness, Directorate of Compensation, 2021). RMC includes basic pay, basic allowance for housing, basic allowance for subsistence, and the federal income tax advantage from the exclusion of the allowances from federal income tax. For civilian pay, we used the median wage for full-time male workers with associate degrees. Note that the pay streams used in the model are in 2007 dollars and that the BRS cost estimates produced in the next chapter are in 2019 dollars.

Model Fits

Appendix E contains a series of figures illustrating the fit of DRM predictions to the data used in developing them. Visual inspection of the figures shows that the model fits the observed data well; that is, the predicted retention shows good correspondence with actual retention observed in the data. To measure the goodness of fit, we estimate each mode's pseudo R^2 where values between 0.2 and 0.4 are deemed as showing "excellent fit" (McFadden, 1977). The pseudo R^2 values for the models range from 0.77 to 0.80, demonstrating that the models fit the data well.

Impact of the Blended Retirement System on Accessions and Cost Holding Force Size Constant

We use the models to simulate the impact of the BRS on accessions and cost holding force size constant. This analysis compares a regime in which all service members are covered by the legacy retirement system with a regime in which all service members are covered by the BRS.

A limitation of the DRM is that it does not model savings decisions. Consequently, the DRM does not provide us with information on how much a service member might contribute to the TSP or whether a service member would choose a lump-sum payout versus the full retirement annuity. Instead, we assume that service members contribute 5 percent of their basic pay to their TSP accounts and receive the maximum DoD match of 4 percent plus the 1-percent automatic agency contribution. In total, 10 percent of basic pay is assumed to be contributed to a service member's TSP between 2 and 26 YOS. We assume the TSP annual real rate of return is 4.95 percent, which is the rate of return assumed by the January 2015 Final Report of the Military Compensation and Retirement Modernization Commission.

If we hold force size constant, we can show how many accessions would need to change under the BRS to maintain the same end strength as that of the legacy retirement system. We use Air Force maintainer force sizes as of September 2019 reported in the Air Force personnel data

files for this exercise. Figures 4.1–4.4 show the distribution of personnel by YOS under the legacy retirement system (black line) and the BRS (red line). To maintain force size, we find that accessions would need to fall under the BRS across the two-digit AFSC Air Force enlisted

Figure 4.1. Aerospace Maintainers 2A Changes in Retention and Accessions Under BRS

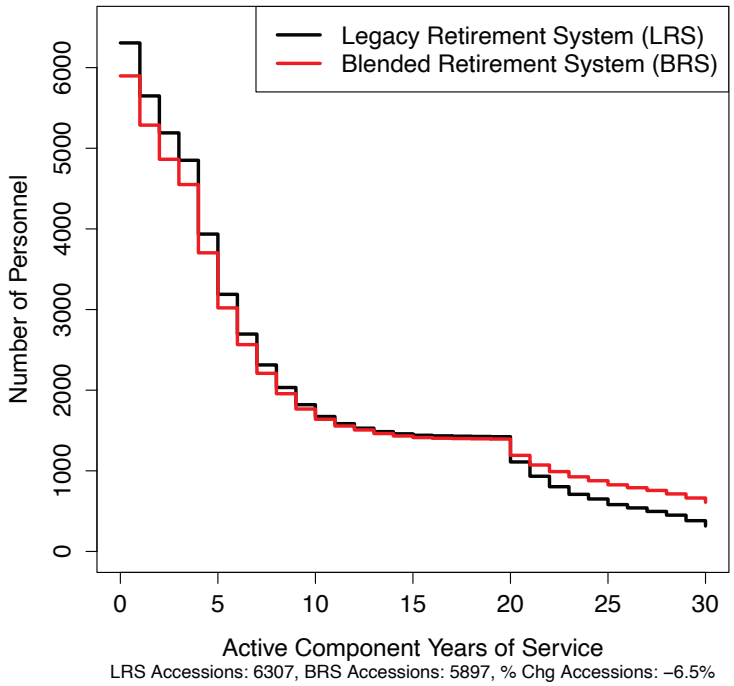


Figure 4.2. Precision Management 2P Changes in Retention and Accessions Under BRS

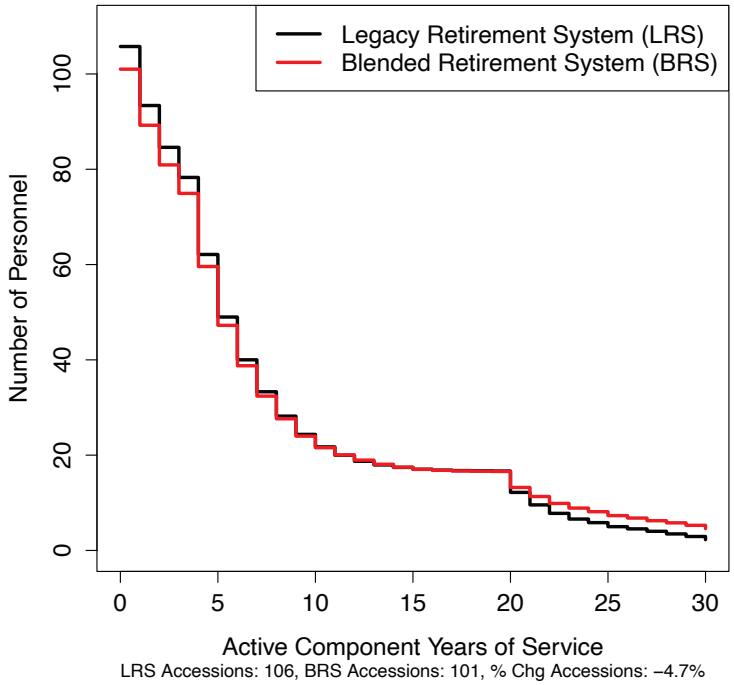


Figure 4.3. Maintenance Management 2R Changes in Retention and Accessions Under BRS

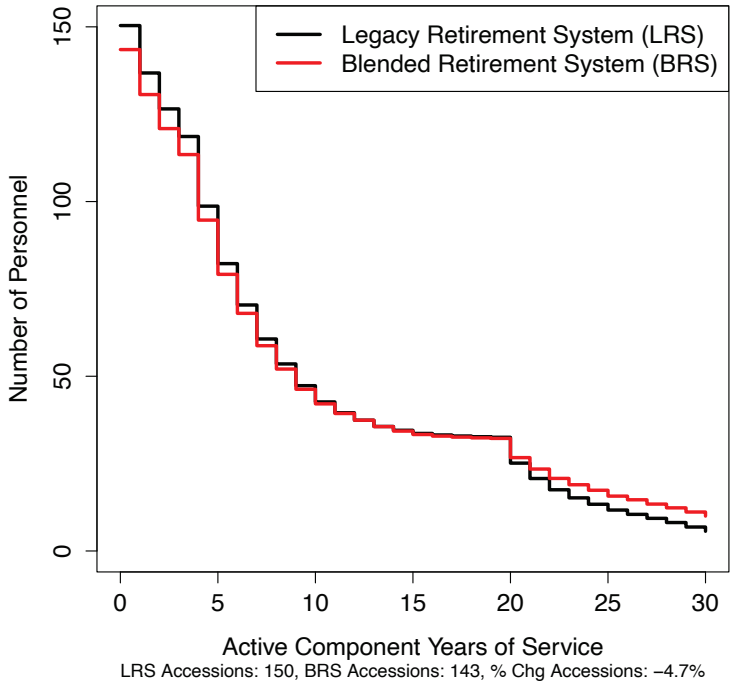
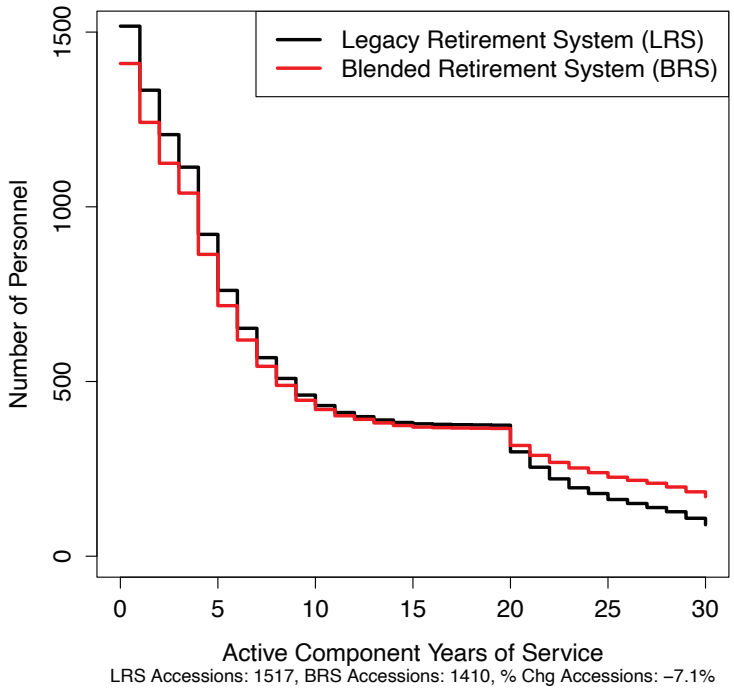


Figure 4.4. Munitions and Weapons 2W Changes in Retention and Accessions Under BRS



maintainer occupations to counteract the increase in retention among those with 20 or more YOS. To achieve the same end strength, we estimate that accessions must be reduced by 4.7 percent for precision management and maintenance management, 4.5 percent for aerospace maintainers, and 7.1 percent for munitions and weapon maintainers under the BRS. Consequently, to maintain force size, the BRS would create a more senior force compared with the legacy retirement system.

As described earlier, the defined benefit plan under the BRS is less generous than that provided by the legacy retirement system, while the defined contribution plan and continuation pay are new benefits that increase retirement benefits and pay, respectively. The increase in retention among those with 20-plus YOS suggests that the TSP plus the remaining defined benefit under the BRS provide a greater expected value to retirement-eligible service members than the pre-BRS defined benefit.

Prior RAND work used an aggregate DRM for the overall Air Force–enlisted service member population to help DoD select the BRS parameters in such a way as to cause retention to remain approximately unchanged compared with the legacy retirement system (Asch, Hosek, and Mattock, 2014). However, for the subspecialties in this study—namely, the Air Force–enlisted maintainer populations—we find that the BRS increases retention compared with the legacy retirement system. The difference in retention results between the aggregate model and the Air Force–enlisted maintainer community are driven by differences in parameter estimates. For example, comparing DRM estimates between the Air Force–enlisted maintainer models and the aggregate model reveals that the scale parameter of the distribution of the shock for leaving active duty, τ, in the four Air Force–enlisted maintainer models ranges from about \$20,000 to \$34,000, which is lower than that estimated in the aggregate model (\$35,000). These lower values of τ suggest that a shock experienced by an Air Force–enlisted maintainer is less likely to cause that member to leave active duty compared with a shock experienced by a service member from the Air Force–enlisted population. These differences in parameter estimates result in higher retention under the BRS for the Air Force–enlisted community compared with the overall Air Force–enlisted population.

We note that the simulated changes in retention from the BRS do not account for constraints that would achieve the optimal experience mix. It remains to be determined whether the predicted experience mix of each Air Force–enlisted maintainer occupation under the BRS is optimal.

Holding force size constant, we estimate the percentage change in cost from moving from the legacy retirement system to the BRS. The cost estimates include regular military compensation (i.e., basic pay, allowances, and federal income tax advantage for allowances), retirement accrual charges, TSP agency contributions, and continuation pay. Table 4.3 shows the estimated reductions in cost from the BRS, which range from –0.7 percent to –1.8 percent. However, these cost estimates have two important limitations. First, these estimates do not include recruiting and training costs. Given that accessions are lower under the BRS compared with the legacy retirement system, accounting for recruiting and training costs would yield an even greater cost

Table 4.3. Estimated Change in Cost from the BRS, Holding Force Size Constant

Air Force–enlisted Maintainer Specialty	Percentage Change in Cost (percentage)
Aerospace Maintenance, 2A	–0.8
Precision Maintenance, 2P	–1.6
Maintenance Management, 2R	–1.8
Munitions and Weapon, 2W	–0.7

savings. Second, the cost estimates do not include special and incentive pays. If these pays mainly apply to mid- and senior-level service members, then accounting for special and incentive pays would increase the cost of the BRS relative to the legacy retirement system since there are predicted to be more experienced service members under the BRS. Consequently, it is unclear what the net effect on cost would be from including recruiting and training costs and special and incentive pays since they work in opposite directions.

Summary

In this chapter, we provide an overview of BRS, describe the Air Force–enlisted maintainer DRMs, and simulate the effects of the BRS on accessions and costs holding force size constant. We find that the models fit the data well. Holding force size constant, we determined that accession levels would be lower under the BRS and estimated the change in costs. We estimate that, compared with expected accession levels estimated for the legacy retirement system, accessions under the BRS would decrease by 4.7–7.1 percent across the Air Force–enlisted maintainer occupations and that costs would go down by 0.7–1.8 percent.

These results are a first step in using the DRM to understand the effects of the BRS on retention. The changes to retention and the excursion estimating accessions and costs holding force size constant do not incorporate constraints to ensure that the desired experience mix of service members within each Air Force–enlisted maintainer occupation is achieved. Future work should consider potential changes to other aspects of compensation (e.g., special and incentive pays) to achieve optimal experience mixes if necessary. To refine estimated impact of the BRS on personnel costs, future work should incorporate recruiting and training costs and special and incentive pays. Furthermore, the results presented in this chapter are at the two-digit AFSC level and may not be representative of retention responses to the BRS for Air Force–enlisted maintainer subspecialties. Future work could simulate the BRS responses for this community at the three-digit AFSC level using the models presented in Appendix E. Finally, it is unclear whether civilian demand for workers with Air Force–enlisted skill sets will fundamentally change as a consequence of COVID-19. The DRMs and the simulations in this chapter do not account for this potentially new economic environment.

5. Key Findings, Recommendations, and Next Steps

Key Findings

Our overall assessment of retention in the maintenance, munitions, and logistics career fields is that, except for periods marked by unusual economic conditions or U.S. Air Force strength reductions, retention has improved over the past 15 years. As indicated in Figure 2.1, an earlier period (2006–2007) saw retention in the vicinity of 50 percent collectively in the three YOS bands covered in our analysis. This rose to plateaus near 55 percent in 2011–2013 and 60 percent in 2016–2019.

Our marginal effects do not follow the same pattern. As indicated in Figure 3.6, the marginal effects associated with fiscal year are relatively flat, particularly for bands 3–5 and 6–9, in the years preceding 2015. For that period, the variables in our model (which include a series of economic indicators) capture and explain most of the changes in retention, including the peak in 2009 and the valley in 2014. From 2015 to 2019, however, our fiscal-year margins show a gradual increase, indicating that something other than the variables captured in our analysis drove an increase in retention in those years.

The marginal effects associated with AFSC provide another way of determining how well our variables explain differences in retention. The small range of differences in marginal effect across AFSCs (Figure 3.7) contrasts with the wider range of differences in actual reenlistment rates by AFSC (Figure 3.8), indicating that our analysis captures much of what influences different retention outcomes across the AFSCs.

The marginal effects associated with the other variables in the analysis can be used to gauge their relative impact. Among military characteristics, we note that being in a higher grade and being selected for promotion are positively related to retention. For the two lower YOS bands, initial six-year enlistments are associated with less retention. Reenlistment propensity was better than other major commands for those assigned in AET and worse than other major commands for those in AFE and Pacific Air Forces (PACAF). Similarly, our geographic region variable showed those in overseas assignments are less likely to retain than those in various regions of the United States. In the YOS 3–5 band, higher SRB multiples were associated with higher retention.

Not surprisingly, aptitude scores do not predict retention in our data,[1] but most of the performance quality indicators we captured were associated with retention in the hoped-for direction. Better retention was associated with graduating from ALS, receiving an NCOA or

[1] Many other studies have also demonstrated that aptitude does not predict retention (see, for example, Griffeth, Hom, and Gaertner, 2000), so this result is not necessarily surprising. However, an organization would ideally *want* people with high aptitude to retain at higher rates than those with lower aptitude.

SNCOA award, having a top rating on the most recent EPR, and having no promotion detractors. For the two lower YOS bands, higher PFE and SKT scores were also positively correlated with retention.

On the other hand, in our logistic regression results, having received a BPZ promotion to E-4, having a higher count of commendation and achievement medals, and time to promotion were related to retention in the opposite directions we would hope for, after controlling for all of the other variables. However, when we examine the raw data for these quality indicator variables, they show the opposite relationships (i.e., they show relationships in the direction we would hope for: higher quality is related to higher retention). We attribute the reversal of the relationship for time to promotion and BPZ in our logistic regression results to multicollinearity among the various promotion quality variables.

Among demographic and family-related issues, we found married members retained better in the two lower YOS bands and small positive effects (sometimes not reaching statistical significance) for having a military spouse or children in the household. Gender produces a significant difference (male retention is higher) in the YOS 10–13 band, while Black airmen retain somewhat better than others in the two lower bands. We also found that being older at the time of a decision point and having acquired some college credit was associated with better retention. Better manning in the individual's AFSC produces small but statistically significant retention gains, while deployment data confirmed that some deployment is good for retention, but more is bad. In fact, some of the largest differences in marginal retention rates were associated with our deployment variable.

Among the geographic and economic variables in our analysis, only the geographic region and national unemployment rate were associated with retention. Central, northeast, and southeast regions affected retention more favorably than northern tier, western, or non-U.S. regions. Unemployment rate had a relatively strong effect in the 3–5 and 10–13 bands but was not statistically significant in the 6–9 band.

Finally, our analysis also showed that while the BRS opens the door to greater losses at midcareer points in future years as those accessed in or after 2018 reach those career points, our modeling specific to the career fields included in our study confirms the expectation that design of the BRS will produce about the same retention outcomes as the retirement system it replaces. While the older system relied entirely on a cliff-vested defined benefit to motivate retention, this suggests that the BRS provides an important tool—a midcareer retention bonus—that can be varied to either replicate the retention outcomes produced by the earlier retirement system or reshape outcomes to better meet personnel management objectives.

Considerations for Future Research

Because of project resource limitations, we were not able to compute a DRM estimate of BRS impacts at the three-digit AFSC level, we were not able to delve deeply into the munitions and logistics career fields in our logistic regression modeling, and we were not able to examine

the impacts of the BRS on the logistics career fields. Although we were not able to explore those additional analyses in this project, such further analyses could prove useful.

For example, the effort to explore the application of the DRM to the maintainer career fields focused on the two-digit AFSC level and applied the results to the three-digit level. However, it is unclear whether separate models at the three-digit level would yield different (and perhaps better) results from those derived using the two-digit models. Future exploration of this question may be warranted, especially if retention behavior is expected to differ in meaningful ways across the various three-digit AFSCs. In addition, exploration of the BRS impacts for the logistics career fields may yield additional insights.

There are also some variables that we did not include in our analysis but that may be useful as predictors of retention within these workforces. However, those variables were available only for a small subset of observations in the 2005–2019 data we explored in this study. As a result, we could not include them in our overall regression analysis.[2] For example, completion of certain high school courses was available for only a small subset of our records, and scores on the Tailored Adaptive Personality Assessment were only available in recent years. Nevertheless, a separate analysis of these data might provide useful insights.

Additionally, our project was not scoped to gather current perspectives (via interviews, surveys, or focus groups) from managers and workers in the functions of interest or to reanalyze opinion-based data or findings from earlier studies. Such efforts, however, could yield additional insights beyond those explored here, including suggesting additional variables that should be gathered and retained in the personnel records for use in future regression analyses.

Recommendations for Improving Retention

Many of the variables included in our analysis cannot be readily manipulated to affect retention. Air Force bases, for example, cannot be easily shifted to more favorable geographic locations, and the national unemployment rate is clearly outside the Air Force's scope of influence. The benefit of including these variables in our analysis is to control for their effects when evaluating variables over which the Air Force can exercise discretion, thereby avoiding an inadvertent overestimate of what can be gained by exercising that discretion. Although some variables we included are fixed and unchangeable by the Air Force, others are changeable by the Air Force. Those changeable factors could serve as useful levers for making intentional changes to retention.

One such factor in which we noted striking differences in impact was the length of initial enlistment. In both our YOS 3–5 and 6–9 bands, those on initial four-year enlistments retained

[2] Logistic regression analysis requires that each observation have a value for all variables in the analysis. As a result, we would have had to impute values for those missing data points, and that would have resulted in imputed data for a very large proportion of the data for those variables. Instead, we suggest exploring this data in a separate, smaller analysis where data would not need to be imputed.

better than those on six-year enlistments. Further examination of this phenomenon is warranted but would likely require focus groups or other similar probing of individual perspectives to gain an understanding.

SRB multiples also appear to serve their purpose and therefore would likely continue to be a useful tool for influencing retention in the future. Our data show a correlation with retention only in the YOS 3–5 band, but lack of correlation in the other bands could be due to use of the bonus to shore up sagging retention. Careful attention to use of SRBs is warranted, as perhaps is additional research using the DRM to better understand its current costs and retention impacts.

Both military characteristics (current grade and selection for pending promotion) and a variety of performance quality indicators show that retention and performance are positively correlated. Enhancing performance through factors such as better training, effective leadership, and improvements in organizational climate is an objective in itself. As our analysis suggests, it also has the potential added benefit of improving retention, possibly because it contributes to improved job satisfaction.

Marriage and family formation are both also related to retention. More specifically, people who are married tend to retain at slightly higher rates, and people with children tended to retain at higher rates than those without children. This suggests that supports, benefits, or other incentives for those who are not married could potentially be improved. And, for those who do have families and spouses, it appears that the existing family support services or benefits are working to help incentivize their retention. It is also possible that further increasing those family-friendly management practices could yield even greater retention among that population.

Finally, the data suggest that stress on individuals and families can also potentially be reduced, with favorable retention impacts, by ensuring adequate manning of all specialties (through better alignment of accession and initial skills training pipelines) and through careful distribution of deployment demands, which, given their favorable retention impact through some measurable range, might be viewed more appropriately as deployment *opportunities*.

Recommended Next Steps

As mentioned above, data are available for more intense scrutiny of munitions and logistics career fields and for extending our BRS analysis to an additional level of occupational disaggregation. However, given the general consistency of aggregate occupational and Air Force–wide outcomes we have observed, we would not expect to find anything markedly different in those additional explorations. As also mentioned, insights might be gleaned from a limited data set pertaining to individual characteristics captured at the time of enlistment.

We have noted that the variables we examined can account for much of the improvement in retention that occurred between 2005 and 2019. However, because of limited resources, we did not closely examine how the variables themselves changed over that period. A more fine-grained, time-sensitive analysis would be useful to examine those trends.

A more fundamental research effort might seek to determine the ideal level of retention in the maintenance, munitions, and logistics career fields, or in the Air Force enlisted force more generally. While higher retention reduces front-end recruiting and training costs and yields a more experienced (and presumably more productive) workforce, it also increases overall force costs because of the interaction of the basic pay table with the YOS distribution in the force—a more experienced force is a more expensive force, particularly if the force is not reduced in size to avoid unneeded productivity gains. While more experience is worth the additional cost through some range, there may be a point at which diminishing returns to experience may not warrant the additional cost.

Appendix A. Technical Information About the Regression Analysis Data

Air Force Personnel and Transaction Files (AAE and AKA)

The U.S. Air Force's personnel transaction files (also known as the AKA files) and the enlisted personnel data files (also known as the AAE files)[1] were used to define most of the variables we included in our regression analyses.

Both files were used to define our outcomes of interest (separations and reenlistments/ extensions). First, we include all reenlistments, separations, and extensions of two years or more that are recorded in the AKA transaction file. Second, the AAE file was used to fill in gaps in the transaction information that might exist in the AKA file.

We also used the AAE files as the primary source of most of the predictor variables included in the regressions. For this use of the data files, we pulled data from the month in the AAE file that corresponded to each transaction that we identified in the AKA file. For example, if a person had a reenlistment in the AKA file that occurred in March 2008, we pulled the personnel data from the March 2008 AAE and merged the information with that transaction. If the person also had a separation in July 2013, we pulled the personnel data for that same person, but we pulled it from the July 2013 AAE file to merge with that transaction. In other words, we pull a separate snapshot of the personnel data for every transaction that a person has in the AKA file.

Nonindependence of Observations in Our Data

As noted in the main body of the report, a single individual often contributes multiple transaction records to our data. As a result, these records are not independent. In other words, in some cases, the same person is giving us information about his or her willingness to reenlist, separate, and extend, but at multiple points in time. And, a decision at a later term of service is necessarily not independent of a decision made at an earlier term of service (i.e., one has to choose to reenlist after the first term of service in order to be able to make a reenlistment decision after the second term of service). This issue of nonindependence can be handled in several ways. Survival analysis is one option (see, for example, Cox, 1972). However, in this

[1] The AAE files include detailed records on a wide variety of characteristics of personnel and descriptive information about their status and experience in the Air Force. For example, they include data on where personnel are stationed; how often they have been deployed and for how long; their race, gender, age, and family status; test scores at point of accession; types of professional military education received; and medals and awards.

study we opted to break our regressions into the three YOS bands, which significantly reduces the number of transactions per person in each regression.

That said, it is important to keep in mind that the second and third regression models (for YOS 6–9 and YOS 10–13) are essentially a subset of the individuals included in the earlier YOS regressions. As such, the separate regressions reflect different sample sizes, but they are not independent samples (each sample overlaps with the others). This means that regression results from the different models will be correlated to some extent because they are not independent.

The average number of transactions per person in our YOS 3–5 band was 1.02, YOS band 6–9 was 1.20, and YOS 10–13 was 1.30. The average number of transactions across all bands was 1.65.

Appendix B. Enlisted Tenure Decision Points and Shaping Mechanisms

Initial Enlistment

Most initial enlistments are for four- or six-year terms. There is also a little-used option for a shorter initial term (initial skills training plus 15 months) under the National Call to Service program.[1] Although E-1 is the lowest enlisted grade, individuals may enlist at grade E-2 if they have completed two years of the high school Junior Reserve Officer Training Corps (JROTC) program, 20 semester hours of college credit, or several other qualifiers; they may enlist at grade E-3 if they have completed three years of JROTC and 45 semester hours of college credit, are in a designated critical skill program, or have fulfilled several other qualifiers (AFI 36-2032, pp. 48–49). Additionally, six-year enlistees not otherwise enlisted in a grade above E-1 are promoted to E-2 upon completion of initial skills training or 20 weeks after completion of basic training, whichever comes first. Their date of rank is adjusted to the date they completed basic training, accelerating the point at which they reach time-in-grade requirements for fully qualified promotion to E-3 (AFI 36-2502, p. 21).[2]

Extension of Enlistment

Airmen may voluntarily extend an enlistment for up to 48 months in order to obtain retainability for service obligations associated with promotion, assignment, or training, or for other miscellaneous reasons (AFI 36-2606, pp. 74–84). As an example, the minimum service retainability for most assignments is 24 months (AFI 36-2110, pp. 187–188); an individual on a four-year initial enlistment selected for reassignment to be effective in the fortieth month of service must extend for 18 months in order to have 24 months of retainability at the time of the transfer. In lieu of an extension, an individual may in some cases obtain needed retainability by reenlisting before reaching his or her expiration of term of service (ETS).[3]

In most cases, to be granted an extension, airmen must be eligible for reenlistment and must extend for the minimum number of months required (AFI 36-2606, p. 69). As an exception,

[1] After initial skills training and 15 months of active duty, participants can choose between an additional 24 months of active duty and 24 months of active status in a Selected Reserve. The balance of their standard eight-year military service obligation may be served on active duty, in the Selected Reserve, in the Individual Ready Reserve, or in certain domestic national service programs.

[2] Fully qualified promotion to E-3 occurs with 36 months' time in service and 20 months' time in grade or 28 months' time in grade (whichever occurs first).

[3] ETS is the date that a term of enlistment is completed.

individuals who are eligible for an SRB may extend for a period of 36–48 months to qualify for an assignment or deployment (AFI 36-2606, p. 69) even if the extension exceeds the minimum requirement; by extending for at least 36 months, they are entitled to receive the SRB (AFI 36-2606, p. 31).

Airmen may be involuntarily extended for stop-loss actions or for investigative and disciplinary reasons.

Reenlistment

First-term airmen may reenlist after 36 months if on a four-year enlistment and after 60 months if on a six-year enlistment. After the first term, individuals reenlist for four- to six-year terms within a 90-day window of their ETS or earlier if required to obtain needed retainability (AFI 36-2606, p. 61). In a new policy implemented in 2019, airmen with over 12 YOS may enlist for an indefinite period.

Career Job Reservation

U.S. Air Force policy provides for a limiting mechanism for first-term reenlistments—a Career Job Reservation (CJR)—to help shape the experience profile of an AFSC (AFI 36-2606, p. 26 ff.). An Air Force point of contact indicated that the Air Force is not currently using this mechanism, so all CJRs are automatic.

Selective Reenlistment Bonus

The SRB is used to enhance retention in selected AFSCs. SRBs are designated by AFSC, the zone (time in service) at the time of reenlistment or entry into an extension, and the multiple of base pay used to compute the bonus.[4] The zones are designated A (no more than 6 YOS), B (6 but no more than 10 YOS), C (10 but no more than 14 YOS), and E (18 but no more than 20 YOS). Current multiples range from 0 to 7. The SRB is computed as one month's base pay times the number of additional years extending/reenlisting times the multiple. Airmen typically receive 50 percent of the bonus as an initial payment and the remainder in equal annual installments over the course of the reenlistment or extension, but in some cases can receive 100 percent in the initial payment.

[4] The zone structure was previously prescribed by DoD policy, but the requirement to use this structure was eliminated in 2014. However, the Air Force has not revised its policy to adopt more flexible approaches now authorized in the *DoD Financial Management Regulation* and Title 37, U.S. Code.

High Year of Tenure

The high year of tenure (HYT) is a grade-related restriction on reenlistments and extensions. Generally, an airman may not extend or reenlist for a period that exceeds HYT plus one month. HYT terms are adjusted, although infrequently, based on retention, promotion, and strength management considerations. In 2018, HYT limits were extended from 8 to 10 years for E-4s, 15 to 20 years for E-5s, and 20 to 22 years for E-6s. HYTs for senior noncommissioned officers remained unchanged at that time: 24 years for E-7s, 26 years for E-8s, and 30 years for E-9s.

Retirement

Generally, individuals must have completed 20 YOS to be eligible for voluntary retirement (AFI 36-3203, p. 31). Their requested retirement date must be no later than the month following HYT. With some exceptions, enlisted members are involuntarily separated if they do not voluntarily retire before reaching 30 YOS.

Separation

Generally, individuals who do not reenlist, extend, or retire before their ETS are separated upon ETS. There is no minimum vesting period for military members' own contributions and earnings. Members are vested in service automatic contributions (1 percent of basic pay) and earnings after two YOS. They are also fully vested in any service matching contributions (up to 4 percent of basic pay) and earnings that begin at 25 months of service.

Appendix C. Logistic Regression Model Results

Tables C.1–C.6 provide the results of logistic regressions for each of the three YOS bands examined in our analysis. In these and other reported results, we grouped the variables into five broad categories:

- military characteristics
- aptitude
- performance quality indicators
- demographics, family, and stressors
- geographic and economic factors.

Table C.1. Model Summary for Maintenance AFSCs, YOS 3–5

Statistic	Value
Number of observations	49,179
Likelihood ratio chi-square test	46,968.44
Probability of chi-square test	0.0000
Pseudo R^2	0.6925

Table C.2. Parameter Estimates for Maintenance AFSCs, YOS 3–5

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Military characteristics						
Grade						
E-1	–4.8561	0.7368	–6.59	0.000	–6.3002	–3.4119
E-2	–3.3034	0.6364	–5.19	0.000	–4.5507	–2.0562
E-3	0.0000	(base)				
E-4	2.3847	0.1368	17.43	0.000	2.1165	2.6529
E-5	3.4092	0.1543	22.10	0.000	3.1068	3.7116
E-6	–1.0355	1.0752	–0.96	0.335	–3.1428	1.0718
E-7	0.0000	(empty)				
YOS						
3	0.0000	(base)				
4	–2.0787	0.0538	–38.67	0.000	–2.1841	–1.9734
5	0.5992	0.0624	9.60	0.000	0.4769	0.7215
Initial enlistment						
4	0.0000	(base)				
6	–1.1759	0.0539	–21.81	0.000	–1.2815	–1.0702

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Major command						
ACC	0.0000	(base)				
AET	0.2385	0.0730	3.27	0.001	0.0954	0.3816
AFE	–0.3061	0.1707	–1.79	0.073	–0.6407	0.0285
AFSOC	0.0545	0.0889	0.61	0.540	–0.1198	0.2287
AMC	0.0815	0.0614	1.33	0.184	–0.0388	0.2018
MTC	–0.1263	0.1439	–0.88	0.380	–0.4084	0.1558
OTH	0.1615	0.0920	1.75	0.079	–0.0189	0.3419
PACAF	0.0716	0.1660	0.43	0.666	–0.2537	0.3969
SPC	0.8117	0.6035	1.35	0.179	–0.3711	1.9945
Selected for promotion						
0	0.0000	(base)				
1	0.5135	0.0619	8.30	0.000	0.3922	0.6349
Under ADSC						
0	0.0000	(base)				
1	4.8973	0.0610	80.24	0.000	4.7777	5.0170
SRB multiple						
	0.3630	0.0753	4.82	0.000	0.2153	0.5106
SRB multiple squared						
	–0.0220	0.0248	–0.89	0.376	–0.0705	0.0266
Aptitude						
AFQT score						
	–0.0288	0.0249	–1.16	0.247	–0.0775	0.0199
AFQT score squared						
	0.0002	0.0002	0.92	0.359	–0.0002	0.0006
Mechanical component						
	0.0030	0.0105	0.29	0.773	–0.0175	0.0236
Mechanical component squared						
	0.0000	0.0001	–0.39	0.699	–0.0002	0.0001
Administrative component						
	–0.0095	0.0162	–0.58	0.559	–0.0413	0.0223
Administrative component squared						
	0.0000	0.0001	0.35	0.726	–0.0002	0.0003
General component						
	0.0108	0.0158	0.68	0.496	–0.0203	0.0418
General component squared						
	–0.0002	0.0001	–1.44	0.151	–0.0004	0.0001
Electronic component						
	0.0149	0.0104	1.44	0.151	–0.0054	0.0352

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Electronic component squared						
	–0.0001	0.0001	–1.09	0.278	–0.0002	0.0001
Performance quality indicators						
ALS graduate						
0	0.0000	(base)				
1	0.6476	0.0724	8.94	0.000	0.5056	0.7895
NCOA or SNCOA award						
0	0.0000	(base)				
1	1.7728	0.3808	4.66	0.000	1.0265	2.5191
Promotion detractors						
0	0.0000	(base)				
1	–0.5407	0.0508	–10.64	0.000	–0.6403	–0.4411
Ever fail fitness test						
0	0.0000	(base)				
1	0.2082	0.0421	4.94	0.000	0.1256	0.2908
E-5 PFE score						
	0.1206	0.3385	0.36	0.722	–0.5428	0.7839
E-5 PFE score squared						
	1.1078	0.3085	3.59	0.000	0.5031	1.7125
E-5 SKT score						
	–1.1634	0.3411	–3.41	0.001	–1.8320	–0.4948
E-5 SKT score squared						
	1.5150	0.3086	4.91	0.000	0.9101	2.1199
Top rating on last EPR						
0	0.0000	(base)				
1	0.6008	0.0473	12.71	0.000	0.5082	0.6934
Top rating on second-to-last EPR						
0	0.0000	(base)				
1	0.0097	0.0479	0.20	0.840	–0.0841	0.1035
Standardized time to promotion						
	0.1505	0.0285	5.28	0.000	0.0947	0.2064
Standardized time to promotion squared						
	0.041823	0.0122	3.44	0.001	0.018	0.0657
Selected for E-4 BPZ						
0	0.0000	(base)				
1	–0.2643	0.0567	–4.66	0.000	–0.3754	–0.1531
Commendation medals						
0	0.0000	(base)				
1	–0.4625	0.1104	–4.19	0.000	–0.6790	–0.2461
2	–0.1838	0.4910	–0.37	0.708	–1.1460	0.7785

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Achievement medals						
0	0.0000	(base)				
1	–0.1338	0.0436	–3.07	0.002	–0.2191	–0.0484
2	–0.1878	0.0784	–2.40	0.017	–0.3414	–0.0342
3	–0.3512	0.1874	–1.87	0.061	–0.7184	0.0161
4	0.1976	0.5496	0.36	0.719	–0.8796	1.2748
Demographic, family, and stressor variables						
Married						
Current	0.0000	(base)				
Former	–0.1597	0.0825	–1.94	0.053	–0.3214	0.0021
Never	–0.2906	0.0430	–6.76	0.000	–0.3749	–0.2063
Military spouse						
0	0.0000	(base)				
1	0.1218	0.0769	1.58	0.113	–0.0289	0.2724
Age of youngest child in household						
0	0.0000	(base)				
1–2	0.0867	0.0718	1.21	0.228	–0.0541	0.2275
3–5	0.2243	0.0990	2.26	0.024	0.0301	0.4184
6–8	0.0086	0.2283	0.04	0.970	–0.4389	0.4562
9–11	0.5535	0.4165	1.33	0.184	–0.2628	1.3698
12–14	1.2686	0.7332	1.73	0.084	–0.1684	2.7055
15–17	–0.3946	1.1588	–0.34	0.733	–2.6659	1.8766
18–20	2.0402	1.1867	1.72	0.086	–0.2857	4.3661
Age						
20–21	0.5337	1.5919	0.34	0.737	–2.5864	3.6538
22–23	0.5899	1.5893	0.37	0.711	–2.5251	3.7048
24–35	0.7036	1.5891	0.44	0.658	–2.4109	3.8181
26–27	0.8036	1.5893	0.51	0.613	-2.3113	3.9185
28–29	0.7906	1.5899	0.50	0.619	-2.3255	3.9067
30–31	0.9781	1.5918	0.61	0.539	-2.1417	4.0980
32–33	0.6738	1.5992	0.42	0.674	–2.4606	3.8083
34–35	–0.0572	1.7270	–0.03	0.974	–3.4421	3.3278
36–37	0.9822	1.8371	0.53	0.593	–2.6185	4.5829
38–39	2.8754	3.3763	0.85	0.394	–3.7420	9.4929
40–41	0.0000	(omitted)				
Gender						
Female	–0.2773	0.0699	–3.97	0.000	–0.4143	–0.1404
Male	0.0000	(base)				
Race/ethnicity						
American Indian/Alaskan	–0.0220	0.1617	–0.14	0.892	–0.3390	0.2950
Asian/Pacific Islander	–0.0173	0.0946	–0.18	0.855	–0.2026	0.1681

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Hispanic	0.2958	0.0665	4.45	0.000	0.1654	0.4262
Black	0.0750	0.0557	1.35	0.179	–0.0343	0.1842
Other	–0.5356	0.5032	–1.06	0.287	–1.5218	0.4506
Unknown	–0.1524	0.1728	–0.88	0.378	–0.4911	0.1862
White	0.0000	(base)				
Education level						
Associate's	0.0000	(base)				
Bachelor's	–0.0208	0.1390	–0.15	0.881	–0.2932	0.2517
College <1 year	0.9180	0.0938	9.78	0.000	0.7340	1.1019
College <2 years	0.9918	0.0718	13.81	0.000	0.8511	1.1325
College <3 years	0.8164	0.0707	11.55	0.000	0.6779	0.9550
College <4 years	0.6730	0.2592	2.60	0.009	0.1650	1.1810
High school	0.8613	0.2042	4.22	0.000	0.4611	1.2615
Master's	–1.9753	0.6122	–3.23	0.001	–3.1752	–0.7753
AFSC manning	–0.1685	0.0278	–6.07	0.000	–0.2229	–0.1141
AFSC manning squared	0.0008	0.0001	6.16	0.000	0.0005	0.0010
Days deployed per year	0.0937	0.0043	22.01	0.000	0.0853	0.1020
Days deployed per year squared	–0.0010	0.0001	–11.13	0.000	–0.0012	–0.0009
Geographic and economic factors						
Geographic region						
Central	0.0000	(base)				
Northeast	–0.2933	0.1135	–2.58	0.010	–0.5158	–0.0708
Northern tier	–0.5212	0.1101	–4.74	0.000	–0.7369	–0.3055
Other	–2.0511	0.2144	–9.57	0.000	–2.4713	–1.6309
Southeast	–0.0782	0.0986	–0.79	0.428	–0.2714	0.1151
West	–0.3412	0.0881	–3.87	0.000	–0.5139	–0.1685
Non-U.S.	–1.2821	0.1685	–7.61	0.000	–1.6124	–0.9519
National unemployment rate	0.3156	0.1484	2.13	0.033	0.0247	0.6065
National unemployment rate squared	–0.0240	0.0099	–2.41	0.016	–0.0435	–0.0045
Neighborhood index	–0.0011	0.0016	–0.71	0.476	–0.0043	0.0020

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Neighborhood index squared						
	0.0000	0.0000	–0.29	0.773	0.0000	0.0000
RUCC						
	–0.0085	0.0753	–0.11	0.910	–0.1560	0.1390
RUCC squared						
	–0.0020	0.0117	–0.17	0.864	–0.0249	0.0209
Military/Civilian median income ratio						
	–0.2441	0.2262	–1.08	0.281	–0.6873	0.1992
Military/Civilian median income ratio squared						
	0.1937	0.1032	1.88	0.061	–0.0086	0.3960
Local poverty rate						
	0.0699	0.0500	1.4	0.162	–0.0281	0.1680
Local poverty rate squared						
	–0.0018	0.0012	–1.48	0.139	–0.0041	0.0006
Median household income						
	0.0000	0.0000	0.20	0.841	0.0000	0.0000
Median household income squared						
	0.0000	0.0000	0.43	0.665	0.0000	0.0000
Other factors						
Fiscal year						
2005	0.0000	(base)				
2006	0.8735	0.1148	7.61	0.000	0.6484	1.0985
2007	0.8817	0.1230	7.17	0.000	0.6406	1.1228
2009	0.9079	0.1135	8.00	0.000	0.6854	1.1303
2010	1.0585	0.2106	5.03	0.000	0.6458	1.4712
2011	0.7994	0.2540	3.15	0.002	0.3017	1.2972
2012	0.5214	0.2364	2.21	0.027	0.0581	0.9846
2013	0.5006	0.2149	2.33	0.020	0.0795	0.9217
2014	0.5051	0.2032	2.49	0.013	0.1069	0.9034
2015	0.7002	0.1686	4.15	0.000	0.3697	1.0307
2016	1.3501	0.1499	9.01	0.000	1.0564	1.6438
2017	1.3867	0.1548	8.96	0.000	1.0832	1.6901
2018	2.0200	0.1703	11.86	0.000	1.6861	2.3538
2019	2.3254	0.2044	11.38	0.000	1.9247	2.7261
AFSC						
2A0X1	0.0000	(base)				
2A2X1	0.6307	0.2201	2.87	0.004	0.1994	1.0620
2A2X2	0.0644	0.2879	0.22	0.823	–0.4999	0.6286
2A2X3	0.3849	0.2995	1.29	0.199	–0.2021	0.9719
2A3X1	–0.0169	0.2058	–0.08	0.935	–0.4202	0.3865

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
2A3X2	–0.1129	0.1926	–0.59	0.558	–0.4905	0.2646
2A3X3	–0.0995	0.1385	–0.72	0.472	–0.3710	0.1719
2A3X4	–0.5103	0.1795	–2.84	0.004	–0.8621	–0.1585
2A3X5	0.2580	0.2040	1.26	0.206	–0.1418	0.6578
2A3X7	0.2789	0.1935	1.44	0.150	–0.1004	0.6583
2A3X8	0.0062	0.2718	0.02	0.982	–0.5265	0.5388
2A5X1	0.1574	0.1474	1.07	0.286	–0.1315	0.4463
2A5X2	0.2257	0.2049	1.10	0.271	–0.1759	0.6272
2A5X3	–0.0347	0.1889	–0.18	0.854	–0.4050	0.3355
2A5X4	0.1810	0.1564	1.16	0.247	–0.1256	0.4875
2A6X1	0.4858	0.1399	3.47	0.001	0.2116	0.7600
2A6X2	0.3661	0.1520	2.41	0.016	0.0682	0.6640
2A6X3	–0.5721	0.2105	–2.72	0.007	–0.9847	–0.1595
2A6X4	0.0675	0.1633	0.41	0.679	–0.2526	0.3875
2A6X5	0.1893	0.1618	1.17	0.242	–0.1278	0.5064
2A6X6	0.3634	0.1439	2.53	0.012	0.0814	0.6454
2A7X1	0.2791	0.2115	1.32	0.187	–0.1353	0.6936
2A7X2	0.2339	0.2111	1.11	0.268	–0.1798	0.6477
2A7X3	0.5119	0.1566	3.27	0.001	0.2051	0.8188
2A7X4	0.3775	0.4195	0.90	0.368	–0.4446	1.1996
2A7X5	0.1808	0.2277	0.79	0.427	–0.2656	0.6272
2A8X1	0.2425	0.2127	1.14	0.254	–0.1744	0.6595
2A8X2	0.0651	0.2284	0.29	0.776	–0.3825	0.5127
2A9X1	0.0562	0.2561	0.22	0.826	–0.4457	0.5581
2A9X2	0.2748	0.2638	1.04	0.298	–0.2423	0.7918
2A9X3	0.3908	0.2174	1.80	0.072	–0.0353	0.8168
2R0X1	0.1635	0.2047	0.80	0.424	–0.2377	0.5647
2R1X1	0.2808	0.1917	1.46	0.143	–0.0950	0.6565
Constant	–0.6552	2.6587	–0.25	0.805	–5.8662	4.5558

Table C.3. Model Summary for Maintenance AFSCs, YOS 6–9

Statistic	Value
Number of observations	51,627
Likelihood ratio of chi-square test	41,599.20
Probability of chi-square test	0.0000
Pseudo R^2	0.5843

Table C.4. Parameter Estimates for Maintenance AFSCs, YOS 6–9

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Military characteristics						
Grade						
E-1	–1.8736	0.4244	–4.41	0.000	–2.7055	–1.0417
E-2	–0.7633	0.6659	–1.15	0.252	–2.0685	0.5419
E-3	0.0000	(base)				
E-4	1.9247	0.2541	7.57	0.000	1.4267	2.4228
E-5	2.8776	0.2561	11.23	0.000	2.3756	3.3797
E-6	3.9888	0.2745	14.53	0.000	3.4507	4.5269
E-7	0.2107	1.0053	0.21	0.834	–1.7597	2.1812
YOS						
6	0.0000	(base)				
7	0.8765	0.0455	19.28	0.000	0.7875	0.9656
8	0.3070	0.0584	5.26	0.000	0.1926	0.4214
9	0.4408	0.0696	6.33	0.000	0.3043	0.5772
Initial enlistment						
4	0.0000	(base)				
6	–0.6701	0.0477	–14.04	0.000	–0.7637	–0.5766
Major command						
ACC	0.0000	(base)				
AET	0.4822	0.0586	8.23	0.000	0.3674	0.5970
AFE	–0.2236	0.1066	–2.10	0.036	–0.4326	–0.0147
AFSOC	–0.3135	0.1018	–3.08	0.002	–0.5130	–0.1139
AMC	–0.0592	0.0516	–1.15	0.252	–0.1604	0.0420
MTC	0.0000	(empty)				
OTH	0.2493	0.0992	2.51	0.012	0.0549	0.4436
PACAF	0.0408	0.0795	0.51	0.608	–0.1150	0.1966
SPC	–0.0406	0.0751	–0.54	0.589	–0.1878	0.1067
Selected for promotion						
0	0.0000	(base)				
1	1.1444	0.0743	15.40	0.000	0.9988	1.2900
Under ADSC						
0	0.0000	(base)				
1	4.7980	0.0496	96.76	0.000	4.7008	4.8951
SRB multiple						
	–0.1090	0.0830	–1.31	0.189	–0.2718	0.0538
SRB multiple squared						
	0.0494	0.0287	1.72	0.086	–0.0069	0.1057

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Category of enlistment						
First term	0.0000	(base)				
Second term	–0.7821	0.0531	–14.73	0.000	–0.8862	–0.6781
Career	1.3311	0.0847	15.71	0.000	1.1651	1.4972
Aptitude						
AFQT score						
	–0.0022	0.0154	–0.14	0.888	–0.0324	0.0280
AFQT score squared						
	0.0000	0.0001	–0.01	0.994	–0.0002	0.0002
Mechanical component						
	0.0043	0.0083	0.52	0.606	–0.0119	0.0205
Mechanical component squared						
	–0.0001	0.0001	–1.26	0.207	–0.0002	0.0000
Administrative component						
	0.0021	0.0087	0.25	0.806	–0.0150	0.0193
Administrative component squared						
	0.0000	0.0001	–0.26	0.794	–0.0002	0.0001
General component						
	–0.0083	0.0119	–0.70	0.483	–0.0316	0.0149
General component squared						
	0.0000	0.0001	0.11	0.910	–0.0002	0.0002
Electronic component						
	0.0025	0.0085	0.30	0.765	–0.0141	0.0192
Electronic component squared						
	0.0000	0.0001	0.14	0.886	–0.0001	0.0001
Performance quality indicators						
ALS graduate						
0	0.0000	(base)				
1	0.4341	0.0658	6.60	0.000	0.3051	0.5631
NCOA or SNCOA award						
0	0.0000	(base)				
1	1.5030	0.2710	5.55	0.000	0.9719	2.0341
Promotion detractors						
0	0.0000	(base)				
1	–0.2454	0.0376	–6.53	0.000	–0.3190	–0.1717

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Ever fail fitness test						
0	0.0000	(base)				
1	0.0400	0.0325	1.23	0.218	–0.0236	0.1036
E-5 PFE score						
	0.9555	0.3269	2.92	0.003	0.3147	1.5963
E-5 PFE score squared						
	–0.2619	0.2758	–0.95	0.342	–0.8025	0.2787
E-5 SKT score						
	0.9231	0.3106	2.97	0.003	0.3144	1.5319
E-5 SKT score squared						
	–0.3138	0.2626	–1.19	0.232	–0.8285	0.2009
Top rating on last EPR						
0	0.0000	(base)				
1	0.5137	0.0374	13.72	0.000	0.4404	0.5871
Top rating on second-to-last EPR						
0	0.0000	(base)				
1	–0.0580	0.0394	–1.47	0.141	–0.1352	0.0192
Standardized time to promotion						
	0.3791	0.0248	15.30	0.000	0.3306	0.4277
Standardized time to promotion squared						
	–0.0532	0.0100	–5.30	0.000	–0.0728	–0.0335
Selected for E-4 BPZ						
0	0.0000	(base)				
1	–0.1668	0.05	–3.68	0.000	–0.2556	
Commendation medals						
0	0.0000	(base)				
1	–0.0582	0.0433	–1.35	0.179	–0.1431	0.0266
2	–0.3118	0.0933	–3.34	0.001	–0.4947	–0.1289
3	–0.6203	0.2656	–2.34	0.020	–1.1408	–0.0997
4	–0.1830	0.7237	–0.25	0.800	–1.6013	1.2354
Achievement medals						
0	0.0000	(base)				
1	–0.0279	0.0346	–0.81	0.420	–0.0956	0.0399
2	–0.0217	0.0482	–0.45	0.653	–0.1162	0.0728
3	–0.1330	0.0866	–1.54	0.125	–0.3027	0.0368
4	0.1177	0.1959	0.60	0.548	–0.2663	0.5018
5	–0.1302	0.5755	–0.23	0.821	–1.2583	0.9978
6	–1.9953	1.1955	–1.67	0.095	–4.3385	0.3478

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Demographic, family, and stressor variables						
Married						
Current	0.0000	(base)				
Former	–0.0876	0.0551	–1.59	0.112	–0.1956	0.0204
Never	–0.1874	0.0380	–4.93	0.000	–0.2620	–0.1129
Military spouse						
0	0.0000	(base)				
1	0.1668	0.0633	2.63	0.008	0.0427	0.2910
Age of youngest child in household						
0	0.0000	(base)				
1–2	0.1927	0.0516	3.74	0.000	0.0916	0.2938
3–5	0.0778	0.0560	1.39	0.165	–0.0319	0.1875
6–8	0.2393	0.0904	2.65	0.008	0.0622	0.4165
9–11	0.5101	0.1753	2.91	0.004	0.1666	0.8537
12–14	0.5260	0.3083	1.71	0.088	–0.0782	1.1303
15–17	–0.4723	0.5831	–0.81	0.418	–1.6152	0.6706
18–20	1.2765	0.7105	1.80	0.072	–0.1161	2.6691
21–22	–1.6591	1.6650	–1.00	0.319	–4.9224	1.6042
Age						
22–23	0.3362	1.1262	0.30	0.765	–1.8712	2.5436
24–35	0.1208	1.1148	0.11	0.914	–2.0642	2.3059
26–27	0.3532	1.1142	0.32	0.751	–1.8307	2.5371
28–29	0.5051	1.1141	0.45	0.650	–1.6785	2.6887
30–31	0.6382	1.1145	0.57	0.567	–1.5462	2.8226
32–33	0.5717	1.1155	0.51	0.608	–1.6147	2.7580
34–35	0.9652	1.1184	0.86	0.388	–1.2268	3.1573
36–37	0.3585	1.1410	0.31	0.753	–1.8777	2.5948
38–39	–0.6061	1.3684	–0.44	0.658	–3.2880	2.0758
40–41	0.0000	(omitted)				
Gender						
Female	–0.2064	0.0588	–3.51	0.000	–0.3216	–0.0911
Male	0.0000	(base)				
Race/Ethnicity						
American Indian/Alaskan	–0.1906	0.1331	–1.43	0.152	–0.4515	0.0704
Asian/Pacific Islander	0.0969	0.0766	1.27	0.206	–0.0532	0.2470
Hispanic	0.3772	0.0514	7.34	0.000	0.2765	0.4779
Black	0.0162	0.0470	0.34	0.730	–0.0759	0.1083
Other	–0.1338	0.3135	–0.43	0.670	–0.7482	0.4807
Unknown	–0.0675	0.1315	–0.51	0.608	–0.3251	0.1902
White	0.0000	(base)				

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Education level						
Associate's	0.0000	(base)				
Bachelor's	–0.6201	0.1046	–5.93	0.000	–0.8252	–0.4150
College <1 year	0.6592	0.1063	6.20	0.000	0.4508	0.8676
College <2 years	0.5734	0.0509	11.27	0.000	0.4737	0.6731
College <3 years	0.4755	0.0458	10.39	0.000	0.3858	0.5652
College <4 years	0.5086	0.2161	2.35	0.019	0.0851	0.9321
High school	0.7617	0.3467	2.20	0.028	0.0821	1.4413
Master's	–0.9860	0.3689	–2.67	0.008	–1.7090	–0.2631
AFSC manning						
	–0.1183	0.0257	–4.61	0.000	–0.1686	–0.0680
AFSC manning squared						
	0.0005	0.0001	4.64	0.000	0.0003	0.0008
Days deployed per year						
	0.1553	0.0065	23.83	0.000	0.1425	0.1680
Days deployed per year squared						
	–0.0033	0.0003	–13.27	0.000	–0.0038	–0.0028
Geographic and economic factors						
Geographic region						
Central	0.0000	(base)				
Northeast	0.0325	0.0961	0.34	0.735	–0.1559	0.2208
Northern tier	–0.4130	0.1047	–3.94	0.000	–0.6182	–0.2077
Other	–0.5410	0.1469	–3.68	0.000	–0.8290	–0.2530
Southeast	0.0514	0.0826	0.62	0.534	–0.1106	0.2134
West	–0.2956	0.0750	–3.94	0.000	–0.4427	–0.1486
Non-U.S.	–0.2888	0.1081	–2.67	0.008	–0.5008	–0.0768
National unemployment rate						
	0.2645	0.2156	1.23	0.220	–0.1581	0.6872
National unemployment rate squared						
	–0.0130	0.0147	–0.88	0.377	–0.0419	0.0159
Neighborhood index						
	–0.0006	0.0014	–0.39	0.693	–0.0033	0.0022
Neighborhood index squared						
	0.0000	0.0000	0.27	0.787	0.0000	0.0000
RUCC						
	–0.0473	0.0641	–0.74	0.461	–0.1730	0.0784
RUCC squared						
	0.0010	0.0101	0.10	0.918	–0.0187	0.0208

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Military/Civilian median income ratio						
	0.1118	0.0891	1.26	0.209	–0.0628	0.2864
Military/Civilian median income ratio squared						
	0.2645	0.2156	1.23	0.220	–0.1581	0.6872
Local poverty rate						
	0.0461	0.0422	1.09	0.274	–0.0366	0.1288
Local poverty rate squared						
	–0.0012	0.0010	–1.16	0.244	–0.0032	0.0008
Median household income						
	0.0000	0.0000	1.68	0.094	0.0000	0.0001
Median household income squared						
	0.0000	0.0000	–1.33	0.185	0.0000	0.0000
Other factors						
Fiscal year						
2005	0.0000	(base)				
2006	0.3745	0.1061	3.53	0.000	0.1667	0.5824
2007	0.3415	0.1118	3.05	0.002	0.1223	0.5607
2009	0.2936	0.1080	2.72	0.007	0.0819	0.5053
2010	0.5201	0.1903	2.73	0.006	0.1471	0.8931
2011	0.4162	0.2423	1.72	0.086	–0.0587	0.8912
2012	0.4066	0.2236	1.82	0.069	–0.0316	0.8447
2013	0.3315	0.1967	1.69	0.092	–0.0539	0.7170
2014	0.6782	0.1790	3.79	0.000	0.3274	1.0290
2015	0.7925	0.1461	5.42	0.000	0.5061	1.0789
2016	1.5792	0.1263	12.50	0.000	1.3317	1.8268
2017	1.5615	0.1268	12.31	0.000	1.3130	1.8100
2018	1.8106	0.1420	12.75	0.000	1.5323	2.0890
2019	2.1117	0.1697	12.44	0.000	1.7791	2.4443
AFSC						
2A0X1	0.0000	(base)				
2A2X1	–0.0260	0.1739	–0.15	0.881	–0.3669	0.3148
2A2X2	–0.2249	0.1997	–1.13	0.260	–0.6164	0.1666
2A2X3	0.0320	0.2520	0.13	0.899	–0.4619	0.5259
2A3X1	–0.5058	0.1938	–2.61	0.009	–0.8856	–0.1260
2A3X2	–0.3813	0.1744	–2.19	0.029	–0.7231	–0.0395
2A3X3	–0.5966	0.1188	–5.02	0.000	–0.8294	–0.3638
2A3X4	–0.7716	0.1574	–4.90	0.000	–1.0801	–0.4632
2A3X5	–0.7281	0.1747	–4.17	0.000	–1.0705	–0.3858
2A3X7	–0.5780	0.1632	–3.54	0.000	–0.8979	–0.2580
2A3X8	–0.9050	0.2191	–4.13	0.000	–1.3343	–0.4756

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
2A5X1	–0.1651	0.1236	–1.34	0.182	–0.4074	0.0771
2A5X2	–0.2831	0.1659	–1.71	0.088	–0.6081	0.0420
2A5X3	–0.3538	0.1478	–2.39	0.017	–0.6435	–0.0641
2A5X4	–0.2397	0.1303	–1.84	0.066	–0.4950	0.0157
2A6X1	0.0682	0.1163	0.59	0.558	–0.1598	0.2961
2A6X2	–0.0671	0.1257	–0.53	0.593	–0.3134	0.1792
2A6X3	–0.6826	0.1782	–3.83	0.000	–1.0319	–0.3333
2A6X4	–0.1968	0.1334	–1.48	0.140	–0.4583	0.0646
2A6X5	–0.0467	0.1336	–0.35	0.726	–0.3085	0.2150
2A6X6	–0.1823	0.1197	–1.52	0.128	–0.4169	0.0522
2A7X1	–0.3177	0.1832	–1.73	0.083	–0.6768	0.0415
2A7X2	–0.3514	0.1841	–1.91	0.056	–0.7123	0.0094
2A7X3	–0.0648	0.1318	–0.49	0.623	–0.3231	0.1934
2A7X4	1.2720	0.4421	2.88	0.004	0.4054	2.1385
2A7X5	–0.1721	0.1820	–0.95	0.344	–0.5288	0.1846
2A8X1	0.0819	0.1622	0.50	0.614	–0.2360	0.3998
2A8X2	–0.4504	0.1726	–2.61	0.009	–0.7887	–0.1121
2A9X1	–0.1191	0.2019	–0.59	0.555	–0.5149	0.2766
2A9X2	–0.1727	0.2151	–0.80	0.422	–0.5942	0.2488
2A9X3	–0.0978	0.1708	–0.57	0.567	–0.4325	0.2369
2R0X1	–0.2874	0.1840	–1.56	0.118	–0.6481	0.0732
2R1X1	–0.2849	0.1692	–1.68	0.092	–0.6165	0.0468
Constant	–2.2527	2.1736	–1.04	0.300	–6.5129	2.0075

Table C.5. Model Summary for Maintenance AFSCs, YOS 10–13

Statistic	Value
Number of observations	26,396
Likelihood ratio of chi-square test	13,959.44
Probability of chi-square test	0.0000
Pseudo R^2	0.5450

Table C.6. Parameter Estimates for Maintenance AFSCs, YOS 10–13

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Military characteristics						
Grade						
E-1	–5.9946	0.6443	–9.30	0.000	–7.2574	–4.7318
E-2	0.0000	(empty)				
E-3	0.0000	(empty)				
E-4	–4.7838	0.3016	–15.86	0.000	–5.3749	–4.1927
E-5	–1.5313	0.2306	–6.64	0.000	–1.9833	–1.0793
E-6	–0.4972	0.2178	–2.28	0.022	–0.9240	–0.0704
E-7	0.0000	(omitted)				
E-8	0.0000	(omitted)				
YOS						
10	0.0000	(base)				
11	0.1028	0.0652	1.58	0.115	–0.0250	0.2306
12	–0.0653	0.0787	–0.83	0.407	–0.2196	0.0890
13	0.1017	0.0872	1.17	0.244	–0.0693	0.2726
Initial enlistment						
4	0.0000	(base)				
6	–0.1096	0.0611	–1.80	0.073	–0.2293	0.0101
Major command						
ACC	0.0000	(base)				
AET	0.1220	0.0850	1.44	0.151	–0.0445	0.2885
AFE	–0.2157	0.1774	–1.22	0.224	–0.5633	0.1320
AMC	–0.0383	0.0833	–0.46	0.646	–0.2016	0.1250
MTC	–0.0278	0.1475	–0.19	0.851	–0.3168	0.2612
OTH	0.1819	0.1279	1.42	0.155	–0.0688	0.4327
PACAF	–0.0889	0.1692	–0.53	0.599	–0.4205	0.2427
AFSOC	–0.0126	0.1275	–0.10	0.921	–0.2624	0.2373
SPC	–1.2900	0.5956	–2.17	0.030	–2.4573	–0.1227
Selected for promotion						
0	0.0000	(base)				
1	1.2448	0.1217	10.23	0.000	1.0064	1.4833
Under ADSC						
0	0.0000	(base)				
1	4.1913	0.0695	60.32	0.000	4.0552	4.3275
SRB multiple						
	0.1000	0.1384	0.72	0.470	–0.1712	0.3712
SRB multiple squared						
	–0.0268	0.0453	–0.59	0.554	–0.1156	0.0619

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Aptitude						
AFQT score						
	–0.0051	0.0199	–0.26	0.798	–0.0440	0.0338
AFQT score squared						
	0.0000	0.0002	0.05	0.963	–0.0003	0.0003
Mechanical component						
	0.0126	0.0129	0.98	0.326	–0.0126	0.0378
Mechanical component squared						
	–0.0001	0.0001	–1.30	0.193	–0.0003	0.0001
Administrative component						
	0.0019	0.0108	0.17	0.862	–0.0192	0.0230
Administrative component squared						
	0.0000	0.0001	0.00	0.998	–0.0002	0.0002
General component						
	–0.0116	0.0162	–0.72	0.472	–0.0433	0.0201
General component squared						
	0.0001	0.0001	0.72	0.469	–0.0002	0.0004
Electronic component						
	0.0078	0.0127	0.62	0.538	–0.0171	0.0328
Electronic component squared						
	–0.0001	0.0001	–0.63	0.529	–0.0003	0.0001
Performance quality indicators						
ALS graduate						
0	0.0000	(base)				
1	0.3590	0.3426	1.05	0.295	–0.3125	1.0305
NCOA or SNCOA award						
0	0.0000	(base)				
1	1.0617	0.4911	2.16	0.031	0.0993	2.0242
Promotion detractors						
0	0.0000	(base)				
1	–0.2627	0.0537	–4.89	0.000	–0.3680	–0.1575
Ever fail fitness test						
0	0.0000	(base)				
1	–0.0792	0.0520	–1.52	0.128	–0.1811	0.0227
E-5 PFE score						
	–0.6206	0.5439	–1.14	0.254	–1.6867	0.4455
E-5 PFE score squared						
	0.3187	0.4541	0.70	0.483	–0.5713	1.2087

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
E-5 SKT score						
	0.5050	0.5375	0.94	0.347	–0.5485	1.5585
E-5 SKT score squared						
	–0.3627	0.4412	–0.82	0.411	–1.2274	0.5020
Top rating on last EPR						
0	0.0000	(base)				
1	0.7968	0.0604	13.20	0.000	0.6784	0.9151
Top rating on second-to-last EPR						
0	0.0000	(base)				
1	0.1052	0.0638	1.65	0.099	–0.0199	0.2302
Standardized time to promotion						
	0.3016	0.0339	8.89	0.000	0.2351	0.3681
Standardized time to promotion squared						
	–0.0841	0.0132	–6.36	0.000	–0.1101	–0.0582
Selected for E-4 BPZ						
0	0.0000	(base)				
1	–0.2838	0.0710	–4.00	0.000	–0.4230	–0.1447
Commendation medals						
0	0.0000	(base)				
1	–0.1266	0.0608	–2.08	0.037	–0.2457	–0.0075
2	–0.2158	0.0788	–2.74	0.006	–0.3703	–0.0613
3	–0.3408	0.1215	–2.80	0.005	–0.5790	–0.1026
4	–0.5805	0.2503	–2.32	0.020	–1.0711	–0.0899
5	–0.6057	0.5618	–1.08	0.281	–1.7069	0.4955
6	–2.3486	1.0942	–2.15	0.032	–4.4932	–0.2040
Achievement medals						
0	0.0000	(base)				
1	0.0036	0.0584	0.06	0.950	–0.1108	0.1181
2	–0.2093	0.0707	–2.96	0.003	–0.3479	–0.0708
3	–0.2249	0.1053	–2.14	0.033	–0.4312	–0.0185
4	–0.3975	0.1756	–2.26	0.024	–0.7417	–0.0534
5	–0.1614	0.3278	–0.49	0.622	–0.8039	0.4811
6	–0.2717	0.6127	–0.44	0.657	–1.4725	0.9291
7	–0.2836	1.2940	–0.22	0.827	–2.8197	2.2526
Demographic, family, and stressor variables						
Married						
Current	0.0000	(base)				
Former	–0.0191	0.0773	–0.25	0.805	–0.1706	0.1324
Never	0.1186	0.0780	1.52	0.128	–0.0343	0.2714

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Military spouse						
0	0.0000	(base)				
1	0.2296	0.0975	2.35	0.019	0.0385	0.4207
Age of youngest child in household						
0	0.0000	(base)				
1–2	0.1109	0.0816	1.36	0.174	–0.0490	0.2708
3–5	0.1693	0.0761	2.22	0.026	0.0200	0.3185
6–8	–0.0107	0.0851	–0.13	0.900	–0.1776	0.1561
9–11	0.0341	0.1180	0.29	0.773	–0.1973	0.2655
12–14	–0.3094	0.2252	–1.37	0.169	–0.7508	0.1320
15–17	–0.6704	0.4282	–1.57	0.117	–1.5096	0.1689
18–20	–0.0395	0.6610	–0.06	0.952	–1.3351	1.2561
21–22	0.8768	5.8712	0.15	0.881	–10.6306	12.3841
Age						
26–27	–0.0135	0.4544	–0.03	0.976	–0.9041	0.8772
28–29	–0.2173	0.3375	–0.64	0.520	–0.8788	0.4442
30–31	–0.1235	0.3328	–0.37	0.711	–0.7758	0.5288
32–33	–0.1031	0.3317	–0.31	0.756	–0.7532	0.5470
34–35	0.0948	0.3358	0.28	0.778	–0.5633	0.7529
36–37	0.2897	0.3449	0.84	0.401	–0.3863	0.9656
38–39	0.2763	0.3750	0.74	0.461	–0.4588	1.0113
40–41	0.0000	(omitted)				
Gender						
Female	–0.5812	0.1076	–5.40	0.000	–0.7920	–0.3703
Male	0.0000	(base)				
Race/Ethnicity						
American Indian/Alaskan	0.1434	0.2118	0.68	0.498	–0.2717	0.5585
Asian/Pacific Islander	0.0417	0.1255	0.33	0.739	–0.2043	0.2878
Hispanic	0.2284	0.0851	2.68	0.007	0.0616	0.3952
Black	0.2338	0.0836	2.80	0.005	0.0700	0.3976
Other	0.4497	0.4007	1.12	0.262	–0.3357	1.2352
Unknown	0.0714	0.2107	0.34	0.735	–0.3416	0.4843
White	0.0000	(base)				
Education level						
Associate’s	0.0000	(base)				
Bachelor’s	–0.9343	0.1115	–8.38	0.000	–1.1528	–0.7157
College <1 year	0.4928	0.2578	1.91	0.056	–0.0124	0.9980
College <2 years	0.4386	0.0818	5.36	0.000	0.2784	0.5989
College <3 years	0.3466	0.0652	5.32	0.000	0.2189	0.4744
College <4 years	0.4651	0.3295	1.41	0.158	–0.1808	1.1110

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
High school	1.0432	0.9120	1.14	0.253	–0.7443	2.8307
Master's	–1.5264	0.2725	–5.60	0.000	–2.0606	–0.9923
AFSC manning						
	–0.1128	0.0387	–2.91	0.004	–0.1887	–0.0369
AFSC manning squared						
	0.0005	0.0002	3.09	0.002	0.0002	0.0009
Days deployed per year						
	0.3384	0.0214	15.84	0.000	0.2965	0.3802
Days deployed per year squared						
	–0.0117	0.0014	–8.61	0.000	–0.0143	–0.0090
Geographic and economic factors						
Geographic region						
Central	0.0000	(base)				
Northeast	0.0481	0.1543	0.31	0.755	–0.2544	0.3505
Northern tier	–0.1701	0.1674	–1.02	0.310	–0.4982	0.1581
Other	–0.8837	0.2337	–3.78	0.000	–1.3418	–0.4257
Southeast	–0.1266	0.1353	–0.94	0.349	–0.3918	0.1385
West	–0.2158	0.1209	–1.79	0.074	–0.4528	0.0211
Non-U.S.	–0.2818	0.1804	–1.56	0.118	–0.6353	0.0718
National unemployment rate						
	0.7622	0.3609	2.11	0.035	0.0548	1.4695
National unemployment rate squared						
	–0.0368	0.0240	–1.53	0.125	–0.0839	0.0102
Neighborhood index						
	–0.0018	0.0022	–0.81	0.416	–0.0061	0.0025
Neighborhood index squared						
	0.0000	0.0000	–0.15	0.880	0.0000	0.0000
RUCC						
	–0.0221	0.1026	–0.22	0.829	–0.2233	0.1791
RUCC squared						
	–0.0018	0.0160	–0.11	0.911	–0.0332	0.0296
Military/Civilian median income ratio						
	–0.6379	0.3875	–1.65	0.100	–1.3973	0.1215
Military/Civilian median income ratio squared						
	0.1370	0.1399	0.98	0.327	–0.1372	0.4112
Local poverty rate						
	0.1086	0.0645	1.68	0.092	–0.0177	0.2349

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
Local poverty rate squared						
	–0.0021	0.0015	–1.33	0.184	–0.0051	0.0010
Median household income						
	0.0000	0.0000	1.21	0.226	0.0000	0.0001
Median household income squared						
	0.0000	0.0000	–0.83	0.408	0.0000	0.0000
Other factors						
Fiscal year						
2005	0.0000	(base)				
2006	0.6742	0.2075	3.25	0.001	0.2674	1.0809
2007	0.7056	0.2075	3.40	0.001	0.2990	1.1122
2009	0.6275	0.1901	3.30	0.001	0.2549	1.0001
2010	–0.0539	0.3021	–0.18	0.858	–0.6460	0.5381
2011	–0.0175	0.3653	–0.05	0.962	–0.7336	0.6985
2012	–0.3879	0.3389	–1.14	0.252	–1.0522	0.2763
2013	–0.4276	0.3103	–1.38	0.168	–1.0358	0.1805
2014	–0.1419	0.2902	–0.49	0.625	–0.7106	0.4269
2015	–0.2761	0.2424	–1.14	0.255	–0.7511	0.1990
2016	0.7423	0.2218	3.35	0.001	0.3076	1.1771
2017	0.9277	0.2258	4.11	0.000	0.4851	1.3704
2018	1.3183	0.2510	5.25	0.000	0.8263	1.8103
2019	2.0614	0.2984	6.91	0.000	1.4764	2.6463
AFSC						
2A0X1	0.0000	(base)				
2A2X1	0.4648	0.3117	1.49	0.136	–0.1461	1.0757
2A2X2	0.1481	0.3574	0.41	0.679	–0.5524	0.8485
2A2X3	–0.1918	0.4279	–0.45	0.654	–1.0305	0.6470
2A3X1	–0.5691	0.3343	–1.70	0.089	–1.2243	0.0860
2A3X2	–0.3929	0.2908	–1.35	0.177	–0.9628	0.1771
2A3X3	–0.3915	0.1993	–1.96	0.050	–0.7822	–0.0009
2A3X4	–0.3545	0.2654	–1.34	0.182	–0.8747	0.1658
2A3X5	–0.1960	0.2995	–0.65	0.513	–0.7829	0.3910
2A3X7	0.2673	0.2722	0.98	0.326	–0.2662	0.8008
2A3X8	–0.3801	0.3600	–1.06	0.291	–1.0857	0.3255
2A5X1	–0.0591	0.2105	–0.28	0.779	–0.4715	0.3534
2A5X2	–0.2441	0.2764	–0.88	0.377	–0.7858	0.2975
2A5X3	–0.2698	0.2400	–1.12	0.261	–0.7401	0.2005
2A5X4	–0.2650	0.2201	–1.20	0.228	–0.6963	0.1663
2A6X1	0.0982	0.2020	0.49	0.627	–0.2977	0.4941
2A6X2	–0.0222	0.2142	–0.10	0.917	–0.4421	0.3977
2A6X3	–0.6569	0.2824	–2.33	0.020	–1.2104	–0.1033

Variable	Coefficient	Standard Error	z	P>|z|	95-Percent Confidence Interval	
2A6X4	–0.1178	0.2244	–0.52	0.600	–0.5576	0.3220
2A6X5	–0.3194	0.2239	–1.43	0.154	–0.7582	0.1194
2A6X6	0.0101	0.2073	0.05	0.961	–0.3963	0.4165
2A7X0	–2.9587	2.4849	–1.19	0.234	–7.8291	1.9116
2A7X1	–0.1366	0.2711	–0.50	0.614	–0.6678	0.3947
2A7X2	–0.6741	0.3083	–2.19	0.029	–1.2782	–0.0699
2A7X3	0.0085	0.2245	0.04	0.970	–0.4315	0.4486
2A7X4	–0.2356	0.6621	–0.36	0.722	–1.5332	1.0620
2A7X5	–0.1927	0.3075	–0.63	0.531	–0.7954	0.4101
2A8X1	0.1229	0.2633	0.47	0.641	–0.3932	0.6390
2A8X2	0.4810	0.3088	1.56	0.119	–0.1242	1.0863
2A9X1	0.3919	0.3525	1.11	0.266	–0.2989	1.0828
2A9X2	–0.4954	0.3631	–1.36	0.172	–1.2071	0.2162
2A9X3	0.0805	0.3082	0.26	0.794	–0.5236	0.6847
2R0X1	–0.0565	0.2989	–0.19	0.850	–0.6423	0.5292
2R1X1	0.0072	0.2809	0.03	0.980	–0.5433	0.5577
Constant	0.4798	2.8989	0.17	0.869	–5.2019	6.1616

Appendix D. Average Marginal Effects for Years of Service 6–9 and 10–13

This appendix contains graphic plots of the AME derived from the YOS 6–9 and YOS 10–13 logistic regression models described in Appendix C. Comparable data for the YOS 3–5 band are in Figures 4.1–4.6 in Chapter 4. Marginal effects in these figures indicate the expected impact of a single variable on reenlistment probability when all other variables are held at their observed levels.

For categorical variables, the AME is calculated by applying logistic regression coefficients (see Appendix C) to all observations at the observed levels of all variables except the one for which the margin is being determined. The margin is calculated as the difference between the average reenlistment probability with the variable set at one for all observations and the average with the variable set at zero for all observations. When the variable is set at one, the resulting margin is the probability of reenlistment if all observations shared the characteristic represented by the variable. For example, if the variable is gender, and male is the base (omitted) variable in the regression model, the female variable is set at one so that all observations are characterized as female. Conversely, if the variable is set at zero, the resulting margin is the probability if no observation shared the characteristic. In the foregoing example, it is set so that no observation is characterized as female. The difference between these probabilities can be interpreted as the independent effect of a variable on reenlistment probability after controlling for the effects of all other variables.

For continuous variables, the margin is calculated as the rate at which the reenlistment probability is changing at each point in the range of observed values of the variable. Mathematically, it is the derivative of the logistic regression equation at each point on the curve of reenlistment probabilities.

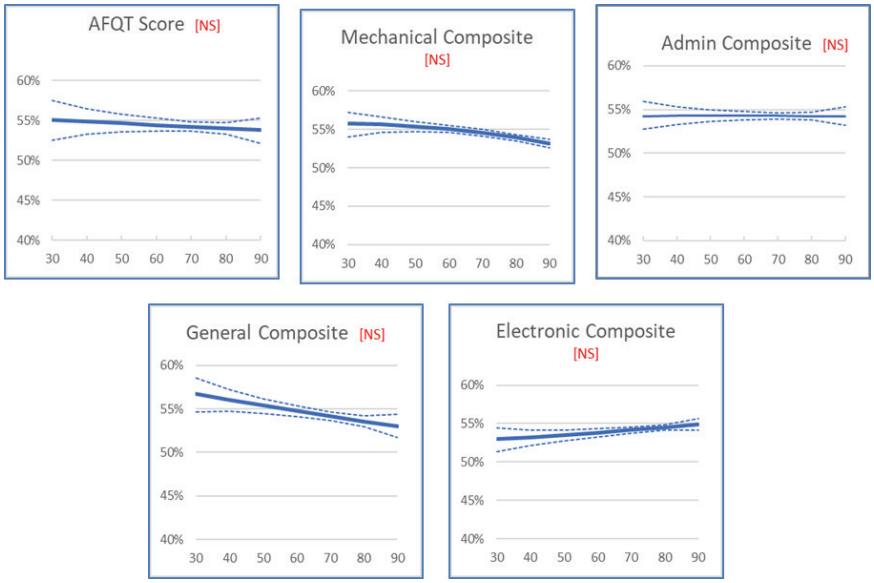
In Figures D.1–D.11, categorical variables are shown using bar graphs, and continuous variables are shown using line graphs. Confidence intervals are shown using whisker bars in the bar graphs and dotted lines in the line graphs.[1] To allow easy comparison among variables, we generally adhered to a common range of values on the vertical axis for graphs within a YOS band. Where necessary to depict a margin outside these common ranges, a nonconforming value is indicated by a red tint. Additionally, the graphics are grouped into the five broad categories used elsewhere in the report.

[1] The confidence intervals are based on the standard error of the estimated margin derived from the logistic regression. Our confidence intervals indicate that there is a 95-percent probability that the true margin associated with a variable lies within the interval indicted by the whisker bars.

Figure D.1. Marginal Retention Probabilities for Military Characteristics Variables, YOS 6–9

NOTE: The range of vertical axis values for YOS 6–9 is 40–60 percent except where indicated by a red tint over the value. “NS” in red type indicates that the marginal effects are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.2. Marginal Retention Probabilities for Aptitude Variables, YOS 6–9



NOTE: “NS” in red type indicates that the marginal effects are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.3. Marginal Retention Probabilities for Performance Quality Indicator Variables, YOS 6–9

NOTES: The range of vertical axis values for YOS 6–9 is 40–60 percent except where indicated by a red tint over the value. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.4. Marginal Retention Probabilities for Demographic, Family, and Stressor Variables, YOS 6–9

NOTE: The range of vertical axis values for YOS 6–9 is 40–60 percent except where indicated by a red tint over the value. Dotted lines and whisker bars indicate 95-percent confidence intervals.

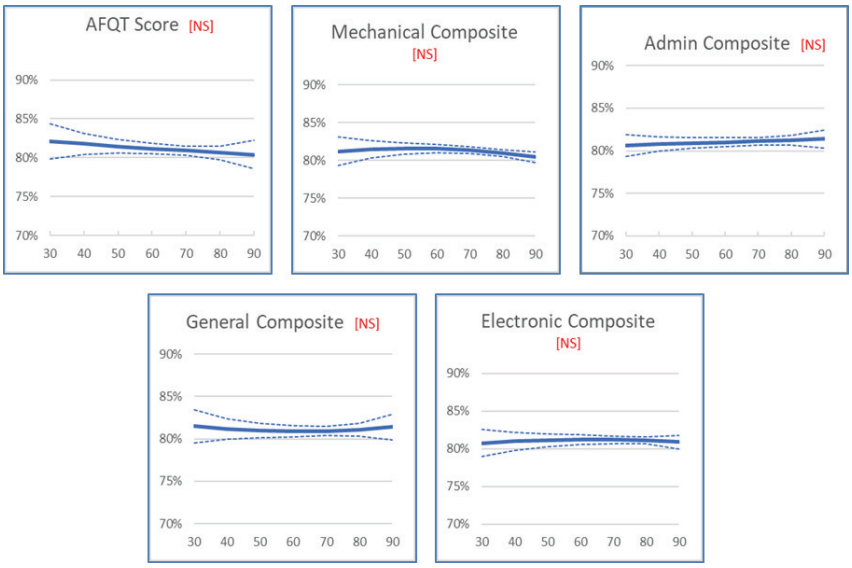
Figure D.5. Marginal Retention Probabilities for Geographic and Economic Factor Variables, YOS 6–9

NOTES: “NS” in red type indicates that the marginal effects for the continuous variables are not statistically significant.

Figure D.6. Marginal Retention Probabilities for Military Characteristics Variables, YOS 10–13

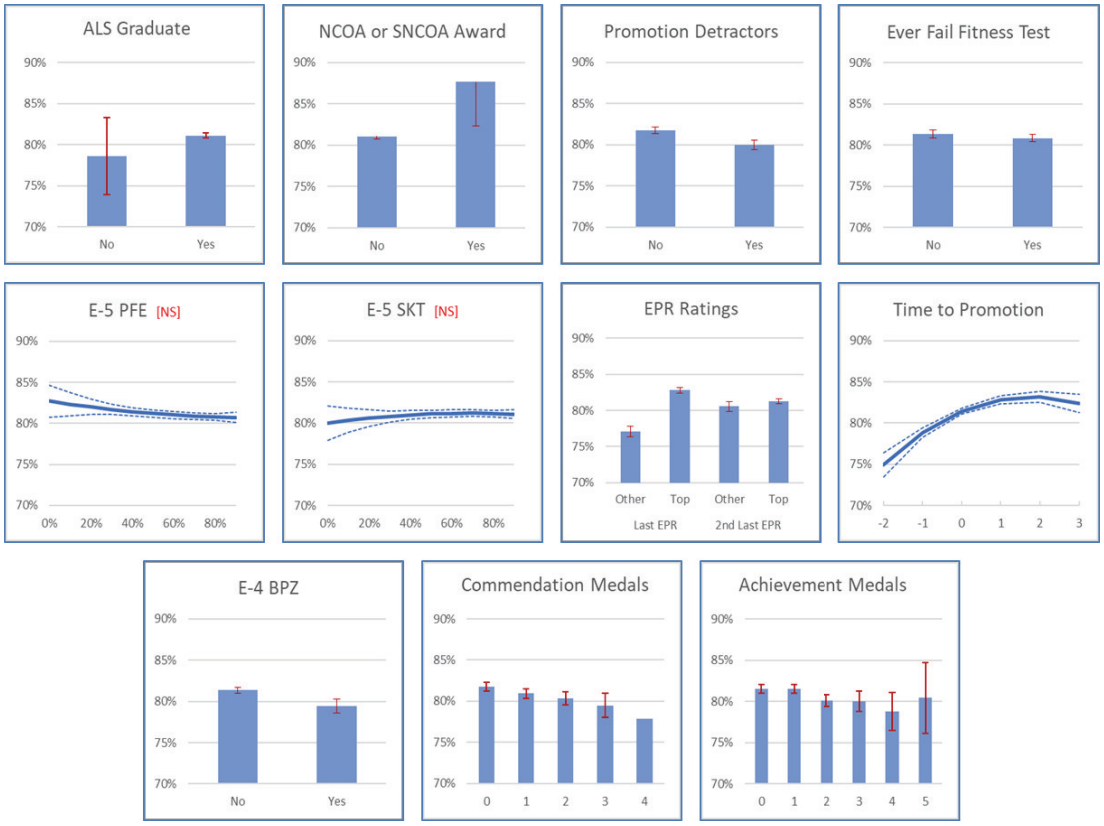
NOTES: The range of vertical axis values for YOS 10–13 is 70–90 percent except where indicated by a red tint over the value. “NS” in red type indicates that the marginal effects are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.7. Marginal Retention Probabilities for Aptitude Variables, YOS 10–13



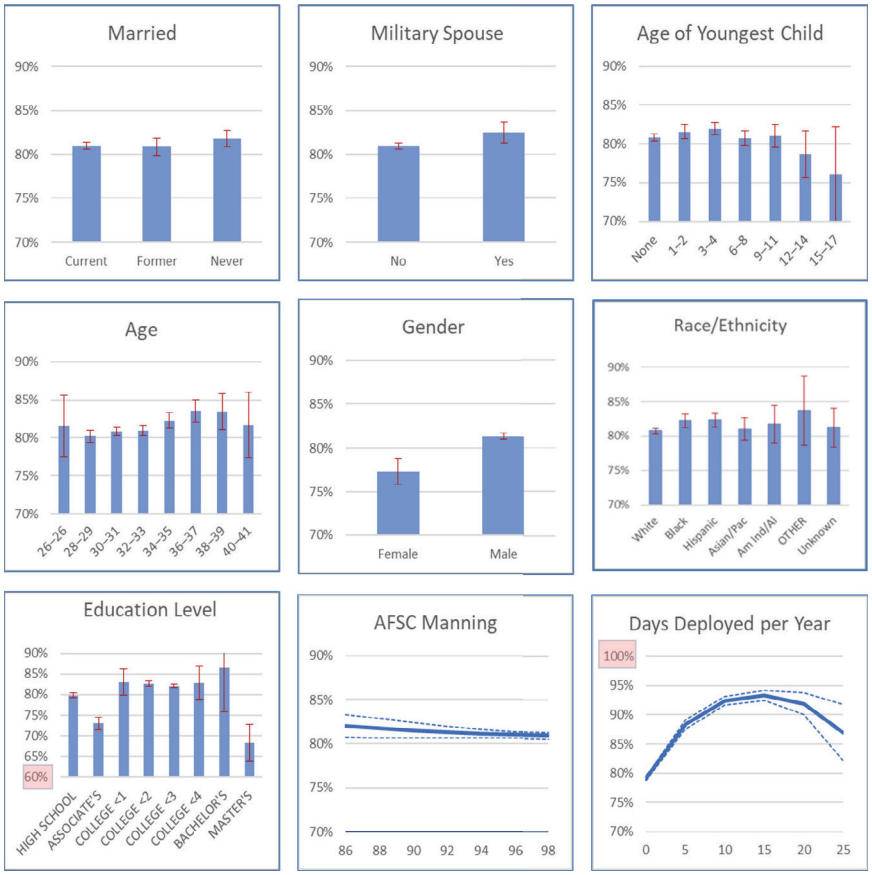
NOTES: "NS" in red type indicates that the marginal effects are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.8. Marginal Retention Probabilities for Performance Quality Indicator Variables, YOS 10–13



NOTES: "NS" in red type indicates that the marginal effects for the continuous variables are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.9. Marginal Retention Probabilities for Demographic, Family, and Stressor Variables, YOS 10–13

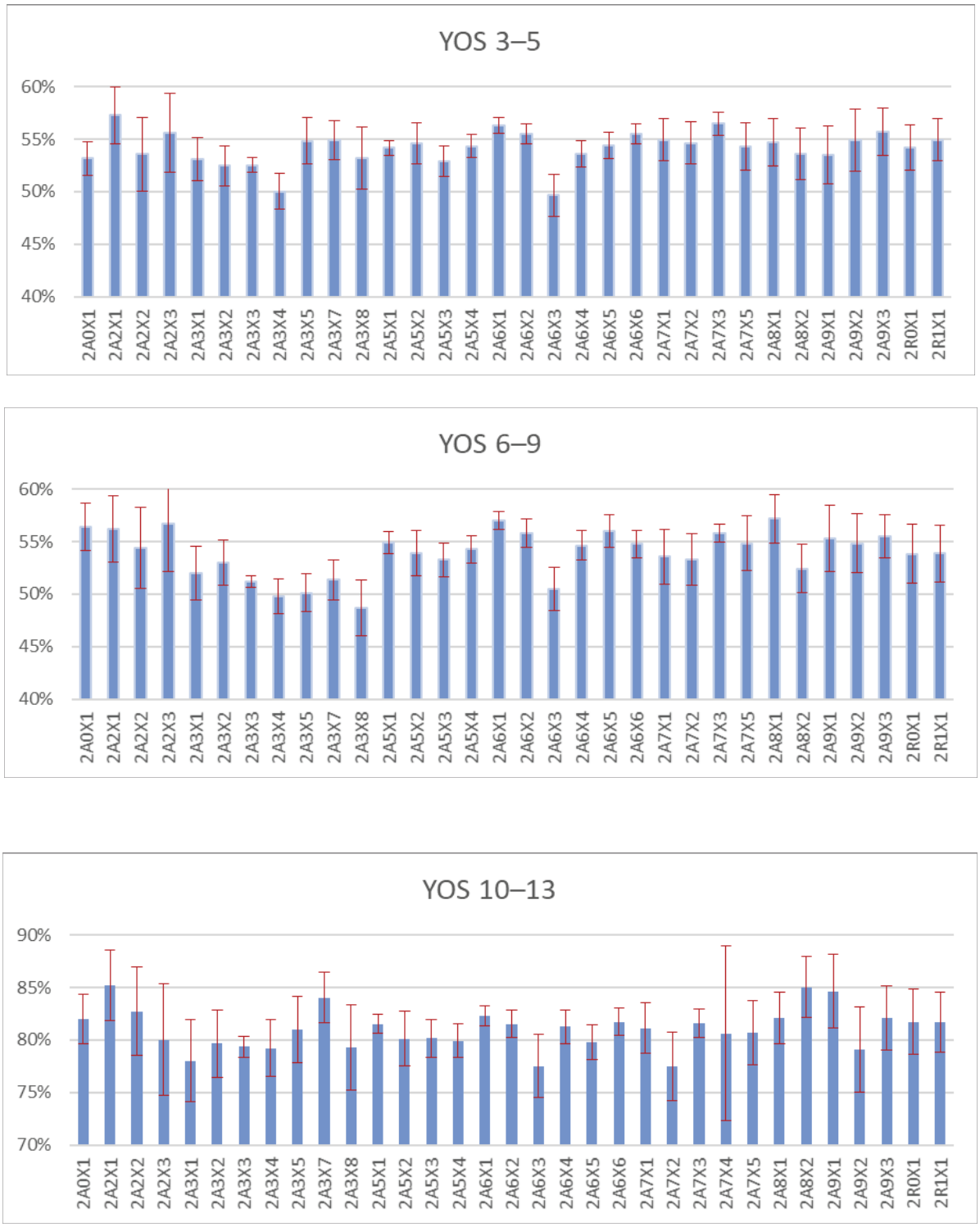


NOTES: The range of vertical axis values for YOS 10–13 is 70–90 percent except where indicated by a red tint over the value. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.10. Marginal Retention Probabilities for Geographic and Economic Factor Variables, YOS 10–13

NOTES: “NS” in red type indicates that the marginal effects for the continuous variables are not statistically significant. Dotted lines and whisker bars indicate 95-percent confidence intervals.

Figure D.11. Marginal Retention Probabilities for AFSC Variables, All YOS Bands



NOTE: Whisker bars indicate 95-percent confidence intervals.

Appendix E. Dynamic Retention Model Parameter Estimates and Model Fits

In this appendix, we describe the DRM parameter estimates for the two-digit AFSC U.S. Air Force maintainer models, show the model fits for these models, and show the model fits when we apply the two-digit model to three-digit AFSCs.

Discussion of Parameter Estimates

The raw parameter estimates and standard errors in Table E.1 show that with the exception of the standard deviation of active taste for the 2P, 2R, and 2W models, all of the parameter estimates are statistically significant. Table E.2 contains the transformed parameter estimates, which are reported in thousands of dollars, except for the correlation of the taste parameter.

In each of the models, the mean active taste and mean reserve taste are negative, suggesting a distaste for military service relative to being a civilian. Mean taste for active duty ranges from about –$8,300 for the 2Rs to –$10,500 for the 2Ps. There is a larger distaste for reserve duty compared with active duty, with a wide range in estimates across the models from as low as –$20,400 for the 2Rs up to –$140,600 for the 2Ps. The implicit cost of leaving active duty before the first term is completed (switch cost 1) varies from –$24,600 among the 2Ws to –$38,100 for the 2Rs. The implicit cost associated with switching from civilian to the reserves (switch cost 2) varies from $24,100 for the 2Rs to –$71,700 for the 2As. With the exception of the 2Rs, the implicit cost associated with switching from civilian to the reserves is greater than that of leaving before the first term.

Two-Digit Air Force Specialty Code Model Fits

Figures E.1–E.4 show the model fits for each of the two-digit AFSCs for Air Force–enlisted maintainers.[1] These figures show the model-predicted AC retention (red line) and the Kaplan-Meier survival curves for the observed data (black line). The Kaplan-Meier curve is created using a nonparametric method to estimate a survival function from lifetime data.[2] The Kaplan-Meier 95-percent confidence intervals are shown in black dashed lines. Both the model-predicted retention and observed retention curves show the fraction of initial accessions retained by years of AC service. The fraction is equal to 1 at YOS zero, and retention falls as YOS increases.

[1] The bottom of each figure shows the model estimates and can be ignored by the reader. They are included to ensure we can track the estimates associated with each figure.

[2] For more details, see Kaplan and Meier, 1958.

Table E.1. Parameter Estimates and Standard Errors

	Aerospace Maintenance (2A)		Precision Management (2P)		Maintenance Management (2R)		Munitions and Weapons (2W)	
	Est	Std Error	Est	Std Error	Est	Std Error	Est	Std Error
Scale parameter, τ	3.07	0.02	3.28	0.11	3.52	0.11	3.04	0.06
Scale parameter, λ	2.65	0.05	2.16	0.29	1.68	0.25	2.66	0.16
Mean active taste = μ_a	2.25	0.01	2.35	0.04	2.11	0.08	2.19	0.02
Mean reserve taste = μ_r	4.05	0.06	4.95	0.76	3.02	0.23	4.38	0.18
SD active taste = σ_a	0.83	0.14	–5.55	22.96	–5.80	22.02	0.70	0.41
SD reserve taste = σ_r	3.59	0.07	4.51	0.79	2.34	0.33	3.94	0.20
Taste correlation = ρ	0.49	0.01	0.41	0.02	1.05	0.11	0.49	0.01
Switch cost 1: leave active before 4 YOS	3.49	0.02	3.52	0.10	3.64	0.12	3.20	0.07
Switch cost 2: switch from civilian to reserve	4.27	0.05	3.77	0.29	3.18	0.26	4.26	0.15

SOURCE: Parameter estimates from Air Force–enlisted maintainers entering active duty 1990–1993.
NOTES: Definitions of variables are provided in Table 4.2. Coefficients that are not significantly different from zero are in red. Est = estimate, Std = standard, SD = standard deviation.

Table E.2. Transformed Parameter Estimates

	Aerospace Maintenance (2A)	Precision Management (2P)	Maintenance Management (2R)	Munitions and Weapons (2W)
Scale parameter, τ	21.45	26.46	33.80	20.96
Scale parameter, λ	14.19	8.69	5.38	14.26
Mean active taste = μ_a	–9.47	–10.46	–8.28	–8.93
Mean reserve taste = μ_r	–57.28	–140.57	–20.41	–79.75
SD active taste = σ_a	2.30	0.00	0.00	2.02
SD reserve taste = σ_r	36.25	91.27	10.34	51.18
Taste correlation = ρ	0.45	0.38	0.78	0.45
Switch cost 1: leave active before 4 YOS	–32.66	–33.65	–38.08	–24.60
Switch cost 2: switch from civilian to reserve	–71.68	–43.30	–24.12	–70.70

SOURCE: Parameter estimates from Air Force–enlisted maintainers entering active duty 1990–1993.
NOTES: Transformed parameters are denominated in thousands of dollars, with the exception of the taste correlation. Definitions of variables are provided in Table 4.2. Coefficients that are not significantly different from zero are in red.

Figure E.1. Aerospace Maintainers 2A Model Fit

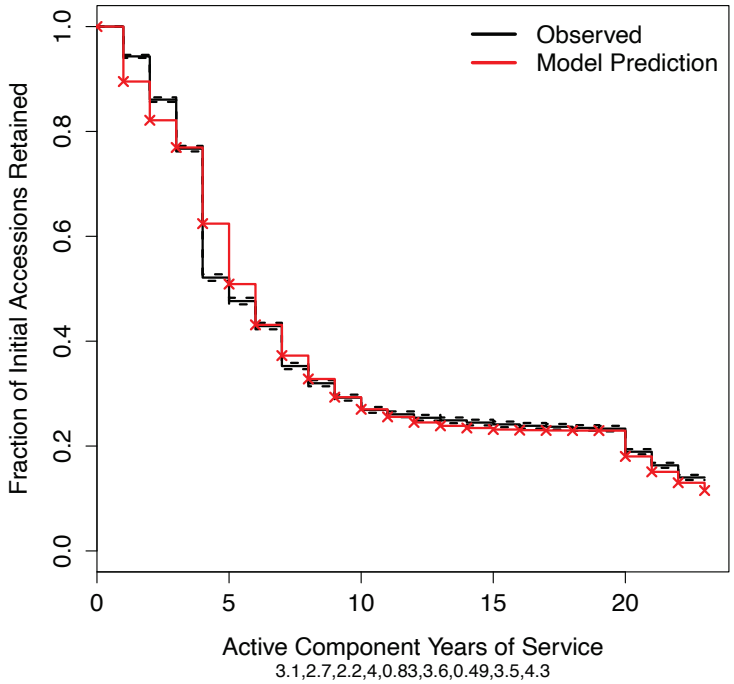


Figure E.2. Precision Management 2P Model Fit

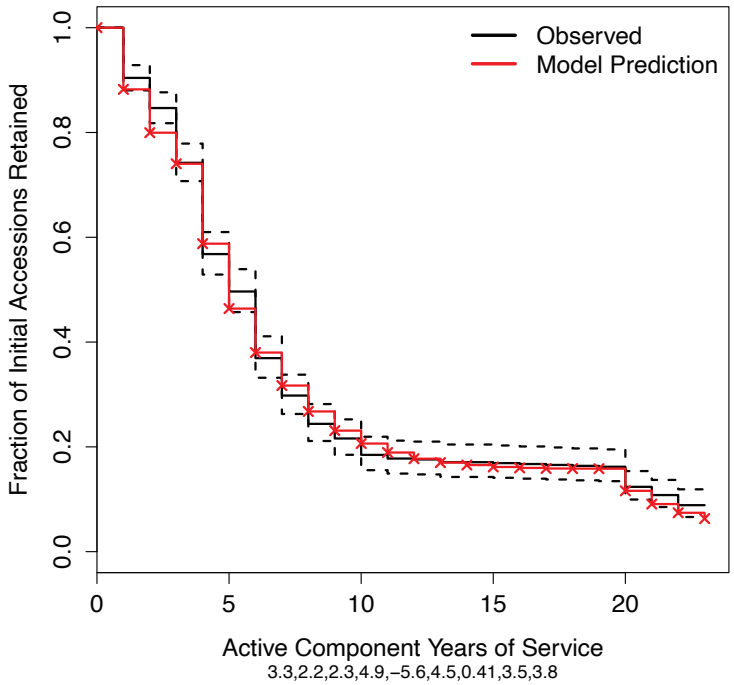


Figure E.3. Maintenance Management 2R Model Fit

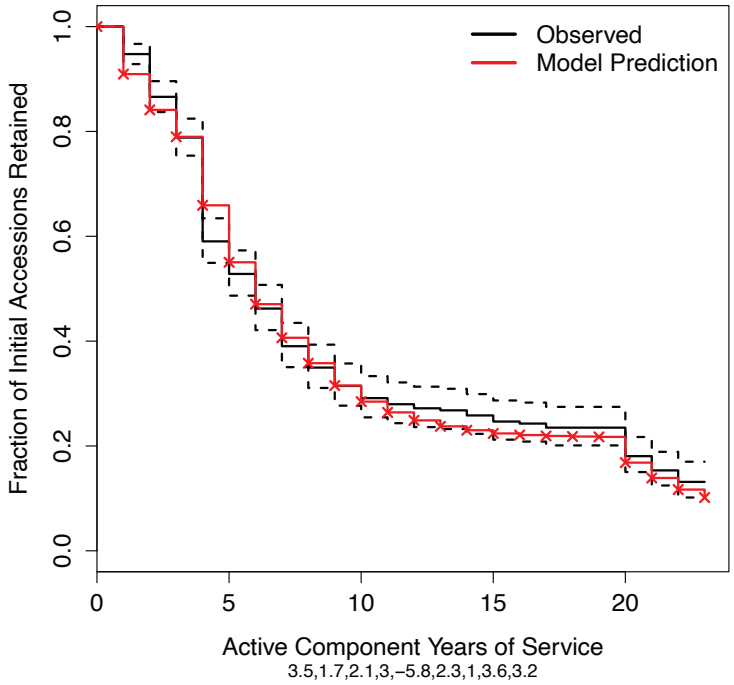
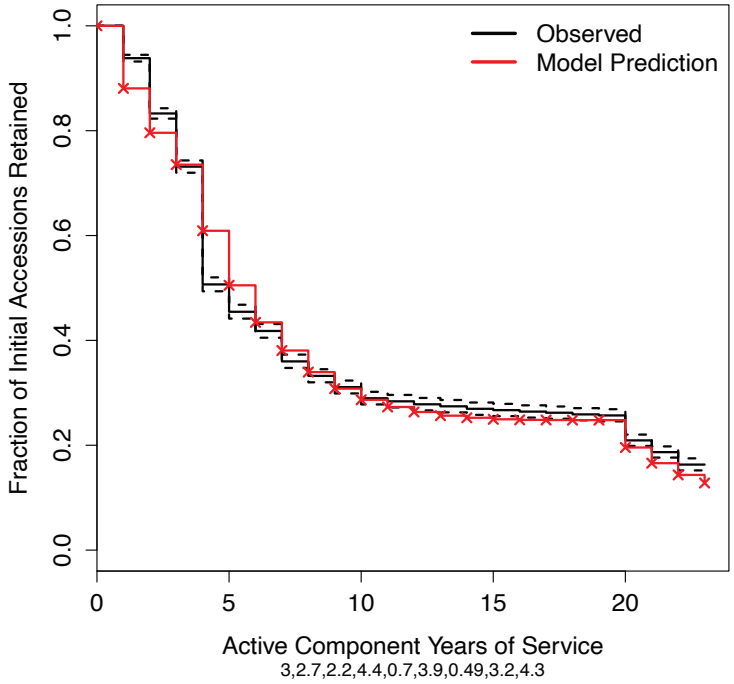


Figure E.4. Munitions and Weapons 2W Model Fit



Three-Digit Air Force Specialty Code Model Fits

We applied the two-digit AFSC model to the three-digit AFSCs. Figures E.5–E.14 demonstrate that the model fits the data well at the three-digit AFSC level. The pseudo R^2 values for the models range from 0.76 to 0.79, demonstrating that the models fit the data well.

Figure E.5. 2A0 Model Fit

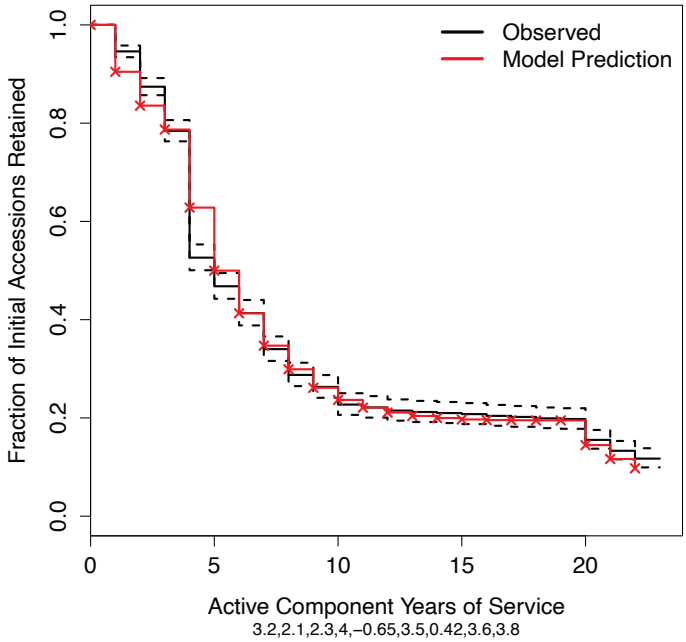


Figure E.6. 2A2 Model Fit

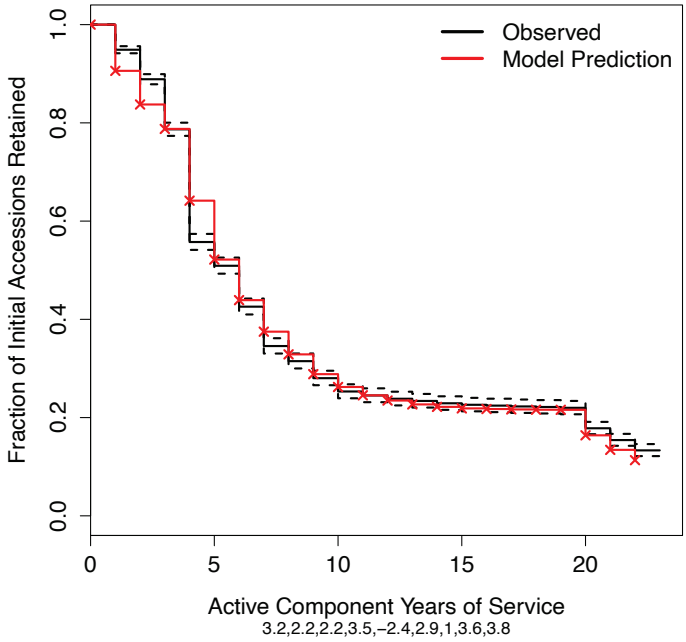


Figure E.7. 2A3 Model Fit

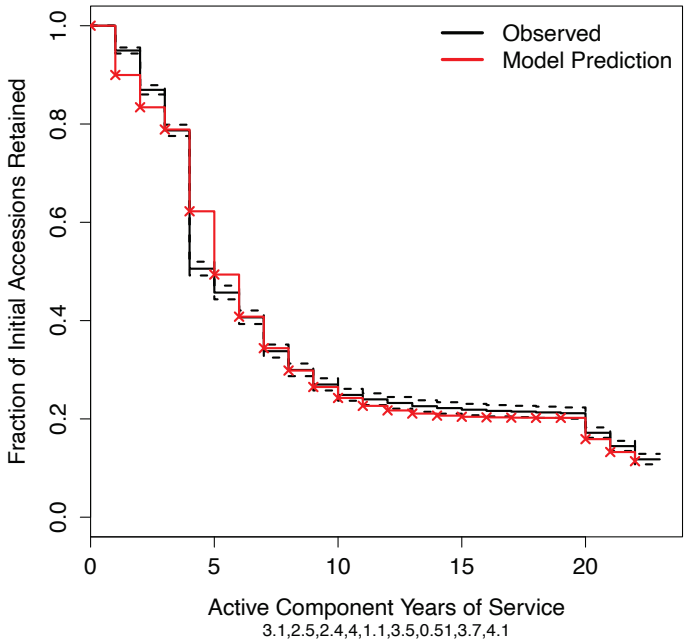


Figure E.8. 2A5 Model Fit

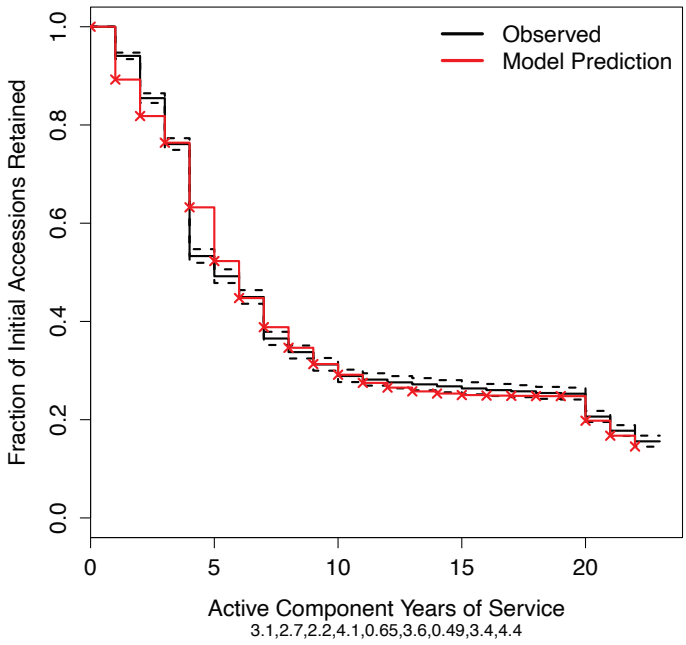


Figure E.9. 2A6 Model Fit

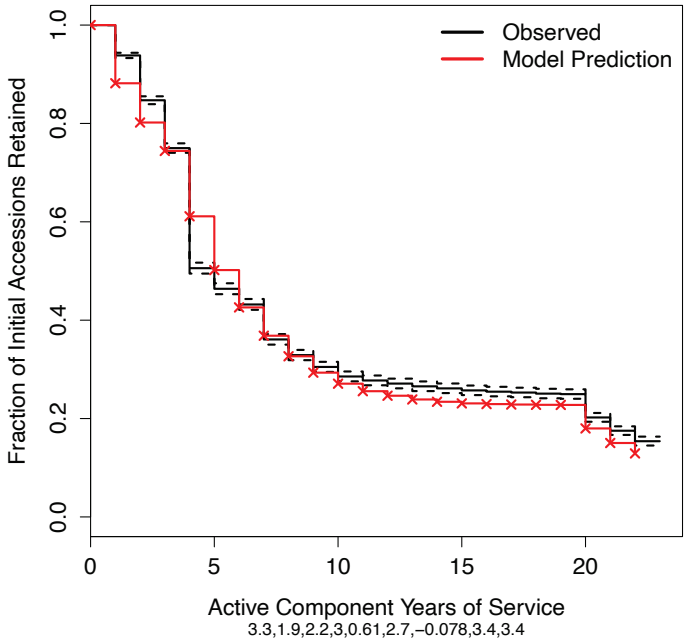


Figure E.10. 2A7 Model Fit

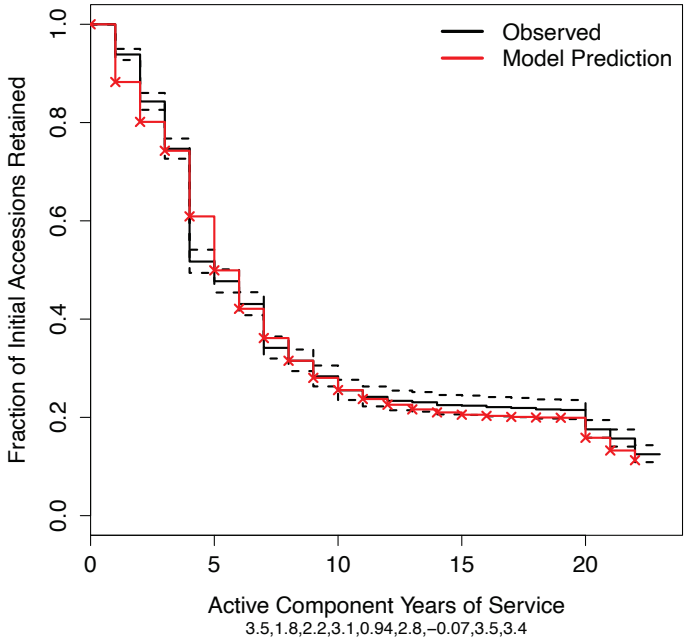


Figure E.11. 2R0 Model Fit

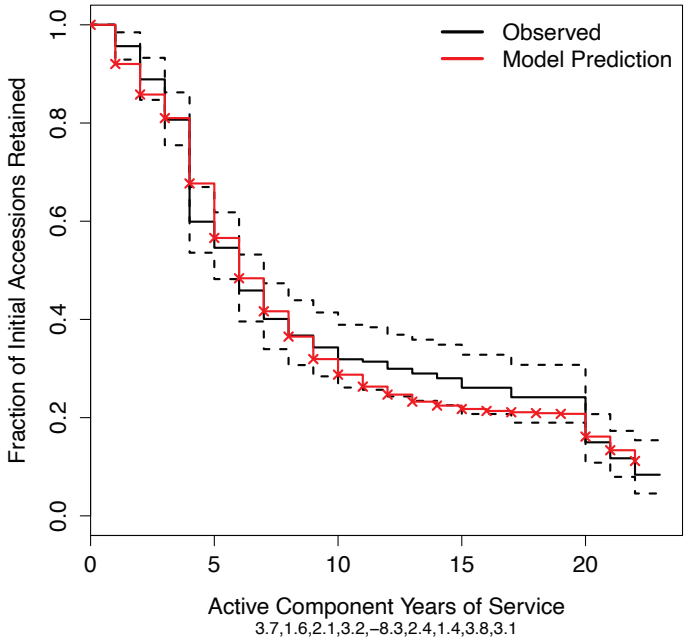


Figure E.12. 2R1 Model Fit

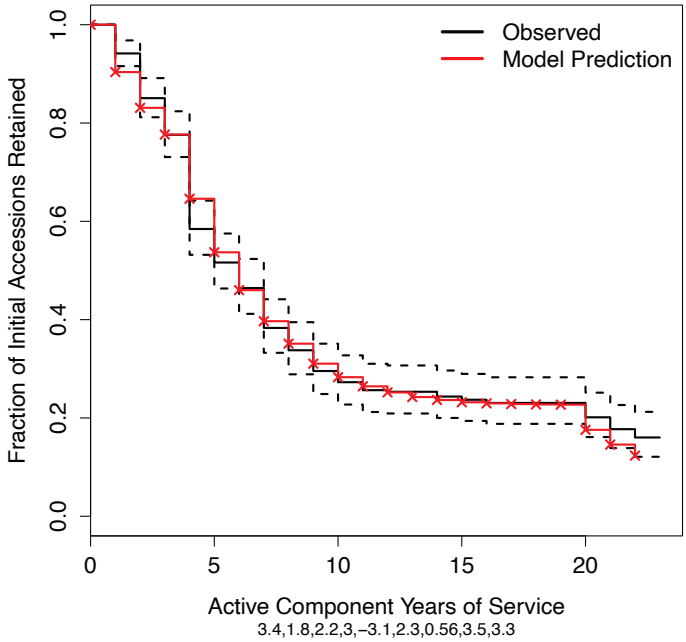


Figure E.13. 2W0 Model Fit

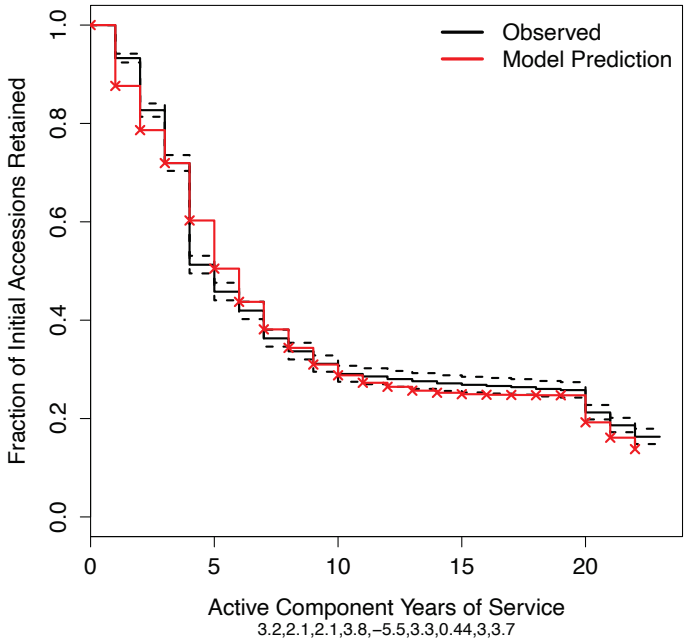
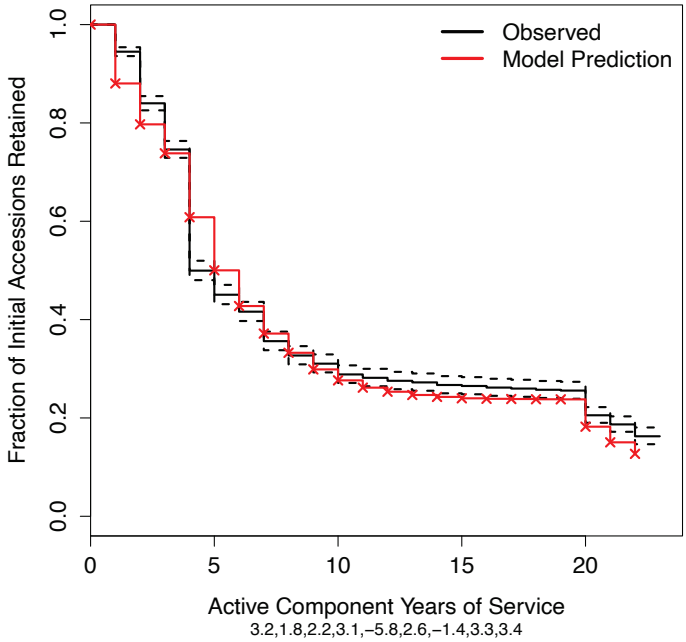


Figure E.14. 2W1 Model Fit



References

AFI—*See* Air Force Instruction.

Air Force Instruction 36-2032, *Military Recruiting and Accessions*, Washington, D.C.: Department of the Air Force, September 27, 2019. As of September 23, 2021: https://static.e-publishing.af.mil/production/1/af_a1/publication/afman36-2032/afman36-2032.pdf

Air Force Instruction 36-2110, *Total Force Assignments*, Washington, D.C.: Department of the Air Force, August 2, 2021. As of September 23, 2021: https://static.e-publishing.af.mil/production/1/af_a1/publication/dafi36-2110/dafi36-2110.pdf

Air Force Instruction 36-2502, *Enlisted Airman Promotion and Demotion Programs*, Washington, D.C.: Department of the Air Force, April 16, 2021. As of September 23, 2021: https://static.e-publishing.af.mil/production/1/af_a1/publication/afi36-2502/afi36-2502.pdf

Air Force Instruction 36-2606, *Reenlistment and Extension of Enlistment in the United States Air Force*, Incorporating Change 1, Washington, D.C.: Department of the Air Force, January 27, 2021. As of March 24, 2021: https://static.e-publishing.af.mil/production/1/af_a1/publication/afi36-2606/afi36-2606.pdf

Air Force Instruction 36-3203, *Service Retirements*, with corrective actions applied on February 2, 2021, Washington, D.C.: Department of the Air Force, January 29, 2021. As of September 23, 2021: https://static.e-publishing.af.mil/production/1/af_a1/publication/afi36-3203/afi36-3203.pdf

Asch, Beth J., James Hosek, and Michael G. Mattock, *A Policy Analysis of Reserve Retirement Reform*, Santa Monica, Calif.: RAND Corporation, MG-378-OSD, 2013. As of September 1, 2020: https://www.rand.org/pubs/monographs/MG378.html

Asch, Beth J., James Hosek, and Michael G. Mattock, *Toward Meaningful Military Compensation Reform in Support of DoD's Review: Research in Support of DoD's Review*, Santa Monica, Calif.: RAND Corporation, RR-501-OSD, 2014. As of April 23, 2021: https://www.rand.org/pubs/research_reports/RR501.html

Asch, Beth J., Michael G. Mattock, James Hosek, *The Blended Retirement System: Retention Effects and Continuation Pay Cost Estimates for the Armed Services*, Santa Monica, Calif.: RAND Corporation, RR-1887-OSD/USCG, 2017. As of September 2, 2020: https://www.rand.org/pubs/research_reports/RR1887.html

Asch, Beth J., John A. Romley, and Mark E. Totten, *The Quality of Personnel in the Enlisted Ranks*, Santa Monica, Calif.: RAND Corporation, MG-324-OSD, 2005. As of April 22, 2021: https://www.rand.org/pubs/monographs/MG324.html

Cox, D. R. "Regression Models and Life-Tables (with Discussion)." *Journal of the Royal Statistical Society*, Series B, Vol. 34, No. 2, 1972, pp. 187–220. As of September 23, 2021: http://www.stat.cmu.edu/~ryantibs/journalclub/cox_1972.pdf

DoD—*See* U.S. Department of Defense.

GAO—*See* U.S. Government Accountability Office.

Griffeth, Rodger W., Peter W. Hom, and Stefan Gaertner, "A Meta-Analysis of Antecedents and Correlates of Employee Turnover: Update, Moderator Tests, and Research Implications for the Next Millennium," *Journal of Management*, Vol. 26, No. 3, 2000, pp. 463–488.

Hosek, James, Jennifer Kavanagh, and Laura L. Miller, *How Deployments Affect Service Members*, Santa Monica, Calif.: RAND Corporation, MG-432-RC, 2006. As of May 5, 2021: https://www.rand.org/pubs/monographs/MG432.html

Hosek, James, and Paco Martorell, *How Have Deployments During the War on Terrorism Affected Reenlistment?* Santa Monica, Calif.: RAND Corporation, MG-873-OSD, 2009. As of May 5, 2021: https://www.rand.org/pubs/monographs/MG873.html

Hosek, James, and Michael G. Mattock, *Learning About Quality: How the Quality of Military Personnel Is Revealed over Time*, Santa Monica, Calif.: RAND Corporation, MR-1593-OSD, 2003. As of April 25, 2021: https://www.rand.org/pubs/monograph_reports/MR1593.html

Hosek, James R., Shanthi Nataraj, Michael G. Mattock, and Beth J. Asch, *The Role of Special and Incentive Pays in Retaining Military Mental Health Care Providers*, Santa Monica, Calif.: RAND Corporation, RR-1425-OSD, 2017. As of December 1, 2019: https://www.rand.org/pubs/research_reports/RR1425.html

House Armed Service Committee, *Hearings Before and Special Reports Made by Committee on Armed Services of the House of Representatives on Subjects Affecting the Naval and Military Establishments*, 1968. As of May 20, 2021: https://books.google.com/books?id=prNp2uaEvVgC&printsec=frontcover#v=onepage&q&f=false

Joffrion, Justin, and Nathan Wozny, "Military Retention Incentives: Evidence from the Air Force Selective Reenlistment Bonus," Upjohn Institute, Working Paper 15-226, 2015. As of May 5, 2021: http://research.upjohn.org/up_workingpapers/226

Kaplan, E. L., and Paul Meier, "Nonparametric Estimation from Incomplete Observations," *Journal of the American Statistical Association*, Vol. 53, No. 282, 1958, pp. 457–481.

Mattock, Michael G., James Hosek, Beth J. Asch, and Rita Karam, *Retaining U.S. Air Force Pilots When the Civilian Demand for Pilots Is Growing*, Santa Monica, Calif.: RAND Corporation, RR-1455-AF, 2016. As of September 1, 2020: https://www.rand.org/pubs/research_reports/RR1455.html

McFadden, Daniel, "Quantitative Methods for Analyzing Travel Behavior of Individuals: Some Recent Developments," Cowles Foundation, Discussion Paper 474, 1977.

Meadows, Sarah O., Laura L. Miller, Jeremy N. V. Miles, Gabriella C. Gonzalez, and Brandon T. Dues, *Exploring the Association Between Military Base Neighborhood Characteristics and Soldiers' and Airmen's Outcomes*, Santa Monica, Calif.: RAND Corporation, TR-1234-RC/A/AF, 2013. As of March 1, 2021: https://www.rand.org/pubs/technical_reports/TR1234.html

Miller, Jason, "To Keep Cyber Workers, Army Opens Up Its Wallet," *Federal News Network*, January 28, 2020. As of May 18, 2021: https://federalnewsnetwork.com/reporters-notebook-jason-miller/2020/01/to-keep-cyber-workers-army-opens-up-its-wallet/

Office of the Under Secretary of Defense for Personnel and Readiness, Directorate of Compensation, "Military Compensation," webpage, 2021. As of September 23, 2021: https://militarypay.defense.gov/References/Greenbooks/

O*NET Resource Center, "Crosswalk Files," webpage, 2021a. As of September 23, 2021: https://www.onetcenter.org/crosswalks.html

———, homepage, 2021b. As of September 23, 2021: https://www.onetcenter.org/

Philpott, Tom, "Final Opt-In Rates for Blended Retirement Yield More Surprises," *Stars and Stripes*, January 17, 2019. As of September 1, 2020: https://www.stripes.com/final-opt-in-rates-for-blended-retirement-yield-more-surprises-1.564861

Rubenstein, Alex L., Marion B. Eberly, Thomas W. Lee, and Terence R. Mitchell, "Surveying the Forest: A Meta-Analysis, Moderator Investigation, and Future-Oriented Discussion of the Antecedents of Voluntary Employee Turnover," *Personnel Psychology*, Vol. 71, No. 1, 2018, pp. 23–65.

Senate Appropriations Committee, Subcommittee on Department of Defense, *Hearings Before a Subcommittee of the Committee on Appropriations, United States Senate, Ninety-Fifth Congress, First Session, on H.R. 7933, Part 2—Defense Manpower*, 1977. As of May 21, 2021: https://books.google.com/books?id=GM7PAAAAMAAJ&pg=PA179&lpg=PA179&dq=%22pro-pay%22+special+pay+air+force&source=bl&ots=-SWsuyTmVr&sig=ACfU3U0dKDyGuwZRVywaW4kqSEr1JdEcMw&hl=en&sa=X&ved=2ahUKEwjg456BztTwAhUEbawKHaTbBb0Q6AEwEXoECBYQAw#v=onepage&q=%22pro-pay%22&f=false

Speer, Andrew B., Subhadra Dutta, Menghan Chen, and Glenn Trussell, "Here to Stay or Go? Connecting Turnover Research to Applied Attrition Modeling," *Industrial and Organizational Psychology*, Vol. 12, No. 3, 2019, pp. 277–301.

Tong, Patricia K., Michael G. Mattock, and Beth J. Asch, *Cost-Benefit Analysis of Special and Incentive Pays for Career Enlisted Aviators*, Santa Monica, Calif.: RAND Corporation, RR-A189-1, 2021. As of September 23, 2021: https://www.rand.org/pubs/research_reports/RRA189-1.html

Troyer, Doug, "Program Budget Decision 720, Force Shaping: Why Now?" *Vance Air Force Base*, August 28, 2007. As of March, 29, 2021: https://www.vance.af.mil/News/Commentaries/Display/Article/372321/program-budget-decision-720-force-shaping-why-now/

U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey," webpage, January 22, 2021. As of September 23, 2021: https://www.bls.gov/cps/cpsaat01.htm

U.S. Census Bureau, "American Community Survey," webpage, undated. As of May 24, 2020: https://www.census.gov/programs-surveys/acs

U.S. Department of Agriculture, "Rural-Urban Continuum Codes," webpage, undated. As of March 6, 2021: https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/

U.S. Department of Defense, "Uniformed Services Blended Retirement System," webpage, undated a. As of September 23, 2021: https://militarypay.defense.gov/blendedretirement/

———, "Greenbooks," webpage, undated b. As of September 23, 2021: https://militarypay.defense.gov/References/Greenbooks/

U.S. Government Accountability Office, *Strategy Needed to Improve Retention of Experienced Air Force Aircraft Maintainers*, GAO-19-160, 2019. As of September 23, 2021: https://www.gao.gov/assets/gao-19-160.pdf

———, *Female Active-Duty Personnel: Guidance and Plans Needed for Recruitment and Retention Efforts*, GAO-20-61, 2020. As of May 20, 2021: https://www.gao.gov/assets/gao-20-61.pdf

Ward, Michael P., and Hong W. Tan, *The Retention of High Quality Personnel in the U.S. Armed Forces*, Santa Monica, Calif.: RAND Corporation, R-3117-MIL, 1985. As of April 23, 2021: https://www.rand.org/pubs/reports/R3117.html

Warner, John, "The Effect of the Civilian Economy on Recruiting and Retention," in *11th Quadrennial Review: Supporting Papers*, 2012, pp. 71–91. As of May 20, 2021: https://militarypay.defense.gov/Portals/3/Documents/Reports/SR05_Chapter_2.pdf

Wong, Kin Fai Ellick, Gilad Feldman, and Cecilia Cheng, "Macroeconomics, Turnover Intention, and Actual Turnover Behavior: A Meta-Analysis," *Academy of Management Proceedings*, Vol. 2017, No. 1, 2017.

PROJECT AIR FORCE

Over the past ten years, maintenance career fields in the U.S. Air Force have been negatively affected by a series of events that have resulted in an experience shortage. Although there has been an improvement in Total Force manning since 2015, several skill levels are still experiencing shortages. To bridge the experience shortfall, the U.S. Government Accountability Office called for an Air Force retention strategy tailored to retain experienced maintainers. The RAND Corporation was asked to explore whether individual characteristics, economic and geographic factors, and the new Blended Retirement System (BRS) could provide additional insights into what predicts retention of this workforce.

This report focuses primarily on aircraft maintenance career fields, with some attention to munitions and logistics career fields as resources permitted. The authors undertake two analytic approaches to examine the underlying determinants of retention. First, they use logistic regression to determine how strongly a variety of individual and environmental characteristics are associated with decisions to reenlist, extend an enlistment, or separate from the Air Force; second, they use RAND's Dynamic Retention Model to estimate how the new BRS will affect maintenance, munitions, and logistics career fields when those in the new system reach retention decision points.

The authors find that changes in individual characteristics and environmental variables have improved retention in the maintenance, munitions, and logistics career fields. Although much of what influences retention is beyond the Air Force's control, the authors offer a number of recommendations and identify areas of emphasis that could be exploited.

$33.00

ISBN-10 1-9774-0860-5
ISBN-13 978-1-9774-0860-0

www.rand.org

RR-A546-1